SUPPLEMENT

TO THE

ENCYCLOPÆDIA,

OR

DICTIONARY

OF

ARTS, SCIENCES,

AND

MISCELLANEOUS LITERATURE.

IN THREE VOLUMES.

ILLUSTRATED WITH COPPERPLATES.

NON IGNORO QUÆ BONA SINT, FIERI MELIORA POSSE DOCTRINA, ET QUÆ NON OPTIMA, ALIQUO MODO ACUI TAMEN, ET CORRIGI POSSE.—*CICERO.*

VOL. II.

ELE———PHI

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SUPPLEMENT

TO THE

ENCYCLOPÆDIA.

Electrometer.

ELECTROMETER, is an instrument which measures the quantity of electricity in any electrified body. The most common electrometers are described in the article ELECTRICITY *(Encycl.)*, n° 27, and 182—233. A very valuable one is likewise described in n° 85. of the article ELECTRICITY in this Supplement; but there are still two electrometers, of which we have hitherto given no account, though they are of such value, that to pass them unnoticed would be unpardonable. The first, which is by much the most accurate and delicate instrument of the kind that we have seen, was invented by Mr Coulomb, and is adapted to ascertain the smallest quantity of redundant electricity. The second is a late invention of Mr Cuthbertson, the ingenious improver of the air-pump, and is employed only to measure the charge of large jars and batteries.

ELECTROMETER, by *Mr Coulomb* of the Royal Academy of Sciences at Paris, described in the Memoirs for 1785.

Mr Coulomb had made some experiments in examination of Dr Hooke's theory of springs "*ut tensio sic vis*;" and found, that it was surprisingly exact, in regard to the force necessary for twisting elastic wires. Having suspended a nicely turned metal cylinder by a fine wire in the direction of its axis, and having given it several turns, and left it to regain its natural position, he observed, that it performed all its revolution of untwisting and twisting in times precisely equal, whether these oscillations were of a few degrees, or consisted of several revolutions. He thence concluded, that the force with which the wire endeavoured to regain its natural position was exactly proportional to its distance from it. Engaged, soon after, by order from the Minister of Marine, in an examination of the phenomena of the mariner's compass, he took this method of suspending his needles, in order to obtain exact measures of the forces which caused them to deviate from the magnetic meridian. He made some observations with needles so suspended; which are highly valuable to the philosopher engaged in that study. When his success in this research had fully gratified his wishes, he turned his thoughts to the examination of the law of electric action by the help of an electrometer suspended in the same manner. It is constructed as follows:

Plate XXVII.

ABDC (fig. 1.) represents a glass cylinder, 12 inches in diameter and in height. This is covered by a glass plate fitted to it by a projecting fillet on the under surface. This cover is pierced with two round holes of $1\frac{1}{4}$th inches in diameter. One of them *f* is in the centre, and it receives the lower end of the glass tube *f h*, of 24 inches height, which is fixed in the hole with a cement made of sealing-wax, or other electric substance. The top of this tube receives the brass collar H (fig. 2. n° 3.), bored truly cylindrical, and having a small shoulder, which rests on the top of the tube. This collar is fastened with cement, and receives the hollow cylinder Φ (fig. 2. n° 2.), to which is joined the circular plate *a b*, divided on the edge into 360 degrees. It is also pierced with a round hole G in the centre, which receives the cylindrical pin *i* (fig. 2. n° 1.), having a milled head *b*, and an index *i o*, whose point is bent down, so as to mark the divisions on the circle *a b*. This pin turns stiffly in the hole G, and the cylinder Φ turns steadily in the collar H. To the lower end of the centre pin is fastened a little pincer *q*, formed like the end of a port-crayon, and tightened by the ring *q*, so as to hold fast the suspension wire, the lower end of which is grasped by a similar pincer P *o* (fig. 3.), tightened by the ring φ. The lower end φ *o* is cylindrical, and it is of such weight as to strain the wire perfectly straight, but without any risk of breaking it. It may be made half of the weight that will just break it.

This pincer is enlarged at C, and pierced with a hole, which receives tightly the arm *g* C *q* of the electrometer. This is eight inches long, and consists of a dry silk thread, or slender straw of some grass completely dried, and dipped in melted gum lac or fine sealing-wax, and held upright before a clear fire, till it form a slender cylinder of about $\frac{1}{40}$th of an inch in diameter. This occupies six of the eight inches, from *g* to *q*: the remaining two inches is a fine thread of the lac or sealing-wax, as it drains off in forming the arm. At *a* is a ball of pith of elder or fine cork, one-fourth or one-half of an inch in diameter, made very smooth, and gilded. It is balanced by a vertical circle *g* of paper, of large dimensions, stiffened with varnish. The resistance of the air to this plane soon checks the oscillations of the arm.

The whole is seen in its place in fig. 1. where the arm hangs horizontally about the middle of the height of the great cylinder. In its oscillations the ball *a* moves round in a circle, whose centre is in the axis of the whole instrument. Its situation is indicated by a graduated circle Z O Q, drawn on a slip of paper, and adhering to the glass with varnish. The electrified body, whose action is to be observed, is another small ball of cork *t*, also gilt, or a brass ball well polished. This is is carried by a ſtalk of gum lac *m e*, incloſing a dry ſilk thread. This ſtalk is graſped by a clamp of cleft deal, or any ſimilar contrivance which lies firm on the glaſs cover. When this ball is let down through the hole *m*, it ſtands ſo as to touch the ball *a* on the arm when that ball is oppoſite *o* on the graduated circle.

To electriſy the ball *t*, we employ the inſulating handle, fig. 4. which is a ſlender ſtick of ſealing-wax or lac, holding a metal wire that carries a ſmall poliſhed metal ball. We touch with it ſome electrified body, ſuch as the prime conductor of a machine, the knob of a jar, &c. Introduce this electrified ball cautiouſly into the hole *m*, and touch the ball *t* with it. The ball *a* is immediately repelled, and goes to a diſtance, twiſting the ſuſpenſion-wire, till the force of twiſt exerted by the wire balances the mutual repulſion of the balls *t* and *a*.

Such is the proceſs for examining the law of electric action. But when we would examine the action of different bodies in different ſtates, another apparatus is wanted. This is repreſented by the piece *cAd* (fig. 5.), conſiſting of a plug of ſealing-wax A, which fits tight into the hole *m*, and is pierced by the wire *c d*, hooked at *c*, to receive a wire connecting it occaſionally with an electrified body, and having below a poliſhed metal ball *d*.

The inſtrument is fitted for obſervation in the following manner: Turn the milled button *b* at top, till the twiſt-index *i o* is on the mark *o* of the twiſt circle. Then turn the whole in the collar H, till the ball *a* ſtands oppoſite to the mark *o* of the paper circle z OQ, and at the ſame time touches the ball *t* or *d*.

The obſervation is made thus: The ball *t* is electrified as already ſaid, and *a* is repelled, and retires from *t*, twiſting the wire, and, after a few oſcillations, ſettles at a diſtance correſponding to the repulſion. Now turn the twiſt-index, ſo as to force the ball *a* nearer to *t*. We eſtimate the force of this new repulſion by adding the motion of the twiſt-index to the angle at which the ball firſt reſted. By turning the twiſt-index ſtill more, we bring the balls ſtill nearer, and have a meaſure of another repulſion.—And thus may we obtain as many meaſures as we pleaſe.

In this way Coulomb aſcertained the relation between the repulſion and the diſtance to be the inverſe duplicate ratio of the diſtances. He diſcovered the law of diſſipation by air in contact, and the relation which this bears to the primitive repulſion, by obſerving the gradual approach of *a* to *t* as the electricity diſſipates from both, and by ſlackening the twiſt-index till the ball *a* retires to its primitive diſtance. He aſcertained the diſſipation along imperfect conductors, and the length neceſſary for inſulation, by completely inſulating the ball *t*, and obſerving the loſs by air in contact with it, and then ſliding a metal rod down the inſulating ſtalk, till the diſſipation began to exceed what took place by the air alone. He examined the proportion of redundant fluid in communicating bodies, by connecting them alternately with the piece, fig. 5.; as alſo by electrifying one ball, and obſerving its repulſive force, and then ſharing its electricity with another, and obſerving the diminution. He examined the graduation of his electrometer, by ſharing the electricity of one ball with an equal ball, which gave him the poſition that indicated one half; and, by repeating this, for one-fourth, &c. in the ſame manner as we practiſed and related in ELECTRICITY (*Suppl.*), n° 141, &c.

An example of one or two of theſe trials will give a clear conception of the concluſions deduced from theſe obſervations.

The ball *t* was introduced and electrified; *a* was repelled, and ſettled at 40°; the index was twiſted 140°, which brought *a* to 20; and the time was noted. The electricity gradually diſſipated, and *a* came nearer to *t*. The index was untwiſted 30°, and *a* retired a little beyond 20°; but on waiting a few ſeconds, it ſtood exactly at 20°. The time was again noted. The interval was exactly three minutes. The concluſion from the experiment was as follows:

When the ball was brought to 20°, the repulſion was evidently 140 + 20, or 160. Three minutes afterwards it was 110, + 20, or 130; and 30° were loſt in three minutes, or 10° per minute. The mean force was 145. Therefore the mean loſs per minute was, $\frac{10}{145}$. Obſerve alſo, that the primitive force correſponding to the diſtance was 40: and the force correſponding to 20 was 160, or inverſely as 20^2 to 40^2.

But obſerve, that the diſtances were not meaſured by the angles, but by the chord of the angles. The obliquity of action muſt alſo be accounted for; and the real lever is leſs than the arm, in the proportion of radius to the coſine of $\frac{1}{2}$ the angle.

The wire uſed by Coulomb in his firſt experiments on the law of action was of ſuch ſtrength, that $\frac{1}{340}$th of a French grain, applied at the point *a*, held it faſt till the twiſt-index was turned 360°; ſo that one degree correſponded to $\frac{1}{122400}$ of a grain. A foot of this wire weighed $\frac{1}{10}$th of a grain. Experience having ſhewn that this was a ſenſibility far exceeding what was neceſſary for the meaſures that he had in view, and made the inſtrument too delicate for common uſes, he ſubſtituted much ſtronger and ſhorter wires, and recommends much ſmaller dimenſions for the whole inſtrument. We have made two of only five inches in diameter and 14 inches high; the arm *a g* being $2\frac{1}{2}$ inches, and the ſuſpenſion a ſingle fibre of ſilk, carrying 30 grains. It is far more ſenſible than Bennet's gold leaf electrometer. The ſame inſtrument, with a ſilver wire ſuſpenſion, and a thread of lac projecting from the end *g*, as an index to coincide more cloſely with the ſcale, is ſufficiently nice for all experiments of meaſurement. It is always proper to have the diameter of the cylinder double the length of the arm, that the action of the glaſs may not diſturb the poſition of the arm. It is greatly improved by having a round hole in the bottom of the inſtrument, in which the cylinder C *o* of the lower pincer may hang freely: this prevents much tedious oſcillation. For ordinary experiments, for meaſuring charges of batteries, and the like, a much leſs delicate inſtrument, with a ſuſpenſion-wire ſtrained at both ends, is abundantly delicate, and vaſtly more manageable. The wire ſhould extend as far below the arm as above it, and ſhould be graſped below, by a pincer turning by a milled head in a hole at the end of a ſlender ſpring. This enables us to adjuſt the inſtrument ſpeedily. Having placed the twiſt-index at o, turn this lower button gently till the ball *a* points exactly to o on the paper circle. Even in this coarſeſt ſtate we have found it more delicate, and much more exact, than the electrometer deſcribed in ELECTRICITY (*Suppl.*) n° 85. which was much more costly, and liable to accidents. Coulomb's electrometer has the great advantage of wasting very little electricity; whereas Henley's, or Brookes's, or de Luc's, waste it very fast when it is intense.

We improved it greatly by taking away the apparatus with the ball *t*, and substituting the piece, fig. 5. for it, after changing its construction a little. Instead of the wire *c d*, we used the smallest glass tube that we could varnish on the inside, by drawing through it a silk thread dipped in varnish. Having varnished it with lac both within and without, a brass ball *d* was fixed on its lower end, and a fine wire, with a ball at top, was put down into the tube, so as to touch the ball below. When the plug was fitted into the hole *m* once for all, the situation of the ball *d* suffered no alteration. When delicate experiments are to be made, the upper ball *c* is touched by the charger, fig. 4. which electrifies *d*. C is immediately drawn out with a glass forceps; and thus *d* is left completely insulated. When external electricity, such as the faint electricity of the atmosphere is to be examined, the wire is allowed to remain in the tube.—*N. B.* A scrupulous experimenter, who may object to the straining spring recommended above, may substitute a small weight, which will be constant in its action.

The reader will observe, that this electrometer, as hitherto managed, measures only repulsions. It is not so easy to measure attractions with it; and Mr Coulomb was obliged to take a very circuitous method, during which a great deal of electricity was dissipated. In this respect, the electrometer described in the article ELECTRICITY (*Suppl.*) has the advantage; but in every other respect, Mr Coulomb's is the finest electrometer that has yet been published, giving *absolute* measures, and this with great accuracy. The Hon. Mr Cavendish has employed the construction in his most valuable experiments on the force of gravity (*Phil. Trans.* 1798, Part II.); an experiment which Newton would have been delighted with observing.

Cuthbertson's ELECTROMETER is thus described by himself in the last number of the second volume of *Nicholson's Philosophical Journal.* GH (fig. 6.) is an oblong piece of wood, about 18 inches in length, and six in breadth, in which are fixed three glass supporters, D, E, F, mounted with brass balls, *a*, *c*, *b*. Of these supporters, E and F are exactly of the same length; but D is four inches shorter. Under the brass ball *a* is a long brass hook; the ball *c* is made of two hemispheres, the under one being fixed to the brass mounting, and the upper turned with a groove to shut upon it, so that it can be taken off at pleasure. The ball *b* has a brass tube fixed to it, about three inches long, cemented on the top of F, and the same ball has a hole at the top, of about one-half inch diameter, corresponding with the inside of the tube. AB is a straight brass wire, with a knife edged centre in the middle, placed a little below the centre of gravity, and equally balanced with a hollow brass ball at each end, the centre, or axis, resting upon a proper shaped piece of brass fixed in the inside of the ball *c*: that side of the hemisphere towards *c* is cut open to permit the end *c* A of the balance to descend till it touches the ball *a*, and the upper hemisphere C is also cut open to permit the end *c* B to ascend; *i* is a weight, weighing a certain number of grains, and made in the form of a pin with a broad head; the ball B has two holes, one at the top, and the other at the bottom; the upper hole is so wide, as to let the head of the pin pass through it, but to stop at the under one with its shank hanging freely in *b*; *k* is a common Henley's quadrant electrometer; and when in use it is screwed upon the top of *c*.

It is evident, from the construction, that if the foot stand horizontal, and the ball B be made to touch *b*, it will remain in that position without the help of the weight *i*; and if it should by any means receive a very low charge of electric fluid, the two balls *b*, B, will repel each other; B will begin to ascend, and, on account of the centre of gravity being above the centre of motion, the ascension will continue till A rest upon *a*. If the balance be set again horizontal, and the pin *i* be put into its place in B, it will cause B to rest upon *b*, with a pressure equal to that weight, so that more electric fluid must be communicated than formerly before the balls will separate; and as the weight in B is increased or diminished, a greater or less quantity of electric fluid will be required to effect a separation.

When this instrument is to be applied to a jar, or battery, one end of a wire L must be inserted into a hole in *b*, and the other end into a hole of any ball proceeding from the inside of a battery, as M. A chain, or wire, or any body through which the charge is to pass, must be hung to the hook at *m*, and carried from thence to the outside of the battery, as is represented by the line N. *k* must be screwed upon *c*, with its index towards A. The reason of this instrument being added, is to shew, by the index continuing to rise, that the charge of the battery is increasing, because the other part of the instrument does not act till the battery has received its required charge.

It is almost needless to observe that this instrument consists of three electrometers, viz. Henley's electrometer, Lane's discharging electrometer considerably improved, and Brookes's steelyard electrometer improved likewise. By this combination and these improvements, we possess all that can be required in an electrometer for batteries and large jars; for, by *k*, we see the progress of the charge; by the separation of B *b*, we have the repulsive power in weight; and by the ball A, the discharge is caused when the charge has acquired the strength proposed.

In the journal from which this abstract is taken, the reader will find some curious experiments made with batteries by means of this electrometer; but one will be sufficient to explain its use. Prepare the electrometer in the manner shewn in the figure, with the jar M annexed, which contains about 168 square inches of coating. Take out the pin in B, and observe whether the ball B will remain at rest upon *b*; if not, turn the adjusting screw at C till it just remains upon A. Put into B the pin, marked *i*, weighing 15 grains; take two inches of watch-pendulum wire, fix to each end a pair of spring tongs, as is represented at G *m*, hook one end to *m*, and the other to the wire N, communicating with the outside of the jar; let the uncoated part of the jar be made very clean and dry; and let the prime conductor of an electrical machine, or a wire proceeding from it, touch the wire L; then, if the machine be put in motion, the jar and electrometer will charge, as will be seen by the rising of the index of *k*; and when charged high enough, B will be repelled by *b*, *b*, and A will descend and discharge the jar through the wire which was confined in the tongs, and the wire will be fused and run into balls. The ingenious author, by breathing through a glass pipe into the jar, damped it a little in the inside. Then loading B with a pin of 30 grains, he obtained such a charge as fused eight inches of watch pendulum wire, disposed exactly as the two inches were disposed in the former experiment. By repeating and varying his experiments, he found that double quantities of electrical fluid, in the form of a discharge, will melt four times the length of wire of a certain diameter.

ELECTROPHORUS. See ELECTRICITY in this *Supplement*.

ELEPHAS, the ELEPHANT. See *Encyclopædia*; where the natural history of this huge and sagacious animal is detailed at considerable length. Since that article was published, we have seen the third volume of the Asiatic Researches, in which some important questions, which we were then obliged to leave in uncertainty, seem to be decided by John Corse, Esq. They relate, *1st*, To the mode in which elephants copulate; which Buffon asserts (and in proof of his assertion adduces the structure and position of the generative organ in the female) to be performed while that female remains recumbent on the back; but which Mr Corse insists, from ocular evidence, takes place after the manner in which the horse copulates with the mare. *2d*, To the method of receiving nourishment from the mother; which is not, as Buffon avers, by the trunk, but by the mouth, which sucks the dug, while the trunk of the young animal grasps it round to press out the milk. *3d*, To the period of their going with young; which Mr Corse conceives cannot be less than two years; whereas Buffon and Pennant assign only nine months for the gestation of their young. His reasons for this supposition are unanswerable, and shall be given in his own words.

"As far as I know, the exact time an elephant goes with young has not yet been ascertained; but it cannot be less than two years, as one of the elephants brought forth a young one twenty-one months and three days after she was taken. She was observed to be with young in April or May 1788, and she was only taken in January preceding; so that it is very likely she must have had connection with the male some months before she was secured, otherwise they could not have discovered that she was with young, as a fetus of less than six months cannot well be supposed to make any alteration in the size or shape of so large an animal. The young one, a male, was produced October 16, 1789, and appeared in every respect to have arrived at its full time. The gentleman to whom it belongs examined its mouth a few days after it was brought forth, and found that one of its grinders on each side had partly cut the gum."

When Mr Corse wrote his memoir, the young elephant was active and well, and beginning to eat a little grass. In Africa the Hottentots feed on the elephant; and M. Vaillant declares, that an elephant's foot, when baked in their manner, is a most delicious morsel.

ELEPHANTIASIS (see MEDICINE, n° 352. *Encycl.*) is one of the most dreadful maladies with which the human race is any where afflicted. It is not indeed common, if it be found at all, in the temperate climates of Europe; but it is frequent in the East and West Indies, where it too often baffles the skill of the ablest physicians. In the second volume of the Asiatic Researches we have the following prescription for its cure:

"Take of fine fresh white arsenic one tólá, or 105 grains; of picked black pepper six times as much: let both be well beaten at intervals for four days successively in an iron mortar, and then reduced to an impalpable powder in one of stone with a stone pestle, and thus completely levigated, a little water being mixed with them. Make pills of them as large as tares or small pulse, and keep them dry in a shady place. One of those pills must be swallowed morning and evening with some betel leaf, or in countries where betel is not at hand, with cold water: if the body be cleansed from foulness and obstructions by gentle cathartics and bleeding before the medicine is administered, the remedy will be speedier."

This prescription, we are told, is an old secret of the Hindoo physicians, which they consider as a powerful remedy against all corruptions of the blood, whether occasioned by the elephantiasis or the venerial disease, which they call the *Persian* fire, and which they apply likewise to the cure of cold and moist distempers, or palsy, distortions of the face, relaxation of the nerves, and similar diseases. As the Hindoos are an ingenious and scientific people, it might be worth some European physician's while to make trial of this ancient medicine in the West Indies, where the elephantiasis or kindred diseases prove so frequently fatal.

ELEVATION, in architecture, denotes a draught or description of the principal face or side of a building; called also its *upright* or *orthography*.

ELEUTHERA, or *Alabaster*, one of the Bahama or Lucaya islands, where above 60 families formerly settled under Dep. Gov. Holmes, and erected a small fort.—*Morse.*

ELIAS, MOUNT ST. a mountain near the shore of the N. W. coast of North-America, N. W. of Admiralty bay, and S. E. of Prince William's sound.—*ib.*

ELIZABETH CITY *Co.* in Virginia, lies between York and James rivers, having Warwick and York counties on the W. and Chesapeak bay on the E. and N. There are several small islands on its sea-coast, the chief of which are Long and Egg islands. Point Comfort is the S. eastern extremity of the co. It contains 3450 inhabitants, of whom 1876 are slaves.—*ib.*

ELIZABETH *Islands*, several small islands on the S. E. side of Buzzard's bay, extending S. westerly from the extremity of Barnstable co. in Massachusetts, and bearing N. W. from Martha's Vineyard; situated between 41. 24. and 41. 32. N. lat. and between 70. 38. and 70. 56. W. long. They are about 16 in number; the chief of which are Nashawn, Pasqui, Nashawenna, Pinequese, and Cattahunk islands. All these belong to Duke's county.—*ib.*

ELIZABETH, a short southern arm of James river in Virginia. It affords an excellent harbor, and large enough for 300 ships. The channel is from 150 to 200 fathoms wide; and at common flood tide it has 18 feet water to Norfolk, which stands near the mouth of its eastern branch. The S. branch rises in the Dismal Swamp. Craney island, at the mouth of Elizabeth, lies 5 miles S. W. of Point Comfort, at the mouth of James river.—*ib.*

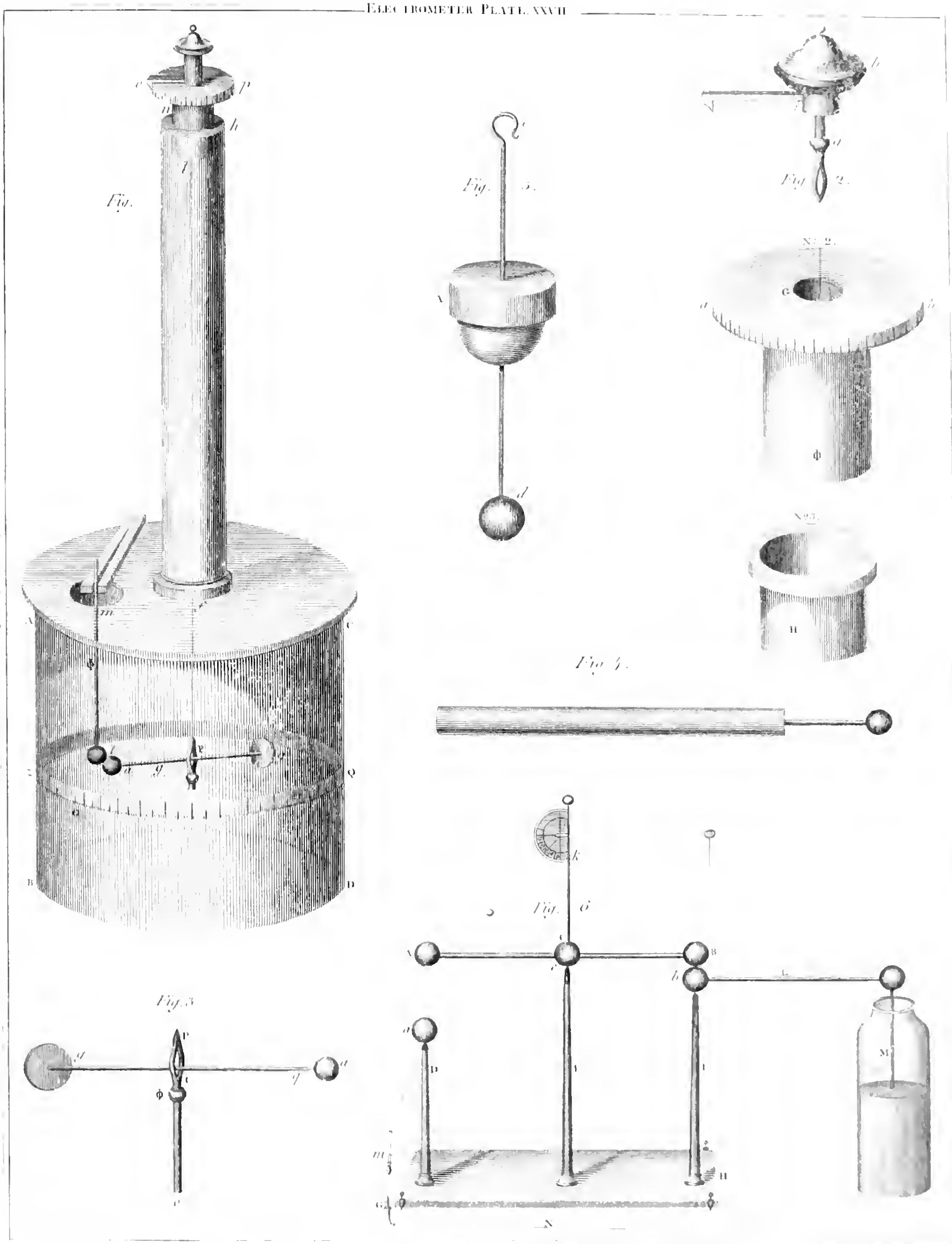
Fig.
Fig. 5.
Fig. 2.
N° 2.
N° 3.
Fig. 4.
Fig. 6
Fig. 3

ELIZABETH'S ISLAND, QUEEN, in the ſtraits of Magellan, in S. America. Here freſh water, herbs fit for ſallad, and wild fowl may be had in great plenty. The ſhores alſo abound with ſhell-fiſh.—*ib.*

ELIZABETH, a townſhip in Lancaſter co. Pennſylvania, containing about 30 houſes, and a Dutch church; 18 miles N. W. by W. of Lancaſter, and 84 W. by N. of Philadelphia.—*ib.*

ELIZABETHTOWN, a poſt town and borough, in Eſſex county, New-Jerſey; pleaſantly ſituated on a ſmall creek which empties into Arthur Kull. Its ſoil is equal to any in the ſtate. In the compact part of the town, there are about 150 houſes, two brick churches, one for Preſbyterians, very handſome, the other for Epiſcopalians, and an academy. This is one of the oldeſt towns in the ſtate, having been purchaſed of the Indians as early as 1664, and ſettled ſoon after. It lies 6 miles ſoutherly of Newark, and 15 S. W. by W. of New-York.—*ib.*

ELIZABETHTOWN, a village of Alleghany co. Pennſylvania, ſituated on the S. E. ſide of Monongahela river between Redſtone Old Fort and Pittſburg, about 18 miles from each, and 6 above the mouth of the Youghagany. Many boats are built here for the trade and emigration to Kentucky, and in the environs are ſeveral ſaw-mills. N. lat. 40. 13. W. long. 79. 22—*ib.*

ELIZABETHTOWN, a poſt town of Maryland, and capital of Waſhington co. formerly called Hagarſtown, ſeated in the fertile valley of Conegocheague. It has ſeveral ſtreets regularly laid out. The houſes are principally built of brick and ſtone, in number about 300. Epiſcopalians, Preſbyterians, and German Lutherans have each a church. The court-houſe and market-houſe are handſome buildings, and the gaol is of ſtone, and ſubſtantial. The trade with the weſtern country is conſiderable; and there are a number of mills in the neighbourhood, on Antietam creek.—*ib.*

ELIZABETHTOWN, the chief town of Tyrrel co. in Edenton diſtrict, North-Carolina, has a gaol, court-houſe, and a few dwelling-houſes. It is 40 miles from Fayetteville, and 55 from Wilmington.—*ib.*

ELIZABETHTOWN, a poſt town and the chief in Bladen co. N. Carolina, is ſituated on the N. W. branch of Cape Fear. It contains a court-houſe, gaol, and about 30 houſes; 36 miles ſouthward of Fayetteville, and 47 N. W. of Wilmington.—*ib.*

ELK, a creek in Northumberland co. Pennſylvania, which uniting with Penn's creek, falls into the Suſquehanna, 5 miles below Sunbury.—*ib.*

ELK, a navigable river of the eaſtern ſhore of Maryland, which riſes in Cheſter co. Pennſylvania, by two branches; Big and Little Elk creeks. At their confluence ſtands Elkton. The canals in contemplation from Elk river, to Delaware bay, are noticed under Delaware bay.—*ib.*

ELK, a ſhort navigable river, in the ſtate of Tenneſſee. It riſes on the N. W. ſide of Cumberland mountain, runs S. weſterly, and falls into the Tenneſſee a little above the Muſcle ſhoals; about 40 miles W. N. W. of the Creeks' Croſſing Place.—*ib.*

ELKHORN, a ſmall water of Kentucky river. The Elkhorn lands are much eſteemed, being ſituated in a bend of Kentucky river, in Fayette co. in which this ſmall river, or creek, riſes.—*ib.*

ELK, *Lake*, one of the chain of ſmall lakes which connects the lake of the Woods with lake Superior. N. lat. 48. 41. W. long. 93.—*ib.*

ELKRIDGE, a ſmall town in Ann Arundel co. Maryland, ſituated on the S. bank of Patapſco river, and on the W. ſide of Deep Run. This place is famous for the bright tobacco called *kite's foot*. It is 8 miles S. W. of Baltimore, and 19 N. W. of Annapolis. N. lat. 39. 12. 30.—*ib.*

ELKTON, a poſt town of conſiderable trade, at the head of Cheſapeak bay, in Maryland, and the capital of Cecil co. It is ſituated at the confluence of the head branches of Elk river, 13 miles from its mouth at Turkey Point, and a mile above French town. The tide flows up to the town, and it enjoys great advantages from the carrying trade, between Baltimore and Philadelphia. Upwards of 250,000 buſhels of wheat are collected here annually, for ſupplying thoſe markets, or the neighbouring mills. Elkton conſiſts of one ſtreet, in which are about 90 houſes, a court-houſe, and gaol. On the W. ſide of the town is an academy. It is 12 miles S. W. of Chriſtiana bridge, 10 N. E. of Charleſtown, 47 S. W. of Philadelphia, and 56 N. E. of Baltimore.—*ib.*

ELLINGTON, a townſhip of about 200 families, in Tolland co. Connecticut. It lies about 12 miles N. E. of Hartford city, and 6 W. of Tolland.—*ib.*

ELLIPSE, or ELLIPSIS, is one of the conic ſections, popularly called an *oval*; being called an *ellipſe* or *ellipſis* by Apollonius, the firſt and principal author on the conic ſections, becauſe in this figure the ſquares of the ordinates are *leſs* than, or *defective* of, the rectangles under the parameters and abſciſſes. See *Conic Sections*, Encycl.

ELLIPSOID, is an elliptical ſpheroid, being the ſolid generated by the revolution of an ellipſe about either axis.

ELLIPTOIDE, an infinite or indefinite ellipſis, defined by the indefinite equation $a y^{m+n} = b x^{m} \overline{.a - x}^{n}$ when *m* or *n* are greater than 1: for when they are each = 1, it denotes the common ellipſe.

There are ſeveral kinds or degrees of elliptoides, denominated from the exponent $m+n$ of the ordinate y. As the cubical elliptoide, expreſſed by $a y^{3} = b x^{2} \overline{.a - x}$; the biquadratic, or furſolid $a y^{4} = b x^{2} \overline{.a - x}^{2}$; &c.

ELMORE, the ſouthernmoſt townſhip in Orleans co. in Vermont; and contained, by the cenſus, only 12 inhabitants.—*Morse.*

EMERY'*s River*, a ſmall river in Tenneſſee, which runs S. E. into the Tenneſſee, 7 miles N. by E. of the mouth of Clinch river.—*ib.*

EMINENTIAL EQUATION, a term uſed by ſome algebraiſts, in the inveſtigation of the areas of curvilineal figures, for a kind of aſſumed equation that contains another equation eminently, the latter being a particular caſe of the former.

EMMAUS, a Moravian ſettlement, 8 miles from Bethlehem, in Pennſylvania.—*Morse.*

EMMITSBURGH, or *Emmitſburgh*, a flouriſhing village in Frederick co. Maryland, ſituated between Flat Run and Tom's creek, weſtern head waters of the Monocacy, and about a mile S. of the Pennſylvania line. It is 24 miles N. E. by E. of Frederick, and 50 N. W. of Baltimore. N. lat. 39. 10. 30. —*ib.*

ENAMELLING of Vessels for the Kitchen. In the year 1779 the Society of Emulation in Paris proposed as a prize question "To discover a composition fit for making kitchen utensils which should be free from the disadvantages attending copper, lead, tinned vessels, glazed earthen ware, &c. which should be as strong as possible, less costly than the vessels used at present, and which should be able to bear the highest degree of kitchen fire, and the most sudden changes from heat to cold."

In consequence of this proposal, Mr Sven Rinman of the Royal Academy of Stockholm, without any intention of being a candidate for the premium offered by the Society of Emulation, instituted a set of experiments on small vessels of copper and hammered iron, with the view of giving to them a coating of what may properly be called *enamel*, which should not have the defects of tinning, and which, when applied to iron, should take from it the inconveniency of rusting, and of blackening many sorts of victuals when they are dressed in it. These experiments he submitted to the academy of which he was a member; and as we think them important, we shall lay the substance of them before our readers.

The most common, and the cheapest kind of white enamel that is to be met with in the shops (which is an opaque white glass, composed of powdered quartz, of glass of lead, and of calx of tin), was tried for coating kitchen utensils; and he found that it was excellent for the purpose, as it produced a coating, which was not only clean and agreeable in its appearance, but possessed likewise all the power of resisting the action of fire and of acids that could be desired. But, as it is very difficult to apply, is very dear for common use, and is besides considered as not being capable of resisting violent blows or falls, he made various experiments with substances of less price; of which the following are certainly worthy of being related.

1. The white semi-transparent fluor spar was reduced into a fine powder, with an equal quantity of unburnt gypsum, and afterwards calcined in a strong fire with a white heat; the whole being, from time to time, carefully stirred. The vessel, which he intended to coat, having first been wetted by dipping it in water, had as much of the aforesaid powder applied to its inside, by means of a very fine silk sieve, as would adhere to it of itself, or could be made to do so by pressing it with the finger. After this vessel had been dried and gradually heated, it was exposed to a sudden and violent heat, partly in a coal-fire, kept up by a pair of bellows (the vessel being at the same time covered, so that no coals or ashes could fall into it,), and partly in an assaying furnace.

In the coal fire, and with the heat as violent as is commonly used to make copper solder run, the mixture was melted, in about the space of a minute, into an opaque white enamel, which evenly covered the surface of the copper, and fixed itself pretty firmly to the metal; it also bore hard blows without breaking, and resisted the trials made by boiling things in it, and by applying acids to it. The forementioned mixture was also reduced into a fine powder in a glass mortar, and made into a sort of thin paste with water; it was then applied to the vessel with a small brush, an operation as easy as that of applying any other wet colouring matter. He likewise tried this paste, by covering vessels with it in the same way the potters apply their common glazing for stone ware. By both the above mentioned processes he obtained a very smooth coating, particularly by the latter, which is more quickly performed. When the paste is applied, the vessel should be made a little warm, so also should the paste itself.

If the constituent parts of these two substances be considered (that is to say, that gypsum is composed of calcareous earth saturated with vitriolic (sulphuric) acid, and fluor spar of a particular acid united to siliceous earth; also, that the whole, when put into the fire without the addition of any other substance, is, of all earthy or stony mixtures, that which the most easily melts into an opaque white glass, not very brittle) and if, on the other hand, the action of acids be attended to—we shall easily conceive these substances must attach themselves strongly to copper, and that the varnish formed by them cannot afterwards be dissolved or acted upon by acids.

The greatest difficulty attending on this simple mixture is, the strong and sudden heat necessary to apply it with effect, that heat being greater than is commonly to be obtained in an assaying furnace. On that account, M. Rinman endeavoured to render it more fusible by the addition of some other substance.

Of his experiments made with this view, some failed, and others succeeded. We shall record only such as were successful, and at the same time attended with such moderate expence as not to preclude them from common use.

2. With the substances employed in his first experiment, which, with the author, we shall henceforth call n° 1. he mixed an equal quantity of what is called *fusible glass (vitrum fusibile)*, composed of six parts of lime, four of fluor spar, two of quartz reduced into a fine powder, and one-tenth of a part of manganese; the whole having been calcined, and ground with water, in the manner colours are ground, he spread it on the vessel with a brush. This mixture ran pretty well upon the copper in the coal fire; it also attached itself very strongly to it, and produced an enamel which was firm and hard, and seemed likely to bear wear; but it was of a dark grey colour, and without any brilliancy. The mixture did not melt more readily in the assaying furnace.

Two parts of n° 1. with one part of the fusible glass, and a quarter of a part of manganese, had nearly the same effect. This last mixture, indeed, was rather more easily melted, but it had a darker colour.

3. Eight parts of n° 1. with one half of a part of borax, one quarter of a part of nitre, and half a part of manganese, were melted, in the space of ten minutes, into a brown liver-coloured glass; which, in the assaying furnace, produced upon the copper vessel a black enamel, which had a dull surface. In other respects it was firm, even, and hard; but it did not sufficiently cover the vessel by a single application, nor was it capable of resisting the action of acids.

4. One part of the brown glass mentioned in the last experiment, with three parts of n° 1. became, in the assaying furnace with a red heat, almost as fluid as the last, and had an even and smooth surface; but it was of a dark

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a dark colour, and had not any brilliancy. It was not ſenſibly acted upon by vitriolic (ſulphuric) acid.

5. Four parts of n° 1, mixed with one half of a part of litharge, were melted in a crucible, with the help of the bellows, in five minutes, ſo as to become as fluid as water. This mixture, during the fuſion, emitted a ſmell of ſulphureous acid, and formed an opaque glaſs of a ſtraw colour; which, after being ground, as uſual, and ſpread upon a copper veſſel, produced an enamel which covered the veſſel very evenly, and was without bubbles. It was likewiſe, perhaps the hardeſt of all, but could not be melted in the aſſaying furnace, requiring a ſtronger fire kept up by the bellows. It preſerved its ſtraw colour, but without any luſtre, and reſiſted the action of acids better than the common glazing of the potters.

6. Mr Rinman mixed together equal quantities of gypſum, fluor, ſpar, and what the potters call *white lead* (A), and which ſerves for the baſis of their glazing. This mixture, after being calcined, melted in five minutes, with the aſſiſtance of a pair of bellows into a very white, hard, and opaque enamel, which was very eaſily poured out of the crucible. This enamel, treated like the others, ran very freely, equally, and without bubbles, by the heat of the aſſaying furnace. It was alſo pretty hard and ſtrong, but without any luſtre, and had green and yellow ſpots, occaſioned by the acids of the gypſum and fluor ſpar, which had acted upon the copper during the fuſion of the enamel. It, however, bore melting two or three times, and then appeared of a white colour; it was but very little affected by other acids.

7. Equal parts of fluor ſpar, of gypſum, of litharge, and of pure flint glaſs, powdered and mixed together, melted in five minutes, by the help of a pair of bellows, and produced a white and hard glaſs, very like that of the laſt experiment, but rather harder. After being applied on the veſſel in the uſual manner, it formed, with the greateſt heat of an aſſaying furnace, an enamel of a yellowiſh white colour, firm and hard, but without luſtre. In order to avoid the formation of bubbles, care was taken (as ought always to be done in enamelling) to remove the veſſel from the fire as ſoon as it had acquired a brilliant appearance therein, or as ſoon as the enamel was completely melted.

8. Twelve parts of glaſs of lead or of litharge, with eight parts of flint glaſs, and two of flowers of zinc, were melted, in the ſpace of ſeven minutes, into a clear yellow glaſs, which, when uſed for enamelling, was diſpoſed to form bubbles; but, by continuing the heat for a longer time, the bubbles were diſperſed, and he obtained a pretty good enamel, of a yellow brown colour with a greeniſh caſt, very hard and firm. It reſiſted the action of the vegetable acids, like the enamels already ſpoken of, but it was a little attacked by the mineral acids.

9. He powdered and mixed together five parts of fluor ſpar, five parts of gypſum, two parts of minium, one half of a part of borax, two parts of flint glaſs, one half of a part of calx of tin, and only one twenty-fifth of a part of calx of cobalt. This mixture was melted in a crucible in ſix minutes, by help of the bellows, and produced an opaque glaſs of a pearl colour, a little inclining to blue, on account of the calx of cobalt. It was pretty hard, and, after being ground with water in the uſual way, it became of a very good conſiſtence, ſo as to be very fit for ſpreading over veſſels, to which it adhered very ſtrongly. If any bubbles formed on the veſſel during its drying, they might be rubbed down with the finger, and the whole ſurface rendered ſmooth and even. After being warmed, and gradually heated, it was put into an aſſaying furnace, made very hot with birch charcoal, which had been juſt kindled under the muffle. After a minute it melted, and began to appear brilliant; ſo that he found it neceſſary to take out the veſſel very quickly, which was already very evenly coated with a thick, and ſufficiently hard, enamel, the ſurface of which, however, had no brilliancy.

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The colour remained always inclining to green, becauſe the copper had been a little attacked by the acids of the gypſum and fluor ſpar during the fuſion; but in other reſpects this enamel was very firm, was very little hurt by ſlight blows, and bore very well ſudden changes of heat and cold. Weak acids had no action upon it; but he had ſome reaſon to think that it would, in length of time, have been acted upon, to a certain degree, by vitriolic (ſulphuric) acid. Its colour, except the forementioned ſhade of green, was white, with a dull, and rather changeable, ſurface.

The calx of cobalt, which has been juſt mentioned, and which Mr Rinman made uſe of merely with the intention of obtaining a fine colour, was prepared by ſaturating a ſolution of cobalt in aquafortis (nitric acid) with common ſalt, and evaporating to dryneſs; by which means he obtained a fine roſe-coloured calx. A very ſmall quantity of this calx, when mixed with any fuſible glaſs, gives it a beautiful blue colour.

Of the various ſpecies of enamel, which have been deſcribed in the courſe of theſe experiments, and which may be all applied, with more or leſs advantage, to kitchen utenſils, the leaſt expenſive are n^os 1, 2, and 5.; but they are alſo thoſe which require the greateſt heat. On the other hand, n° 9 may be recommended as the moſt eaſy of fuſion, and, at the ſame time, very durable when uſed for coating veſſels in which victuals are to be dreſſed, which is here the principal object, and is of far greater importance than the brilliant appearance reſulting from the enamel generally uſed by artiſts, which however may be employed when the ſaving of expence is not regarded.

The enamels hitherto deſcribed are not applicable to veſſels made of iron, though they may be employed to cover copper with great advantage. Iron will not indeed bear the common practice of enamellers, namely, to be put into the fire and taken out again ſeveral times; for the ſparks which fly from iron, when in a hot fire, detach and carry off the enamel from the parts contiguous to thoſe where the ſparks are formed. The acids, too, of the gypſum and fluor ſpar, made uſe of in the enamels already mentioned, acted upon the iron during the fuſion of the enamel, from which reſulted bubbles and bare ſpots, which entirely ſpoiled the appearance of the work. Our author therefore continued his experiments with a view to diſcover a proper enamel for veſſels made of this metal.

10. He reduced into a very fine powder, and ground together

(A) This ſubſtance is itſelf a mixture, being compoſed of four parts of lead and one of tin.

together, nine parts of minium (red oxyd of lead), six parts of flint glass, two parts of pure potash, two parts of purified nitre, and one part of borax. This mixture was put into a large crucible, which it only half filled; he covered the crucible so that no coals could fall into it, and gradually increased the fire under it. When the effervescence had entirely ceased, he caused the mixture to melt, by using the bellows for four or five minutes; by these means he obtained a clear and compact glass, which he poured out of the crucible upon a piece of marble. Having quenched it in water, and reduced it to a very fine powder in a glass mortar, he ground it with water to the consistence of a very thin paste. He then covered an iron vessel with it on both sides, which, after having dried and heated it by degrees, he put under a muffle well heated in an assaying furnace. The enamel melted very readily in the space of half a minute, and with a very brilliant appearance. He immediately withdrew the vessel, and let it cool. It was found to be entirely coated with a beautiful enamel of a black colour; which colour appeared to be caused by a thin layer of calcined iron, which might be seen through the transparency of the enamel.

A copper vessel, having been covered with the same enamel, the fine colour of the copper was visible through the thin coat of glass; and it was as well defended from rust by this coating as it would have been by an enamel of a stronger kind.

11. To hinder the colour of the metal from being seen through the coating, he added to the mixture, used in the preceding experiment, only one hundredth part of the calx of cobalt described in n° 9. The whole was melted into a beautiful blue glass; it was prepared for enamelling, and applied, in the manner before described, upon another iron vessel. The enamel proved to be smooth, thick and brilliant, like the preceding, but it covered the vessel more perfectly; it was of a fine blue colour, with some black spots in those parts where it had been most thinly applied.

12. The glass of n° 10. reduced into powder, and ground with potters white lead, of which mention has already been made, melted with the same facility; it produced a very smooth enamel, of a grey colour, but more firm and hard than the former, and, on account of the addition made to it, of a still less price. By mixing with the same glass a small quantity of crocus martis, he obtained a very fine enamel, of a dark red colour, not to mention other colours in it still more beautiful. The crocus martis he used in this experiment was prepared from a solution of iron in aqua regia (nitro-muriatic acid), which was evaporated to dryness, and the matter thus edulcorated and calcined.

13. In order to render the forementioned enamel more solid, and to give it what is called *body*, he melted together a mixture of twelve parts of flint glass, eighteen parts of minium, four parts of potash, four parts of nitre, two parts of borax, three parts of calx of tin, and one eighth part of calx of cobalt, observing always the usual precautions. He obtained a glass of a light blue colour, which, after having been ground with water, and spread upon small iron basins, or tea cups, produced, by means of a brisk fire in an assaying furnace, an enamel which was smooth and even, and of a pearl colour. The coating was of a proper thickness, to obtain which requires a certain degree of dexterity and practice. He also tried to paint upon this enamel with what is called *mineral purple (purpura mineralis)*, which he used with a little powdered quartz, nitre, and borax. It produced a very beautiful red colour.

Though this last mentioned composition is more beautiful when applied upon iron, and more even than the preceding, it has the disadvantage, on account of the salts which it contains, of not resisting the action of the stronger vegetable acids, and still less that of the mineral ones. But as a vessel when coated with this enamel bears, without any injury, sudden changes of heat and cold, and also to have any greasy mixtures baked or boiled in it, (even those which are of a caustic alkaline nature, or those which contain the usual weak acids which are used in the preparation of our food), it may be applied to vessels of various kinds, among others to tea cups; particularly as it is neither brittle nor subject to crack, provided it is not exposed to violent blows. It is hardly necessary to say, that this enamel can only be applied upon vessels made of hammered iron, and not upon those of cast iron, these last being always too thick to be heated with sufficient quickness: for the greater is the space of time necessary to make the vessels red hot, the greater is the quantity of scales formed upon them, and, of course, the enamel becomes more injured.

Our author makes some other judicious observations on the enamel for iron, of which he has described the composition, and says, that, independent of its use for coating kitchen utensils, it might be made to serve many other purposes, such as preserving things made of that metal, not only from rust, but also, as he proved by experiment, to a certain degree, from calcination.

ENCAUSTIC Painting. See Painting in this *Supplement*.

ENDEAVOUR *Straits*, are between the N. point of New-Holland, and the S. coast of New-Guinea. S. lat. 10. E. long. from Paris 140.—*Morse*.

ENFIELD (William, L. L. D.), well known in the learned world by several useful and elegant publications, was born at Sudbury, on March 29, O. S. 1741, of parents in a humble walk of life, but of very respectable characters. His amiable disposition and promising talents early recommended him to the Rev. Mr Hextall, the dissenting minister of that place, who took great care of his education, and infused into his young mind that taste for elegance in composition which ever afterwards distinguished him.

In his 17th year he was sent to the academy at Daventry, then under the direction of the Rev. Dr Ashworth, where he passed through the usual course of instruction preparatory to the office of the ministry; and with such success did he cultivate the talents of a preacher, and of an amiable man in society, that, on leaving the academy, he was at once chosen, in 1763, minister of the very respectable congregation of Benn's Garden in Liverpool.

In that agreeable town he passed seven of the happiest years of his life, very generally beloved and esteemed. He married, in 1767, the daughter of Mr Holland draper in Liverpool, with whom he passed all the rest of his days in most cordial union. His literary reputation was extended, during his residence in this place, by the publication of two volumes of sermons, which were very well received, and have ſerved to grace many pulpits beſides that in which they were originally preached. A collection of hymns and of family prayers, which he alſo publiſhed at Liverpool, did credit to his taſte and judgment.

About 1770, he was invited to take a ſhare in the conduct of the academy at Warrington, and alſo to occupy the place of miniſter to the diſſenting congregation there, both vacant by the death of the Rev. Mr Seddon. His acceptance of this honourable invitation was a ſource of a variety of mixed ſenſations and events to him, of which anxiety and vexation compoſed too large a ſhare for his happineſs. No aſſiduity on his part was wanting in the performance of his various duties; but the diſeaſes of the inſtitution were radical and incurable; and perhaps his gentleneſs of temper was ill adapted to contend with the difficulties, in matter of diſcipline, which ſeem entailed on all diſſenting academies, and which, in that ſituation, fell upon him, as the domeſtic reſident, with peculiar weight. He always, however, poſſeſſed the reſpect and affection of the beſt diſpoſed of the ſtudents; and there was no reaſon to ſuppoſe that any other perſon, in his place, could have prevented that diſſolution which the academy underwent in 1783.

During the period of his engagement there, his indefatigable induſtry was exerted in the compoſition of a number of works, moſtly, indeed, of the claſs of uſeful compilations, but containing valuable diſplays of his powers of thinking and writing. The moſt conſiderable was his "Inſtitutes of Natural Philoſophy" (quarto, Johnſon, 1783;) a clear and well-arranged compendium of the leading principles, theoretical and experimental, of the ſciences compriſed under that head. And it may be mentioned, as an extraordinary proof of his diligence and power of comprehenſion, that, on a vacancy in the mathematical department of the academy, which the ſtate of the inſtitution rendered it impoſſible to ſupply by a new tutor, he prepared himſelf, at a ſhort warning, to fill it up; and did fill it with credit and utility, though this abſtruſe branch of ſcience had never before been a particular object of his ſtudy. He continued at Warrington two years after the academy had broken up, taking a few private pupils.

In 1785, receiving an invitation from the principal diſſenting congregation at Norwich, he accepted it, and firſt fixed his reſidence at Thorpe, a pleaſing village near the city, where he purſued his plan of taking a limited number of pupils to board in his houſe. He afterwards removed to Norwich itſelf; and, at length, fatigued with the long cares of education, entirely ceaſed to receive boarders, and only gave private inſtructions to two or three ſelect pupils a few hours in the morning. This too he at laſt diſcontinued, and devoted himſelf ſolely to the duties of his congregation, and the retired and independent occupations of literature. Yet, in a private way and ſmall circle, few men had been more ſucceſsful in education, of which many ſtriking examples might be mentioned, and none more ſo than the members of his own family. Never, indeed, was a father more deſervedly happy in his children; but the eldeſt, whom he had trained with uncommon care, and who had already, when juſt of age, advanced in his profeſſional career ſo far as to be choſen town-clerk of Nottingham, was moſt unfortunately ſnatched away by a fever a few years ſince.

This fatal event produced effects on the doctor's health which alarmed his friends. The ſymptoms were thoſe of *angina pectoris*, and they continued till the uſual ſerenity of his mind was reſtored by time and employment. Some of the laſt years of his life were the moſt comfortable: employed only in occupations which were agreeable to him, and which left him maſter of his own time; witneſſing the happy ſettlement of two of his daughters; contracted in his living within the domeſtic privacy which he loved; and connected with ſome of the moſt agreeable literary companions, and with a ſet of the moſt cordial and kind-hearted friends that perhaps this iſland affords, he ſeemed fully to enjoy life as it flowed, and indulged himſelf in pleaſing proſpects for futurity. Alas! an unſuſpected and incurable diſeaſe was preparing a ſad and ſudden change: a ſchirrous contraction of the rectum, the ſymptoms of which were miſtaken by himſelf for a common laxity of the bowels, brought on a total ſtoppage, which, after a week's ſtruggle, ended in death. Its gradual approach gave him an opportunity to diſplay all the tenderneſs, and more than the uſual firmneſs, of his nature. He died November 3, 1797, amidſt the kind offices of mourning friends, and his laſt hours were peace!

Beſides the literary performances already mentioned, Dr Enfield completed, in 1791, the laborious taſk of an abridgment of "Brucker's Hiſtory of Philoſophy," which he compriſed in two volumes quarto. It may be truly ſaid, that the tenets of philoſophy and the lives of its profeſſors were never before diſplayed in ſo pleaſing a form, and with ſuch clearneſs and elegance of language. Indeed it was his peculiar excellence to arrange and expreſs other mens ideas to the utmoſt advantage. Perhaps, at the time of his deceaſe, there was not in England a more perfect maſter of what is called the middle ſtyle in writing, combining the qualities of eaſe, elegance, perſpicuity, and correctneſs, entirely free from affectation and ſingularity, and fitted for any ſubject. If his caſt of thought was not original, yet it was free, enlarged, and manly. What he was in the capacity of a teacher of religion, his ſeveral congregations will teſtify with grateful and affectionate rememberance. Few miniſters have paid ſuch unremitting attention to the perfection of their pulpit compoſitions; nor was it only by detached diſcourſes that he inculcated the truths of morality and religion, but by methodical plans of inſtruction, drawn up with great care and comprehenſion. The valuable ſtores of this kind which he left behind him, will not be conſigned to oblivion; but, it is hoped, will inform and improve numbers to whom the voice of the preacher could never have extended. In delivery, his manner was grave and impreſſive, depending rather on the weight of juſt enunciation than on the arts of oratory. Little need be added to this ſketch of the moral qualities of the excellent man above commemorated. If moderation, compliancy, and gentleneſs were ever prevalent in him to a degree of exceſs, who that knew him will blame an exceſs which opened his ſoul to every emotion and office of affection and friendſhip?

This account of Dr Enfield, which is taken from the *Monthly Magazine*, is acknowledged by its author to be the effuſion of friendſhip; but we believe that the panegyric, though high, is in general just. It is our duty, however, to warn our readers against placing implicit confidence in the Doctor's representation of ancient philosophy; for though we have frequently found him correct, and have therefore quoted him with approbation ourselves, we have likewise found him sometimes mistaking the sense of his authors. In a work like his, mistakes were indeed unavoidable; for when he resolved to compress the substance of Brucker's five volumes within the compass of two, he could not avoid sometimes giving what he thought the *sense* of the ancients, when accuracy required their very *words* to be given. This we believe to be the source of those errors in his elegant history, which we have heard others unjustly attribute to design; for had it been his *design* to deceive, he would not surely have stored his margin with references to enable every reader to detect the deceit.

Enfield, a township in Hartford co. Connecticut, on the E. bank of Connecticut river, opposite to Suffield, and bounded on the N. by the Massachusetts line: it was granted by the court of Massachusetts, to Springfield, in 1648, and was settled in 1681. In 1769 it contained 214 English families. In the town are two Congregational churches, and a meeting-house for Shakers. The compact part of the town, contiguous to the river, is very pleasant. It is 16 or 18 miles N. of Hartford.—*Morse.*

Enfield, a township in Grafton co. New-Hampshire, about 11 miles S. E. of Dartmouth College. It was incorporated in 1761, and has 724 inhabitants, chiefly farmers.—*ib.*

ENGANNO, Trompeur, or *False Cape*, is the easternmost land of the island of St. Domingo, 5½ leagues northerly of Pointe de l'Epee, and 22 S. E. of Cape Raphael, or Round Mountain. N. lat. 19. 3. W. long. from Paris 71. 25—*ib.*

ENGINEER is the appellation of him whose profession it is to contrive or make any kind of useful engine or machine. He is denominated either a civil or military engineer, according as the objects of his profession respect civil or military purposes. See Fortification, *Encycl.* and Machine in this *Supplement.*

ENGLISH *Harbor*, one of the best harbors in the island of Antigua, on the S shore, a mile S. E. of the mouth of Falmouth harbor. It it well fortified, and has a royal navy yard and arsenal, with conveniences for careening ships of war. N. lat. 17. 8. 25. W. long. 61. 27. 30.—*Morse.*

English Neighbourhood, a village in Bergen co. New-Jersey, on a N. E. branch of Hackinsack river, W. of, and in the vicinity of Fort Lee.—*ib.*

Englishtown, in New-Jersey, a small village in the N. western part of Monmouth co. on the road from Princetown to Shrewsbury, 21 miles from the former, 6 W. of Monmouth court-house, and 18 E. of Princeton.—*ib.*

ENGONASIS, in astronomy, the same as Hercules, one of the northern constellations.

ENGRAFTING. See Grafting, *Encycl.* where it is said that there is little hope of producing mixed fruits by engrafting one tree upon another of the same class. We confess ourselves to be unwilling to relinquish this opinion; but it would be very unfair to withhold from the public any fact which seems to militate against it, and has come to our knowledge. We shall therefore transcribe from the *Philosophical Magazine* the following communication from Dr Thornton, lecturer on medical botany at Guy's Hospital, respecting a supposed *Lusus naturæ*, which he considers as the consequence of engrafting.

In the first volume of the *Philosophical Transactions*, No XXIX. published November 1667, you have the following communication, intitled,

"Some Hortulan Experiments about the engrafting of Oranges and Lemons or Citrons, whereby is produced an individual Fruit, half Orange and half Lemon, growing together as one Body upon the same Tree."

We have here orange trees (saith the intelligence from Florence) that bear a fruit which is citron on one side and orange on the other. They have been brought hither out of other countries, and they are now much propagated by engrafting. This was confirmed to us (says the editor of the Transactions of the royal Society) by a very ingenious English gentleman, who asserted, that himself not only had seen, but bought of them, anno 1660, in Paris, whither they had been sent by Genoa merchants; and that on some trees he had found an orange on one branch and a lemon on another branch (which is not so remarkable as what follows); as also, one of the same fruit, half orange and half lemon; and sometimes three quarters of one, and a quarter of the other.

In the third part of the Reports of the Board of Agriculture, among the foreign communications, we see, with equal pleasure and astonishment, an account of the American apple, which, by a peculiar mode of budding (A), is half sweet an half sour, half white and half red, without the least confusion of the respective halves.

At Mr Mason's, florist, Fleet-street, opposite the Bolt and Tun, there is a production now, September 1798, to be seen half peach and half nectarine. It has all the softness and yellow down of the peach, and the sleek red smoothness of the nectarine; supposed to be a *lusus naturæ*, but probably is rather the sportings of art than of nature, and which perhaps will be the cause why we shall in future see many other such vegetable wonders, which, as we see, were known to our ancestors.

ENNEADECATERIS, in chronology, a cycle or period of 19 solar years, being the same as the golden number and lunar cycle, or cycle of the moon.

ENO, a river in N. Carolina, which unites with Little and Flat rivers in Orange co. and forms the Neus, about 17 miles below Hillsborough.—*Morse.*

ENOREE, a N. W. branch of Broad river in S. Carolina. It separates Pinckney and Ninety-Six districts, and joins Broad river about 5 miles below Tyger river.—*ib.*

ENSETE. See Musa, *Encycl.*

EOLIPILE. See Æolipile, *Encycl.*

EPAULE,

(A) The manner in which the extraordinary nectarine peach first produced in this country was effected, was by inserting the bud of one fruit upon the stock bearing a different sort.

EPAULE, or Espaule, in fortification, the ſhoulder of the baſtion, or the angle made by the face and flank, otherwiſe called the angle of the epaule.

EPHRATA, or *Dunkard Town*, a village in Lancaſter co. Pennſylvania, ſituated on the N. W. ſide of Calico creek, which, joining the Coneſtoga, falls into the Suſquehanna. It lies 12 miles N. of the town of Lancaſter, and upwards of 60 W. of Philadelphia. It is ſituated in a romantic and ſequeſtered vale, and poſſeſſed by a religious community called *Tunkers*, who are moſtly of German deſcent, and believe in general redemption. They uſe great plainneſs of dreſs and language, and will neither ſwear, nor fight, nor go to law, nor take intereſt for the money they lend. They have many peculiarities; but their innocent manners have acquired them the name of the harmleſs Tunkers. This ſettlement is ſometimes called Tunker's Town, and conſiſts of about 40 buildings; of which 3 are places of worſhip. They ſubſiſt by cultivating their lands, by attending a printing-office, a griſt-mill, a paper-mill, an oil-mill, &c. and the ſiſters by ſpinning, weaving, ſewing, &c. Beſides this congregation at Ephrata, there were in 1770, 14 others of this ſect in various parts of Pennſylvania, and ſome in Maryland. The whole, excluſive of thoſe in Maryland, amounted to upwards of 2000 ſouls.—*Morſe*.

EPISCOPACY is a ſubject of which, in our own opinion, enough has been ſaid in the *Encyclopædia*. We are requeſted however to inſert in this place an argument additional to n° 17. of that article; and we comply with the requeſt the more readily that we find the argument, which has been ſuggeſted to us, in that very work of Dr Berkeley's which we were permitted to abridge even before our amiable friend had publiſhed it himſelf. The argument indeed is not new. It was, we believe, *firſt* uſed by Dr Wells in ſome controverſial letters againſt the Engliſh diſſenters, which were publiſhed early in the current century. Dr Berkeley adopted it from Dr Wells; and other doctors have taken it from Dr Berkeley. It is as follows:

That the apoſtles eſtabliſhed *two* orders of miniſters in the Chriſtian church is admitted by all who contend not for the equal and common rights of Chriſtians; and that the perſons occupying the higher order, by whatever title they were known, or however limited may have been the juriſdiction of each, poſſeſſed authority as well to ordain others as to preach the goſpel and adminiſter the ſacraments, is the very point on which the advocates for the divine right of preſbytery inſiſt. At the reformation, however, and for 1400 years before, there was an intermediate order of miniſters between theſe two, known by the name of prieſts or preſbyters, *authoriſed* indeed to preach the goſpel and to adminiſter its ſacraments, but *not* authoriſed to ſend labourers of any kind into Chriſt's vineyard. This *intermediate* order therefore being, by the ſuppoſition, diſtinct from the two *apoſtolical* orders of miniſters, muſt have been, at whatever period it was introduced into the church, an order of *human* invention; but it is from this order of miniſters that the clergy of thoſe churches, which are not Epiſcopal, derive all their authority to miniſter in holy things. The conſequence is obvious.

Scotch Episcopalians are a ſociety of Chriſtians certainly as reſpectable, if not ſo numerous, as any other in the kingdom which diſſents from the worſhip and diſcipline of the eſtabliſhed church. For many years, however, the public worſhip of that ſociety was proſcribed by the legiſlature; and there is reaſon to ſuſpect that its real principles are not yet univerſally underſtood. If this be ſo, it ſurely becomes the editors of a work in which ſome account is given of almoſt every denomination of Chriſtians down to the novel ſect which ſtiles its members Bereans, to do juſtice to the venerable remains of what was once the eſtabliſhed church of their native country.

1
Eſtabliſhment of Epiſcopacy in Scotland.

That the reformation from popery was in Scotland tumultuous and irregular, is known to all Europe: and very few of our readers can be ignorant that there was neither order in the reformed church, nor decency in her worſhip till James VI. with much addreſs, accompliſhed the eſtabliſhment of a very moderate epiſcopacy. To this form of church government the better part of the nation was ſufficiently attached; and it continued to be the eccleſiaſtical polity, ſupported by the ſtate, till the grand rebellion, when it was overthrown by the partizans of the *national covenant*. It was reſtored, however in 1662; and again aboliſhed in 1689 by that convention which placed the Prince and Princeſs of Orange on the ancient throne of the Scottiſh monarchs.

2
No liturgy uſed in the Scotch church,

Theſe events are ſo univerſally known, that it is ſufficient in this place barely to mention them; but there are probably many of our readers who do not know, that, during the whole period of her legal eſtabliſhment, the Scotch epiſcopal church had no public liturgy. It appears indeed, that the firſt reformers made uſe of the Engliſh book of common prayer; and there is on record ſufficient evidence that John Knox himſelf, though he diſapproved of ſome things in that book, had no objection either to ſtated forms of prayer in general, or to a ſubordination among the miniſters of the goſpel; but his ſucceſſor Andrew Melvil, who poſſeſſed neither his learning nor his worth, had influence enough to introduce into the church a perfect parity of miniſters, and to excite among the people a very general abhorrence of liturgical worſhip. So rooted indeed was that abhorrence, that, as every one knows, an attempt to introduce into the church of Scotland a book of common prayer, copied with ſome alterations from that of England, produced the *ſolemn league and covenant*, which involved in one common ruin the unfortunate Charles and his darling Epiſcopacy. At the reſtoration of the monarchy, the Epiſcopal conſtitution of the church was reſtored, but no new attempt was made to eſtabliſh the uſe of a public liturgy, and except at the ordinations of the clergy, when the Engliſh forms were uſed, no ſervice book was ſeen in a Scottiſh church.

3
Except at ordinations.

For ſome years after Epiſcopacy had ceaſed to be the religion of the ſtate, the deprived clergy made no alteration in their modes of ſocial worſhip. Having refuſed to transfer to King William that allegiance which they had ſworn to King James, they were treated, during his reign with ſuch ſeverity, that on the Lord's day they durſt not venture further than to officiate "in their own hired houſes, where they received ſuch friends as choſe to come in unto them;" and in thoſe ſmall congregations, if congregations they may be called, they continued to pray, if not extempore, at leaſt without book, till the acceſſion of Anne to the throne of her anceſtors. The attachment of that Princeſs, not only to the conſtitution, but alſo to the worſhip of the church of England, was well known to them; and they very reasonably thought that they could not more effectually recommend themselves to her protection than by adopting the use of the English liturgy, which the most enlightened among them had long professed to admire. It was accordingly introduced by degrees into Scotland; and an act of parliament being passed on the 3d of March 1712, "to prevent the disturbing of those of the Episcopal communion in that part of Great Britain called Scotland, in the exercise of their religious worship, and in the use of the liturgy of the church of England," that liturgy was universally adopted by the Scotch Episcopalians; and public chapels, which had hitherto been prohibited, were everywhere built, and well frequented.

4 Introduction of the English liturgy.

That those who had refused allegiance to King William and Queen Anne should scruple to pay it to a new family, clogged as it was by so many oaths, can excite no wonder; nor, is it at all wonderful, that, for their attachment to the abdicated family, the public worship of the Scotch Episcopalians was, after the insurrection of 1715 and 1716, laid under some restraints. These, however, were neither rigorously severe, nor of long duration; and by the year 1720, their congregations were as numerous as formerly, consisting, especially in the northern counties, of men of all ranks, even such as held offices of trust under the established government, who frequented the Episcopal chapels in preference to the parish churches.

Hitherto the Episcopalians had been safely conducted through all dangers and difficulties by the prudence of Dr Rose, the deprived bishop of Edinburgh; but soon after his death, which happened on the 20th of March, 1720, divisions broke out among them, which threatened to prove more fatal to their church than any persecution to which they had yet been subjected. For reasons which will be seen afterwards, it is proper to trace those divisions from their source.

5 Sources of division among the Scotch Episcopalians.

No native of Britain, who knows any thing of the history of his country, can be ignorant, that Dr Sancroft, the archbishop of Canterbury, and five other bishops, were at the Revolution deprived of their sees by an act of parliament; because, like the Scotch bishops, they could not bring themselves to transfer to King William and Queen Mary that allegiance which they had so lately sworn to King James. As those prelates were extremely popular for the vigorous opposition which they had given to some of the Popish projects of the late king, and as a number of inferior clergymen, of great eminence for piety and learning, were involved in the same fate with them; it need not excite great surprise, that a sweeping deprivation, which, in all its circumstances, was perhaps without a precedent in ecclesiastical history, produced a schism in the church of England. The deprived clergy, considering the bishops who were placed in the sees thus vacated as intruders, and all who adhered to them as schismatics, opened separate chapels under the authority of the primate and his nonjuring suffragans; and contended, that they and their adherents constituted the only orthodox and catholic branch of the church in England.

Both churches, however, made use of the same liturgy: and during the lives of the deprived prelates, there was no other apparent difference in their worship than what necessarily resulted from their paying allegiance to different sovereigns. But this uniformity was not of long duration. The bishops, who had been possessed of sees before the Revolution, were scarcely dead, when their successors, being under no civil restraint, found, in the principles which they had brought with them from the establishment, the means, not only of dividing their own little church, but likewise of sowing the seeds of dissension among their brethren in Scotland.

It has been observed elsewhere*, that in the church of England there are three opinions respecting the nature and end of the Lord's Supper, which, in opposition to each other, have been all patronised by men of great eminence for theological learning. It appears, indeed, from the first liturgy set forth by authority in the reign of King Edward VI. that the reformers of that church, from the errors of popery unanimously held the Lord's Supper to be a eucharistical sacrifice; and this opinion, which has been adopted by great numbers in every age since, seems to have been the most prevalent of the three among those clergy who were deprived of their livings at the Revolution. It is indeed countenanced by several passages in the present order for the administration of the Lord's Supper; and therefore, though there are other things in that order which cannot be easily reconciled to it, archbishop Sancroft, and his suffragans, whatever their own opinions might be, chose not to widen the breach between themselves and the establishment, by deviating in the smallest degree from the form in which they had been accustomed to celebrate that sacrament. Their successors, however, in office, were men of different dispositions. Considering themselves as totally unconnected with the state, and no longer bound by the act of uniformity, one party, at the head of which was bishop Collier, the celebrated ecclesiastical historian (A), judged it proper to make such alterations in the communion office as might render it more suitable to their own notions of the Lord's Supper, and bring it nearer, both in matter and form, to the most ancient liturgies of the Christian church.

* Supper of the Lord, *Encycl.*

Of the proposed alterations, some were perhaps proper in their circumstances; whilst others, to say the best of them, were certainly needless, if not inexpedient. They were accordingly *all* opposed by another powerful party of nonjurors; and the questions in dispute were referred, first to Dr Rose, the deprived bishop of Edinburgh, and afterwards to Dr Atterbury and Dr Potter, the bishops of Rochester and Oxford. What judgment the two English prelates gave in this controversy we know not; but that of bishop Rose did him much honour. Declining the office of umpire between the parties, he recommended mutual forbearance and occasional communion with each other, according to either form; and employed a gentleman, well versed in ecclesiastical literature, to prove that such a compliance of bishops with each other's innocent prejudices was not uncommon in the purest times.

These

(A) This very learned, though violent man, of whom the reader will find some account in the *Encyclopædia*, was, with Dr Hickes and others, consecrated by the deprived prelates, for the purpose of preserving the Episcopal succession in what they considered as the true church of England.

These disputes among the English nonjurors, and the appeal which was made to Dr Rose, drew, more closely than hitherto it had been drawn, the attention of the Scotch Episcopal clergy, not only to their own liturgy, which had been authorised by King Charles I. but likewise to the most ancient liturgies extant, as well as to what the fathers of the first three centuries have taught concerning the nature of the Lord's Supper. The consequence was, that such of them as were scholars soon discovered, that the Scotch communion office approached much nearer to the most ancient offices than the English; and a powerful party was formed for reviving the use of it in Scotland.

Had those men aimed at nothing farther, it is probable they would have met with very little opposition. Their opponents, who, in general, were less learned than they, were so strongly attached to the house of Stuart, that they would have adopted almost any thing sanctioned by the royal martyr's authority; but the advocates for the Scotch office knew not where to stop. They wished to introduce some other usages of the primitive church, such as the commemoration of the faithful departed, and the mixture of the eucharistic cup (See *Supper of the Lord*, n° 2. and 3. *Encycl.*); and their brethren, perceiving no authority from Charles I. for these things, and being accustomed to consider them as Popish practises, a violent controversy was ready to burst forth about what every enlightened mind must consider as matters of very little importance.

6 Revival of ancient usages.

That the eucharistic cup was in the primitive church mixed with a little water, is a fact incontrovertible; that the practice was harmless and decent, it is wonderful that any man should deny; but that such a mixture is *essential* to the sacrament, we cannot believe, for the reasons assigned in the article referred to; and therefore it ought surely to have been no object of contention.

That the faithful departed were commemorated in the primitive church long before the invention of purgatory, is known to every scholar; that in those days such a commemoration tended to invigorate the faith and the charity of Christians, it would, in our opinion, be very easy to prove; and that at present every Christian prays in private for his deceased friends, we have proved elsewhere by arguments, of the confutation of which we are under no apprehension (See *Greek-church* in this *Supplement*): but we see not the *necessity* of introducing such prayers into public worship at any period; and we perceive impropriety in doing it at a period when, from various circumstances, they may cause weak brethren to err. But those who pleaded for the revival of this practice in the beginning of the current century, were blinded by their very erudition (B); and those who opposed it seem not to have been acquainted with the workings of a benevolent and devout mind, or indeed to have known in what the essence of a prayer consists.

The ancient usages, however, were not the only subjects which, on the death of bishop Rose, furnished matter for controversy among the Scotch Episcopalians. That excellent prelate, together with the deprived archbishop of Glasgow, and the deprived bishop of Dunblain, had, from time to time, as they saw occasion, raised to the Episcopal dignity some of the most deserving Presbyters of the church; but it was resolved, for what reason we do not very well know, that none of the new bishops should be appointed to vacant dioceses during the life of any one prelate who had possessed a legal establishment; so that bishop Rose, who survived all his brethren, was for several years the ecclesiastical governor of the whole Episcopal church in Scotland. On his death, therefore, though there were four bishops in Scotland, and two Scotch bishops residing in London, there was not one of those prelates who could claim to himself the authority of a diocesan over any portion of the Catholick church. This they at first unanimously

(B) Paradoxical as this assertion may at first sight appear, nothing is more certain than that erudition, and even science, if *partially* cultivated, is as likely to blind as to enlighten the understanding. When a man devotes all his time, and all his attention, to *one* pursuit, he contracts such a fondness for it, as gradually to consider it as the *only* valuable pursuit, which will infallibly lead to truth, and to nothing but truth; and in this disposition of mind, he is ready to embrace the most extravagant absurdity to which it may conduct him. Of this the reader will find one very striking instance in page 628 vol. I. of this Suppl. where the celebrated Euler appears so devoted to his darling analysis, as to place implicit confidence in it, even when he himself seems sensible that it had led him to a conclusion contrary to common sense, and the nature of things. That Dr Bentley was a very eminent philologist, is universally known; that his emendatory criticisms on the Classics are often happy, no man will deny; and yet, misled by his favourite pursuits, he never pronounces more dogmatically than when the dogma which he utters is untenable. We appeal to his criticisms on Milton. Perhaps there is not a man alive who will refuse to Dr Waburton the praise of learning and ingenuity. The address with which he detects the double doctrines of the ancient philosophers, is sometimes almost astonishing; yet, misled by his own ardour in this pursuit, he discovers hidden meanings everywhere, and has found a rational system of religion in some of the ancient mysteries, where there is every reason to believe that nothing in reality was to be found but atheism and vice. Just so it is with the ardent reader of the Christian fathers. If he devote all his time to the study of their writings, he not only becomes enamoured of his employment, but acquires gradually such a veneration for the character of his masters (and venerable they undoubtedly are) as renders him afraid to question any thing which they advance, and unable to distinguish between their testimony, which is deserving of all credit, and their reasonings, which are often inconclusive. We trust it is needless to disclaim any wish to discourage, by this note, the study either of the Christian fathers, the Greek philosophers, philological criticism, or the modern analysis; we only wish to dissuade men of letters from devoting their whole time to any *one* pursuit whatever; for they may depend upon it, that such *partial* studies contract the mind. One of the most eminent mathematicians at present in England is reported to have declared his contempt of *the Paradise Lost*, because he found in it nothing *demonstrated!*

Episcopacy. nimously acknowledged; and one of them, in the name of himself and his brethren, recommended to the clergy of the diocese of Edinburgh to elect, after the primitive plan, a successor to their late venerable diocesan. The advice was followed; the election was made, and approved by the bishops: and Dr Fullarton, the bishop chosen, became bishop of Edinburgh, by the same means and the same authority as, in the primitive church, St Cyprian became bishop of Carthage, or Cornelius bishop of Rome.

The clergy in other districts, following the example of those in Edinburgh, diocesan Episcopacy was about to be revived throughout all Scotland upon principles purely ecclesiastical, when some of the bishops, whom Dr Rose had left behind him merely for preserving the Episcopal succession, conceived a new and very extraordinary constitution for the Scotch Episcopal church.

7 College of bishops. Whether they were envious of their colleagues, and offended that none of the elections had fallen upon them; whether they were so ignorant as not to know that diocesan Episcopacy had subsisted long before the conversion of the Roman empire, in absolute independence on the state; or that they were actuated, as there is reason to suspect, by some political principle which they could not with safety avow;—so it was, that they opposed diocesan Episcopacy of every kind, and proposed to govern the whole Scotch church by a college of bishops. Against this unprecedented scheme the more learned bishops opposed all their influence; and being exceedingly disagreeable to the inferior clergy, it was very soon abandoned by its authors themselves, who, after some acrimonious controversy, were glad to come to an agreement with their diocesan brethren.

8 Those divisions healed. Of this agreement, or *concordate* as it was called, the following were the principal articles: 1. "That the Scotch or English liturgy, and no other, might be indifferently used in the public service; and that the peace of the church should not be disturbed by the introduction of any of the ancient usages which had lately excited such dissensions. 2. That no man should thenceforward be consecrated a bishop of the Scotch church without the consent and approbation of the majority of the bishops. 3. That the bishops, by a majority of voices, should choose one of their number to preside in the meetings of his brethren, and to convocate such meetings when he judged them necessary: that this president should be styled *Primus Episcopus*, or more shortly *Primus*; but that he should not possess metropolitical power, or claim any kind of jurisdiction without the bounds of his own diocese or district. 4. That upon the vacancy of any diocese or district, the presbyters should neither elect, nor submit to, another bishop, without receiving a mandate by the Primus, issued with the consent of the majority of his colleagues."

This concordate was in 1731-2 subscribed by all the bishops then in Scotland, who immediately became diocesans, and thought no more of the college system. It was afterwards, with a few additions, for ascertaining more precisely the prerogatives of the Primus; for regulating the conduct of synods; for exempting bishops from the jurisdiction of other bishops, in whose districts they might chance to reside; and for preventing inferior clergymen from deserting their congregations, or removing from one district to another, without the consent of the bishops of both—thrown into the form of canons; and these canons have continued to be the code of the Scotch Episcopal church down to the present day. Episcopacy.

9 Political opinions. The members, and more especially the clergymen of this church, had always been considered as unduly attached to the family of Stuart; and though there was undoubtedly at first some ground for that suspicion, the writer of this article knows, from the most incontrovertible evidence, that it was continued too long, and carried by much too far. Jacobitism was imputed to the society as its distinguishing tenet; but the members of that society have at all times contended, that their distinguishing tenets were the apostolical institution of Episcopacy, and in the exercise of those powers which are purely spiritual, the independency of the church upon the state. In politics, indeed, they have unanimously maintained, that the only ruler of princes or *legislatures* is God, and not the people. They are, of course, no friends to the fashionable doctrine of resistance, which they believe to be not only condemned in express terms by Christ and two of his apostles, but to be also the source of that anarchical tyranny which is at present deluging Europe with blood. They consider a limited monarchy, like that of Britain, as the most perfect form of civil government which the world has ever seen; an hereditary monarchy is infinitely preferable to one that is elective; and with respect to the title of the monarch, when they take a retrospective view of the origin of all civil governments, they cannot but look upon a permanent and unquestioned establishment as an indication of the plan and determination of Providence furnishing the best right to a crown which any modern sovereign can claim.

10 Persecution. Surely these are harmless opinions; and yet the worship of those who held them was, in 1746 and 1748, laid under such restraints as were calculated to produce disaffection where it did not previously exist. Two laws were then enacted against the Scotch Episcopalians; which, under the pretence of eradicating their attachment to the house of Stuart, were so contrived as to preclude such of their clergy as were willing to pay allegiance to the reigning sovereign, and to pray for the royal family by name, from reaping the smallest benefit from their loyalty. The experiment was tried by some of them; of whom one venerable person, who was never suspected of undue attachment to the house of Stuart, is still alive; but he, and his complying brethren, had their chapels burnt, and were themselves imprisoned, as if they had been the most incorrigible Jacobites. This was a kind of persecution which, since the Reformation, has had no precedent in the annals of Britain. A priest of the church of Rome, by renouncing the errors of Popery, has at all times been qualified to hold a living in England; a dissenting minister, of whatever denomination, might at any time be admitted into orders, and rise to the highest dignities of the English church;—but while the laws of 1746 and 1748 remained in force, there was nothing in the power of a Scotch Episcopal clergyman to do from which he could reap the smallest benefit. By taking the oaths to government, he was not qualified to hold a living in England, or even to enjoy a toleration in Scotland; and his clerical character being acknowledged by the English bishops, he could not by those prelates be canonically reordained.

Upon

Upon the clergy, however, thoſe laws of uncommon rigour were not long rigorouſly executed. After a few years, the burning of chapels, and the impriſoning of miniſters, were occurrences far from frequent; but the laws to which we allude affected likewiſe the political privileges of ſuch laymen as frequented the Epiſcopal chapels; and in that part of their operation, thoſe laws were never relaxed till 1792, when they were wholly repealed, and the Epiſcopalians in Scotland tolerated like other well affected diſſenters from the national eſtabliſhment.

11 Toleration.

12 Faith of the Scotch Epiſcopal church.

While Epiſcopacy was the eſtabliſhed form of church government in Scotland, the clergy of that church ſubſcribed a confeſſion of faith ſummed up in twenty-five articles, which the reader will find in the hiſtory attributed to John Knox. It is ſufficient to obſerve in this place, that in eſſentials it differs little from the articles of moſt other reformed churches; and in every thing which does not immediately relate to *papiſtry*, it is moderate and unexceptionable; perhaps more ſo than the preſent confeſſion of either of the Britiſh churches. During the period which intervened between the Revolution and the year 1792, no ſubſcription was indeed required from Scotch Epiſcopalian clergymen to any ſummary of Chriſtian doctrine; but at their ordinations, thoſe clergy ſolemnly profeſſed their belief of all the canonical books of the Old and New Teſtaments; declared their perſuaſion that thoſe books contain ſufficiently all doctrines neceſſary to ſalvation, through faith in Jeſus Chriſt; and were obliged to read daily in their chapels the Engliſh book of Common Prayer, which contains the Apoſtles, Nicene, and Athanaſian creeds. But now thoſe clergymen are enjoined by act of parliament to ſubſcribe the 39 articles of the church of England; ſo that the principles of their faith are well known. No doubt there are differences of opinion among them about the ſenſe of ſome of thoſe articles; and it is well known that there are ſimilar differences among the Engliſh clergy themſelves: but there is every reaſon to believe, that the faith of the Scotch Epiſcopalians has, in every important point, been at all times orthodox.

13 Their worſhip.

We are aware, that they have been repreſented as unfriendly to the Engliſh ſervice; but ſuch a repreſention appears to be either a wilful falſehood, or the offspring of ignorance. The only reformed liturgy that ever had the ſanction of a civil eſtabliſhment in Scotland, is *the Book of Common Prayer, and Adminiſtration of the Sacraments, and other parts of Divine Service* authoriſed by King Charles I. In that book, the order of adminiſtration of the Lord's Supper differs in ſome particulars from the Engliſh order, and is unqueſtionably better adapted to the opinions of thoſe who conſider that holy ordinance either as an euchariſtical ſacrifice, or as a feaſt upon a ſacrifice. In the one or other of theſe lights, the Lord's Supper is viewed by a great majority of the Scotch Epiſcopalians; and of courſe the Scotch communion office is uſed in a great majority of their chapels: but it is not uſed in them all. Their biſhops, who, when in England, communicate with the eſtabliſhed church, leave the inferior clergy at liberty to uſe either the Engliſh or the Scotch form, as is moſt agreeable to themſelves and to the people among whom they miniſter; and to ſilence the clamour of ſymbolizing with the church of Rome, which was ſome years ago either ignorantly or maliciouſly raiſed againſt them, they altered the *arrangement* of the Scotch prayer of conſecration, ſo as not only to bring it nearer to the moſt primitive forms, but alſo to make it abſolutely inconſiſtent with the real preſence, as taught either by the church of Rome or by the Lutheran churches. On this ſubject, ſee Greek-Church, n° 17. in this *Supplement*.

14 Engliſh clergymen in Scotland.

Thus have we given a ſhort view of the diſtinguiſhing principles of what muſt ſurely be conſidered as a very reſpectable ſociety of Chriſtians, and the only reformed *Epiſcopal* ſociety in that part of Great Britain called Scotland. There are, indeed, chapels in Scotland diſtinct from the church of which we have been treating, where the Engliſh liturgy is read by clergymen who have received Epiſcopal ordination either in England or in Ireland; but thoſe chapels being all independent of each other, and under the inſpection of no biſhop, the perſons who frequent them ſeem to be rather Congregationaliſts than Epiſcopalians, and certainly do not conſtitute what can, with any propriety, be called an *Epiſcopal church*.

EPPING, a plantation in the diſtrict of Maine, of about 25 families, 12 miles from Narraguague.—*Morſe.*

Epping, a townſhip in Rockingham co. New-Hampſhire, taken from the N. W. part of Exeter, and incorporated in 1741. In 1790 it contained 1235, now 1740 inhabitants. It is 6 miles N. W. of Exeter, and 23 W. of Portſmouth.—*ib.*

EPSOM, a townſhip in Rockingham co. New-Hampſhire, lies E. of Pembroke, adjoining; 10 miles E. of Concord, and 45 miles N. W. of Portſmouth. It was incorporated in 1727; in 1775 it contained 387, and in 1790, 799 inhabitants.—*ib.*

EQUANT, in aſtronomy, a fanciful circle, introduced into ſcience to remove ſome of the defects of the Ptolemaic ſyſtem of the univerſe. In this artificial ſyſtem of epicycles and eccentric circles, the idea of circular and equable motion was by no means abandoned; but while each of the heavenly bodies revolved in its own orb, the centre of that orb was ſuppoſed to be carried at the ſame time round the circumference of another circle. The more obvious inequalities were thus explained with a geometrical preciſion. With all its nice combination, however, of circles, the ſyſtem was ſoon found to have defects; to remove which, the fine contrivance of the equant was introduced. Though the angular motion of a planet viewed from the earth was confeſſed to be unequal, a point could be conceived from which it would be ſeen to move with perfect uniformity. That point was made the centre of the equant, and lay at the ſame diſtance from the centre of the eccentricity on the one ſide, as the earth was removed on the other. "Nothing (ſays Dr Smith, from whom this account of the equant is taken) can more evidently ſhew, how much the repoſe and tranquillity of the imagination is the ultimate end of philoſophy, than the invention of this equalizing circle."

EQUATION of a curve. See Algebra *(Encycl.)* Part III. chap. ii.

Secular Equation, in aſtronomy. See Astronomy in this *Supplement*, n° 25—38.

EQUICURVE circle, the ſame with *Circle of Curvature*, which ſee in this Supplement.

ERGETT

ERGETT EL KRANE } Two Abyssinian shrubs of
ERGETT Y'DIMMO } the genus MIMOSA, which see, *Encycl.*

ERIE, FORT, a strong fortification in Upper Canada, situated on the N. shore of lake Erie, and on the W. bank of Niagara river, 27 miles S. by E. of Niagara Fort, and 18 above the carrying place at the Falls of Niagara. N. lat. 42. 59. W. long. 78. 20. 30. —*Morse.*

ERIE, a lake of the fourth magnitude in North-America, and through which runs the line between the United States and Upper Canada. D'Etroit river on the W. brings the waters of the great lakes with which lake Erie has a communication on the N. W. and Niagara river on the E. forms its communication with the waters of lake Ontario and the river St. Lawrence. It is situated between 41. and 43. N. lat. and between 78. 48. and 83. W. long. Its form is eliptical. Its length is about 225 miles; and its medium breadth about 40. It affords good navigation for shipping of any burden. The coast on both sides of the lake is generally favourable for the passage of batteaux and canoes. Its banks in many places have a flat sandy shore, particularly to the eastward of the peninsula called Long Point, which runs upwards of 18 miles into the lake, and being composed of sand is very convenient to haul boats out of the surf upon it, when the lake is too rough for sailing and rowing; yet in some places, chiefly on the S. side towards both ends of the lake, it would be dangerous to approach and impossible to land, by reason of the perpendicular height of the rocks. Some of these, (as at Cayahoga, which are already described) are magnificent beyond description, and must also inspire dread in the boldest breast, when viewed from the water. Lake Erie has a great variety of fine fish, such as sturgeon, eel, white fish, trout, perch, &c. Lakes Huron and Michigan afford communication with lake Erie, by vessels of 8 feet draught. There are portages into the waters of lake Erie from the Wabash, Great Miami, Muskingum, and Alleghany, from 2 to 16 miles. The portage between the Ohio and Potowmac will be about 20 miles, when the obstructions in the Monongahela and Cheat rivers are removed.—*ib.*

ERIE'S, an Indian nation, called by the French, du Chat, or Cat-nation. They were extirpated by the Iroquois about the year 1655. Were it not for the lake which still bears the name of that nation, one would not have known that they ever existed.—*ib.*

ERKOOM, an Abyssinian bird, part of a large tribe, "in which (says Mr Bruce) the greatest variety lies in his beak and horn. The horn he wears sometimes upon the beak and sometimes upon the forehead above the root of the beak." This bird is by naturalists called the *Indian crow* or *raven;* and our author, though he seems to think this classification improper, admits that he has one characteristic of the raven; he walks, and does not hop or jump in the manner that many others of that kind do; but then he at times runs with very great velocity, and, in running, very much resembles the turkey or bustard when his head is turned from you.

The colour of the eye of this bird is of a dark brown, or rather reddish, cast, but darker still as it approaches the pupil; he has very large eyelashes, both upper and lower, but especially his upper. From the point of the beak to the extremity of the tail is three feet ten inches; the breadth, from one point of the wing to the other extended, is six feet, and the length twenty-two inches; the length of the neck ten inches, and its thickness three inches and a half; the length of the beak, measuring the opening near the head straight to the point, ten inches; and from the point of the beak to the root of the horn, seven inches and three eighths. The whole length of the horn is three inches and a half. The length of the horn, from the foot to the extremity where it joins the beak, is four inches. The thickness of the beak in front of the opening is one inch and seven eighths. The thickness of the horn in front is one inch and five eighths. The horn in height, taken from the upper part of the point to the beak, two inches. The length of the thighs seven inches, and that of the legs six inches and five eighths. The thickness in profile seven lines, and in front four lines and a half. It has three toes before and one behind, but they are not very strong, nor seemingly made to tear up carcases. The length of the foot to the hinder toe is one inch six lines, the innermost is one inch seven lines, the middle two inches two lines, and the last outer one two inches one line. This bird is all of a black, or rather black mixed with soot-colour; the large feathers of the wing are ten in number, milk-white both without and within. The tip of his wings reaches very nearly to his tail; his beak and head measured together are eleven inches and a half, and his head three inches and a quarter. At his neck he has those protuberances like the Turkey-cock, which are light-blue, but turn red upon his being chafed, or in the time the hen is laying.

The erkoom, though not easily raised, flies (says our author) both strong and far. It has a rank smell, and is said in Abyssinia to feed upon dead carcases. This, however, he thinks a mistake, as he never saw it following the army, nor approaching a dead carcase; and as often as he had occasion to open this bird, he found in its stomach nothing but the green scarabeus or beetle. It builds in large thick trees, always, if it can, near churches; has a covered nest like that of a magpie, but four times as large as the eagle's. It places its nest firm upon the trunk, without endeavouring to make it high from the ground: the entry is always on the east side.

ERROL, a small town on lake Umbagog, in the N. easternmost settled part of Grafton co. New-Hampshire, incorporated in 1774.—*Morse.*

ERVINE, a township in Ontario co. New-York. Of its inhabitante 93 are qualified to be electors.—*ib.*

ESCAMBIA, one of the most considerable rivers that fall into the bay of Pensacola in West-Florida, empties itself near the head of the N. branch, about 12 or 15 miles from Pensacola, through several marshes and channels, which have a number of islands between them, that are overflowed when the water is high. A shoal near its mouth prevents vessels, drawing more than 5 or 6 feet, from entering; but there is from 2 to 4 fathoms of water afterwards. Capt. Hutchins ascended it in a boat upwards of 80 miles, and from the depth of water there, it appeared to be navigable for pettiaugers many miles further. It is uncertain where its

its source is. The course is very winding. At the mouth of the river on the W. side was the town of Cambleton, settled by French Protestants in 1766, but was afterwards abandoned.

The lands in general on each side of the river, are rich, low or swampy, admirably adapted for the culture of rice or corn. The great number of rivulets which fall into this river from the high circumjacent country, may be led over any part of the rice lands, at any season of the year. The numerous islands at the mouth of the river, some of very considerable extent, are not inferior for rice to any in America. The settlements made by Messrs. Tait and Mitchell, capt. Johnson, Mr. M'Kinnon, and some others, are very evident proofs of this assertion; who within two years of their first settlement, had nearly cleared all the expenses they had been at in making very considerable establishments; and would entirely have done it in another year, had not the Spaniards taken possession of the country.—*ib.*

ESPIRITU SANCTO, a bay on the W. coast of East Florida, in 27. 8. N. lat. It has a good harbor, 4 fathom water, and safe anchorage; but the land all about the coast is very low, and cannot be seen from a ship's deck when in 7 fathom water. Several low, sandy islands and marshes, covered with mangrove bushes, lie before the main land. Here are immense numbers of fish in the summer time, which may be caught with a sein, enough to load a ship, (if the climate would admit of curing them) even in a few days. —*ib.*

ESQUIMAUX, a large bay on the Labrador coast, into which a river of the same name empties. It lies in the N. W. part of the gulf of St Lawrence, near the mouth of the straits of Belleisle. Esquimaux islands lie across its mouth.—*ib.*

ESSEX *Co.* in Massacusetts, is bounded N. by the state of N. Hampshire; E. and S. by the ocean, and the town of Chelsea in Suffolk co.; W. by Middlesex co.; in length about 38 miles, in breadth 25; and is shaped triangularly, Chelsea being the acute point. The chief islands on its coast, belonging to it, are Cape Anne and Plumb islands. It is subdivided into 22 townships, which contain 7644 houses and 57,913 inhabitants; being the most populous, of its size, of any in the state, having about 135 souls to a square mile. The first settlement in Massachusetts Proper was made in Salem, the capital of the county, in 1628, by John Endicott, Esq. one of the original patentees, and many years governor of the colony. It was made a shire in 1643, being one of the three into which the colony was first divided. Essex co. pays about one seventh part of the state tax, elects six senators and counsellors for the government of the commonwealth, and one representative in the legislature of the United States.—*ib.*

The face of the county is pleasingly variegated with hills, vales, woods, and plains. The land is generally fruitful; but is more favourable to barley than most other parts of the state. Quarries of marble and limestone are found in this county; and the sea coast is indented with a number of good harbors. Merrimack river, intersects the N. part of Essex county; between it and the New-Hampshire line are the towns of Methuen, Haverhill, Amsbury and Salisbury. —*ib.*

ESSEX *Co.* in Virginia, is bounded E. and N. E by Rappahannock river, which divides it from Richmond. It is about 55 miles long and 12 broad, and contains 9122 inhabitants, of whom 5440 are slaves.—*ib.*

ESSEX *Co.* in New-Jersey, is in the eastern part of the state, and divided from Staten-Island by Newark bay. It is about 25 miles in length and 16 in breadth, and has three townships, viz. Newark, Elizabethtown and Acquackanack, which contain 17,785 inhabitants, of whom 1171 are slaves. The soil is very fertile, and its fruits and other productions meet with a quick sale in New-York city. Essex county has within it 7 Presbyterian churches, 3 for Episcopalians, 1 for Anabaptists, and 2 for Dutch Calvanists.—*ib.*

ESSEX *Co.* in Vermont, is the north-easternmost in the state.—*ib.*

ESSEX, a township in Chittenden co. Vermont, contains 354 inhabitants. It lies between Jericho on the S. E. and Colchester on the N. W.—*ib.*

ESTAPA, or *Estape*, a town belonging to the province of Tabasco, and audience of Mexico, in New-Spain, N. America. It is mentioned by Dampier, as situated on Tabasco river, 4 leagues beyond Villa de Mose. It is said to be a place of considerable trade; and so strong, that it repulsed capt. Hewet, when he attacked it with 200 desperate buccaneers.—*ib.*

ESTAPO, a strong town in New-Spain, inhabited by Spaniards and native Americans; situated at the mouth of the river Tlaluc. N. lat. 17. 30. W. long. 103. 5.—*ib.*

ESTHER *Town*, in Lancaster co. Pennsylvania, situated on the E. bank of Susquehanna river, a little N. of Harrisburg.—*ib.*

ETON is a place which, on account of its college, should not be omitted in a repository of arts, sciences, and literature; and as no notice is taken of it in the *Encyclopædia*, we shall deviate for once from the plan which we had laid down for this Supplement, and which is, not to admit into it descriptions of places in our own island that may be visited by the greater part of our readers with little trouble.

Though in a different county, namely, Buckinghamshire, Eton may be said to be one and the same town with Windsor, for which see *Encycl.* It is pleasantly situated on the banks of the Thames, in a delightful valley, which is of a remarkably healthy soil. Its college was founded by Henry VI. for the support of a provost and seven fellows, one of whom is vice-provost, and for the education of seventy King's scholars, as those are called, who are on the foundation. These, when properly qualified, are elected, on the first Tuesday in August, to king's college Cambridge, but they are not removed till there are vacancies in the college, and then they are called according to seniority; and after they have been three years at Cambridge, they claim a fellowship. Besides those on the foundation, there are seldom less than three hundred scholars, and often many more, who board at the masters houses, or within the bounds of the college. The school is divided into upper and lower, and each of these into three classes. To each school there is a master and four assistants or ushers. The revenue of the college is about

Eton.

£.5000 a-year. Here is a noble library, and in the great court is a fine statue of the founder, erected at the expence of a late provost Dr Godolphin dean of St Paul's. The chapel is in a good style of Gothic architecture. The schools and other parts, which are in the other style of building, are equally well, and seem like the design of Inigo Jones.

At Eton there is a singular, and we think a laudable, festival, called the *Montem*, celebrated triennially (formerly duennially) by the scholars of the school upon Whit-Tuesday. The following account of this festival, taken from the Monthly Magazine, will probably be acceptable to many of our readers.

It commences by a number of the senior boys taking post upon the bridges or other leading places of all the avenues around Windsor and Eton soon after the dawn of day. These youths so posted are chiefly the best figures, and the most active of the students; they are all attired in fancy dresses of silks, satins, &c. and some richly embroidered, principally in the habits or fashion of running footmen, with poles in their hands; they are called *salt-bearers*, and demand salt, i. e. a contribution from every passenger, and will take no denial.

When the contribution is given, which is *ad libitum*, a printed paper is delivered with their motto and the date of the year, which passes the bearer free through all other salt-bearers for that day, and is as follows, viz.

"Pro more et monte,
1799, (A)
Vivant Rex et Regina."

These youths continue thus collecting their salt at all the entrances for near seven miles round Windsor and Eton, from the dawn of day until about the close of the procession, which is generally three o'clock in the afternoon.

The procession commences about twelve o'clock at noon, and consists of the Queen's and other bands of music; several standards borne by different students; all the Etonian boys, two and two, dressed in officers uniforms; those of the king's foundation wearing blue, the others scarlet uniforms, swords, &c.

The Grand Standard-bearer.

The Captain, or Head Boy of Eton School.

The Lieutenant, or Second Boy.

His Majesty, attended by the Prince of Wales, and other male branches of the royal family on horseback, with their suite.

The Queen and Princesses in coaches, attended by their suite.

Band of music, followed by a great concourse of the Nobility and Gentry in their carriages and on horseback.

The procession commences in the great square at Eton, and proceeds through Eton to Slough, and round to Salt Hill, where the boys all pass the king and queen in review, and ascend the Montem: here an oration is delivered, and the grand standard is displayed with much grace and activity by the standard bearer, who is generally selected from among the senior boys.

There are two extraordinary salt-bearers appointed to attend the king and queen, who are always attired in fanciful habits, in manner of the other salt-bearers already described, but superbly embroidered. These salt-bearers carry each an embroidered bag, which not only receives the royal salt, but also whatever is collected by the out-stationed salt-bearers. The donation of the king and queen, or, as it is called upon this occasion, the *royal salt*, is always fifty guineas each; the Prince of Wales thirty guineas; all the other princes and princesses twenty guineas each. As soon as this ceremony is performed, the royal family return to Windsor. The boys are all sumptuously entertained at the tavern at Salt Hill; and the beautiful gardens at that place are laid out for such ladies and gentlemen as choose to take any refreshments, the different bands of music performing all the time in the gardens.

Eton ‖ Eudiometer.

About six o'clock in the evening all the boys return in the same order of procession as in the morning (with the exception only of the royal family), and, marching round the great square in Eton school, are dismissed. The captain then pays his respects to the royal family at the queen's lodge, Windsor, previous to his departure for King's College, Cambridge; to defray which expence, the produce of the montem is presented to him; and upon Whit-Tuesday, in the year 1796, it amounted to more than 1000 guineas. The day concludes by a brilliant display of beauty, rank, and fashion, a promenade on Windsor Terras, bands of music performing, &c. and the scene highly enlivened and enriched by the affable condescension of the royal family, who indiscriminately mix with the company, and parade the Terrace till nearly dark.

EVANSHAM, the capital of Wythe co. in Virginia, is situated on the E. side of Reedy creek, which falls into the Great Kanhaway, Woods or New river. It contains a court-house, gaol, and about 25 houses; 40 miles W. by S. of Christiansburg, 242 in a like direction from Bichmond, and 518. S. W. by W. of Philadelphia.—*Morse*.

SPONTANEOUS EVAPORATION. See WEATHER, n° 17, &c. *Encycl.*

EUDIOMETER, an instrument for ascertaining the purity of the atmospherical air. Many have been the contrivances of chemists for this purpose (see EUDIOMETER, *Encycl.*); but perhaps the best eudiometer is that of *Morveau* (or *Guyton*, as he now chooses to call himself), of which mention has been made in CHEMISTRY, n° 420. in this Supplement. The following short description will make the nature and use of this instrument plain to every reader.

AB, (Plate XXVIII.) represents a small glass retort with a long neck; its whole capacity being from seven to nine solid inches. It must be chosen of such a curvature that, when the neck is set upright, the bulb may form at its lower part a cavity to retain the matters introduced. The extremity of the neck of this retort is ground with emery to enter the glass tube CD, which is open at both ends, and about 12 or 15 inches in length. The retort then closes the tube in the manner of a ground stopper, and intercepts all external communication. A cylindrical glass vessel F is provided, of the form of a common jar, in which the glass tube CD may be entirely plunged beneath the level of the water. Lastly, the sulphuret of potash is prepared and broken

(A) Or whatever the year may be.

broken into pieces sufficiently small to be introduced into the retort. These are to be inclosed, dry and even hot, in a bottle for use. These constitute the whole apparatus and preparation of materials.

When it is required to examine an aeriform fluid, by separating its oxygen, two or three pieces of the sulphuret, of the size of a pea, are put into the retort. It is then filled with water, taking care to incline it so that all the air may pass out from the bulb. The orifice of the retort is then to be closed, and inverted into the pneumatic tube, in order that the gas proposed for examination may be transferred into it in the usual manner. By an easy manœuvre of alternately inclining the retort in different directions, all the water is made to flow out of the bulb in which the sulphuret remains. When this is done, the retort is placed in the vertical situation, and its extremity introduced into the tube of glass CD, which must always be under water. A small lighted taper is then to be placed under the bulb. To support the retort in its position, the jar is provided with a wooden cover, in which there is a notch to receive it.

The first impression of the heat dilates the gaseous fluid so much that it descends almost to the bottom of the tube, which is disposed expressly for its reception; otherwise the partial escape would prevent an accurate determination of its change of bulk. But as soon as the sulphuret begins to boil, the water quickly rises, not only in the inferior tube, but likewise in the neck of the retort, notwithstanding the application, and even the increase of the heat.

If the fluid be absolutely pure vital air, the absorption is total. In this case, to prevent the rupture of the vessel by too sudden refrigeration, the ascent of the water must be rendered slower, either by removing the taper, or by increasing the perpendicular height; which will not prevent the absorption from continuing while any gas remains which is proper to support combustion.

If the fluid be common air, or oxygen mixed with any other gas, the quantity of water which has entered the retort must be accurately measured after the cooling. It represents the volume of air absorbed. Care must be taken to inclose the remaining gas under the same pressure, by plunging the retort to the level of the line at which the inclosed water rests, before the orifice is stopped.

This operation of measuring, which is very easy when measuring vessels are at hand, may be habitually performed by a slip of paper pasted on the neck of the retort, upon which divisions are drawn from observation, and which must be covered with varnish to defend it from the action of the water.

EUDOXUS of Gnidus was a celebrated philosopher of the school of Pythagoras. His first preceptor was Archytas, by whom he was instructed in the principles of geometry and philosophy. About the age of twenty-three he came to Athens; and though his patrimony was small, by the generous assistance of Theomedon, a physician, he was enabled to attend the schools of the philosophers, particularly that of Plato. The liberality of his friends afterwards supported him during a visit to Egypt, where he was introduced by Agesilaus to king Nectanebis II. and by him to the Egyptian priests. It has been said that he accompanied Plato into Egypt; but this is inconsistent with chronology; for Nectanebis II. reigned in Egypt from the second year of the hundred and fourth Olympiad, to the second year of the hundred and seventh; and it was before Plato opened his school, that is, before the ninety-eighth Olympiad, about the fortieth year of his age, that he visited Egypt. Eudoxus is highly celebrated by the ancients for his skill in astronomy, but none of his writings on this or any other subject are extant. Aratus, who has described the celestial phenomena in verse, is said to have followed Eudoxus. He flourished about the ninety-seventh Olympiad, and died in the fifty-third year of his age. *Enfield's Hist. of Philosophy*.

EVECTION is used by some astronomers for the libration of the moon, being an inequality in her motion, by which, at or near the quadratures, she is not in a line drawn through the centre of the earth to the sun, as she is at the syzygies, or conjunction and opposition, but makes an angle with that line of about 2° 51′. The motion of the moon about her axis only is equable; which rotation is performed exactly in the same time as she revolves about the earth; for which reason it is that she turns always the same face towards the earth nearly, and would do so exactly, were it not that her monthly motion about the earth, in an elliptic orbit, is not equable; on which account the moon, seen from the earth, appears to librate a little upon her axis, sometimes from east to west, and sometimes from west to east; or some parts in the eastern limb of the moon go backwards and forwards a small space, and some that were conspicuous, are hid, and then appear again.

The term *evection* is used by some astronomers to denote that equation of the moon's motion which is proportional to the sine of double the distance of the moon from the sun, diminished by the moon's anomaly. This equation is not yet accurately determined: some state it at 1° 30′, others, at 1° 16′, &c. It is the greatest of all the moon's equations, except the equation of the centre. *Hutton's Dictionary*.

EVENLY EVEN NUMBER. See NUMBER, *Encycl.*

EVENLY Odd Number. See NUMBER, *Encycl.*

EVESHAM, a township in Burlington co. New-Jersey, situated between the forks of Moore's creek, which runs N. westerly to Delaware river. It is 7 miles easterly of Haddonfield, 16 E. of Philadelphia, and 25 S. of Burlington.

Here is an Indian settlement, called Edge Pelick, a tract of land reserved by the ancient natives. They have some hundreds of acres of improved lands, about 30 houses, and a meeting-house. They formerly had a minister of their own order, who statedly officiated in the Indian language.—*Morse*.

EVOLVENT, in the higher geometry, a term used by some writers for the involute or curve resulting from the evolution of a curve, in contradistinction to that evolute, or curve supposed to be opened or evolved. See EVOLUTE and INVOLUTE, *Suppl.*

EVOLUTE, in the higher geometry, a curve first proposed by Huyghens, and since much studied by mathematicians. It is any curve supposed to be evolved or opened, by having a thread wrapped close upon it, fastened at one end, and beginning to evolve or unwind the thread from the other end, keeping the part evolved or wound off tight stretched; then this end of the thread will describe another curve, called the *involute*. Or the same involute is described the contrary way, by wrapping the thread upon the evolute, keeping it always stretched. For the INVOLUTION and EVOLUTION *of Curves*, see INVOLUTION in this Supplement.

Imperfect EVOLUTE, a name given by M. Reaumur to a new kind of evolute. The mathematicians had hitherto only considered the perpendiculars let fall from the involute on the convex side of the evolute: but if other lines not perpendicular be drawn upon the same points, provided they be all drawn under the same angle, the effect will still be the same; that is, the oblique lines will all intersect in the curve, and by their intersections form the infinitely small sides of a new curve, to which they would be so many tangents. Such a curve is a kind of evolute, and has its radii; but it is an imperfect one, since the radii are not perpendicular to the first curve or involute.

EUPHON, a musical instrument invented lately by Dr Chladni of Wittenberg, well known by his various publications on philosophical subjects, especially the theory of musical sounds. The euphon consists of forty-two immoveable parallel cylinders of glass of equal length and thickness; but its construction, tone, and the method of playing it, are totally different from those of the harmonica, with which indeed it has nothing in common but the glass. See HARMONICA, *Encycl.*

Dr Chladni gives the following account of his invention. In his 19th year he began to learn to play the harpsichord; and he afterwards read a great many of the principal works on the theory of music, by which he found that the physico-mathematical part of that science was far more defective than other branches of natural philosophy. Being therefore possessed with an idea that his time could not be better emyloyed than in endeavouring to make discoveries in this department, he accordingly tried various experiments on the vibrations of strings and the different kinds of vibration in cylindric pieces of wood, first discovered, through calculation by the elder Euler; and found, that though a great deal had been said on the nature of these elastic bodies, yet the manner of vibration and the proportion of tones in other elastic bodies, which do not proceed, as in the former, in straight lines, but depend on the vibration of whole surfaces, were totally unknown, and that the little which had been written on that subject, by some authors, did not correspond with nature. He had already long remarked, that every plate of glass or metal emitted various tones according as it was held and struck in different places; and he was desirous to discover the cause of this difference, which no one had ever examined. He fixed in a vice the axle of a brass plate which belonged to a polishing machine, and found, that by drawing the bow of a violin over it, he produced very different tones, which were stronger, and of longer duration than those obtained merely by striking it.

The observation, that not only strings, but also other elastic bodies may be made to produce sounds by drawing a violin bow over them, Dr Chladni does not give as a discovery of his own; as the so called iron violin has been long known, and as he had read of an instrument constructed in Italy*, where glass or metal bells were made to sound by means of two or more violin bows drawn over them. But the idea of employing this instrument to examine vibrating tones was first entertained by himself. Having accurately remarked the tones produced by the abovementioned metal plate, he found that they gave a progression which corresponded with the squares of 2, 3, 4, &c.

* In all probability the *Harmonica* of the Abbé Mazzuchi.

Not long before he had read, in the Transactions of the Royal Society of Gottingen, the observations of Mr Lichtenberg on the phenomena produced by strewing pounded resin over a glass plate or cake of resin, and he repeated many of his experiments. This led him to the idea that, perhaps, the various vibratory movements of such a plate would be discovered by a diversity of phenomena, if he strewed over it sand or any thing of the like kind. By this experiment there was produced a star-formed figure; and the author, having continued his researches, published the result of them in a work entitled Discoveries respecting the Theory of Sound, printed at Leipsic in 1787.

Whilst he was employed in these investigations, he resolved to invent a new musical instrument; and he began to consider whether it might not be possible by rubbing glass tubes in a straight line, with the wet fingers, to produce sounds in the same manner as is done in the harmonica by rubbing them circularly. That glass tubes, like those in his euphon, would not merely by such rubbing emit any tones, he had long known by theory and experience; and he therefore applied himself to the solution of the difficult question, in what manner the instrument ought to be constructed to answer the intended purpose? After various fruitless attempts for a year and a half, during which his imagination was so full of the idea, that sometimes in his dreams he thought he saw the instrument and heard its tones, that is, like those of the harmonica, but with more distinctness and less confusion, he at length, in a state between sleeping and waking, obtained a solution of the problem which had given so much employment to his thoughts. On the second of June 1789, being tired with walking, he sat down on a chair, about nine in the evening, to enjoy a short slumber; but scarcely had he closed his eyes when the image of an instrument, such as he wished for, seemed to present itself before him, and terrified him so much that he awoke as if he had been struck by an electric shock. He immediately started up in a kind of enthusiasm; and made a series of experiments, which convinced him that what he had seen was perfectly right, and that he had it now in his power to carry his design into execution. He made his experiments and constructed his first instrument in so private a manner, that no person knew any thing of them. On the 8th of March 1790 his first instrument of this kind was completed; and in a few days he was able to play on it some easy pieces of music. It was now necessary to give to this instrument, as it was entirely new, a new name; and that of *euphon*, which signifies an instrument that has a pleasant sound, appeared to him the most proper.

It was not, however, brought to perfection at once, for he made a second instrument which was an improvement of the first, and a third which was an improvement of the second. In sound, indeed, and particularly in the higher tones, the first was equal to either of the other two; but the construction was deficient in strength, so that every week some hours were necessary to keep it in proper repair; and it was impossible to convey it the distance of a mile without almost totally destroying it. Dr Chladni also, for want of better tubes, employed those used for thermometers, and marked

Euphon. marked the whole and half tones by a coating of sealwax on the under side; but as the wax, owing to the moisture and vibration, often cracked and flew off, it was attended with danger to the eyes. It was therefore extremely difficult to give to the construction of the instrument sufficient strength; but this the inventor at length accomplished, so that his new euphon cannot be injured or put out of tune either by playing or by carriage. The third instrument was somewhat different from the first and second; as the fore part, which in the two former rose upwards with an oblique angle, stood at right angles, so that it could be transported with ease in a particular carriage made for that purpose. Instead of the thermometer tubes used in the first, the Doctor now employs tubes of different colours. In the second instrument those for the whole tones were of dark green glass; but he used for the half tones, in both, a milk white kind of glass. In a word, the euphon has some resemblance to a small writing-desk. When opened, the abovementioned glass tubes, of the thickness of the barrel of a quill and about 16 inches long, are seen in a horizontal position. They are wetted with water, by means of a sponge, and stroked with the wet fingers in the direction of their length, so that the increase of the tone depends merely on the stronger or weaker pressure, and the slower or quicker movement of the fingers. The number of tubes at present is forty-two. In the back part there is a perpendicular sounding-board divided in the middle, through which the tubes pass. It appears therefore that the euphon ought not to be considered as an altered or improved harmonica, but as a totally new and different instrument. In regard to sweetness of sound, it approaches very near to the harmonica; but it has several advantages which no unprejudiced person, who examines both instruments, will deny.

1. It is simpler, both in regard to its construction and the movement necessary to produce the sound, as neither turning nor stamping is required, but merely the movement of the finger. 2. It produces its sound speedier; so that as soon as it is touched you may have the tone as full as the instrument is capable of giving it; whereas, in the harmonica, the tones, particularly the lower ones, must be made to increase gradually. 3. It has more distinctness in quick passages, because the tones do not resound so long as in the harmonica, where the sound of one low tone is often heard when you wish only to hear the following tone. 4. The unison is purer than is generally the case in the harmonica, where it is difficult to have perfect glasses, which in every part give like tones with mathematical exactness. It is however as difficult to be tuned as the harmonica. 5. It does not affect the nerves of the performer; for a person scarcely feels a weak agitation in the fingers; whereas in the harmonica, particularly in concords of the lower notes, the agitation extends to the arms, and even through the whole body of the performer. 6. The expence of this instrument will be much less in future than that of the harmonica. 7. When one of the tubes breaks or any other part is deranged, it can be soon repaired, and at very little expence; whereas, when one of the glasses of the harmonica breaks, it requires much time, and is very difficult to procure another capable of giving the same tone as the former, and which will correspond sufficiently with the series of the rest. Euphorbia.

EUPHORBIA (See *Encycl.*). Of this plant three new species were discovered by Le Vaillant during his last travels into the interior parts of Africa. The first, which he calls the CUCUMBER-EUPHORBIA, adheres to the earth no otherwise than by a few slender roots. It rises to the height of nine or ten inches only; and exactly resembles a cucumber, of which it has the bent shape. (Plate XXVIII. fig. 1.) It contains abundance of milky juice, which appeared to him as caustic as that of the great euphorbia. Its colour, which is a yellowish green, tinted with a beautiful shade of violet towards the root, gives it a very attractive appearance: but woe betide the man who should be tempted to eat of it! as it is a virulent poison. The second, to which he gave the name of the MELONRIBBED EUPHORBIA, does not rise more than three or four inches from the ground, to which it adheres by a collection of fibrous roots, issuing from several tubercles disposed in the manner of a crown. (Fig. 2.) The stem forms a flatted globe excavated at the summit, and has ribs like the apple which in France is called *calville blanche*. These ribs are elevated, thick, and convex, have a greenish colour, and are marked with brown transversal bands. From the summit of the ribs issue several little tufts of pedunculate flowers. The third he called the CATERPILLAR-EUPHORBIA, because when he first found it, he thought he perceived on it several beautiful caterpillars. (Fig. 3.) The description of it in a few words is as follows: From a very large tuberous root, which here and there throws out a few thready fibres, issue several stalks almost of the length of the finger: they creep along the ground, are twisted, woody, destitute of leaves, and furnished with several rows of round tubercles, each guarded by two prickles.

All these kinds of euphorbia are to be dreaded, the last two in particular; because being low and mixed with the herbage like mushrooms, animals, as they feed, run the risk of eating them with their pasture. Our author confirms the account which has been given in the *Encyclopædia* of the savages poisoning the reservoirs of water with this plant in order to procure the game which shall drink of it. To effect the death of the animal, it is necessary that the poison reach the blood and mingle with it. Yet, inconceivable as it may be, the animal, though poisoned, is not the less wholesome food, as our author says he has experienced. However great may be the proportion of euphorbia thrown into a pond of water, he is persuaded that it never diffuses itself through the whole mass. It is his opinion, that the poison is a resinous juice, which, being from its nature incapable of combining with water, swims on the surface, and there forms a shining greenish oil, which with a little attention may be discerned by the naked eye when the surface is smooth. I tried (says he) the qualities of this oil on myself, taking with a straw, from the surface of the basin, a single drop, which I put upon my tongue; and it gave me that kind of burning pain which a caustic occasions. I then took up some water from the reservoir in the hollow of my hand, and blowing off the oily fluid which swam on the surface, I dipped the end of my tongue into the remainder, but could not perceive in it the slightest taste different from that of water itself. He seems to think that milk is an antidote

tidote to the poison of euphorbia; because he squeezed some of the juice into a bason of milk and gave it to an ape, which swallowed part of it without the least injury. He confesses, however, that the dose was trifling.

EUSTACE, or *Eustatia*, called also Metanzas, or Slaughter, (from a butchery made on it by the Spaniards). It is an inconsiderable island, about 20 miles in circuit. It forms, with a long point of land, the entrance to the harbor of St. Augustine, in East-Florida—*Morse*.

EUSTYLE, is the best manner of placing columns, with regard to their distance; which, according to Vitruvius, should be four modules, or two diameters and a quarter.

EXCENTRIC, or Excentric Circle, in the ancient Ptolemaic astronomy, was the very orbit of the planet itself, which it was supposed to describe about the earth, and which was conceived excentric with it; called also the deferent.

Instead of these excentric circles round the earth, the moderns make the planets describe elliptic orbits about the sun; which accounts for all the irregularities of their motions, and their various distances from the earth, &c. more justly and naturally.

Excentric, or *Excentric Circle*, in the new astronomy, is the circle described from the centre of the orbit of a planet, with half the greatest axis as a radius; or it is the circle that circumscribes the elliptic orbit of the planet.

EXCHANGE. See *Encycl.* under that word, and likewise under *Bills of Exchange*, where the antiquity of such bills, especially among the Chinese, is mentioned. In Professor Beckmann's history of inventions the reader will find an ordinance of the year 1394 concerning the acceptance of bills of exchange, and also copies of two bills of the year 1404, which sufficiently prove that the method of transacting business by bills of exchange was fully established in Europe so early as the fourteenth century; and that the present form and terms were even then used. The ordinance, which was issued by the city of Barcelona, decreed that bills of exchange should be accepted within twenty-four hours after they were presented, and that the acceptance should be written on the back of the bill.

But there are questions relating to bills of exchange of much greater importance than their antiquity; and these questions are not yet decided. For instance, Ought a bill of exchange to be considered by the law merely as a *deposit* belonging to the drawer, and successively confided to the remittees? or should it be considered as transferable *property*, at all times absolutely vested in the holder, whose neglect therefore, when it vitiates the value, falls wholly on himself?

In a work published 1798 by Professor Busch of Hamburgh, entitled, *Additions to the Theoretical and Practical Delineation of Commerce* (A), the reader will find some arguments, which, to say the least of them, are certainly plausible, to prove that bills of exchange ought to be at all times considered as the absolute property of the holder. This theory is then applied to the difficult and still unsettled case of the holder of a bill having many indorsements, where the drawer, drawee, and early indorsers, have all failed. It is evident that, if the holder proves under each bankruptcy the whole amount of the bill, he will receive much more than his due. May he make his election where to prove the whole demand, and where to prove the residue? Or ought he not (which seems most equitable) to be compelled to prove his debt against his immediate predecessor only?—the assignees of that predecessor proving, in their turn, in like manner (each party once only), back to the drawer. This is a case of great importance to discounters, and the reader will find some judicious observations on it in the Professor's work.

EXEGESIS, or Exegetica, in algebra, is the finding, either in numbers or lines, the roots of the equation of a problem, according as the problem is either numeral or geometrical.

EXETER, a post town in Rockingham co. New-Hampshire, and, next to Portsmouth, the most considerable sea-port town in the state. It is situated at the head of navigation on Swamscot, or Exeter river, a branch of the Piscataqua, 15 miles S. W. of Portsmouth, and a like distance N. W. of Newburyport, in Essex co. Massachusetts. The tide rises here 11 feet. It is well situated for a manufacturing town, and has already a duck manufactory in its infancy, 6 saw mills, a fulling mill, slitting mill, paper mill, snuff mill, 2 chocolate and 10 grist mills, iron works, and 2 printing offices. The saddlery business is carried on here to greater extent, than in any town on this side Philadelphia. Before the revolution, ship building was a profitable business; and the vessels were employed in the West India trade. Notwithstanding the loss of this market, there are four or five vessels, of different burden, built here annually; the river being capable of floating down those of 500 tons. An equal number is also employed in the foreign trade, chiefly to the West-Indies. The situation of this place bids fair for extensive population. The public edifices are 2 Congregational churches, an elegant building appropriated for the academy, a handsome and capacious court-house, and a gaol. The public offices of the state are kept here at present. Besides the celebrated Exeter academy, there are here an English school and 6 or 8 private schools, chiefly for females.

This township is of irregular figure, and about 4 miles square. It was incorporated in 1638; prior to which, it had the name of Swamscot Falls, from the falls of the river, which separate the fresh from the tide water; where the body of the town is situated; chiefly on the western side of the river. The number of inhabitants in 1775, was 1741—and in 1790, 1722. It lies 54 miles N. of Boston, and 402 N. E. of Philadelphia. N. lat. 42. 59. W. long. 71.

"Phillips Exeter Academy" was founded and endowed by the hon. John Phillips, L. L. D. of Exeter, and incorporated by act of Assembly in 1781. It is a very respectable and useful institution, under the inspection of a board of trustees, and the immediate government and instruction of a preceptor and an assistant. It has a fund of £.15,000, a part of which is in lands not yet productive. The present annual income is £.480.

(A) Professor Busch published in 1792 a work entitled *A Theoretical and Practical Delineation of Commerce.*

£.480. It has commonly between 50 and 60 students. In 1794, a building was erected, 76 by 36 feet, two stories high; which, in point of convenience, and perhaps elegance, is exceeded by few buildings of the kind in the United States.—*Morse.*

Exeter, the N. westernmost township in Washington co. Rhode-Island state, has North-Kingston on the E. and Voluntown, in Connecticut, on the W. The several branches of Wood river unite here, and take a S. course between Hopkinton and Richmond. It contains 2495 inhabitants, of whom 37 are slaves.—*ib.*

Exeter, a township in Luzern co. Pennsylvania. —*ib.*

Exeter, a town in New-Hanover co. in Wilmington district, N. Carolina; situated on the N. E. branch of Cape Fear, about 36 miles N. from Wilmington, and 22 from the New river.—*ib.*

EXPECTATION of Life, in the doctrine of life annuities, is the share, or number of years of life, which a person of a given age, may, upon an equality of chance, expect to enjoy.

By the expectation or share of life, says Mr Simpson (*Select Exercises*, p. 273), is not here to be understood that particular period which a person hath an equal chance of surviving; this last being a different and more simple consideration. The expectation of a life, to put it in the most familiar light, may be taken as the number of years at which the purchase of an annuity, granted upon it, without discount of money, ought to be valued. Which number of years will differ more or less from the period abovementioned, according to the different degrees of mortality to which the several stages of life are incident. Thus it is much more than an equal chance, according to the table of the probability of the duration of life which the same author has given us, that an infant, just come into the world, arrives not to the age of ten years; yet the expectation or share of life due to it, upon an average, is near twenty years. The reason of which wide difference is the great excess of the probability of mortality in the first tender years of life, above that respecting the more mature and stronger ages. Indeed if the numbers that die at every age were to be the same, the two quantities above specified would also be equal; but when the said numbers become continually less and less, the expectation must of consequence be the greater of the two.

EXPONENTIAL Calculus, the method of differencing, or finding the fluxions of exponential quantities, and of summing up those differences, or finding their fluents.

Exponential *Curve*, is that whose nature is defined or expressed by an exponential equation; as the curve denoted by $a^x = y$, or by $x^x = y$.

Exponential *Equation*, is one in which is contained an exponential quantity: as the equation $a^x = b$, or $x^x = ab$, &c.

Exponential *Quantity*, is that whose power is a variable quantity, as the expression a^x, or x^x. Exponential quantities are of several degrees and orders according to the number of exponents or powers, one over another.

EXTRA Constellary Stars, such as are not properly included in any constellation.

EXTRA-Mundane Space, is the infinite, empty, void space, which is by some supposed to be extended beyond the bounds of the universe, and consequently in which there is really nothing at all. The phrase *extramundane space* has been so long in use among our best writers, that it is now impossible to banish it from the language; and yet it has been the source of some extravagant mistakes. Many philosophers consider space as something *real*, distinct both from body and mind; and no less a man than Dr Clarke considered it as an attribute of the Deity. Yet we think nothing more evident than that if body had never existed, space would never have been thought of; and if this be so, extramundane space, instead of denoting any *real* thing, or attribute infinitely extended, can mean nothing more than the *possibility* of enlarging the corporeal universe, however widely extended it may be. See Metaphysics (*Encycl.*), Part II. ch. iv.

EXTRADOS, the outside of an arch of a bridge, vault, &c. See Arch in this *Supplement*.

EXTREMES Conjunct, and *Extremes Disjunct*, in spherical trigonometry are, the former the two circular parts that lie next the assumed middle part; and the latter are the two that lie remote from the middle part. These were terms applied by Lord Napier in his universal theorem for resolving all right-angled and quadrantal spherical triangles, and published in his *Logarithmorum Canonis Descriptio*, an. 1614. In this theorem, Napier condenses into one rule, in two parts, the rules for all the cases of right angled spherical triangles, which had been separately demonstrated by Pitiscus, Lansbergius, Copernicus, Regiomontanus, and others. In this theorem, neglecting the right angle, Napier calls the other five parts circular parts, which are, the two legs about the right angle, and the complements of the other three, viz. of the hypothenuse, and the two oblique angles. Then taking any three of these five parts, one of them will be in the middle between the other two, and these two are the extremes conjunct when they are immediately adjacent to that middle part, or they are the extremes disjunct when they are each separated from the middle one by another part.

EXUMA *Isle*, one of the Bahama isles, situated on the E. of the Great Bank, between Stocking isles on the S. W. and Long-isle on the E. It is now uninhabited, excepting two families, yet is one of the best of the Bahamas, not only for its fertility, but for the excellence of its anchoring ground, in the sound to which it gives name; where all the British navy could ride in safety. N. lat. 24. 30. W. long. 74. 30.—*Morse.*

Exuma *Sound*, lies E. of the Great Bahama Bank, between it and the isle of Guanahani. N. lat. 24. W. long. 75.—*ib.*

FABIANE,

F.

FABIANE, a river in Louisiana, which runs S. eastward into the Missisippi, in N. lat. 39. 30.; 16 miles above Jastioni river and 50 below the Iowa town and rapids.—*Morse.*

FABIUS, one of the military townships in New-York.—*ib.*

FACE or FAÇADE, in architecture, is sometimes used for the front or outward part of a building, which immediately presents itself to the eye; or the side where the chief entrance is, or next the street, &c.—*ib.*

FAIRFAX *Co.* in Virginia, is about 25 miles long, and 18 broad; on the W. Bank of Potowmack river. It contains 12,320 inhabitants, of whom 4574 are slaves. Chief town, Alexandria.—*ib.*

FAIRFAX, a township in Franklin co. Vermont, E. of Georgia, and on the bank of La Moille river, and contains 254 inhabitants; and is about 9 miles from lake Champlain.—*ib.*

FAIRFIELD, a plantation in Lincoln co. district of Maine, on the S. E. bank of Kennebeck river, S. of Canaan, and opposite Hancock; about 17 miles from Pittstown, and 7 from Fort Halifax. It contains 492 inhabitants, and is 225 miles N. E. of Boston.—*ib.*

FAIRFIELD, a new township in Herkemer county, New-York.—*ib.*

FAIRFIELD, a township in Franklin co. Vermont, E. of St. Albans; and contains 129 inhabitants. It is 13 miles S. of the Canada line, and as far from the nearest part of lake Champlain.—*ib.*

FAIRFIELD, a township in Washington co. New-York. By the state census of 1796, 29 of its inhabitants are electors.—*ib.*

FAIRFIELD, a township in Cumberland co. New-Jersey, on Cohanzy creek, and at the head of Black creek; 25 miles E. by S. of Salem, in Salem co.—*ib.*

FAIRFIELD *Co.* in Connecticut, is the S. westernmost in the state; bounded W. by the state of New-York, E. by New-Haven co. N. by Litchfield, and S. by Long-Island sound. Its shape is very irregular. It is divided into 13 townships, of which Fairfield and Danbury are the chief; and contains 36,250 inhabitants, including 433 slaves. It is separated from New-Haven co. and part of Litchfield co. by Stratford river. The other parts of the county are watered by small streams, as Sagatnck, Safco, Peganook, Five Mile, Rodens, Mill, and Mayamus rivers. Several harbors, and a number of small isles lie along the sound, in the towns of Greenwich, Stamford, Norwalk, Fairfield, and Stratford. The face of the county is rough, but the soil is good.—*ib.*

FAIRFIELD, the *Unquowa* of the Indians, a post town and port of entry of Connecticut, and capital of the above county, is pleasantly situated on Mill-Run, a little above its entrance into Long-Island sound, 22 miles S. W. by W. of New-Haven, and 64 from New York. It contains about 200 houses, a neat Congregational church, and a court-house. About 4 miles N. W. of the body of the town, and in the township, is the beautiful parish of Greenfield, in which is a flourishing academy. A high eminence in the centre of the parish commands a delightful prospect. Fairfield was settled from Weathersfield in 1639, and in 1736 contained 400 families. It was burnt by a party of tories and British, under the command of gov. Tryon, in 1777; the loss sustained, amounted to upwards of £.40,000. Fairfield carries on a considerable trade to the W. Indies. The exports for one year, ending Sept. 30th, 1794, amounted to 77,425 dollars.—*ib.*

FAIRFIELD, a township in Westmoreland co. Pennsylvania.—*ib.*

FAIRFIELD *Co.* in Camden district, S. Carolina, between Wateree river which divides it from Lancaster co. and Broad river which separates it from Newbury and Union counties. It contains 6138 white inhabitants, and 1485 slaves. Its chief town is Winnsborough.—*ib.*

FAIRHAVEN, in Bristol co. Massachusetts, lies on the N. W. side of Buzzard's bay, and on the eastern side of Accushnet river, opposite to Bedford.—*ib.*

FAIRHAVEN, a considerable township in Rutland co. Vermont, N. W. of Poultney. It contains 545 inhabitants, and is 51 miles N. of Bennington.—*ib.*

FAIRLEE, a township in Orange co. Vermont, on the W. bank of Connecticut river, 16 miles N. of Dartmouth College. The township is hilly, but of a good soil, and has several glades of excellent land. It contains 463 inhabitants.—*ib.*

FAIR WEATHER, CAPE, on the E. coast of Patagonia, in S. America, lies northerly from Cape Virgin Mary. S. lat. 51. 45. W. long. from Greenwich 68. 10.—*ib.*

FALCONRY is a species of sport, about the antiquity of which, there has been some dispute. Under the word HAWKING (*Encycl.*) we have deduced what we thought sufficient evidence of its being practised among the Thracians, and likewise among the Britons before the invasion of this island by the Romans. Flavius Blondus, however, and Laurentius Valla, both writers of the 15th century, and the latter, one of the most learned men of his time, affirm that no nation or people were accustomed to catch either land or water-fowls with any rapacious bird trained for the purpose.

We were pleased to see our own opinion, so different from this, completely established by the learned labours of Professor Beckmann. So early (says he) as the time of Ctesias (and he refers to the page and edition of his author) hares and foxes were hunted in India by means of rapacious birds. The account of Aristotle*, however, is still more to the purpose, and more worthy of notice. "In Thrace (says he) the men go out to catch birds with hawks. The men beat the reeds and bushes which grow in marshy places, in order to raise the small birds, which the hawks pursue and drive to the ground, where the fowlers kill them with poles." The same account is to be found in another book ascrib-ed

* *Hist. Animal*, lib. ix. cap. 6.

Falconry. ed alſo to Ariſtotle, and which appears, at any rate, to be the work of an author not much younger. Reſpecting Thrace, which is ſituated above Amphipolis, a wonderful thing is told, which might appear incredible to thoſe who had never heard it before. It is ſaid that boys go out into the fields, and purſue birds by the aſſiſtance of hawks. When they have found a place convenient for their purpoſe, they call the hawks by their names, which immediately appear as ſoon as they hear their voices, and chaſe the birds into the buſhes, where the boys knock them down with ſticks and ſeize them. What is ſtill more wonderful, when theſe hawks lay hold of any birds themſelves, they throw them to the fowlers; but the boys, in return, give them ſome ſhare of the prey. *De mirabilibus auſcultat.* cap. 128.

In this paſſage, there are two additions which render the circumſtance ſtill more remarkable. The firſt is, that the falcons appeared when called by their names; and the ſecond, that of their own accord they brought to the fowlers whatever they caught themſelves. Nothing is here wanting but the Spaniel employed to find out game, the hood which is put upon the head of the hawk while it ſtands on the hand, and the thong uſed for holding it, to form a ſhort deſcription of falconry as ſtill practiſed. Our falconers, when they have taken the bird from the hawk, give him, in return, a ſmall ſhare of it; and in the like manner the Thracian hawks received ſome part of their booty.

Other writers after Ariſtotle, ſuch as Antigonus, Ælian, Pliny, and Phile, have alſo given an account of this method of fowling. Ælian, who ſeldom relates any thing without ſome alteration or addition, ſays, that in Thrace nets were uſed, into which the birds were driven by the hawks; and in this he is followed by the poet Phile. Ælian, alſo, in another place deſcribes a manner of hunting with hawks in India, which, as we are told by ſeveral travellers, is ſtill practiſed in Perſia, where it is well underſtood, and by other eaſtern nations.

The Indians (ſays he) hunt hares and foxes in the following manner: They do not employ dogs, but eagles, crows, and, above all, kites, which they catch when young, and train for that purpoſe. They let looſe a tame hare or fox, with a piece of fleſh faſtened to it, and ſuffer theſe birds to fly after it, in order to ſeize the fleſh, which they are fond of, and which, on their return, they receive as the reward of their labour. When thus inſtructed to purſue their prey, they are ſent after wild foxes and hares in the mountains; theſe they follow in hopes of obtaining their uſual food, and ſoon catch them and bring them back to their maſters, as we are informed by Cteſias. Inſtead of the fleſh, however, which was faſtened to the tame animals, they receive as food the entrails of the wild ones which they have caught.

It ſeems, therefore, that the Greeks received from India and Thrace the firſt information reſpecting the method of fowling with birds of prey; but it does not appear that this practice was introduced among them at a very early period. In Italy, however, it muſt have been very common, for Martial and Apuleius ſpeak of it as a thing every where known; the former calls a hawk the fowler's ſervant.

The Profeſſor traces the hiſtory of this art with great learning down to the preſent time. It was carried to the higheſt perfection at the principal courts of Europe (he ſays) in the 12th century, when the ladies kept hawks, which were as much fondled by thoſe who wiſhed to gain their favour as lap-dogs are at preſent. Among the oldeſt writers on falconry as an art he reckons Demetrius, who about the year 1270 was phyſician to the Emperor Michael Paleologus. His book, written in Greek, was firſt printed at Paris in 1612 with a Latin tranſlation; but its precepts (ſays our author) would be thought of very little value at preſent. For an account of the modern art of falconry ſee *Encyclopædia*.

Falk. FALK (John Peter), known to the world as one of the ſcientific travellers employed by the late Empreſs of Ruſſia to explore her vaſt dominions, was born in Weſtrogothia, a province in Sweden, about the year 1727. He ſtudied medicine in the univerſity of Upſal, and went through a courſe of botany under the celebrated Linnæus, to whoſe ſon he was tutor. He publicly defended the diſſertation (A) which that famous botaniſt had compoſed on a new ſpecies of plants, which he called *aſtromeria*.

In the year 1760, he was ſo deeply affected with depreſſion of ſpirits, that M. de Linné, in the view of obliging him to take exerciſe and diſſipation, ſent him to travel over the iſland of Gothland, to make a collection of the plants it produces, and the various kinds of corals and corallines which the ſea leaves on its ſhores. This voyage was attended with no diminution of his diſtemper, which found a continual ſupply of aliment in a ſanguine melancholy temperament, in a too ſedentary way of life, and in the bad ſtate of his finances.

Profeſſor Forſkael having left Upſal for Copenhagen in 1760, Falk followed him thither in the deſign of applying, by the advice of M. de Linné, to be appointed aſſiſtant to M. Forſkael in his famous journey thro' Arabia; but, notwithſtanding all the pains that M. Œder, and ſeveral other men of literary reputation at Copenhagen, took in his behalf, his application failed, as the ſociety that were to go on that important expedition was already formed. Obliged, with much diſcontent, to return, he herboriſed as he travelled, and enriched the Flora Suecica with ſeveral new diſcoveries.

A man in office at St Peterſburgh having written to M. Linné to ſend him a director for his cabinet of natural hiſtory, M. Falk accepted the poſt, which led him to the chair of profeſſor of botany at the apothecaries garden at St Peterſburg, a place that had been long vacant. His hypocondriac complaint ſtill continued to torment him. When the Imperial academy of ſciences was preparing in 1768 the plan of its learned expeditions, it took M. Falk into its ſervice, though his health was uncertain. He was recalled in 1771; but having got only to Kaſan in 1773, he there obtained permiſſion to go and uſe the baths of Kiſliar, from which he returned again to Kaſan at the end of the year, with his health apparently better.

But his diſeaſe ſoon returned with redoubled violence. From the month of December 1773, he had never

(A) In the collection known under the title of *Linnæi Amœnitates Academicæ*.

never quitted his bed, nor taken any other nourishment than bread dried in the Swedish manner (knækebrœd), of which he scarcely took once a day some mouthfuls dipped in tea. At first he received the visits of a few friends, but afterwards denied himself to them, and was reduced to the strictest solitude. When M. Georgi, member of the society of natural history at Berlin, who had been destined to assist and relieve the professor in the duties of his expedition, went to see him on this occasion, nothing seemed left of him but a skeleton of a wild and terrifying aspect. The few words he drew from him consisted in complaints, occasioned by a host of diseases which kept his body in torture, and threw him into the most cruel sleeplessness. The last evening M. Georgi kept him company till midnight. He spoke little, and said nothing that could give reason to suspect the design he was meditating. His hunter, and at the same time his trusty servant, offered to sit up with him the night; but he could not be persuaded to consent.

M. Georgi being requested the next day, March 31, to come to the lodging of the unfortunate gentleman, he found him lying before his bed, covered with blood; beside him lay a razor, with which he had given himself a slight wound in the throat, the fatal pistol, and a powder horn; all together presenting a tremendous spectacle. He had put the muzzle of the pistol against his throat, and resting the pommel upon his bed, he discharged the contents in such a manner, that the ball, having gone through his head, had stuck in the ceiling. His soldier had seen him still sitting up in his bed at four o'clock, at which time he usually fell into a short slumber. In his chamber was found a note written the evening before, betraying throughout the distracted state of his mind, but nothing declaratory of his design, or that was of any importance.

M. Falk, like all hypochrondriac persons, was not very communicative, and on certain occasions was distrustful. But, at the same time, he was of a sedate temper, complaisant, and upright, which made it a very easy matter to bear with him, and secure to him the indulgence of all his acquaintance. His extreme sobriety had enabled him to make some savings from his pay, though he was very beneficent; it was not, therefore, indigence that drove him to this act of violence. He was of a cold constitution, preferring solitude and quiet to society, to the company of his friends, and to ordinary amusements, which yet he did not shun, except in the latter period of his life. As to religion, he shewed on all occasions more respect for it than any strong effusions of zeal. It was solely to be ascribed to the violence of his distemper, and the weakness of mind which it brought on, that led him to put a period to his days. The fate of this unfortunate scholar was generally and justly lamented.

His papers were found in the greatest disorder. They contain, however, very useful and important relations. He particularly made it his business to inquire about the Kirguises, and other Tartarian nations, and as he frequently remained for the space of nine months together in the same place, he was enabled to procure satisfactory notions concerning the objects of his investigations. The Imperial academy, in 1774, appointed Professor Laxmann to arrange his manuscripts in order for publication; which was done accordingly.

FALLING *Spring*, a branch of James river in Virginia, where it is called Jackson's river, rising in the mountain, 20 miles S. W. of the Warm Spring. The water falls over the rock 200 feet, which is about 50 feet higher than the fall of Niagara. Between the sheet of water and the rock below, a man may walk across dry.—*Morse.*

FALMOUTH, a township, formerly including Portland, in Cumberland co. Maine, containing 2991 inhabitants. It is situated on Casco bay, 120 miles N. N. E. of Boston. Incorporated in 1718.—*ib.*

FALMOUTH, a township in Hants co. Nova-Scotia; situated on the S. E. side of the Basin of Minas, opposite Windsor, 28 miles N. W. of Halifax.—*ib.*

FALMOUTH, a maritime township in Barnstable co. Massachusetts, situated on the N. E. part of the Vineyard sound, on the W. side of the bay of its name; 77 miles S. E. by S. of Boston, 18 from Sandwich, and 9 from Holme's Hole. It was incorporated in 1686, and contains 1637 inhabitants. N. lat. 41. 33. W. long. 70. 35. It is a post town.—*ib.*

FALMOUTH, a post town in Stafford co. Virginia, situated on the N. bank of Rappahannock river, nearly opposite to Fredericksburg. It is irregularly built, and contains an Episcopalian church and about 150 houses. It is 23 miles S. W. of Dumfries, 70 N. by E. of Richmond, and 207 S. westerly of Philadelphia. Considerable quantities of tobacco are inspected here.

FALMOUTH, a town in Lancaster co. Pennsylvania, situated on the S. E. side of Conawago creek, 20 miles westerly of Lancaster. It has been lately laid out.—*ib.*

FALMOUTH, a town and harbor on the S. shore of the island of Antigua, in the West-Indies. It has English harbor on the E. and Rendezvous bay on the W.; and situated in St. Paul's parish, at the N. W. corner of the harbor, which is well fortified.—*ib.*

FALMOUTH, in the island of Jamaica, in the West-Indies, commonly called the Point, is situated on the S. side of Martha Brae harbor; and including the adjoining villages of Martha Brae and the Rock, is composed of 220 houses. Here 30 capital stationed ships load for Great-Britain, exclusive of sloops and smaller craft.—*ib.*

FALSINGTON, a village in Pennsylvania, in Bucks co. 28 miles N. E. of Philadelphia.—*ib.*

FAQUIER *Co.* in Virginia, is bounded N. by Loudon and E. by Prince William. It is about 55 miles long and 20 broad, and contains 17,892 inhabitants, of whom 6642 are slaves—*ib.*

FAREWELL, CAPE, the S. point of West Greenland, on the N. side of the entrance of Davis's straits, North America. N. lat. 59. 37. W. long. 42. 42. —*ib.*

FARMER (Richard D. D.), so well known as one of the commentators on Shakespeare, was a man of such pleasing, though singular manners, that we regret the very imperfect account which we must give of his life. One of us, who had the pleasure of being a little known to him, has been so much delighted with the natural ease and pleasantry of his conversation, that we made all the inquiries which we judged requisite to enable us to draw up such a biographical sketch of this agreeable man as might be acceptable to our readers, and not unworthy of his character; but these inquiries were made in vain. Those to whom we applied knew little more

of

Farmer. of the incidents of his life than what we had previously found in a miscellany, of which the writers seem to consider it as a principle of duty to vilify the character of every person, who, like Dr Farmer, is the friend of order, and the enemy of sudden or rapid innovations. To that miscellany, therefore, we must be beholden for many facts; but we shall certainly copy none of its malevolence.

Dr Farmer was born at Leicester 1735; but what was the station of his father we have not learned. Of his school education he received part, perhaps the whole, in his native town: and from school he was removed to the university of Cambridge, where he devoted himself chiefly to classical learning and the belles lettres. In 1757, he was admitted to the degree of bachelor of arts; in 1760, to that of master of arts; a bachelor of divinity in 1767, and a doctor of divinity in 1775, in which year he was also elected master of Emanuel on the decease of Dr Richardson, and principal librarian on the decease of Dr Barnardiston.

The disturbances in America having by this time become serious, the university of Cambridge, with numberless other loyal bodies, voted an address to the king, approving of the measures adopted by government to reduce the factious colonists to their duty. The address, however, was not carried unanimously. It was, of course, opposed by Jebbe, so well known for his free opinions in politics and religion, and by some others, of whom one man, a member of the caput, carried his opposition so far, as actually to refuse the key of the place which contained the seal necessary on such occasions. In this emergency, Dr Farmer, who was then vice-chancellor, is said to have forced open the door with a sledge-hammer; an exploit which his democratical biographers affect to redicule, by calling it *his courtly zeal*, and the occasion of all his subsequent preferments.

If it be indeed true, that he broke the door in pieces with his own hands, his conduct must be acknowledged to have been not very decorous; but if the office which he filled be taken into consideration, we apprehend it would be as difficult to prove that conduct essentially wrong, as to vindicate the obstinate arrogance of him who occasioned it. The seal was the property of the university, of which this outrageous supporter of the bill of rights was but an individual member. The univetsity had resolved that it should be employed for a certain purpose, which it was the duty of the vice-chancellor to carry into effect; and since the seal was refused to him, he had no alternative but to get possession of it by force. We hope, however, that he employed a servant to break the door; and, indeed, as vice-chancellor, he must have had so many servants at his command, that it is not conceivable he would wield the sledge-hammer himself.

Some time after this, he was made a prebendary of Canterbury, we believe through the recommendation of Lord North, then premier; and it was at Canterbury that the writer of this sketch had the happiness of being introduced to him, and witnessing his hospitality. After enjoying his prebend for several years, he resigned it on being preferred, by the present premier, to a residentiaryship of St Paul's; and we have reason to believe, that he declined a bishopric, which was offered to him as a reward for the constitutional principles which he was at pains to propagate, not only in his college, but, as far as his influence went, through the whole university.

It has been said, that the delights of the pipe and the bottle in Emanuel parlour outweighed, in his estimation, the dazzling splendor of the mitre; but he had other and better reasons for preferring a private to a public station. In early life, at least before he was advanced in years, he had felt the power of love, and had suffered such a disappointment as sunk deep in his mind, and for a time threatened his understanding. From that period, though he retained his faculties entire, he acquired some peculiarities of manner; of which he was so far conscious, as to be sensible that they would hardly become the character of a bishop; being likewise strongly attached to dramatic entertainments, which, if we mistake not, the English bishops never witness, and delighting in clubs, where he could have rational conversation without state or ceremony of any kind—he very wisely preferred his residentiaryship to the highest dignity in the church. At the time of his death, which happened in the autumn of 1797, he was a fellow of the Royal and Antiquarian Societies, master of Emanuel college, principal librarian of the public library in the university, one of the canons residentiary of St Paul's, chancellor of the diocese of Lichfield and Coventry, and prebendary of Worcester.

Though a good classical scholar, Dr Farmer has been celebrated only for that kind of literature which is connected with the English drama, and having a strong predeliction for old English writers, he ranked high among the commentators upon Shakespeare. His "Essay upon the Learning of Shakespeare," dedicated to Mr Cradock, the intelligent resident of Gumley-Hall in Leicestershire, has passed through several editions. This essay was, in fact, the first foundation of his fame, which an unconquerable indolence prevented him from carrying to that height to which the exercise of his literary talents could not have failed to raise it. So great indeed was his love of ease, that after having announced for subscriptions a history of Leicestershire, and actually begun to print it, rather than submit to the fatigue of carrying it through the press, he returned the subscriptions, and presented the MSS. and plates to Mr Nichols, the respectable printer of the Gentleman's Magazine, who has since carried on the history with a degree of spirit, ability, and industry, perhaps unprecedented in this department of literature.

Indolence and the love of ease were indeed the Doctor's chief characteristics; and to them, with the disappointment already mentioned, may be attributed a want of propriety in his external appearance, and in the usual forms of behaviour belonging to his station. The prevailing features of his character distinguished themselves by several oddities: There were three things, it was said, which the master of Emanuel loved, *viz.* old port, old clothes, and old books; and three things which no one could persuade him to perform, *viz.* to rise in the morning, to go to bed at night, and to settle an account. When in Cambridge, if an old house were pulled down, the master of Emanuel was always there in an old blue great coat, and a rusty hat. When in London, he was sure to be found in the same garb at an old book-stall, or standing at the corner of a dirty lane, poring through his glass at an old play bill.

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This character is not drawn by a friendly pencil; but it is nevertheless not unjust. His inattention to the common decencies of dress and behaviour was notorious, insomuch that, in the company of strangers, the eccentricity of his appearance and of his manners made him sometimes be taken for a person half crazed. The writer of this sketch saw him one morning at Canterbury dressed in stockings of unbleached thread, brown breeches, and a wig not worth a shilling; and when a brother prebendary of his, remarkable for elegance of manners, and propriety of dress, put him in mind that they were to attend on the archbishop, Dr Farmer replied, that it had totally escaped him; but he went home, and dressed himself like a clergyman. That he sat late reading, and occasionally drinking brandy and water, cannot be denied; and it is literally true, that he could not easily be prevailed upon to settle his accounts. His accounts with some of his pupils, when tutor of his college, were never settled to the day of his death; and the young gentlemen not unfrequently took advantage of this unconquerable indolence to borrow of him considerable sums, well knowing that there was little chance of a demand being ever made upon their parents. One gentleman, in particular, told a friend of ours, who was himself a pensioner of Emanuel, that when he left that college, he was near fifty pounds in debt to Dr Farmer; "a debt (said he) which I would have scrupulously paid, but, after repeated solicitations, I could get no bill from him."

Having been a warm partizan of government during the American war, it will readily be believed that Dr Farmer was the determined enemy of levellers and anarchists. He was such a Whig as those who placed King William on the throne; and of course deemed a violent Tory by our present republicans, of whom, to say the truth, he could hardly speak with temper. By his enemies he is admitted to have been a man of generosity. As he obtained money easily, so he parted with it easily. Whilst he was always ready to relieve distress, his bounty was frequently bestowed on the patronage of learned men and learned publications. He was, accordingly, a favourite with all good men who knew him. In his own college he was adored; in the university he had, for many years, more influence than any other individual; and, with all his eccentricities, his death was a loss to that learned body, which, in the opinion of some of its members, will not soon be made up.

FARMINGTON, a very flourishing township of excellent land, in Lincoln co. district of Maine, on Sandy river, 35 miles N. W. of Hallowell, 30 same course from Harrington, and 204 N. N. E. of Boston. Number of inhabitants, about 1200. A very few years since this township was a wilderness.—*Morse.*

Farmington, a large, pleasant, and wealthy town in Hartford co. Connecticut, 10 miles S. W. of Hartford city, 32 N. E. of New-Haven, and 22 E. of Litchfield. Farmington river, a water of Connecticut, meanders delightfully through charming intervales, which beautify and enrich this town. The houses, in the compact part of this town, stand chiefly on a street which runs N. and S. along the gentle declivity of a hill, which ascends E. of the intervales; about the centre of the street stands a large and handsome Congregational church. This town was settled as early as 1645, and its limits then were very extensive. Several towns have been since taken from it.—*ib.*

Farmington, a small river of Connecticut, which passes through the town of Farmington, where it receives Cambridge or Poquabock river, from the S. W. when it acquires the name of Windsor river and falls into Connecticut river in the town of Windsor, about 4 miles above Hartford city.—*ib.*

FASCINATION, the art of bewitching, enchantment, an unseen inexplicable influence. Under the title Serpens (*Encycl.* n° 22) we have mentioned several instances of the fascinating power of the rattle-snake, which were related by men of character, and certainly gained some degree of credit among men of science. In Vaillant's New Travels into the Interior Parts of Africa, an account is given of similar instances of fascination by African servants, some of them witnessed by himself, and others reported to him by men of veracity.

On the confines of the European colony, at a place called *Swart-land*, our traveller saw a shrike on the branch of a tree, tremble as if in convulsions, whilst it uttered the most piercing cries of distress. Closer attention led him to discover upon the next branch of the same tree a large serpent, that, with stretched-out neck, and fiery eyes, though perfectly still, was gazing on the poor animal. He shot the serpent; but, in the mean-time, the bird had died. Having measured the distance between the place where the shrike was seen in convulsions and that occupied by the serpent when it was shot, he found it to be three feet and a half; which convinced him and his attendants that the bird had not died either from the bite or the poison of its enemy. Indeed he stripped it before the whole company, and made them observe that it was untouched, and had not received the slightest wound.—In another district of Africa, during the course of the same travels, he saw a small mouse die in convulsions, occasioned by the fascinating power of a serpent, at the distance of two yards from it; and when he consulted his Hottentots upon this incident, they expressed, he says, no sort of astonishment, but assured him that the serpent had the faculty of attracting and fascinating such animals as it wished to devour.

We have already had occasion to remark how regardless this author is of inconsistencies in his narrative; and we perceive something like an inconsistency in the narratives before us. Though his Hottentots expressed no surprise at the fascination of the mouse, and declared that nothing was more common, he says expressly, that to those who witnessed the fascination of the shrike, the fact appeared so extraordinary, that they could hardly believe it, even after they had seen it.

The most wonderful instance of fascination which we have anywhere met with, was that of a Captain in the Dutch service at the Cape, who, after assuring our traveller that it is an event which happens very frequently, proceeded thus: "My testimony ought to have the more weight, as I had once nearly become myself a victim to this fascination. While in garrison at Ceylon, and amusing myself, like you, in hunting in a marsh, I was, in the course of my sport, suddenly seized with a convulsive and involuntary trembling, different from any thing I had ever experienced, and at the same time was strongly attracted, and in spite of myself,

to

Fascination to a particular ſpot of the marſh. Directing my eyes to this ſpot, I beheld, with feelings of horror, a ſerpent of an enormous ſize, whoſe look inſtantly pierced me. Having, however, not yet loſt all power of motion, I embraced the opportunity before it was too late, and ſaluted the reptile with the contents of my fuſee. The report was a taliſman that broke the charm. All at once, as if by a miracle, my convulſion ceaſed; I felt myſelf able to fly; and the only inconvenience of this extraordinary adventure was a cold ſweat, which was doubtleſs the effect of my fear, and of the violent agitation my ſenſes had undergone."

This inſtance of faſcination differs in one very material circumſtance from the two ſomewhat ſimilar inſtances mentioned in the *Encyclopædia*. In both theſe, the eyes of the perſons faſcinated were fixed on the eyes of the ſnake; but here the Dutch Captain was ſtrongly attracted towards the ſerpent before he ſaw, or even ſuſpected that ſo formidable an enemy was in his neighbourhood. If the ſtory therefore be true, the effect which he deſcribes could not poſſibly have been the effect of fear, but of ſome unſeen influence on his whole nervous ſyſtem.

The ſubject has of late attracted the attention of men of ſcience, whoſe local ſituation gives them an opportunity of making experiments upon different ſerpents, with a view to aſcertain whether they really poſſeſs or not this moſt unaccountable of all powers. In the year 1796, was printed at Philadelphia, *a Memoir concerning the Faſcinating Faculty which has been aſcribed to the Rattle-ſnake, and other American Serpents*, by Benjamin Smith Barton, M. D. Profeſſor of natural hiſtory and botany in the univerſity of Pennſylvania. In this memoir, the manner in which the faſcinating power is ſuppoſed to be exerted is thus ſtated by the ingenious profeſſor:

"The ſnake, whatever its ſpecies may be, lying at the bottom of the tree or buſh upon which the bird or ſquirrel ſits, fixes its eyes upon the animal it deſigns to faſcinate or enchant. No ſooner is this done, than the unhappy animal is unable to make its eſcape. It now begins to utter a moſt piteous cry, which is well known by thoſe who hear it, and underſtand the whole machinery of the buſineſs, to be the cry of a creature enchanted. If it is a ſquirrel, it runs up the tree for a ſhort diſtance, comes down again, then runs up, and, laſtly, comes lower down. 'On that occaſion (ſays an honeſt, but rather credulous writer*), it has been obſerved, that the ſquirrel always goes down more than it goes up.' The ſnake ſtill continues at the root of the tree, with its eyes fixed on the ſquirrel, with which its attention is ſo entirely taken up, that a perſon accidentally approaching, may make a conſiderable noiſe without the ſnake's ſo much as turning about. The ſquirrel, as before mentioned, comes always lower, and at laſt leaps down to the ſnake, whoſe mouth is already wide open for its reception. The poor little animal then, with a piteous cry, runs into the ſnake's jaws, and is ſwallowed at once, if it be not too big; but if its ſize will not allow it to be ſwallowed at once, the ſnake liks it ſeveral times with its tongue, and ſmoothens it, and by that means makes it fit for ſwallowing."

* *Profeſſor Peter Kalm.*

From Dr Barton's memoir, it appears that the North American Indians are by no means of one opinion reſpecting the faſcinating power of the rattle-ſnake. Some intelligent friends of his, well acquainted with the manners, religious opinions, and ſuperſtitious prejudices of thoſe people, informed him, that though they had often heard the Indians ſpeak of the ingenuity of theſe reptiles in catching birds, ſquirrels, &c. they did not recollect having ever heard them ſay that ſnakes *charm* birds. On the other hand, however, a Mohegan Indian told the Doctor himſelf, that the Indians are of opinion, that the rattle-ſnake can charm or bewitch, ſquirrels and birds, and that it does this with its rattle, which it ſhakes, thereby inviting the animals to deſcend from the trees, after which they are eaſily caught. According to this Indian, his countrymen do not think that the ſnake, in any manner, accompliſhes the buſineſs with its eyes. A Choktah Indian aſſured the Doctor, that the rattle-ſnake does charm birds, &c.; but he was honeſt enough to confeſs, that he did not know in what manner it does it. The interpreter, through whom the converſation was carried on with this Indian, ſaid that the ſnake charms by means of its rattle.

This opinion of the interpreter was the opinion of Dr Mead. That eminent naturaliſt, controverting, about fifty years ago, the common opinion, that Providence has furniſhed the rattle-ſnake with its rattle to give warning to travellers, was the firſt who aſſerted that this ſingular appendage is given to the animal to terrify ſquirrels and ſmall birds, which are then ſo ſtupified by the ſight of ſo formidable an enemy, that at length they drop down and become its prey; and that this is what the Indians call *faſcination*. The ſame opinion has been adopted by profeſſor Blumenbach of Gottingen, who, in his Manual of Natural Hiſtory, thus expreſſes himſelf on this curious ſubject:

"That ſquirrels, ſmall birds, &c. fall down ſpontaneouſly from trees into the mouth of the rattle-ſnake, lying below them, is an undiſputed fact; and is the leſs ſurpriſing, as the like phenomena have been remarked in regard to other ſnakes, and alſo toads, hawks, and cats; all of which, in certain circumſtances, as appears, have the power of drawing towards them ſmall animals, merely by fixing their eyes ſtedfaſtly on them. In regard to the rattle-ſnake, this effect is produced by the rattle in its tail, the hiſſing noiſe of which makes ſquirrels, &c. whether through curioſity, miſtake, or terror, ſeem to approach the animal as it were ſpontaneouſly. At any rate, I know, from the information of intelligent eye-witneſſes, that it is a common ſtratagem of the young ſavages in America to conceal themſelves in the buſhes, where they imitate the hiſſing noiſe of the rattle-ſnake, and by theſe means attract ſquirrels, which they are then enabled to catch."

To this opinion Dr Barton oppoſes an inſuperable objection. It is, that this faſcinating power is by no means peculiar to the rattle-ſnake. With regard to the ſtratagem of the ſavages, he thinks that Dr Blumenbach has been impoſed upon; as neither he, nor any other perſon of whom he made the inquiry, ever heard of ſuch a ſtratagem. The young Indians, he ſays, place a reed croſs-wiſe in their mouth, and by a tremulous motion of the lips, imitate the cry of young birds; by which means they entice the old ones, ſo that they can eaſily ſhoot them: And this practice may have given riſe to the ſtory of their imitating the hiſſing noiſe of the rattle-ſnake.

Some have ſuppoſed that ſerpents, under certain circumſtances,

cumſtances, emit from their bodies a ſtupifying vapour; and that it is this vapour which produces the effect called *faſcination:* But againſt this opinion Dr Barton alleges the following arguments: "I know, indeed (ſays he), that in ſome of the larger ſpecies of ſerpents, inhabiting South America and other countries, there is evolved in the ſtomach, during the long and tedious proceſs of digeſtion in theſe animals, a vapour or a gas, whoſe odour is intenſely fetid. I have not, however, found that this is the caſe with the rattle-ſnake, and other North American ſerpents, that I have examined. But my own obſervations on this head have not been very minute. I have made inquiry of ſome perſons (whoſe prejudices againſt the ſerpent tribe are not ſo powerful as my own), who are not afraid to put the heads and necks of the black ſnake, and other ſerpents that are deſtitute of venomous fangs, into their mouths, and have been informed, that they never perceived any diſagreeable ſmell to proceed from the breath of theſe animals. I have been preſent at the opening of a box which contained a number of living ſerpents, and although the box had been ſo cloſe as to admit but a very ſmall quantity of freſh air, although the obſervation was made in a ſmall warm room, I did not perceive any peculiarly diſagreeable effluvium to ariſe from the bodies of theſe animals. I am, moreover, informed by a member of this ſociety*, who has, for a conſiderable time, had a rattle-ſnake under his immediate care, that he has not obſerved that any diſagreeable vapour proceeds from this reptile. On the other hand, however, it is aſſerted by ſome creditable perſons of my acquaintance, that a moſt offenſive odour, ſimilar to that of fleſh in the laſt ſtage of putrefaction, is continually emanating from every part of the rattle-ſnake, and ſome other ſpecies of ſerpents. This odour extends under certain circumſtances, to a conſiderable diſtance from the body of the animal. Mr William Bartram aſſures me, that he has obſerved 'horſes to be ſenſible of, and greatly agitated by it, at the diſtance of forty or fifty yards from the ſnake. They ſhewed (he ſays) their abhorrence by ſnorting, winnowing, and ſtarting from the road, endeavouring to throw their riders, in order to make their eſcape.' This fact, related by a man of rigid veracity, is extremely curious; and, in an eſpecial manner, deſerves the attention of thoſe writers who imagine that this fetid emanation from ſerpents is capable of affecting birds, at ſmall diſtances, with a kind of aſphyxy. It even gives *ſome* colour of probability to the ſtory related by Metrodorus, and preſerved in the Natural Hiſtory of Pliny‡.

* *American Philoſophical Society.*

‡ *Lib.* 28. *Cap.* 14.

Some experiments, however, which were made in Philadelphia a little before the Doctor compoſed his memoir, ſeem to have been deciſive not only as to the fetor, but as to every thing which reſembles faſcination in the rattle-ſnake. Birds which were put into a cage which contained a rattle-ſnake, flew or ran *from* the reptile, as though they were ſenſible of the danger to which they were expoſed. The ſnake made many attempts to catch the birds, but could ſeldom ſucceed. When a dead bird was thrown into the cage, the ſnake devoured it immediately. He ſoon caught and devoured a living mole, an animal much more ſluggiſh than the bird. Dr Barton himſelf ſaw a ſnow-bird (ſee EMBERIZE *Encycl.*) in a cage with a large rattle-ſnake. The little animal had been thus impriſoned for ſeveral hours when he firſt ſaw it, but it exhibited no ſigns of fear. It hopped about from the floor of the cage to its rooſt, and frequently perched on the ſnake's back. Its chirp was nowiſe tremulous, but perfectly natural. It ate the ſeeds which were put into the cage; and by its whole actions moſt evidently demonſtrated that its ſituation was not uneaſy.

Having thus diſpoſed of the doctrines of ſome of his predeceſſors, Dr Barton proceeds to ſay: "The reſult of not a little attention to the ſubject has taught me, that there is but one wonder in the buſineſs;—the wonder that the ſtory ſhould ever have been believed by a man of underſtanding and of obſervation." Faſcination, we are informed, is almoſt entirely limited to birds that build low, and "in almoſt every inſtance, I found that the ſuppoſed faſcinating faculty of the ſerpent was exerted upon the birds at the particular ſeaſon of their laying their eggs, of their hatching, or of their rearing their young, ſtill tender and defenceleſs. I now began to ſuſpect, that the cries and fears of birds ſuppoſed to be faſcinated originated in an endeavour to protect their neſt or young. My inquiries have convinced me that this is the caſe.

The rattle-ſnake, which is the lazieſt of all the ſerpent tribe, never moves in a ſpiral manner or climbs up trees; but the black ſnake, and ſome other ſpecies of the genus coluber, do. When impelled by hunger, and incapable of ſatisfying it by the capture of animals on the ground, they begin to glide up trees or buſhes upon which a bird has its neſt. The bird is not ignorant of the ſerpent's object. She leaves her neſt, whether it contains eggs or young ones, and endeavours to oppoſe the reptile's progreſs. In doing this, ſhe is actuated by the ſtrength of her inſtinctive attachment to her eggs, or of affection to her young. Her cry is melancholy, her motions are tremulous. She expoſes herſelf to the moſt imminent danger. Sometimes ſhe approaches ſo near the reptile that he ſeizes her as his prey. But this is far from being univerſally the caſe. Often ſhe compels the ſerpent to leave the tree, and then returns to her neſt.

It is a well known fact, that among ſome ſpecies of birds, the female, at a certain period, is accuſtomed to compel the young ones to leave the neſt; that is, when the young have acquired ſo much ſtrength that they are no longer entitled to all her care. But they ſtill claim ſome of her care. Their flights are aukward, and ſoon broken by fatigue. They fall to the ground, where they are frequently expoſed to the attacks of the ſerpent, which attempts to devour them. In this ſituation of affairs, the mother will place herſelf upon a branch of a tree or buſh, in the vicinity of the ſerpent. She will dart upon the ſerpent, in order to prevent the deſtruction of her young: but fear, the inſtinct of ſelf preſervation, will compel her to retire. She leaves the ſerpent, however, but for a ſhort time, and then returns again. Oftentimes ſhe prevents the deſtruction of her young, attacking the ſnake with her wings, her beak, or her claws. Should the reptile ſucceed in capturing the young, the mother is expoſed to leſs danger. For, whilſt engaged in ſwallowing them, he has neither inclination nor power to ſeize upon the old one. But the appetite of the ſerpent tribe is great: the capacity of their ſtomachs is not leſs ſo. The danger of the mother is at hand when the young are devoured. The

ſnake

snake seizes upon her: and this is the castrophe, which crowns the tale of fascination!

FAVOURABLE *Lake*, in N. lat. 52. 48. W. long. 93. 10. is the source of two large rivers, at the mouth of one of which, emptying into Winnipeg lake, stands the Canadian house. The other is the S. W. branch of Severn river.—*Morse*.

FAUSSE-BRAYE, in fortification, an elevation of earth, about three feet above the level ground, round the foot of the rampart on the outside, defended by a parapet about four or five fathoms distant from the upper parapet, which parts it from the berme and the edge of the ditch. The fausse-braye is the same with what is otherwise called *Chemin des rondes*, and *Basse enceinte*; and its use is for the defence of the ditch.

FAWN, a township in York co. Pennsylvania.—*Morse*.

FAYETTE, a settlement in Tioga co. New-York, between the Unadilla and the main branch of the Chenengo. It is laid out into 100 lots of a square mile each, as nearly as the ground will permit.—*ib*.

FAYETTE, *Co.* in Pennsylvania, is bounded N. by Westmoreland, S. by part of Maryland and Virginia, and W. by Monongahela river. It is 39 miles in length and 29 in breadth, and contains 473,280 acres; divided into 11 townships, of which Union is the chief. The number of inhabitants is 13,325, of whom 282 are slaves.—*ib*.

FAYETTE, a district of N. Carolina, comprehending 6 counties, viz. Moore, Cumberland, Sampson, Richmond, Robeson, and Anson. It is bounded N. by Hillsborough, S. E. by Wilmington and Newbern, W. by Salisbury, and S. by the state of S. Carolina. It is 120 miles in length, and 50 in breadth, and contains 34,020 inhabitants, of whom 5,678 are slaves.—*ib*.

FAYETTE, a co. of Kentucky, surrounded by Clarke, Bourbon, Scott, Franklin, Woodford, Maddison, and Mercer counties. Chief town Lexington.—*ib*.

FAYETTEVILLE, so called in honor of the Marquis La Fayette, a flourishing post town of North-Carolina, the seat of justice for the above district, and pleasantly situated in Cumberland co. on the W. side of the N. W. branch of Cape Fear river, nearly at the head of navigation, and 100 miles above Wilmington, and 61 southerly of Raleigh. On the bank of the river, stand a few buildings and the tobacco ware houses, which have received in one season 6000 hhds. of tobacco, equal in quality to that of Petersburg. The compact part of the town is situated about a mile from the river, near the junction af Blount's and Cross creek; on which last it is chiefly erected, and from that circumstance was formerly named Cross Creek. On both sides the creek are about 400 houses, 2 handsome edifices for the supreme, district, and county courts, and the meetings of the town officers and its citizens. The Free Masons' lodge is also a large and handsome building. The town is regularly laid out, and its principal streets are 100 feet wide. Here are three mills, two considerable distilleries and breweries, and several extensive tan yards. The trade to Wilmington is very considerable, to which it sends down tobacco, wheat, flour, beef, pork, flax-seed, hemp, cotton, butter, lumber, staves, naval stores, &c. The boats used in transporting these articles to Wilmington, contain about 120 barrels, and make their returns of European and India goods, &c. in from 10 to 20 days. The situation of the town is agreeable and healthy, and well adapted for establishing manufactories. The country immediately round the town is considerably elevated, and the soil dry and barren; but near the water courses, which are numerous, the soil is as rich as any in the state. Since the fire in 1792, which destroyed many houses, the people begin to build with brick, which are made here of a good quality, and sold reasonably. The town stands in a settlement of Scotch Highlanders, and is 55 miles N. W. of Camden in S. Carolina, 100 S. W. of Tarborough, 147 S. W. by S. of Halifax, 379 S. by W. of Washington city, and 526 S. W. by S. of Philadelphia.—*ib*.

FEAR POINT, CAPE, at the mouth of Cape Fear river in N. Carolina, 4 miles S S. E. of the light-house on Bald Head.—*ib*.

FEATHER-EDGED, is a term used by workmen for such boards as are thicker on one edge, or side, than on the other.

FEDERALSBURG, a village in Maryland, on the E. side of Chesapeak bay, situated on Marshy Hope creek, partly in Dorchester and partly in Caroline co. 5 miles E. N. E. of Hunting-Creek town, and about 20 N. E. of Cambridge.—*Morse*.

FE D'ANTIOCHIA, SANTA, the most northern town of Popayan, a district of Terra Firma, S. America. It is situated 200 miles N. of Popayan city, near the confines of the province of Carthagena, on the banks of St Martha river, and near 180 miles S. of its conflux with the Magdalena. Thither the inhabitants removed from Antiochia, 15 leagues from it, now an inconsiderable place, whereas Santa Fe d'Antiochia is a considerable place, and capital of the audience of Santa Fe.—*ib*.

FE DE BAGOTA, SANTA, the capital of New-Grenada, S. America, situated on the banks of the little river Pati, a water of the Magdalena; is 180 miles E. of the bottom of Bonaventura bay. It is an archbishop's see, and the seat of an university founded by king Philip III. in 1610. Near this city are gold mines. The air is temperate and healthful, and provisions plenty. S. lat. 4. 10. W. long. 74. 5.—*ib*.

FE, or FOY, SANTA, a place in the middle of Veragua, a province in the audience of Guatimala, in North America, where the king of Spain keeps officers for casting and refining gold. It stands at the source of a river which runs into the North Sea.—*ib*.

FE, SANTA, the capital of New-Mexico, in N. America. It is situated near the source of Rio del Nort, 130 leagues from its mouth, in the gulf of Mexico. It is said to be a rich and regularly built city, and a bishop's see. Baudrand makes it 9 leagues from the river. It is also called Santa Fe de Grenada: by others New-Mexico. N. lat. 36. W. long. 104.—*ib*.

FE, SANTA, a city of Paraguay, S. America, 150 leagues S. by S. W. of the city of Assumption. The inhabitants are chiefly employed in husbandry, grazing, and weaving cloth. They sell their productions and manufactures to good profit in Brazil. From hence is a road to Potosi in Peru, and to Corbuda in Tucumana; which being easy and convenient, is very advantageous to this place. The distance not being above 350 leagues. It stands on the W. side of Paraguay river. S. lat. 30. 45. W. long. 60 40.—*ib*.

FELTING,

Felting. Felting.

FELTING, the method of working up wool or hair into a kind of cloth or stuff, without either spinning or weaving it. In this country felting is little practised except in hat making; and as nine-tenths of those who are employed in the manufacturing of hats know nothing of the principles on which they proceed, the following observations on the mechanism of felting must to them be both agreeable and useful. They are by M. Monge, and taken from the *Annales de Chemie*.

If we examine, in a microscope, human hair, wool, the hair of a rabbit, hare, beaver, &c. however great the magnifying power of the instrument may be, the surface of each hair appears perfectly smooth and even; or at least, if any inequalities are to be perceived, they seem rather to arise from some difference in the colour and transparency of particular parts of these substances than from the irregularity of their surfaces; for their image, when viewed by a solar microscope, is terminated by even lines, without any roughness. The surface of these objects, however, is by no means smooth; on the contrary, it appears to be formed either of *lamellæ* which cover each other from the root to the point, pretty much in the same manner as the scales of a fish cover the animal from the head to the tail; or, more probably, of zones placed one over the other, like what is observed in the structure of horns: to this conformation it is, that the substances here treated of owe their disposition to what is called felting.

If, with one hand, we take hold of a hair by the root, and draw it between two fingers of the other, from the root towards the point, we are hardly sensible of any friction or resistance, nor can we distinguish any sound; but if, on the contrary, we hold the hair at the point, and draw it between the fingers, from the point towards the root, we are sensible of a resistance which did not exist in the former case; a sort of tremulous motion is likewise produced which is not only perceptible to the touch, but may also be distinguished by the ear.

It is evident therefore, that the texture of the surface of a hair is not the same from the root towards the point as from the point towards the root; and that a hair, when grasped, must offer more resistance in sliding or moving progressively towards the point than towards the root; *i. e.* in moving with its point foremost

If a hair, after being taken hold of by the fore finger and thumb, he rubbed by them, in the longitudinal direction of the hair, a progressive motion takes place, and this motion is always towards the root. This effect does not at all depend on the nature of the skin of the fingers or its texture; for if the hair be turned, so that the point is placed where the root was, the movement then becomes contrary to what it was before; that is to say, it is always directed towards the root.

What is observed, in the above instance, is entirely analogous to what happens when country children, by way of sport, introduce an ear of rye or barley between the wrist and the shirt, the points of the beards of which are directed outwards. By the various motions of the arm, this ear, sometimes catching against the shirt, sometimes against the skin, takes a progressive motion backwards, and soon gets up to the arm-pit. It is very clear that this effect is produced by the beards of the ear, and indeed chiefly by the asperities upon those beards; which, being all directed towards the point, do not permit the ear to move in any other direction than towards that part to which it was united to the stalk. There is no doubt that it is the same with respect to hair; and that its surface is beset with asperities, which, being laid one upon the other, and turned towards the points, permit no motion but towards the root.

A tight knot, made in the middle of a hair, is very difficult to untie by the usual means, on account of the extreme thinness of the hair; but if we place the hair in the bend of the hand, so that the knot is in a line with the little finger, and, after grasping the hair by closing the hand, we strike the fist several times against the knee, the asperities of one end of the hair being now in a contrary direction to those of the other, each of the ends recedes a little, one of them one way, the other the contrary way; the knot is thereby opened, and, by introducing a pin into the eye which is formed, it is very easy to finish untying it.

These observations, which it would be useless to multiply, relate to long hair, that having been taken as an example; but they apply with equal propriety to wool, furs, and in general to every kind of animal hair. The surface of all these is therefore to be considered as composed of hard *lamellæ* placed one upon another, like tiles, from the root to the point; which *lamellæ* allow the progressive motion of the hair towards the root, but prevent a similar motion towards the point.

From what has been said, it is easy to explain why the contact of woolen stuffs is rough to the skin, while that of linen or cotten cloths is smooth; the reason is, the asperites upon the surface of the fibres of the wool (notwithstanding the flexibility of each particular fibre), by fixing themselves in the skin, produce a disagreeable sensation, at least till we are accustomed to it; whereas the surface of the fibres of hemp or flax, of which linen is made, being perfectly smooth, do not cause any such sensation. It is also evident, that the injury arising to wounds or sores, from the application of wool, does not proceed from any chemical property, but is occasioned solely by the conformation of the surface of the fibres; the asperities of which attach themselves to the raw and exposed flesh, which they stimulate and irritate to such a degree as to produce inflammation.

This conformation is the principal cause of that disposition to what is called felting, which the hair of all animals in general possesses.

The hatter, by striking the wool with the string of his bow (see HAT, *Encycl.*), separates the hairs from each other, and causes them to spring up in the air; the hairs fall again on the table, in all possible directions, so as to form a layer of a certain thickness, and the workman covers them with a cloth, which he presses with his hands, moving them backwards and forwards in various directions. This pressure brings the hairs against each other, and multiplies their points of contact; the agitation of them gives to each hair a progressive motion towards the root; by means of this motion the hairs are twisted together, and the *lamellæ* of each hair, by fixing themselves to those of other hairs which happen to be directed the contrary way, keep the whole in that compact state which the pressure makes it acquire. In proportion as the mass becomes compact, the pressure of the hands should be increased; not only to make it more close, but also to keep up the progressive

Felting.

progressive motion and twisting of the hairs, which then takes place with greater difficulty: but throughout the whole of this operation, the hairs fix themselves only to each other, and not to the cloth with which they are covered, the fibres of which, as we have already said, are smooth, and have not that disposition to felting which we have described above.

It may not be amiss here to explain why that hair which is intended for making hats is always cut off with a sharp instrument (although that cannot be done without losing a part of its length), and not plucked out by the roots, as might be done after softening the skin: the reason is, the bulb of the hair, which in the latter case would come out with it, would render that end which was fixed in the skin thick and obtuse; and it would consequently be less disposed to introduce itself among the contiguous hairs, and to contribute by its progressive motion to the contexture of the mass.

The above described conformation of the surface of hairs and wool is not the only cause which produces their disposition to felting. It is not sufficient that every hair possesses the forementioned tendency to move progressively towards the root, and that the inclined *lamellæ*, by hooking themselves to each other, preserve the mass in that state to which compression has brought it; but it is also necessary that the hairs should not be straight, like needles; if they were so, pressing and rubbing them together would merely cause them to continue their progressive motion, without changing their direction: and the effect of those operations would only be to make them move from the centre of the mass, without producing any compactness in it. Every hair must therefore be twisted or curled in such a manner that the extremity which is towards the root may be disposed to change its direction perpetually, to twist itself about other hairs, and to incline towards itself again, in case it should be determined thereto by any change in the position of the rest of its length. It is because wool has naturally this crooked form that it is so proper for felting, and that it may be made use of for that purpose without undergoing any previous preparation.

But the hairs of the beaver, the rabbit, the hare, &c. being naturally straight, cannot be employed alone in felting till they have undergone a preliminary operation; which consists in rubbing or combining them, before they are taken off the skin, with a brush dipped in a solution of mercury in aquafortis (nitric acid). This liquor, acting only on one side of the substance of the hairs, changes their direction from a right line, and gives them that disposition to felting which wool naturally possesses.

When the hairs are not intended to enter into the body of the mass, but are only to be employed in making a sort of external coating, such as is sometimes given to the outer surface of hats, the operation just mentioned need not be performed; but the felt on which they are to be fixed being finished, the hair is uniformly spread upon the surface to which the coating is to be applied; and, being covered with a cloth, it is pressed with the hands, and agitated for a certain time. By these means, the hairs introduce themselves, by the root, a certain depth into the felt, and are there fixed by their *lamellæ* in such a manner as not to be easily extracted. A particular direction is afterwards given to them by means of a brush, and they are made to keep this direction by having a hot iron passed over them. If the agitation were continued for a longer time, these hairs, not having their straightness destroyed by the operation before describe l, would pass entirely through the felt, going out at the opposite surface, as each hair follows exactly the direction it acquired at the beginning.

Fer, Point au || Fergusson.

It is owing to the very same circumstances which make wool and hair capable of felting, that woollen cloth is thickened by fulling. See FULLING in this Supplement.

FER, POINT AU, on the W. coast of lake Champlain, lies in Clinton co. nearly 5 miles S. of the division line between New-York and Lower Canada, and 25 miles S. of St. John's. The British occupied a barrack here, furnished with one field piece, a few men, and a subaltern officer. It has been given up according to treaty.—*Morse.*

FERDINAND NARONKA, an island on the coast of Brazil, South America, lies in S. lat. 3. 56. W. long. 32. 43.—*ib.*

FERGUSSON (Robert), who at an early period of life obtained a considerable degree of celebrity as a Scottish poet, was born at Edinburgh on the 5th of September 1750, according to a manuscript account of him with which we have been favoured by a relation. In the biographical sketch prefixed to the Perth edition of his poems he is said to have been born in 1751.

His father William Fergusson possessed, as well as himself, some talents for poetry; but, marrying early, and being wiser than his son, he abandoned the muses for trade, and was employed in different mercantile houses, first in Aberdeen, and afterwards in Edinburgh. At the time of his death, he was an accountant in the British linen hall, but never acquired any thing like opulence.

During the years of infancy and childhood, the constitution of our poet was so weak, that little hopes were entertained of his arriving at manhood. By the care, however, and attention of his parents, he gradually acquired strength, and at the age of six was put to an English school, where his proficiency in reading and reciting was uncommonly great. At the age of seven he was sent to the high school of Edinburgh, where he continued four years, and with very little labour made a rapid progress in the knowledge of the Latin tongue; but for some reason or other he was removed from the high school to the grammar school of Dundee, whence, after two years he was sent to the university of St Andrews. A gentleman of the name of Fergusson had left bursaries in that university for the education of two boys of the same name; and Mr William Fergusson having with difficulty obtained one of them for his son, was induced to educate him at St Andrews in preference to Edinburgh.

Though at no period of his life a severe student, our poet's attainments in science were such as to keep alive in the university the hopes which had been formed of him at school; and he was confessedly the first mathematician of his standing. On this account we are told that he became the favourite of Dr Wilkie, who was then professor of natural philosophy in the university of St Andrews; but it is not improbable that the Doctor valued him as much for his poetical genius as for his skill

ſkill in geometry; for Wilkie was a poet himſelf, and Mr Ferguſſon had already written ſeveral ſmall poems which attracted conſiderable notice, as well from the profeſſors as from his fellow-ſtudents. But whatever was the bond of union, Dr Wilkie patroniſed the youthful poet; and the poet ſhewed afterwards that he was not ungrateful. Upon the Doctor's death, he publiſhed, in the Scottiſh dialect, a beautiful eclogue to his memory, in which the peculiar merits of that eccentric genius are appreciated with great judgment. See Wilkie, in this Supplement.

During the laſt winter that he reſided in St Andrews, our poet had collected materials for a tragedy on the death of Sir William Wallace, and had even completed two acts of the play; but having ſeen a ſimilar work on the ſame ſubject, he abandoned his deſign; "becauſe (ſaid he to a friend) whatever I publiſh ſhall be original, and this tragedy might be conſidered as a copy."

Having finiſhed his ſtudies at the univerſity, he returned to Edinburgh without reſolving on any permanent employment. His father had deſigned him for the church; but he was now dead, and our author turned a deaf ear to the intreaties of his mother, and of every other friend who endeavoured to perſuade him to fulfil his father's intention. He was then adviſed to ſtudy phyſic; but he declined it, becauſe, he ſaid, that, when reading the deſcription of diſeaſes, he fancied that he felt the ſymptoms of them all in himſelf. To the law, however, he could not ſtart the ſame objection; and he began to ſtudy it, but made no progreſs. At this his relation and the editor of his poems expreſs no ſurpriſe; for, according to them, it was a ſtudy the moſt improper for him, as it could not be expected that a genius ſo lively would ſubmit to the drudgery of that dry and ſedentary profeſſion.

That the law was a very improper profeſſion for a man of his narrow fortune is indeed true; but we truſt that his two biographers will not conſider us as intending any offence to them, if we embrace the preſent opportunity of expoſing the folly of a very common remark, that a lively genius cannot ſubmit to what is abſurdly called a dry ſtudy. We might inſtance different lawyers at our own bar, who, with great poetical talents in their youth, have riſen to the ſummit of their profeſſion; but to avoid perſonal diſtinctions at home, we ſhall take our examples from England. The genius of the late Earl of Mansfield was at leaſt as lively as that of Mr Ferguſſon, and if he had pleaſed he could have been equally a poet; yet he ſubmitted to the drudgery of ſtudying a law ſtill drier than that of Scotland. To the fine taſte of Atterbury biſhop of Rocheſter, and to his claſſical compoſitions both in proſe and verſe, no man is a ſtranger who is at all converſant in Engliſh literature: yet that elegant ſcholar and poet, after he had riſen to the dignity of Dean of Carliſle, ſubmitted to the drudgery of ſtudying, through the medium of barbarous Latin, the eccleſiaſtical law of England from the earlieſt ages; and declared, that by dint of perſeverance he came in time to reliſh it as much as the ſtudy of Homer and Virgil. Whatever be thought of Milton's political principles, no man can read his controverſial writings, and entertain a doubt but that he could have ſubmitted to the drudgery of ſtudying the law.

The truth is, and it is a truth of great importance, that a man of real vigour of mind may bring himſelf to delight in any kind of ſtudy which is uſeful and honourable. Such men were Lord Mansfield, the Biſhop of Rocheſter, and Milton; but, whether through ſome radical defect in his nervous ſyſtem, or in conſequence of early diſſipation, Mr Ferguſſon, with many eſtimable qualities was ſo utterly deſtitute of this mental vigour, that rather than ſubmit to what his friends call drudgery, he ſeems to have looked with a wiſhful eye to ſome ſinecure place.

With this view he paid a viſit to an uncle who lived near Aberdeen, a man of great learning and in opulent circumſtances, in hopes that, by his intereſt, he might be ſettled in a poſt ſuitable to his merit: But how deluſive were his hopes! His uncle indeed received him with every mark of affection; but his fondneſs gradually cooled, and at the end of ſix months, he ordered him abruptly to leave his houſe, without having endeavoured to procure for him any ſettlement.

To a mind like Ferguſſon's, feelingly alive, ſuch treatment from ſo near a relation, to whom he had always behaved with becoming reſpect, muſt have been dreadfully galling. Stung with indignation, he returned to his mother's at Edinburgh; and as ſoon as he recovered from a ſevere illneſs, brought upon him by diſappointment and the fatigue of his journey, he compoſed two elegies; one on "The Decay of Friendſhip," and the other "Againſt Repining at Fortune," both occaſioned by his adventure in the North. How much he felt the daſhing of his hopes, is apparent from the following pathetic lines in the Decay of Friendſhip:

But, ah! theſe youthful ſportive hours are fled,
  Theſe ſcenes of jocund mirth are now no more;
No healing ſlumbers 'tend my humble bed,
  No friends condole the ſorrows of the poor.

And what avails the thoughts of former joy?
  What comfort bring they in the adverſe hour?
Can they the canker-worm of care deſtroy,
  Or brighten fortune's diſcontented lour?

So deſtitute was he at this period, that he ſubmitted to copy papers in the commiſſary clerk's office, we believe at ſo much the ſheet; but not liking the employment, and quarrelling with the commiſſary clerk depute, he ſoon left the office in diſguſt.

Hitherto he had lived rather in obſcurity; and happy had it been for him, if in that obſcurity he had been ſuffered to remain: happy had it been for him, had his converſation been leſs faſcinating, and his company leſs courted by the frolic and the gay. Poſſeſſing an inexhauſtible fund of wit, the beſt good nature, much modeſty, and great goodneſs of heart, he was viewed with affection by all to whom he was known; but his powers of ſong, and almoſt unrivalled talents for mimickry, led him oftener into the company of thoſe who wiſhed for him merely to enliven a ſocial hour, than of ſuch as by their virtue were inclined, and by their influence were able, to procure him a competent ſettlement for life. The conſequence of this was great laxity of manners. His moral principles indeed were never corrupted, nor, as we have reaſon to believe, his faith in revelation ſhaken; but there is no doubt but that, courted as he was by the ſyren voice of pleaſure, he yielded to many temptations, and in the hours of ebriety committed

Fergusson.

committed actions which, in his cooler moments, he reflected on with abhorrence.

His conſcience was indeed frequently rouſed. Being on a viſit to a friend at Haddington, and ſauntering one day near the church yard, he was accoſted by a clergyman, who ſeemed to be no ſtranger to the kind of life which he led. This judicious divine contrived to draw his attention to the ſhortneſs of time, the length of eternity, death and judgment, and the awful ſtate that awaits the wicked in an unſeen world; and the converſation made a deep impreſſion on his mind. It ſeemed, however, to be effaced from his memory by the diſſipation of Edinburgh, till it was recalled with double effect by the following accident:

In the room adjoining to that in which he ſlept was a ſtarling, which being ſeized one night by a cat that had found its way down the chimney, awaked Mr Ferguſſon by the moſt alarming ſcreams. Having learned the cauſe of the alarm, he began ſeriouſly to reflect how often he, an immortal and accountable being, had in the hour of intemperance ſet death at defiance, though it was thus terrible in reality even to an unaccountable and ſinleſs creature. This brought to his recollection the converſation of the clergyman, which, aided by the ſolemnity of midnight, wrought his mind up to a pitch of remorſe that almoſt bordered on frantic deſpair. Sleep now forſook his eyelids; and he roſe in the morning, not as he had formerly done, to mix again with the ſocial and the gay, but to be a recluſe from ſociety, and to allow the remembrance of his paſt follies to prey upon his vitals. All his vivacity now forſook him; thoſe lips which were formed to give delight, were cloſed as by the hand of death; and "on his countenance ſat horror plum'd."

From this ſtate of gloomy deſpondency, however, he began gradually to recover; and, except that a ſettled melancholy was viſible in his countenance, his health was completely reſtored, when one evening he fell and cut his head ſo dreadfully, that from the loſs of blood he became delirious. In this deplorable ſtate he continued for ſeveral months, till, being quite exhauſted by want of ſleep and conſtant ſpeaking, he expired on the 16th of October 1774. He was interred in the Canongate church yard, where his friends erected a monument to his memory, which has been ſince removed to make way for a larger and more elegant monument by his enthuſiaſtic admirer the late poet Burns.

Thus died Robert Ferguſſon, a young man of the brighteſt genius and of the beſt heart, who, had he joined prudence to his uncommon talents, muſt have riſen to great eminence in the republic of letters; but, as a late juvenile poet has obſerved of him——

> Complete alike in head and heart,
> But wanting in the prudent part,
> He prov'd a poet's lot.

Of his poems no general character can be given. The ſubjects of them are ſometimes uncommon and generally local or temporary. They are of courſe very unequal. But ſuch of them as are in the Scottiſh dialect have been univerſally admired by his countrymen; and when it is conſidered that they were compoſed amidſt a round of diſſipation, they will be allowed to furniſh complete evidence of his genius and his taſte.

Fermanagh || Fermentation.

FERMANAGH, a townſhip in Mifflin co. Pennſylvania.—*Morse*.

FERMAT (Peter), who was counſellor of the parliament of Toulouſe in France, flouriſhed in the 17th century, and died in 1663. He was a man of great talents, and a very general ſcholar; but being contemporary and intimately connected with Des Cartes, Merſenne, Torricelli, and Huygens, he was naturally led to devote much of his time to the mathematical ſciences. He was (ſays Dr Hutton) a firſt rate mathematician, and poſſeſſed the fineſt taſte for pure and genuine geometry, which he contributed greatly to improve, as well as algebra.

Fermat was author of, 1. A Method for the Quadrature of all ſorts of parabolas.—2. Another on Maximums and Minimums: which ſerves not only for the determination of plane and ſolid problems, but alſo for drawing tangents to curve lines, finding the centres of gravity in ſolids, and the reſolution of queſtions concerning numbers: in ſhort, a method very ſimilar to the fluxions of Newton.—3. An Introduction to Geometric Loci, plane and ſolid.—4. A Treatiſe on Spherical Tangencies: where he demonſtrates in the Solids, the ſame things as Vieta demonſtrated in planes.—5. A Reſtoration of Apollonius's two books on Plane Loci.—6. A General Method for the dimenſion of Curve Lines. Beſides a number of other ſmaller pieces and many letters to learned men; ſeveral of which are to be found in his *Opera Varia Mathematica*, printed at Toulouſe, in folio, 1679.

FERMENTATION is a chemical proceſs which has been already conſidered in the *Encyclopædia*, and will be again reſumed in this *Supplement* under the title *Animal and Vegetable* Substances. In this place we mean nothing more than to give ſuch directions, principally from Mr Richardſon of Hull, for the proper fermentation of malt liquors as have not been fully detailed in the article Brewing (*Encycl.*)

This author controverts, we do not think very ſucceſsfully, the concluſions drawn by Mr Henry from the experiments, of which the reader will find an account in the article Fermentation (*Encycl.*); but it is not his theory with which we are at preſent concerned, but his practice as that of an experienced and enlightened brewer. Having treated of *Worts*, and the proper method of boiling them, for which ſee Wort in this *Supplement*, and having given an hiſtorical view of the proceſs of fermentation, of which a pretty accurate abridgement is inſerted in the articles Brewing and Fermentation (*Encycl.*), he proceeds thus:

"The agency of air, in the buſineſs of fermentation, is very powerful; but as all fermentable ſubjects have an abundant ſupply, we are rather to provide for the egreſs of their own, than to ſuffer the admiſſion of the external air, by which a great number of the fine, volatile, oleaginous parts of the ſubject would be carried off, and a proportionate injury in flavour and ſpirituoſity ſuſtained. Hence ſuch a covering ſhould be provided for the gyle-tun as would barely allow the eſcape of the common air produced by the operation; whilſt the *gas*, or fixed air, from its greater denſity, reſting upon the ſurface of the beer the whole depth of the curb, prevents the action of the external air, and conſequently the eſcape of thoſe fine and valuable parts juſt mentioned.

"But towards the conclusion of vinous fermentation, this aerial covering begins to lose its efficacy; which points out the necessity of then getting the beer into casks as soon as possible, that the consequences may be prevented, of exposing so large a surface, liable to so copious an evaporation. Amongst these, a loss of spirituosity is not the least; for this evaporation is more and more spirituous as the action approaches the completion of vinous fermentation; and that once obtained, the loss becomes still more considerable, if still exposed to the air; whence it might be termed the distillation of Nature, in which she is so much superior to art, that the ethereal spirit rises pure and unmixed, whilst the highest rectification of the still produces at best but a compound of aqueous and spirituous parts.

"Nor is this entirely conjecture. Experience teaches us, that we cannot produce so strong a beer in summer, *ceteris paribus*, as in winter; the reason is, not because the action of fermentation does not realize so much spirit in warm weather, but because the fermenting liquor, after the perfection of vinosity, continues so long in a state of rarefaction, that the spirituous parts are dissipated in a much greater degree at that time than at any other, in a similar state of progression. And this doctrine of natural distillation seems to account for that increase of strength obtainable from long preservation, in well closed casks, and, more particularly so, in glass bottles; for Nature, in her efforts to bring about her grand purpose of resolving every compound into its first principles, keeps up a perpetual internal struggle, as well as an external evaporation; and if the latter be effectually prevented, the former must be productive of additional spirituosity, so long as the action keeps within the pale of vinous fermentation.

"In order to maintain a due regulation of the fermenting power, and to answer the several purposes of the operation, a scrupulous attention to the degree of heat at which the action commences, and a particular regard to the quality and quantity of the ferment employed, are indispensably necessary." The degree of heat must be ascertained by the thermometer, and regulated by experience: the quantity of yeast can be ascertained only by the intention of the artist; but of the quality of that substance we shall treat under Yeast in this *Supplement*.

FERRISBURGH, a township in Addison co. Vermont, on lake Champlain. It contains 481 inhabitants. Otter creek, Little Otter and Lewis's creeks fall into the lake here. The mouth of Otter creek lies in N. lat. 44. 11. 45. W. long. 73. 9. 47.—*Morse*.

FEZZAN is a kingdom in the interior of Africa, placed in the vast wilderness as an island in the ocean. The following account of it was given to Mr Lucas the African traveller by an old shereef, a native of Fezzan; and that account was confirmed by the governor of Mesurata, who had himself visited Fezzan, and who, having treated the traveller with great kindness, ought not to be suspected of having wantonly deceived him.

According to this account, Fezzan is situated to the south of Mesurata (see Mesurata in this *Suppl.*), and the traveller from the latter place to the former arrives in eight days at Wadan, where refreshments are procured for the caravan. From thence in five hours they reach the desart of Soudah, where no vegetable is seen to grow but the talk, a tree from which the lemon coloured wood is taken which forms handles for tools. The passage of the desart takes up some days, when the traveller finds a miserable village, producing nothing but dates, brackish water, and Indian corn; from this village a day's journey conducts to the town of Sebbah, where are the remains of an ancient castle, and other venerable ruins, and in four days more he reaches Mourzouk, the capital of Fezzan.

This city is situated on the banks of a small river, surrounded by a high wall for defence, and is distant from Mesurata 390 computed miles. Eastward of Mourzouk is the town of Queela, in which are the remains of ancient buildings; the size of the cisterns, and the construction of the vaulted caves, exhibit instances of ancient splendor. South of which place is Jermah, distinguished by numerous and majestic ruins, on which are many inscriptions. Tessouwa lies eastward, near which was a river which the shereef remembers, but is now overwhelmed in the moving sands. N. E. from Mourzouk, distant about 120 miles, is the large town of Temmisswa, where the caravans of pilgrims from Bornou and Nigritia, by way of Cairo to Mecca, provide their stores for the desart.

In the town or province of Mendrah is a large quantity of *trona*, a species of fossil alkali, that floats on the surface or settles on the banks of its spreading lakes, great quantity of which is sent to Tripoli, and shipped for Turkey, Tunis, and Morocco: at the latter place it is used as an ingredient in the red dye of the leather. Mendrah is about 60 miles south of Fezzan. The territory of Fezzan extends but little westward, being confined by barren mountains. The smaller towns of this kingdom are said to be about one hundred; these towns are chiefly inhabited by husbandmen and shepherds; in every town a market is regularly held; mutton and goat's flesh are sold by the quarter, usually from thirty-two to forty grains of gold, or from four to five shillings English. The flesh of camels is dearer, and divided into smaller parts.

The houses are of clay, with flat roofs composed of branches of trees, on which earth is laid; this is sufficient in a climate where it never rains. The heats in summer, from April to November, are intense, and the hot winds blow from the south-east, south, and south-west; with such violence as to threaten suffocation; when it changes to the west or north-west a reviving freshness ensues.

The dress of the inhabitants is like that of the Moors of Barbary, consisting of a large pair of trowsers, a shirt which hangs over the trowsers, a kind of waistcoat without sleeves, and a jacket with tight sleeves; over the jacket is a loose robe which reaches below the knee, a girdle of crimson, and a long cloth called a *barakon* or *albaicque*, like a highland plaid, is worn; stockings of leather, laced like half boots, and slippers; on the head a red cap and turban; sometimes over the whole they throw a long cloak with a hood, called a *burnoose*. In summer they throw off all but the shirt and the cap.

The people bear very high degrees of heat, but any cold affects them sensibly. Their diseases are chiefly of the inflammatory and putrid kind; the small pox is common. Their old women are their principal physicians. For pains in the head they cup and bleed; for those in the limbs, they bathe in the hot lakes. They

Fezzan.

have a multitude of noxious and loathsome animals; the air is crowded with mosquitos, and their persons are over-run with the vermin which affect the beggars of Europe.

In their persons they incline to the negro, of a deep swarthy complexion, with curly black hair; they are tall, but indolent, inactive, and weak. In their common intercourse, distinction of rank seems to be forgotten; rich and poor, master and man, converse, eat, and drink, together; they are, however, generous and hospitable.

An extensive plain composes the kingdom of Fezzan: the soil is generally a light sand, the springs are abundant, and few regions in Africa exhibit a richer vegetation. The land produces the talk, the white thorn, date trees, the olive and lime, apricot, pomegranate, and fig: Indian corn and barley are the favourite objects of cultivation, of wheat there is little raised. The tame animals are, the sheep, cow, goat, and camel; and the wild are, the ostrich, antelopes of various kinds, one of which is called the huadee, which when chased plunges with address from a precipice, and lights on its hams.

The food of the lower class consists of flour of Indian corn, seasoned with oil and fruit; those of superior rank eat wheat bread and flesh. Fezzan produces much salt; the water has in general a mineral taste, but the favourite beverage is a liquor from the date tree, which acquires, when fermented, an intoxicating strength. In religion they are rigid Mahomedans, but tolerant. Their government monarchical; their present king is descended from one of the shereefs of Taffilet, who about 400 years since obtained the crown. Till the present century the kingdom was independent, when the Bashaw of Tripoli conquered and made it tributary; the reigning sovereign has nearly thrown off this yoke. In Fezzan, the descendants of the prophet are highly privileged, their property and persons are inviolable; they are exempt from certain punishments. This class are in general either princes or merchants.

The revenue is composed of a tax on towns and villages, a tax on every camel load of goods (except provisions) which enters the capital, fines for offences, lands of persons dying without heirs, and a tax on gardens and date trees. Gold dust by weight is the chief medium of payment; but for convenience they are furnished with small papers of gold dust of different values, from two *xarbes* or one and a half upwards; for smaller articles corn or flour are used as a medium. One grain of gold is equal to 1½d. sterling. The Fezzan grain is the same as in England.

The justice of the sovereign is highly extolled; small offences are punished by the bastinado, and the punishments increase to fine, imprisonment, and death. Trusting to their natural defence, their towns are without guard, and they have no standing forces. The only war the shereef remembered was undertaken against a people inhabiting the mountains of Tibesti, which is separated from the people of Fezzan by a wide and sandy desart. These people are wild and savage, and had plundered a caravan belonging to the king, who sent an army of between 3 and 4000 men against and subdued them. The country of these people produces much senna. The vales of Tibesti are said to be fertile in corn and pasture for cattle, particularly camels. The people live in huts, and profess various religions, some the Mahomedan, others are attached to their ancient idolatry.

Fezzan ‖ Figurate.

The people of Fezzan carry on a considerable trade with Tripoli, Bornou, Nigritia, &c. At the end of October, when the heats are abated, the caravans depart from Mourzouk in small parties of ten or twelve, unless in time of war. They lay in provisions of dates, meal, and mutton salted, dried in the sun, and boiled in oil or fat. The merchants have agents in the chief towns, to whom they send the slaves they purchase. The caravans to Tripoli carry the *trona*, senna, gold and slaves brought from the southern countries; and in return bring back cutlery, woollen, silks, dollars, copper, and brass.

That to Bornou carries brass and copper, for the currency of the country, imperial dollars, and various manufactures, but of their own produce only a preparation of dates, and meal of Indian corn, and they take in return slaves, gold dust, and civet.

To Cashna, an empire in Nigritia, they carry cowries, brass to make rings and bracelets, horses, several kinds of manufactures, and the Gooroo nuts; and in return take gold dust, slaves, cotton cloth, dyed goats skins, hides, senna, and civet, for the countries south of the Niger, where also they convey sabre blades and Dutch knives, coral, brass beads, looking glasses, dollars, &c. and receive back gold dust, slaves, cotton cloths, goat skins, Gooroo nuts, cowries, and ivory.

A caravan of pilgrims sets out likewise in the autumn of every second and third year from Mourzouk, the capital of Fezzan, to Mecca. They proceed to Temessa, over the mountain of Ziltan, and thence to Sibbul, a place subject to Tripoli; and thence nearly in a line with the Mediterranean sea to Cairo, and thence to Mecca by the customary route.

As not one celestial observation has been taken to determine any latitude between Benin and Tripoli, all the positions are fixed by estimation, reckoning fifteen or sixteen miles for a day's journey. Mr Rennell places Mourzouk, the capital of Fezzan, in lat. 27°. 20', or 260 miles from Masurata.

FIDLERS *Elbow*, a bend of Wood creek, between the outlet of South bay and the mouth of the creek, at the northern end of lake Champlain, opposite the mouth of East bay. The mouth of Wood creek lies in N. lat. 43. 32. W. long. 73. 15. 12.—*Morse.*

FIGURATE NUMBERS are such as do or may represent some geometrical figure, such as a triangle, pentagon, or pyramid, &c. These numbers are treated of at great length by Maclaurin in his Fluxions; Simpson in his Algebra; and Malcolm in his Arithmetic; but the following account of them by Dr Hutton is as perspicuous as any that we have seen:

Figurate numbers are distinguished into orders, according to their place in the scale of their generation, being all produced one from another, viz. by adding continually the terms of any one, the successive sums are the terms of the next order, beginning from the first order, which is that of equal units 1, 1, 1, 1, &c.; then the 2d order consists of the successive sums of those of the 1st order, forming the arithmetical progression 1, 2, 3, 4, &c.; those of the 3d order are the successive sums of those of the 2d, and are the triangular numbers 1, 3, 6, 10, 15, &c.; those of the 4th order are the

Figurate Numbers.

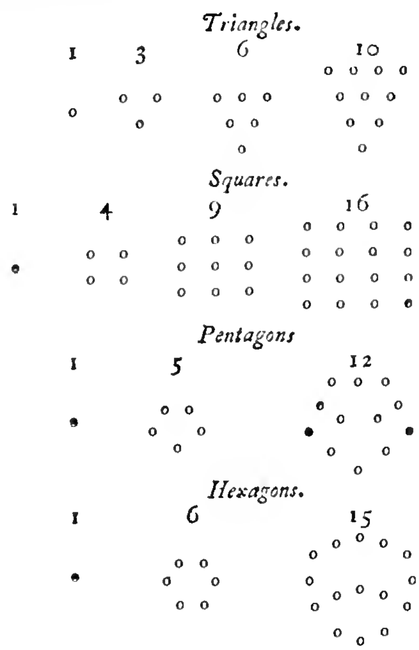
the successive sums of those of the 3d, and are the pyramidal numbers 1, 4, 10, 20, 35, &c.; and so on, as below:

Order.	*Name.*	*Numbers.*					
1.	Equals.	1,	1,	1,	1,	1,	&c.
2.	Arithmeticals,	1,	2,	3,	4,	5,	&c.
3.	Triangulars,	1,	3,	6,	10,	15,	&c.
4.	Pyramidals,	1,	4,	10,	20,	35,	&c.
5.	2d Pyramidals,	1,	5,	15,	35,	70,	&c.
6.	3d Pyramidals,	1,	6,	21,	56,	126,	&c.
7.	4th Pyramidals,	1,	7,	28,	84,	210,	&c.

The above are all considered as different sorts of triangular numbers, being formed from an arithmetical progression whose common difference is 1. But if that common difference be 2, the successive sums will be the series of square numbers: if it be 3, the series will be pentagonal numbers, or pentagons; if it be 4, the series will be hexagonal numbers, or hexagons; and so on. Thus:

Arithmeticals.	1st *Sums*, or *Polygons.*	2d *Sums*, or 2d *Polygons.*
1, 2, 3, 4,	Tri. 1, 3, 6, 10	1, 4, 10, 20
1, 3, 5, 7,	Sqrs. 1, 4, 9, 16	1, 5, 14, 30
1, 4, 7, 10,	Pent. 1, 5, 12, 22	1, 6, 18, 40
1, 5, 9, 13,	Hex. 1, 6, 15, 28	1, 7, 22, 50
&c.		

And the reason of the names triangles, squares, pentagons, hexagons, &c. is, that those numbers may be placed in the form of these regular figures or polygons, as here below:



But the figurate numbers of any order may also be found without computing those of the preceding orders; which is done by taking the successive products of as many of the terms of the arithmeticals 1, 2, 3, 4, 5, &c. in their natural order, as there are units in the number which denominates the order of figurates required, and dividing those products always by the first product. Thus the triangular numbers are found by dividing the products 1 × 2, 2 × 3, 3 × 4, 4 × 5, &c. each by the first prod. 1 × 2; the first pyramids by dividing the products 1 × 2 × 3, 2 × 3 × 4, 3 × 4 × 5, &c. by the first 1 × 2 × 3. And, in general, the figurate numbers of any order n, are found by substituting successively 1, 2, 3, 4, 5, &c. instead of x in this general expression $\frac{x \,.\, \overline{x+1} \,.\, \overline{x+2} \,.\, \overline{x+3} \,.\, \&c.}{1 \,.\, 2 \,.\, 3 \,.\, 4 \,.\, \&c.}$; where the factors in the numerator and denominator are supposed to be multiplied together, and to be continued till the number in each be less by 1 than that which expresses the order of the figurates required.

Filter.

FILTER (See *Encycl.*). It is well known that vessels made of a particular kind of porous stone are employed as filtering basins for freeing water, intended to be drunk, from various kinds of impurity. In sea voyages such filtering basins must be highly useful; and they are frequently found useful at land where no water can be had but from stagnant pools, or springs flowing through clay. The stone, however, of which they are made is not every where to be found; and therefore different persons have endeavoured to employ the art of the potter to supply their place.

In the year 1790 a patent was granted to a female potter, for her invention of the following composition for this purpose; viz. four equal parts, out of nine equal parts, of tobacco-pipe clay; and five equal parts, out of nine equal parts, of coarse sea, river, drift, or pit sand; these two materials, in the above proportions, are sufficient for the purpose of making small basins, and other vessels, to contain a quantity not exceeding one gallon of water, or other liquid. But the composition, when confined to these two materials, and in these proportions, often flies or cracks in the fire, if larger basins, or other vessels, are attempted to be made with it. She, therefore, in the second instance, composes her filtering basins of equal parts of tobacco-pipe clay and coarse sea, river, drift, or pit sand; in the third instance, of three equal parts, out of nine equal parts, of tobacco-pipe clay; one equal part, out of nine equal parts, of Stourbridge clay, or clay from the surface of coal-mines, or any other clay of the same quality; one equal part, out of nine equal parts, of Windsor, or other loam, of the same quality with Windsor loam; and four equal parts, out of nine equal parts, of coarse river, sea, drift, or pit sand. Or, in the fourth instance, of four equal parts, out of eight equal parts, of tobacco-pipe clay; three equal parts, out of eight equal parts, of coarse sea, river, drift, or pit sand; and one equal part, out of eight equal parts, of that burnt ground clay of which crucibles are made.

If the lady who invented, or pretends to have invented, these basins, have a right to her patent, far be it from us to wish our readers of any description to incroach upon it; but as the use of the materials of which her basins are made was known to potters before she was born, they may certainly compound these materials in proportions different from hers, without doing her any legal injury. As she varies her own proportions so much, we think it probable that some proportion differing a little from them all, may answer the purpose of filtering vessels equally well; and it is almost needless to add, that with this precaution any potter may make such vessels, for which he would undoubtedly have a great demand.

Filter.

A patent has likewife been granted to Mr Jofhua Collier of Southwark for a very ingenious contrivance for filtering and fweetening water, oil, and all other liquids. Of this contrivance, which combines the application of machinery with the antifeptic properties of charcoal (See CHEMISTRY N° 34. *Supplement*), we fhall give a detailed account.

Fifh oil is one of the liquids which he had it particularly in view to free from all its impurities in fmell, tafte, and colour; and the chemical procefs employed by him for this purpofe confifts in pouring a quantity of any fpecies of fifh oil, or a mixture of different forts of fifh oil, into any convenient veffel, which is to be heated to the temperature of 110 or 120 degrees of Fahrenheit's fcale, and then adding of cauftic mineral alkali, of the fpecific gravity commonly defcribed as 1.25, or of fuch ftrength that a phial containing 1000 grains of diftilled water will contain 1250 grains of thefe lees, a quantity equal to four parts of the 100 by weight of the quantity of oil; the mixture is then to be agitated, and left to ftand a fufficient time for the falts and fediments to fubfide; it is then drawn off into another veffel, containing a fufficient quantity of frefh burnt charcoal, finely powdered, or any other fubftance poffeffing antifeptic properties, in a powdered or divided ftate, with an addition of a fmall proportion of diluted fulphuric acid, fufficient only to decompofe the fmall quantity of faponaceous matter ftill fufpended in the oil, which appears by the oil becoming clear at the furface: the contents of this veffel are alfo agitated, and the coaly faline and aqueous particles left to fubfide; after which the oil is paffed through proper ftrainers, herein after defcribed, and is thereby rendered perfectly tranfparent and fit for ufe.

The principle of the improved ftrainers, or filtering machines, confifts in the means applied to combine hydroftatic preffure, which increafes according to the perpendicular height of the fluid, with the mode of filtering *per afcenfum*, thereby procuring the new and peculiar advantage that the fluid and its fediment take oppofite directions. A great advantage attending this invention is, that the dimenfions of the chamber in which the fediment is received, may be varied, while the filtering furface remains the fame. To adapt the machines not only to the purpofe of familes, work-houfes, hofpitals, public charities, the navy, or the merchant fervice, but alfo to all the purpofes of oil-men, of diftillers, of the laboratory, the brewery, &c. chambers of various capacities muft be provided for the fediment and precipitated matter. With refpect to the oil-trade, the fpace required is very great, efpecially for fpermaceti, or Brafil bottoms. In the various purpofes of the laboratory, no limits can be fixed, but all dimenfions will be occafionally required: in diftilleries and breweries they may be fmaller in proportion; and in that defigned for water and for domeftic ufe, a very fmall chamber will be fufficient. When water is to be fweetened, or freed from any putrid or noxious particles, it paffes, in its way to the filtering chamber, through an iron-box, or cylinder, containing charcoal finely powdered, or any other antifeptic fubftance infoluble in water, the water being forced into it by hydroftatic preffure, through a tube of any fufficient height. This box has two apertures to receive and deliver the fluid, and thefe are opened and clofed by cocks, or fcrews, or any other method ufed for fuch purpofes, and being affixed to the machine by other fcrews, may be eafily detached from the fame. Thus, whenever the charcoal begins to lofe its antifeptic properties, the box is removed and heated till it is red hot; by which means the foreign matter efcapes through the fmall apertures, after which the box is cooled, and the charcoal becomes fweet, pure, and equally fit for ufe as at firft, though the procefs be ever fo often repeated.

Filter

Another part of the invention confifts in filtering machines in the form of ftills, in which charcoal may be repeatedly burned after any fluid fubftances have paffed through it, for the purpofe of freeing them either from putrid or noxious particles, or of difcharging their colouring matter; which filtering ftills are fo contrived, that the fluid may pafs through in any quantity, without difplacing the charcoal: the part of the fluid remaining interfperfed among the charcoal, may be driven over by heat, and be employed for many inferior purpofes of the arts or manufactures. Laftly, the heat may be raifed fo as to purify the charcoal, as has been before defcribed in the machines for water. The flue of thofe ftills is fo conftructed that water may be employed to cool them without the lofs of time requifite for their gradually parting with their heat to the furrounding atmofphere, fo as to be fit for a fubfequent operation.

But it was not merely to the purifying of oils and various liquids that Mr Collier turned his attention. To his filtering apparatus are attached inftruments for afcertaining the comparative qualities of oils, which depend in part on the principle of their fpecific gravities; fpermaceti oil, contrafted with other fifh oils, being as 875 to 920. For this purpofe, a glafs veffel of any convenient fhape, is made ufe of, furnifhed with a bubble alfo of glafs, and a thermometer. If the oil is pure, this bubble finks, when the mercury rifes to a certain ftandard, by the application of the hand, or any other heat to the veffel containing the oil. If the fpermaceti oil is impure, the bubble will ftill float, though it is of the temperature required; and the degree of impure, or foreign matter, will be fhewn by the ftate of the thermometer at which the bubble finks.

To determine what tendency oils ufed for burning have to congeal in cold weather, a freezing mixture is put in a phial of thin glafs, or any other convenient veffel; into this a thermometer is immerfed, and a fingle drop of the oil, under experiment, fuffered to fall on the outfide of the veffel, where it immediately congeals; as the cold produced by the mixture gradually ceafes, it is eafy to obferve by the thermometer at what point of temperature the oil becomes fluid, and runs down the fide of the glafs.

A fhort defcription of this apparatus will make its principles plain to every reader. A (fig. 1.) is the ciftern, into which the water or other liquor to be filtered is put. B B is a tube opening into the bottom of the ciftern A, and bent along the bottom of the machine conveying the fluid into C C C the filtering chamber which is covered with leather bound down round its circular rim, and through which leather the water is percolated. D D, The bafon rifing above the level of the chamber and receiving the filtered liquor. E, The fpout by which it runs off into a pitcher or other veffel. F, Another fpout furnifhed with a Plate XXIII.

cock

cock to draw off the foul water from the chamber when necessary. G G G, The air tube, which begins above the level of the chamber, is covered with a button, which saves the leather from being cut, and has a small lateral aperture for the air to be carried off. This pipe passes along the bottom and up the side, and rising above the level of the water in the cistern, is there closed, except a small lateral aperture through which the air escapes. H, A guard or rim with cross bars put over the leather to keep it from being forced up by the water. It is fastened down by means of two notches on opposite sides of the guard, by which it locks into two staples rivetted into the bottom of the bason. I, the lid sliding down to cover the water from dust, and suspended at pleasure by means of K K, two springs on each tube for that purpose. L M N O, A cylindrical box containing charcoal, which is connected with the above by means of the tube P, and a continuation of the tube B. L M, The water tube B continued below the charcoal apparatus, so that the fluid may pass through the same into the cylinder, from whence it enters the chambers at P, so as to be filtered through the leather as before described. R R, Collars which may be unscrewed at pleasure, so as to detach the charcoal apparatus whenever the charcoal requires to be purified by heat. S S, Two cocks to direct the fluid through the charcoal cylinder or immediately into the filtering chamber.

Fig. 2. A, A tub or cistern, containing the oil to be filtered, and supplying a tube of sufficient height for the hydrostatic pressure to operate. B B, A main tube of wood, tin, leather, or cloth, to which any number of bags, of the size and shape of corn sacks, or any C C convenient size or shape may be connected. These are bound to D D D, straight double iron bars, furnished with a hinge at one end and a screw at the other, by opening which the bags may be emptied. F, A trough underneath, made to receive the filtered oil from the receivers E E E.

Fig. 3. A, A funnel cask or cistern, into which the fluid is put which passes down. B, A tube fitted into the same, through which it enters. C, An iron still, or still of any other substance capable of sustaining heat, full of finely powdered and sifted charcoal, through the head of which the fluid passes into any receiver. D, A fire place of any construction to drive over the fluid remaining interspersed among the charcoal, and also to purify the charcoal by an increase of temperature when required. E, A cock to let water into the flues to cool the apparatus for a subsequent operation.

Fig. 4. The trial glass with its thermometer.

FINCASTLE, a post town in Virginia, and capital of Botetourt co. situated on the E. side of Catabaw creek, a small stream which falls into James river, on the W. side of the North Mountain. Here are about 50 houses, a court-house and gaol. It lies on the post road from Richmond to Kentucky, 36 miles easterly of Lexington, and 192 W. by N. of Richmond.—*Morse.*

FINDLEY, a township in Washington co. Pennsylvania.—*ib.*

FIRE. See that article *Encycl.* and Caloric and Combustion, *Chemistry Index* in this *Suppl.*

Extinction of FIRE is sometimes a matter of so much consequence, that every thing which promises to be effectual for that purpose is worthy of attention. In the nineteenth number of Mr Nicholson's Journal of Philosophy, Chemistry, and the Arts, we have the following composition for extinguishing fire, invented by M. Von Aken.

Burnt Alum - -	pounds	30
Green vitriol powdered - -		40
Cinabrese or red ochre in powder -		20
Potter's clay, or other clay, also powdered		200
Water, - - - - -		630

With 40 measures of this mixture an artificial fire was extinguished under the direction of the inventor by three persons, which would have required the labour of 20 men, and 1500 measures of common water. Sig. Fabbroni was commissioned to examine the value of this invention, and found, in his comparative trials with engines of equal power, worked by the same number of men, that the mixture extinguished the materials in combustion in one sixth part less time, and three eighths less of fluid than when common water was used. He observed, as might indeed have been imagined from the nature of the material, that the flame disappeared wherever the mixture fell, and that the saline, metallic, and earthy matters formed an impenetrable lute round the hot combustible matter, which prevented the access of the air, and consequently the renewal of the destructive process.

This recipe, Mr Nicholson informs us, is taken from the 85th N° of the Giornale Letterario di Napoli, in which it was inserted in the form of a letter from Sig. Fabbroni to Sig. D. Luigi Targioni of Naples; and the author of the letter estimates the price of the composition at about one halfpenny per pound.

The reason assigned by Mr Nicholson for giving this abridged account a place in his valuable work, will be admitted by him and the public as a sufficient reason for our adopting it into our's. It is, that such inventions are worthy of the attention of philosophers and economists, even though in the first applications they may prove less advantageous than their inventors may be disposed to think. It is scarcely probable that this practice in the large way, with an engine throwing upwards of 200 gallons (value about L. 3, 10s) each minute, would be thought of or adopted, or that a sufficient store of the materials would be kept in readiness; since at this rate the expenditure for an hour would demand provision to the amount of L. 210 sterling. But in country places the process, or some variation of it, might be applied with sufficient profit in the result, more especially if it be considered that common salt or alum, or such saline matter as can be had and mixed with the water, together with clay, chalk, or lime, ochreous earth or common mud, or even these last without any salt, may answer the purpose of the lute with more or less effect, and extinguish an accidental fire with much greater speed and certainty than clear water would do.

Fire-Balls are meteors, of which some account has been given in the *Encyclopædia*, as well as of various hypotheses which have been framed respecting their nature and their origin. Since that article was published, a new and very singular hypothesis has been framed by Professor Chladni of Wittenberg, who maintains it by arguments, which, however fanciful, are yet worthy of the reader's notice.*

He supposes, that fire balls, instead of being collections

* *Phil. Mag.* nos. 5 and 7.

Fire.

tions of the electrical fluid floating in the highest regions of our atmosphere, are masses of very dense matter formed in far distant parts of space, and subjected to similar laws with the planets and comets. He endeavours to prove, that their component parts must be dense and heavy; because their course shews, in so apparent a manner, the effects of gravity; and because their mass, though it distends to a monstrous size, retains sufficient consistency and weight to continue an exceedingly rapid movement through a very large space, without being decomposed or dissolved, notwithstanding the resistance of the atmosphere. It seems to him probable, that this substance is by the effect of fire reduced to a tough fluid condition; because its form appears sometimes round and sometimes elongated, and as its extending till it bursts, as well as the bursting itself, allows us to suppose a previous capability of extension by elastic fluidity. At any rate it appears to be certain, that such dense matter, at so great a height is not collected from particles to be found in our atmosphere, or can be thrown together into large masses by any power with which we are acquainted; that no power with which we are acquainted is able to give to such bodies so rapid a projectile force in a direction almost parallel to the horizon; that the matter does not rise upwards from the earth, but exists previously in the celestial regions, and must have been conveyed thence to our earth. In the opinion of Dr Chladni, the following is the only theory of this phenomenon that agrees with all the accounts hitherto given, which is not contrary to nature in any other respect, and which besides seems to be confirmed by various masses found on the spot where fire-balls fell.

As earthy, metallic, and other particles form the principal component parts of our planets, among which iron is the prevailing part, other planetary bodies may therefore consist of similar, or perhaps the same component parts, though combined and modified in a very different manner. There may also be dense matters accumulated in smaller masses, without being in immediate connection with the larger planetary bodies dispersed throughout infinite space; and which, being impelled either by some projecting power or attraction, continue to move until they approach the earth or some other body, when, being overcome by its attractive force, they immediately fall down. By their exceedingly great velocity, still increased by the attraction of the earth and the violent friction in the atmosphere, a strong electricity and heat must necessarily be excited; by which means they are reduced to a flaming and melted condition, and great quantities of vapour and different kinds of gases are thus disengaged, which distend the liquid mass to a monstrous size, till, by a still farther expansion of these elastic fluids, it must at length burst. Dr Chladni thinks also that the greater part of the *shooting stars*, as they are called, are nothing else than fire-balls, which differ only from the latter in this, that their peculiarly great velocity carries them past the earth at a greater distance, so that they are not so strongly attracted by it as to fall down; and therefore, in their passage through the high regions of the atmosphere, occasion only a transient electric flash, or actually take fire for a moment, and are again speedily extinguished, when they get to such a distance from the earth that the air becomes too much rarefied for the existence of fire.

The grounds on which Dr Chladni supports this opinion are various relations, well authenticated, of the motions of those meteors, and the phenomena which accompany their bursting. Besides those mentioned in the *Encyclopædia*, he lays a particular stress on the account which he received from *M. Baudin*, Professor of philosophy at Pau, of a remarkable fiery meteor seen in Gascony on the 24th of July, 1790. On the evening of that day M. Baudin was in the court of the castle of Mormes with a friend, the atmosphere being perfectly clear, when they suddenly found themselves surrounded by a whitish light, which obscured that of the full moon, then shining with great lustre. On looking upwards, they observed, almost in their zenith, a fire-ball of a larger diameter than the moon, and with a tail equal in length to five or six times the diameter of the body. The ball and the tail were of a pale white colour, except the point of the latter, which was almost as red as blood. The direction of this meteor was from south to north.

"Scarcely (says M. Baudin) had we looked at it for two seconds, when it divided itself into several portions of considerable size, which we saw fall in different directions, and almost with the same appearance as the bursting of a bomb. All these different fragments became extinguished in the air, and some of them, in falling, assumed that blood-red colour which I had observed in the point of the tail. It is not improbable that all the rest may have assumed the same colour; but I remarked only those which proceeded in a direction towards Mormes, and which were particularly exposed to my view.

"About two minutes and a half, or three minutes after, we heard a dreadful clap of thunder, or rather explosion, as if several large pieces of ordnance had been fired off together. The concussion of the atmosphere by this shock was so great, that we all thought an earthquake had taken place. The windows shook in their frames, and some of them, which probably were laid to, and not closely shut, were thrown open. We were informed next day, that in some of the houses at Houga, a small town about half a mile distant from Mormes, the kitchen utensils were thrown from the shelves; so that the people concluded there had been an earthquake. But as no movement was observed in the ground below our feet, I am inclined to think that all these effects were produced merely by the violent concussion of the atmosphere.

"We proceeded into the garden while the noise still continued and appeared to be in a perpendicular direction above us. Sometime after, when it had ceased, we heard a hollow noise, which seemed to roll along the chain of the Pyrenees in echoes, for the distance of fifteen miles. It continued about four minutes, becoming gradually more remote, and always weaker; and at the same time we perceived a strong smell of sulphur.

"While we were endeavouring to point out to some persons present the place where the meteor had divided itself, we observed a small whitish cloud, which arose perhaps from the vapour of it, and which concealed from us the three stars of the Great Bear, lying in the middle of those forming the semicircle. With some difficulty,

difficulty, however, we could at laft diftinguifh thefe ftars again behind the thin cloud. There arofe, at the fame time, a frefh gentle breeze.

"From the time that elapfed between the burfting of the ball, and the explofion which followed, I was inclined to think, that the meteor was at the height of at leaft feven or eight miles, and that it fell four miles to the north of Mormes. The latter part of my conjecture was foon confirmed by an account which we received, that a great many ftones had fallen from the atmofphere at Juliac, and in the neighbourhood of Barbotan. One of thefe places lies at the diftance of about four miles to the north of Mormes, and the other at about the diftance of five to the north-northweft."

M. de Carrits Barbotan, the friend who was with the Profeffor in the court and garden of Mormes when the meteor firft attracted their attention, was at Juliac two days afterwards, and confirmed to him the truth of this circumftance. It appeared, likewife from the account of feveral intelligent perfons, highly worthy of credit, that the meteor burft at a little diftance from Juliac, and that the ftones which fell were found lying in a fpace almoft circular, about two miles in diameter. They were of various fizes. Some were *feen to fall*, which, when found, weighed 18 or 20 pounds, and which had funk into the earth from two to three feet. M. de C. Barbotan tranfmitted one weighing 18 pounds to the academy of fciences at Paris; and M. Baudin was told, that fome were found which weighed even 50 pounds. He examined a fmall one, and found it very heavy in proportion to its fize: it was black on the outfide; of a greyifh colour in the infide, and interfperfed with a number of fmall fhining metallic particles. On ftriking it with a piece of fteel, it produced a few fmall dark red fparks, not very lively. A mineralogift, to whom a like piece of ftone from the fame meteor was fhewn at Paris, defcribed it as a kind of grey flag mixed with calcareous fpar, the furface of which exhibited vitrified blackifh calx of iron. The Profeffor was told alfo, that fome ftones were found totally vitrified.

Such (fays Dr Chladni) is the account given by Baudin of this meteor; the phenomena of which he endeavours to explain from accumulations in the upper parts of the atmofphere.

According to all the obfervations hitherto made with any accuracy on fire-balls, the height at which they were firft perceived was always very confiderable, and by comparing the angles under which they were feen from different points, often 19 German miles, and even more; their velocity, for the moft part, feveral miles in a fecond; and their fize always very great, often a quarter of a mile, and even more, in diameter. They were all feen to fall moftly in an oblique direction; not one of them ever proceeded upwards. All of them have appeared under the form of a globular mafs, fometimes a little extended in length and highly luminous; having behind it a tail, which, according to every appearance, was compofed of flames and fmoke. All of them burft after they were feen to move through a large fpace, fometimes over feveral diftricts, with an explofion which fhook every thing around. In every inftance where there has been an opportunity of obferving the fragments that fell after they burft, and which fometimes have funk to the depth of feveral feet into the earth, they were found to confift of fcorious maffes, which contained iron in a metallic or calcined ftate, pure, or elfe mixed with different kinds of earth and fulphur. All the ancient and modern accounts, written partly by naturalifts, and partly by others, are fo effentially fimilar, that the one feems to be only a repetition of the other. This conformity in accounts, the authors of which knew nothing of thofe given by others, and who could have no intereft in fabricating fimilar tales, can fcarcely have arifen from accident or fiction, and gives to the related facts, however inexplicable many of them may feem, every degree of credibility.

In the third volume of Pallas's Travels, we have an account of a mafs of iron difcovered by him in Siberia, which Dr Chladni confiders as having been undoubtedly a fire-ball, or the fragment of a fire-ball. This problematical mafs was found between Krafnojarfk and Abekanfk in the high flate mountains, quite open and uncovered. It weighed 1600 pounds; had a very irregular and fomewhat compreffed figure like a rough granite; was covered externally with a ferruginous kind of cruft; and the infide confifted of malleable iron, brittle when heated, porous like a large fea fponge, and having its interftices filled with a brittle hard vitrified fubftance of an amber yellow colour. This texture and the vitrified fubftance appeared uniformly throughout the whole mafs, and without any traces of flag or artificial fire.

Dr Chladni fhews with a great deal of ingenuity, that this mafs neither originated by the wet method, nor could have been produced by art, the burning of a foreft, by lightning, or by a volcanic eruption. It appears to him, therefore, in the higheft degree probable, that it is of the fame nature with fire-balls, or, as they have fometimes been called, *flying dragons*. The Tartars, as we are informed by Pallas, confidered this mafs as a facred relict which had dropped down from heaven; and this circumftance Dr Chladni confiders as no flight confirmation of his opinion, which he farther fupports by the following reafonings:

"1. As fire-balls confift of denfe and heavy fubftances, which, by their exceedingly quick movement, and the friction thence excited by the atmofphere, become electric, are reduced to a ftate of ignition, and melted by the heat, fo that they extend to a great fize, and burft; it thence follows, that in places where fragments, produced by the burfting of a fire-ball, have been found, fubftances endowed with all thefe properties muft alfo have been found. Iron, however, the principal component part of all the maffes hitherto found (and he fpeaks of many befides that of Pallas), poffeffes all thefe properties in a very eminent degree. The weight and toughnefs of the principal component parts of fire-balls, which muft be very confiderable, fince, with the greateft poffible diftention, they retain confiftence enough to proceed with the utmoft velocity through fuch an immenfe fpace without decompofition of their mafs, and without their progrefs being obftructed by the refiftance of the air, agree perfectly well with melted iron; their dazzling white light has by many obfervers been compared to that of melted iron; iron alfo exhibits the fame appearances of flaming, fmoking, and throwing out fparks, and all thefe phenomena are moft beautiful when

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when they take place in vital air. Of the extenſion by elaſtic fluids expanded by the heat, and of the contraction which follows from cold, traces may be diſcovered in the internal ſpongy nature of the iron maſſes which have been found, and in the globular depreſſions of the exterior hard cruſt; the latter of which gives us reaſon to ſuppoſe, that in theſe places there have been air-bubbles, which, on cooling, ſunk down. The mixture of ſulphur found in various maſſes, agrees alſo exceedingly well with the phenomena of fire-balls, and eſpecially with the great inflammability of ſulphur in very thin impure air; for it is well known, that ſulphur in an air-pump will take fire in air, in which few other bodies could do the ſame. In regard to thoſe maſſes in which no ſulphur was found, this may have ariſen from the ſulphur eſcaping in vapour, ſince ſome time after the appearance of fire-balls a ſtrong ſmell of ſulphur has been perceived. The brittleneſs of the Siberian iron maſs when heated, may ariſe from ſome ſmall remains of ſulphur, which may perhaps be the cauſe of the facility with which fragments of this maſs, as well as of another found at Aix-la-Chapelle, could be roaſted.

"2. The whole texture of the maſſes betrayed evident ſigns of fuſion. This, however, cannot have been occaſioned by any common, natural, or artificial fire; and particularly for this reaſon, becauſe iron ſo malleable is not fuſible in ſuch fire, and when it is fuſed with the addition of inflammable matters, loſes its malleability, and becomes like common raw iron. The vitrified ſubſtance in the Siberian maſs is equally incapable of being fuſed in a common fire. The fire, then, muſt have been much ſtronger than that produced by the common, natural, and artificial means; or the fuſion muſt have been effected by the force of exceedingly ſtrong electricity; or perhaps both cauſes may have been combined together.

"3. It is totally incomprehenſible how, on the high ſlate mountains, where the Siberian maſs was found, at a conſiderable diſtance from the iron mines; in the chalky ſoil of the extenſive plains of America, where for a hundred miles around there are no iron mines, and not even ſo much as a ſtone to be found; and at Aix-la-Chapelle, where, as far as the author knows, there are no iron works—ſo many ferruginous particles could be collected in a ſmall ſpace as would be neceſſary to form maſſes of 1600, 15,000, and 17,000, up to 33,600 pounds. This circumſtance ſhews, that theſe maſſes could as little have been fuſed by lightning as by the burning of a foreſt or of foſſile coal. Theſe maſſes were found quite expoſed and uncovered, and not at any depth in the earth, where we can much more readily admit ſuch an accumulation of ferruginous particles to have been melted by the effects of lightning.

"Should it be aſked, how ſuch maſſes originated, or by what means they were brought into ſuch an inſulated poſition? this queſtion would be the ſame as if it were aſked how the planets originated. Whatever hypotheſes we may form, we muſt either admit that the planets, if we except the many revolutions which they may have undergone, either on or near their ſurface, have always been ſince their firſt formation, and ever will be the ſame; or that nature, acting on created matter, poſſeſſes the power to produce worlds and whole ſyſtems to deſtroy them, and from their materials to form new ones. For the latter opinion there are, indeed, more grounds than for the former, as alternations of deſtruction and creation are exhibited by all organiſed and unorganiſed bodies on our earth, which gives us reaſon to ſuſpect that nature, to which greatneſs and ſmallneſs, conſidered in general, are merely relative terms, can produce more effects of the ſame kind on a larger ſcale. But many variations have been obſerved on diſtant bodies, which, in ſome meaſure, render the laſt opinion probable. For example, the appearing and total diſappearing of certain ſtars, when they do not depend upon periodical changes. If we now admit that planetary bodies have ſtarted into exiſtence, we cannot ſuppoſe that ſuch an event can have otherwiſe taken place, than by conjecturing that either particles of matter, which were before diſperſed through infinite ſpace in a more ſoft and chaotic condition, have united together in large maſſes by the power of attraction; or that new planetary bodies have been formed from the fragments of much larger ones that have been broken to pieces, either perhaps by ſome external ſhock, or by an internal exploſion. Let whichever of theſe hypotheſes be the trueſt, it is not improbable, or at leaſt not contrary to nature, if we ſuppoſe that a large quantity of ſuch material particles, either on account of their too great diſtance, or becauſe prevented by a ſtronger movement in another direction, may not have united themſelves to the larger accumulating maſs of a new world; but have remained inſulated, and, impelled by ſome ſhock, have continued their courſe through infinite ſpace, until they approached ſo near to ſome planet, as to be within the ſphere of its attraction, and then by falling down to occaſion the phenomena before mentioned."

Whether Chladni be a philoſopher of the French ſchool we know not; but ſome parts of his theory tend ſtrongly towards materialiſm; and the arguments by which he attempts to prop thoſe parts are peculiarly weak. When he talks of *Nature* producing worlds, he either ſubſtitutes Nature for Nature's God, or utters jargon which has no meaning. In what ſenſe the word Nature is uſed by every philoſopher of a ſound mind, we have elſewhere been at ſome pains to ſhew (ſee River, n° 116, *Encycl.*); but how abſurd would it be to ſay, that the ſyſtem of general laws, by which the Author and Governor of the univerſe connects together its various parts, and regulates all their operations, poſſeſſes, independently of him, the "power to produce worlds and whole ſyſtems, to deſtroy them, and from their materials to form new ones!"

As Chladni admits, or talks as if he admitted, the creation of matter, it would be wrong to impute to him this abſurdity; but if by *Nature* he means God, and he can conſiſtently mean nothing elſe, we beg leave to affirm, that it is *directly contrary* to every notion which we can form of Nature in *this ſenſe*, "to ſuppoſe that a large quantity of material particles, either on account of their *diſtance*, or becauſe prevented by a *ſtronger movement* in another direction, have not united themſelves to the larger accumulating maſs of a new world, but remained inſulated, and impelled by ſome ſhock, have continued their courſe through infinite ſpace, &c." Is there any diſtance to which God cannot reach, or any movement ſo ſtrong as to reſiſt his power? Our author's language is indeed confuſed, and probably his

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ideas were not very clear. When he ſpeaks of the particles of matter being at firſt diſperſed through infinite ſpace, and afterwards united by the power of attraction, he revives the queſtion which was long ago diſcuſſed between Newton and Bentley, and diſcuſſed in ſuch a manner as ſhould have ſilenced for ever the bablings of thoſe who form worlds by attraction.

"The hypotheſis (ſays Newton) of matter's being at firſt evenly ſpread through the heavens, is, in my opinion, inconſiſtent with the hypotheſis of innate gravity without a ſupernatural power to reconcile them; and therefore infers a Deity. For if there be innate gravity, it is impoſſible now for the matter of the earth, and all the planets and ſtars, to fly up from them, and become evenly ſpread through all the heavens, without a ſupernatural power; and certainly that which can never be hereafter without a ſupernatural power, could never be heretofore without the ſame power". Dr Chladni, indeed, does not ſay that his particles of matter were *evenly* diſperſed through infinite ſpace; but ſuch muſt be his meaning, if he has any meaning: for matter *unevenly* diſperſed muſt, by an innate attraction, be united as ſoon as it exiſts, and ſo united as not to leave ſmall fragments of it to wander, we know not why, through the trackleſs void. Turn matter on all ſides, make it eternal or of late production, finite or infinite, there can be no regular ſyſtem produced but by a voluntary and meaning agent; and therefore, if it be true that fire-balls are maſſes of denſe matter, coeval with the planetary ſyſtem, exiſting in the celeſtial regions, and thence conveyed to our earth, they muſt have been formed, and their motions impreſſed upon them, by the Author of Nature for ſome wiſe purpoſe, though by us that purpoſe may never be diſcovered. One thing ſeems pretty clear, that wherever they may be formed, the phenomena attending their burſting, account ſufficiently for the notions of thunderbolts which have been generally entertained in all ages, and in every country.

Greek-Fire (ſee *Wild-Fire, Encycl.*). In the ſecond volume of Mr Nicholſon's Philoſophical Journal, we have the following receipt for making this compoſition, taken from ſome manuſcripts of Leonard de Vinci, who flouriſhed in the end of the fifteenth and beginning of the ſixteenth centuries, and who appears to have advanced far before his contemporaries in phyſical ſcience. Take the charcoal of willow, nitre, brandy, reſin, ſulphur, pitch, and camphor. Mix the whole well together over the fire. Plunge a woollen cord in the mixture, and form it into balls, which may afterwards be provided with ſpikes. Theſe balls, being ſet on fire, are thrown into the enemy's veſſels. It is called the Greek fire, and is a ſingular compoſition, for it burns even upon the water. Callinicus the architect taught this compoſition to the Romans (of Conſtantinople), who derived great advantage from it, particularly under the emperor Leo, when the Orientals attacked Conſtantinople. A great number of their veſſels were burned by means of this compoſition.

The compoſition of the Greek fire thus given by Vinci is found in nearly the ſame words in ſome of the writings of Baptiſta Porta; whence it appears that both authors derived their information from the ſame ſource. A compoſition which burnt without acceſs to the atmoſphere could not fail to fill the minds of our forefathers with wonder; but the modern diſcoveries in chemiſtry have diſcloſed the ſecret, by ſhewing, that the combuſtion is carried on by means of the oxygen contained in the nitre.

Raſant or *Razant Fire*, is a fire from the artillery and ſmall arms, directed parallel to the horizon, or to thoſe parts of the works of a place that are defended.

Running Fire is when ranks of men fire one after another; or when the lines of an army are drawn out to fire on account of a victory; in which caſe each ſquadron or battalion takes the fire from that on its right, from the right of the firſt line to the left, and from the left to the right of the ſecond line, &c.

FISHERSFIELD, a townſhip in Hillſborough co. New-Hampſhire, incorporated in 1763, containing 331 inhabitants. Sunapee pond lies partly here, and in the townſhip of Wendel. It is about 16 miles eaſterly of Charleſtown.—*Morſe.*

FISHER'*s Iſland*, in Long-Iſland ſound, lies oppoſite to Groton in Connecticut, is about 10 miles in length and 2 in breadth, having a light ſoil, favorable for raiſing ſheep. It produces alſo wheat and other grain. It is annexed to the townſhip of Southhold, in Suffolk co. on Long-Iſland.—*ib.*

FISHING, the art of catching fiſh. See Angling, Fishery, and Fishing, &c. *Encycl.*

Chineſe Fishing. We venture to give this appellation to ſome very ingenious contrivances of the people of China for catching in their lakes, not only fiſh, but water-fowl. For the purpoſe of catching fiſh they have trained a ſpecies of pelican, reſembling the common corvorant, which they call the *Leu-tze*, or fiſhing bird. It is brown, with a white throat, the body whitiſh beneath, and ſpotted with brown; the tail is rounded, the irrides blue, and the bill yellow. Sir George Staunton, who, when the embaſſy was proceeding on the ſouthern branch of the great canal, ſaw thoſe birds employed, tells us, that on a large lake, cloſe to the eaſt ſide of the canal, are thouſands of ſmall boats and rafts, built entirely for this ſpecies of fiſhery. On each boat or raft are ten or a dozen birds, which, at a ſignal from the owner, plunge into the water; and it is aſtoniſhing to ſee the enormous ſize of fiſh with which they return, graſped within their bills. They appeared to be ſo well trained, that it did not require either ring or cord about their throats to prevent them from ſwallowing any portion of their prey, except what their maſter was pleaſed to return to them for encouragement and food. The boat uſed by theſe fiſhermen is of a remarkable light make, and is often carried to the lake, together with the fiſhing birds, by the men who are there to be ſupported by it.

The ſame author ſaw the fiſhermen buſy on the great lake Wee-chaung-hee; and he gives the following account of a very ſingular method practiſed by them for catching the fiſh of the lake without the aid of birds, of net, or of hooks.

To one ſide of a boat a flat board, painted white, is fixed, at an angle of about 45 degrees, the edge inclining towards the water. On moonlight nights the boat is ſo placed that the painted board is turned to the moon, from whence the rays of light ſtriking on the whitened ſurface, give to it the appearance of moving water; on which the fiſh being tempted to leap as on their element, the boatman raiſing with a ſtring the board, turn the fiſh into the boat.

Water-fowl are much sought after by the Chinese, and are taken upon the same lake by the following ingenious device. Empty jars or gourds are suffered to float about upon the water, that such objects may become familiar to the birds. The fisherman then wades into the lake with one of those empty vessels upon his head, and walks gently towards a bird; and lifting up his arm, draws it down below the surface of the water without any disturbance or giving alarm to the rest, several of whom he treats in the same manner, until he fills the bag he had brought to hold his prey. The contrivance itself is not so singular, as it is that the same exactly should have occurred in the new continent, as Ulloa asserts, to the natives of Carthagena, upon the lake Cienega de Tesias.

FISHING *Bay*, in Maryland, lies on the E. side of Chesapeak bay, partly in Dorchester and Somerset counties. It receives several rivers from each county, the chief of which are Wicomico, Nanticoke; also Transquaking and Blackwater creeks. The entrance into this large bay lies between Goldsborough and Devil's islands.—*Morse.*

Fishing *Bay*, on the S. side of lake Ontario, is about 37 miles E. of Fort Niagara.—*ib.*

FISHING-CREEK, a township on Susquehanna river, in Pennsylvania.—*ib.*

FISHKILL, a post town in Dutchess co. New-York, 5 miles E. of Hudson river, on Fishkill or creek, at the foot of the Highlands, which rise S. of it; containing about 30 houses, a church for Episcopalians, and one for Low Dutch. The township is very extensive, and contained, in 1790, 5941 inhabitants, of whom 601 were slaves. It lies 14 miles S. by E. of Poughkeepsie, opposite Newburgh, and 66 N. of New-York city. There are a few houses only at the Landing, on the margin of the river.—*ib.*

Fish *Kill*, or *Creek*, on which the town above described stands, and from which it derives its name, is small, and empties into Hudson river, about a mile below the Landing, and nearly opposite New-Windsor.—*ib.*

Also, the name of a small stream which runs S. W. into Oneida lake.

Likewise, a stream which rises from Saratoga lake, and runs 6 miles easterly to the Hudson. Its mouth is opposite Batten kill, 2 miles above Saratoga town; and on the N. side of which Gen. Burgoyne's army laid down their arms as prisoners.—*ib.*

FISTULA Lachrymalis is a disease which, in all its stages, has been treated of in the article Surgery, chap. xiv. *Encycl.* A work, however, has been lately published by James Ware surgeon, in which there is the description of an operation for its cure considerably different from that most commonly used, and which, while it is simple, the author's experience has ascertained to be successful.

In the cure of this disease, which is very troublesome, and not very uncommon, it is a well known practice to insert a metallic tube in the nasal duct of the lachrymal canal: but the advantage derived from this operation is not at all times lasting. Among other causes of failure, Mr Ware notices the lodgment of inspissated mucus in the cavity of the tube. To remedy this defect, he recommends the following operation.

" If the disease has not occasioned an aperture in the lachrymal sac, or if this aperture be not situated in a right line with the longitudinal direction of the nasal duct, a puncture should be made into the sac, at a small distance from the internal juncture of the palpebræ, and nearly in a line drawn horizontally from this juncture towards the nose with a spear-pointed lancet. The blunt end of a silver probe, of a size rather smaller than the probes that are commonly used by surgeons, should then be introduced through the wound, and gently, but steadily, pushed on in the direction of the nasal duct, with a force sufficient to overcome the obstruction in this canal, and until there is reason to believe that it has freely entered into the cavity of the nose. The position of the probe, when thus introduced, will be nearly perpendicular; its side will touch the upper edge of the orbit; and the space between its bulbous end in the nose and the wound in the skin will usually be found, in a full-grown person, to be about an inch and a quarter, or an inch and three-eighths. The probe is then to be withdrawn, and a silver style, of a size nearly similar to that of the probe, but rather smaller, about an inch and three-eighths in length, with a flat head, like that of a nail, but placed obliquely, that it may sit close on the skin, is to be introduced through the duct, in place of the probe, and to be left constantly in it. For the first day or two after the style has been introduced, it is sometimes advisable to wash the eye with a weak saturnine lotion, in order to obviate any tendency to inflammation which may have been excited by the operation; but this in general is so slight, that our author has rarely had occasion to use any application to remove it. The style should be withdrawn once every day for about a week, and afterwards every second or third day. Some warm water should each time be injected through the duct into the nose, and the instrument be afterwards replaced in the same manner as before. Mr Ware formerly used to cover the head of the style with a piece of diachylon plaster spread on black silk, but has of late obviated the necessity for applying any plaster by blackening the head of the style with sealing-wax.

" The effect (says he) produced by the style, when introduced in the way above mentioned, at first gave me much surprise. It was employed with a view similar to that with which Mr Pott recommends the introduction of a bougie; viz. to open and dilate the nasal duct, and thus to establish a passage, through which the tears might afterwards be conveyed from the eye to the nose. I expected, however, that whilst the style continued in the duct the obstruction would remain, and of course that the watering of the eye, and the weakness of the sight, would prove as troublesome as they had been before the instrument was introduced. I did not imagine that any essential benefit could result from the operation until the style was removed, and the passage thereby opened. It was an agreeable disappointment to me to find that the amendment was much more expeditious. The watering of the eye almost wholly ceased as soon as the style was introduced; and in proportion as the patient amended in this respect, his sight also became more strong and useful. The style, therefore, seems to act in a twofold capacity: first, it dilates the obstructed passage; and then, by an attraction somewhat similar to that of a capillary tube, it guides the tears through the duct into the nose.

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"The wound that I usually make into the sac, if the suppurative process has not formed a suitable aperture in this part, is no larger than is just sufficient to admit the end of the probe or style; and this, in general, in a little time, becomes a fistulous orifice, through which the style is passed without occasioning the smallest degree of pain. The accumulation of matter in the lachrymal sac, which, previous to the operation, is often copious, usually abates soon after the operation has been performed; and, in about a week or ten days, the treatment of the case becomes so easy, that the patient himself, or some friend or servant who is constantly with him, is fully competent to do the whole that is necessary. It consists solely in withdrawing the style two or three times in the week, occasionally injecting some warm water, and then replacing the instrument in the same way in which it was done before.

"It is not easy to ascertain the exact length of time that the style should be continued in the duct. Some have worn it many years, and, not finding any inconvenience from the instrument, are still afraid and unwilling to part from it. Others, on the contrary, have disused it at the end of about a month or six weeks, and have not had the smallest return of the obstruction afterwards."

The author relates so many successful cases of this operation, that we thought it our duty to record his method in this Supplementary volume of our general repository of arts and sciences; for a successful practice, as well in surgery as in physic, must rest on the basis of experience.

FITCHBURGH, a post town of Massachusetts, Worcester co. 23 miles N. of Worcester, 24 from Concord, and 42 N. W. of Boston. It has 1151 inhabitants.—*Morse.*

FITZWILLIAM, a township in Cheshire co. New-Hampshire, about 16 miles E. of Connecticut river, and separated from Royalston in Worcester co. Massachusetts, by the state line. It was incorporated in 1773, and contains 1038 inhabitants.—*ib.*

Oblique or Second FLANK, or *Flank of the Curtain*, is that part of the curtain from whence the face of the opposite bastion can be seen, being contained between the lines rasant and fichant, or the greater and less lines of defence; or the part of the curtain between the flank and the point where the fichant line of defence terminates.

Covered, Low or *Retired Flank*, is the platform of the casemate which lies hid in the bastion, and is otherwise called the *orillon*.

Fichant Flank, is that from whence a cannon playing, fires directly on the face of the opposite bastion.

Rasant or *Razant Flank*, is the point from whence the line of defence begins, from the conjunction of which with the curtain the shot only raseth the face of the next bastion, which happens when the face cannot be discovered but from the flank alone.

FLATBUSH, the chief town of King's co. Long-Island, New-York. It is a pleasant and healthy town, situated on a small bay which opens E. from New-York harbor, and is 5 miles S. by E. from New-York city. It contains a number of dwelling-houses, mostly in one street; many of which are elegant and commodious. The inhabitants are chiefly of Dutch extraction. It contains 941 inhabitants, of whom 107 are qualified electors, and 378 are slaves. The productions are various kinds of fruit, vegetables, grain, &c. which find a ready market in the metropolis. The land lies low; and in summer the whole township appears like an extensive garden. The public buildings are a Dutch church, a court-house, and an academy, called Erasmus Hall, the most flourishing of all the academies in the state. It is in a pleasant and healthful situation, 4 miles from Brookline ferry.

A bloody battle was fought near this town on the 27 August, 1776, when the Americans were defeated by the British with great loss. The remains of the American army retreated to New-York under the cover of a thick fog.—*Morse.*

FLATLANDS, a small township in Kings co. Long-Island, distant from New-York city 6 or 7 miles. It contains 423 inhabitants, of whom 44 are qualified to be electors, and 137 are slaves.—*ib.*

FLAT *Rock*, is an expansive, clear, flat rock, but a little above the surface of the ground, and near the banks of a delightful rivulet of excellent water, which is one of the head branches of Great Ogeechee river, in Georgia. This is a common rendezvous or camping place for traders and Indians.—*ib.*

FLATTERY, Cape, so named by captain Cook, on account of its promising at a distance what it denied on a nearer approach. Lat. 48. 15. long. 235. 30. E. This cape, captain Ingraham of Boston, found to be the S. side of the entrance of the straits of Juan de Fuca. N. lat. 48 25. W. long. 124. 52.—*ib.*

FLEMINGTON, a small post town of New-Jersey, in Hunterdon co. lies about 6 miles N. eastward of Amwell on Delaware river, 23 N. N. W. of Trenton, 9 S. of Pittstown, and 53 N. E. by N. of Philadelphia. It contains about a dozen compact houses.—*ib.*

FLETCHER, a township in Franklin co. Vermont, containing only 47 inhabitants. It has Cambridge on the S. E. and Georgia W.—*ib.*

FLIE or Fly, that part of the mariner's compass on which the thirty-two points of the wind are drawn, and over which the needle is placed, and fastened underneath.

FLINT *River*, a considerable river of Georgia, which rises in the country of the Creek Indians, and running a S. and thence a S. W. course, joins the Appalachicola, at its entrance into Florida. The Flint is about 30 rods wide, and from 12 to 15 feet deep in summer, and has a gentle current. The territory lying on this river, especially on the upper part of it, presents every appearance of a delightful and fruitful region in some future day; it being a rich soil, and exceedingly well situated for every branch of agriculture, and offers an uninterrupted navigation to the bay of Mexico, and Atlantic ocean, and thence to the West-India islands and over the whole world. There are a number of villages of Creek Indians on this river. —*Morse.*

Flint, a small river, about 28 miles long, in the Genessee country, in New-York, which runs N. N. E. into Canandarqua creek.—*ib.*

FLINTSTON, a plantation in Cumberland co. Maine, having 180 inhabitants. It has one eminence in it called Saddle-Back mountain, but the country in general

general is level enough for cultivation. One half of it is covered with pine and white oak.—*ib.*

FLOATING Bodies are ſuch as ſwim on the ſurface of a fluid, of which the moſt important are ſhips and all kinds of veſſels employed in war and in commerce. Every ſeaman knows of how much conſequence it is to determine the ſtability of ſuch veſſels, and the poſitions which they aſſume when they float freely and at reſt on the water. To accompliſh this, it is neceſſary to ſtate the principles on which that ſtability and theſe poſitions depend; and this has been done with ſo much ingenuity and ſcience by George Atwood, Eſq; F. R. S. in the Philoſophical Tranſactions for the year 1796, that we are perſuaded a large claſs of our readers will thank us for inſerting an abſtract of his memoir in this place.

A floating body is preſſed downwards by its own weight in a vertical line that paſſes through its centre of gravity; and it is ſuſtained by the upward preſſure of a fluid, acting in a vertical line that paſſes through the centre of gravity of the immerſed part; and unleſs theſe two lines be coincident, ſo that the two centres of gravity may be in the ſame vertical line, the ſolid will revolve on an axis, till it gains a poſition in which the equilibrium of floating will be permanent. Hence it appears that it is neceſſary, in the firſt place, to aſcertain the proportion of the part immerſed to the whole; for which purpoſe the ſpecific gravity of the floating body muſt be known; and then it muſt be determined, by geometrical or analytical methods, in what poſitions the ſolid can be placed on the ſurface of the fluid, ſo that the two centres of gravity already mentioned may be in the ſame vertical line when a given part of the ſolid is immerſed under the ſurface of the fluid. When theſe preliminaries are ſettled, ſomething ſtill remains to be done. Poſitions may be aſſumed in which the circumſtances juſt recited concur, and yet the ſolid will aſſume ſome other poſition in which it will permanently float. If a cylinder, *e. g.* having its ſpecific gravity to that of the fluid on which it floats as 3 to 4, and its axis to the diameter of the baſe as 2 to 1, be placed on the fluid with its axis vertical, it will ſink to a depth equal to a diameter and a half of the baſe; and while its axis is preſerved in a vertical poſition by external force, the centres of gravity of the whole ſolid and of the immerſed part will remain in the ſame vertical line: but when the external force that ſuſtained it is removed, it will decline from its upright poſition, and will permanently float with its axis horizontal. If the axis be ſuppoſed to be half of the diameter of the baſe, and be placed vertically, the ſolid will ſink to the depth of three-eighths of its diameter; and in that poſition it will float permanently. If the axis be made to incline to the vertical line, the ſolid will change its poſition until it ſettles permanently with the axis perpendicular to the horizon.

Whether, therefore, a ſolid floats permanently, or overſets when placed on the ſurface of a fluid, ſo that the centre of gravity of the ſolid and that of the part immerſed ſhall be in the ſame vertical line, it is ſaid to be in a poſition of equilibrium; and of this equilibrium there are three ſpecies, viz. the equilibrium of ſtability, in which the ſolid floats permanently in a given poſition: the equilibrium of inſtability, in which the ſolid, though the two centres of gravity already mentioned are in the ſame vertical line, ſpontaneouſly overſets, unleſs ſupported by external force; and the equilibrium of indifference, or the inſenſible equilibrium, in which the ſolid reſts on the fluid indifferent to motion, without tendency to right itſelf when inclined, or to incline itſelf farther.

If a ſolid body floats permanently on the ſurface of a fluid, and external force be applied to incline it from its poſition, the reſiſtance oppoſed to this inclination is termed the ſtability of floating. Among various floating bodies, ſome loſe their quieſcent poſition, and ſome gain it, after it has been interrupted, with greater facility and force than others.

Some ſhips at ſea (*e. g.*) yield to a given impulſe of the wind, and ſuffer a greater inclination from the perpendicular than others. As this reſiſtance to heeling or pitching, duly regulated, has been deemed of importance in the conſtruction of veſſels, ſeveral eminent mathematicians have inveſtigated rules for determining the ſtability of ſhips from their known dimenſions and weight, without recurring to actual trial. To this claſs we may refer Bouguer, Euler, Fred. Chapman, and others, who have laid down theorems for this purpoſe, founded on a ſuppoſition that the inclinations of ſhips from their quieſcent poſitions are evaneſcent, or, in a practical ſenſe, very ſmall.

"But ſhips at ſea (ſays our ingenious author) are known to heel through angles of 10° 20°, or even 30°, and therefore a doubt may ariſe how far the rules, demonſtrated on the expreſs condition that the angles of inclination are of evaneſcent magnitude, ſhould be admitted as practically applicable in caſes where the inclinations are ſo great."—"If we admit that the theory of ſtatics can be applied with any effect to the practice of naval architecture, it ſeems to be neceſſary that the rules, inveſtigated for determining the ſtability of veſſels, ſhould be extended to thoſe caſes in which the angles of inclination are of any magnitude likely to occur in the practice of navigation."

A ſolid body placed in the ſurface of a lighter fluid, at the depth correſponding to the relative gravities, cannot change its poſition by the combined actions of its weight, and the preſſure of the fluid, except by revolving on ſome horizontal axis which paſſes through the centre of gravity: but as many axes may be drawn through this point of the floating body in a direction parallel to the horizon, and the motion of the ſolid reſpects one axis only, this axis muſt be determined by the figure of the body, and the particular nature of the caſe. When this axis of motion, as it is called, is determined, and the ſpecific gravity of the ſolid is known, "the poſitions of permanent floating will be obtained, firſt by finding the ſeveral poſitions of equilibrium through which the ſolid may be conceived to paſs, while it revolves round the axis of motion; and ſecondly, by determining in which of thoſe poſitions the equilibrium is permanent, and in which of them it is momentary and unſtable."

Such as we have now briefly ſtated are the general principles, on which are founded Mr Atwood's inveſtigations for determining the poſitions aſſumed by homogeneous bodies, floating on a fluid ſurface; and alſo for determining the ſtability of ſhips and of other floating bodies. We cannot farther accompany him in his elucidation of them, in the problems to the ſolution

tion of which they lead, and in the important practical purposes of naval architecture to which they are referred. The whole paper, comprehending no less than 85 pages, is curious and valuable; it abounds with analytical and geometrical disquisitions of the most elaborate kind; and it serves to enlarge our acquaintance with a subject that is not only highly interesting to the speculative mathematician, but extremely useful in its practical application.

With this latter view, the author seems to have directed his attention to the various objects of inquiry which this article comprehends. They are such as intimately relate to the theory of naval architecture, so far as it depends on the pure laws of mechanics, and they contribute to extend and improve this theory. The union of those principles that are deduced from the laws of motion, with the knowledge which is derived from observation and experience, cannot fail to establish the art of constructing vessels on its true basis, and gradually to lead to farther improvements of the greatest importance and utility. To this purpose, the author observes, that

"If the proportions and dimensions adopted in the construction of individual vessels are obtained by exact geometrical mensurations, and calculations founded on them, and observations are made on the performance of these vessels at sea; experiments of this kind, sufficiently diversified and extended, seem to be the proper grounds on which theory may be effectually applied in developing and reducing to system those intricate, subtil, and hitherto unperceived causes, which contribute to impart the greatest degree of excellence to vessels of every species and description. Since naval architecture is reckoned among the practical branches of science, every voyage may be considered as an experiment, or rather as a series of experiments, from which useful truths are to be inferred towards perfecting the art of constructing vessels: but inferences of this kind, consistently with the preceding remark, cannot well be obtained, except by acquiring a perfect knowledge of all the proportions and dimensions of each part of the ship; and secondly, by making and recording sufficiently numerous observations on the qualities of the vessel, in all the varieties of situation to which a ship is usually liable in the practice of navigation."

In the valuable miscellany entitled the *Philosophical Magazine*, there is a paper on this subject by Mr John George English, teacher of mathematics and mechanical philosophy; which, as it is not long, and is easily understood, we shall take the liberty to transcribe.

"However operose and difficult the calculations necessary to determine the stability of nautical vessels may, in some cases, be, yet they all depend, says this author, upon the four following simple and obvious theorems, accompanied with other well known stereometrical and statical principles.

"*Theorem* 1. Every floating body displaces a quantity of the fluid in which it floats, equal to its own weight: and consequently, the specific gravity of the fluid will be to that of the floating body, as the magnitude of the whole is to that of the part immersed.

"*Theorem* 2. Every floating body is impelled downward by its own essential power, acting in the direction of a vertical line passing through the centre of gravity of the whole; and is impelled upward by the reaction of the fluid which supports it, acting in the direction of a vertical line passing through the centre of gravity of the part immersed: therefore, unless these two lines are coincident, the floating body thus impelled must revolve round an axis, either in motion or at rest, until the equilibrium is restored.

"*Theorem* 3. If by any power whatever a vessel be deflected from an upright position, the perpendicular distance between two vertical lines passing through the centres of gravity of the whole, and of the part immersed respectively, will be as the stability of the vessel, and which will be positive, nothing, or negative, according as the metacentre is above, coincident with, or below, the centre of gravity of the vessel.

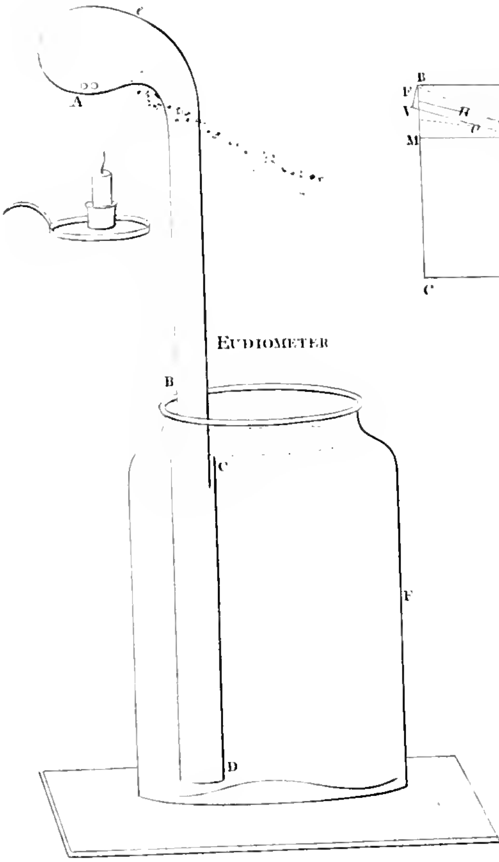
"*Theorem* 4. The common centre of gravity of any system of bodies being given in position, if any one of these bodies be moved from one part of the system to another, the corresponding motion of the common centre of gravity, estimated in any given direction, will be to that of the aforesaid body estimated in the same direction, as the weight of the body moved is to that of the whole system.

"From whence it is evident, that in order to ascertain the stability of any vessel, the position of the centres of gravity of the whole, and of the part immersed, must be determined; with which, and the dimensions of the vessel, the line of floatation, and angle of deflection, the stability or power either to right itself or overturn, may be found.

"In ships of war and merchandize, the calculations necessary for this purpose become unavoidably very operose and troublesome; but they may be much facilitated by the experimental method pointed out in the New Transactions of the Swedish Academy of Sciences, first quarter of the year 1787, page 48.

"In river and canal boats, the regularity and simplicity of the form of the vessel itself, together with the compact disposition and homogeneal quality of the burden, render that method for them unnecessary, and make the requisite calculations become very easy. Vessels of this kind are generally of the same transverse section throughout their whole length, except a small part in prow and stern, formed by segments of circles or other simple curves; therefore a length may easily be assigned such, that any of the transverse sections being multiplied thereby, the product will be equal to the whole solidity of the vessel. The form of the section ABCD is for the most part either rectangular, as in fig. 1. trapezoidal, as in fig. 2. or mixtilineal as in fig. 3. in all which MM represents the line of floatation when upright, and EF that when inclined at any angle MXE; also G represents the centre of gravity of the whole vessel, and R that of the part immersed. Plate XXVIII.

"If the vessel be loaded quite up to the line AB, and the specific gravity of the boat and burden be the same, then the point G is simply the centre of gravity of the section ABCD; but if not, the centres of gravity of the boat and burden must be found separately, and reduced to one by the common method, namely, by dividing the sum of the momenta by the sum of weights, or areas, which in this case are as the weights. The point R is always the centre of gravity of the section MMCD, which, if consisting of different figures, must also be found by dividing the sum of the momenta by the sum of the weights as common. These two points being found, the



FLOATING BODIES

Fig 1.

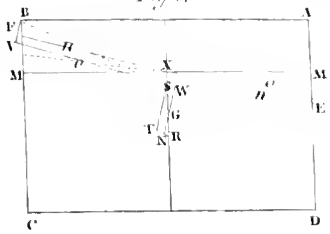


Fig 2.

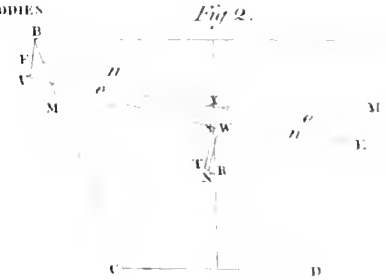
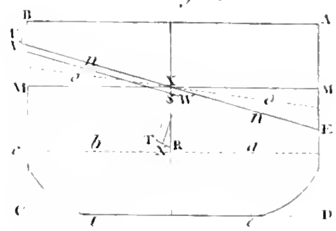


Fig 3.



EUPHORBIA

Fig 1.

Fig 2.

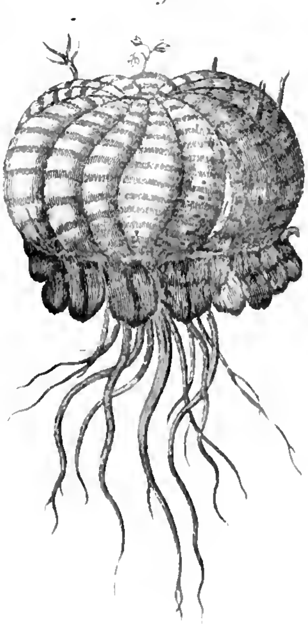
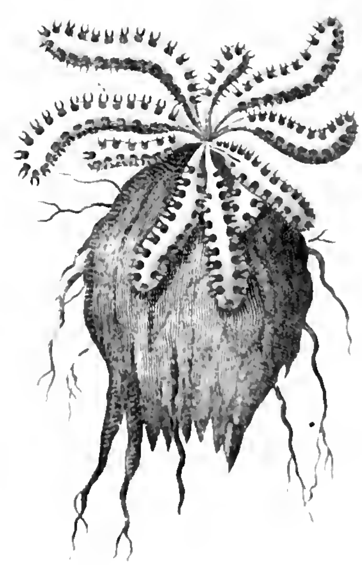


Fig 3.



Floating.

the next thing neceſſary is to determine the area of the two equal triangles MXE, MXF, their centres of gravity *o*, *o*, and the perpendicular projected diſtance *n n* of theſe points on the water line EF. This being done, through R, and parallel to EF draw RT=a fourth proportional to the whole area MMCD, either triangle MXE or MXF, and the diſtance *n n*; through T, and at right angles to RT or EF, draw TS meeting the vertical axis of the veſſel in S the metacentre; alſo through the points G, B, and parallel to ST, draw NGW and BV; moreover through S, and parallel to EF, draw WSV, meeting the two former in V and W; then SW is as the ſtability of the veſſel, which will be poſitive, nothing or negative, according as the point S is above, coincident with, or below, the point G. If now we ſuppoſe W to repreſent the weight of the whole veſſel and burden (which will be equal to the ſection MMCD multiplied by the length of the veſſel), and P to repreſent the required weight applied at the gunwale B to ſuſtain the veſſel at the given angle of inclination; we ſhall always have this proportion: as VS : SW : : W : P; which proportion is general, whether SW be poſitive or negative; it muſt only in the latter caſe be ſuppoſed to act upward to prevent an overturn.

"In the rectangular veſſel, of given weight and dimenſions, the whole proceſs is ſo evident, that any farther explanation would be unneceſſary. In the trapezoidal veſſel, after having found the points G and R, let AD, BC be produced until they meet in K. Then, ſince the two ſections MMCD, EFDC are equal, the two triangles MMK, EFK are alſo equal; and therefore the rectangle EK × KF = KM × KM = $\overline{KM}^2$; and ſince the angle of inclination is ſuppoſed to be known, the angles at E and F are given. Conſequently, if a mean proportional be found between the ſines of the angles at E and F, we ſhall have the following proportions:

"As the mean proportional thus found : ſine ∠ E : : KM : KF, and as the ſaid mean proportional : ſine ∠ F : : KM : KE; therefore ME, MF become known: from whence the area of either triangle MXE or MXF, the diſtance *n n*, and all the other requiſites, may be found.

"In the mixtilineal ſection, let AB = 9 feet = 108 inches, the whole depth = 6 feet = 72 inches, and the altitude of MM the line of floatation 4 feet or 48 inches; alſo let the two curvelinear parts be circular quadrants of two feet, or 24 inches radius each. Then the area of the two quadrants = 904·7808 ſquare inches, and the diſtance of their centres of gravity from the bottom = 13·8177 inches very nearly; alſo the area of the included rectangle *a b i e* = 1440 ſquare inches, and the altitude of its centre of gravity 12 inches; in like manner, the area of the rectangle AB *c d* will be found = 5184 ſquare inches, and the altitude of its centre of gravity 48 inches: therefore we ſhall have

Momentum of the two quad.	= 904·7808	× 13·8177	=	12501·98966016
Moment. of the rectan. *a b i e*	= 1440·	× 12	=	17280·
Moment. of the rectan. AB *c d*	= 5184·	× 48	=	248832·
	7528·7808			278613·98966016

Floating ‖ Florida.

"Now the ſum of the momenta, divided by the ſum of the areas, will give $\frac{278613·98966016}{7528·7808}$ = 37·006 inches, the altitude of G, the centre of gravity of the ſection ABCD above the bottom. In like manner, the altitude of R, the centre of gravity of the ſection MMCD, will be found to be equal $\frac{123093·98966016}{4936·7808}$ = 24·934 inches; and conſequently their difference, or the value of GR = 12·072 inches will be found.

Suppoſe the veſſel to heel 15°, and we ſhall have the following proportion; namely, As radius : tangent of 15° : : MX = 54 inches : 14·469 inches = ME or MF; and conſequently the area of either triangle MXE or MXF = 390·663 ſquare inches. Therefore, by theorem 4th, as 4936·7808 : 390·663 : : 72 = *n n* = ⅔ AB : 5·6975 inches = RT; and, again, as radius : ſine of 15° : : 12·072 = GR : 3·1245 inches = RN; conſequently RT—RN = 5·6975—3·1245 = 2·573 inches = SW, the ſtability required.

"Moreover, as the ſine of 15° : radius : : 5·6975 = RT : 22·013 = RS, to which, if we add 24·934, the altitude of the point R, we ſhall have 46 947 for the height of the metacentre, which taken from 72, the whole altitude, there remains 25·053; from which, and the half width = 54 inches, the diſtance BS is found = 59·529 inches very nearly, and the angle SBV = 80°—06′—42″; from whence SV = 58·645 inches.

Again: Let us ſuppoſe the mean length of the veſſel to be 40 feet, or 480 inches, and we ſhall have the weight of the whole veſſel equal to the area of the ſection MMCD = 4936·7808 multiplied by 480 = 2369654·784 cubic inches of water, which weighs exactly 85708 pounds avoirdupoiſe, allowing the cubic foot to weigh 62·5 pounds.

"And, finally, as SV : SW (*i. e.*) as 58·645 : 2·573 : : 85708 : 3760 +, the weight on the gunwale which will ſuſtain the veſſel at the given inclination. Therefore a veſſel of the above dimenſions, and weighing 38 tons, 5 cwts. 28 lbs. will require a weight of 1 ton, 13 cwts. 64 lbs. to make her incline 15°.

"In this example, the deflecting power has been ſuppoſed to act perpendicularly on the gunwale at B; but if the veſſel is navigated by ſails, the centre velique muſt be found; with which, and the angle of deflection, the projected diſtance thereof on the line SV may be obtained; and then the power, calculated as above, neceſſary to be applied at the projected point, will be that part of the wind's force which cauſes the veſſel to heel. And converſely, if the weight and dimenſions of the veſſel, the area and altitude of the ſails, the direction and velocity of the wind be given, the angle of deflection may be found."

FLORIDA, a townſhip in Orange co. New-York, 6 or 8 miles S. of Goſhen, and 50 N. W. of New-York city. 377 of its inhabitants are qualified to be electors. It has been lately incorporated.—*Morſe.*

Florida, *Eaſt* and *Weſt*, belonging to Spain, ſituated between 25. and 31. N. lat. and between 80. and 91. W. long. about 600 miles in length. Its breadth is various; the broadeſt part of Weſt Florida is about 130 miles, while the narrow peninſula of Eaſt Florida extends, in the ſame direction, from S. to N. 400 miles. It is bounded N. by Georgia, S. by the gulf of Mexico, E. by the Atlantic ocean, and W. by the Miſſiſip-

pi,

pi, which separates it from Louisiana, and is nearly of the form of the letter L. Among its rivers that fall into the Atlantic, St. John's and Indian rivers are the chief. Seguana, Appalachicola, Chatahatchi, Escambia, Mobile, Pascagoula and Pearl rivers all rise in Georgia, and run southerly into the gulf of Mexico. The principal bays are St Bernard's, Ascension, Mobile, Pensacola, Dauphin, Joseph, Apalachy, Spiritu Sancto; and the chief capes are Blanco, St Blaize, Anclote, and cape Florida at the extremity of the peninsula. The climate is little different from that of Georgia. There are, in this country, a great variety of soils; the eastern part of it, near to, and about St Augustine, is by far the most unfruitful; yet even there, two crops of Indian corn are annually produced. The banks of the rivers which water the Floridas, and the parts contiguous, are of a superior quality, and well adapted to the culture of rice and corn. The fine lands near the river Escambia, are described under the account of that river. The interior country, which is high and pleasant, abounds with wood of almost every kind; particularly white and red oak, live oak, laurel magnolia, pine, hickory, cypress, red and white cedar. The live oaks, though not tall, contain a prodigious quantity of timber. The trunk is generally from 12 to 20 feet in circumference, and rises 10 or 12 feet from the earth, and then branches into 4 or 5 great limbs, which grow in nearly a horizontal direction, forming a gentle curve. "I have stepped" says Bartram, "above 50 paces, on a straight line, from the trunk of one of these trees to the extremity of the limbs." They are ever green, and the wood almost incorruptible. They bear a great quantity of small acorns, which is agreeable food when roasted, and from which the Indians extract a sweet oil, which they use in cooking homminy and rice.

The laurel magnolia is the most beautiful among the trees of the forest, and is usually 100 feet high, though some are much higher. The trunk is perfectly erect, rising in the form of a beautiful column, and supporting a head like an obtuse cone. The flowers, which are on the extremity of the branches, are large, white, and expanded like a rose, and are the largest and most complete of any yet known; when fully expanded, they are from 6 to 9 inches diameter, and have a most delicious fragrance. The cypress is the largest of the American trees. "I have seen trunks of these trees," says Bartram, "that would measure 8, 10 and 12 feet in diameter, for 40 and 50 feet shaft." The trunks make excellent shingles, boards, and other timber; and when hollowed, make durable and convenient canoes. The garden vegetables are in high perfection; the orange and lemon trees grow here, without cultivation, to a large size, and produce better fruit than in Spain and Portugal. The intervales between the hilly parts of this country are extremely rich. The principal town in West Florida is Pensacola; in East Florida St Augustine.

The Spanish strength in the Floridas, and Louisiana, in 1790, was as follows, according to Mr Melford's account: Troops and levies at St Augustine and on St John's river, 400—St Marks, 100—Pensacola, 350—Mobile and Tombigbee, 150—at the Natchez, 200—Red river, 100—Illinois river, 300—in all 1600 men, called the Orleans or Louisiana regiment.

The number of American families that have been Spanish subjects since 1783, amounts to 1720, viz. at Tensau, near Mobile bay, 90—on Tombigbee river, 130—at the Natchez on the Mississippi, 1500. All the settlers in these districts are under the immediate orders of the military commandants, and subject to martial law; with an appeal from stage to stage, up to the viceroy of Mexico. The property of the subject at his decease is to be managed by the commandant, whose fees, by law, are enormous.

Until the year 1586 the continent of North-America went by the name of Florida. It received this name from John Ponce, because when he landed in N. lat. 38. 8. in April 1513, he found the country there in full bloom. Florida has frequently changed masters, belonging alternately to the French and Spaniards. West-Florida, as far as Perdido river, was owned and occupied by the French; the remainder, and all East-Florida, by the Spaniards, previous to their being ceded to the British, at the peace of 1763. The British divided this country into E. and W. Florida. During the American war, both the Floridas were reduced by the Spaniards, and guarantied to the crown of Spain by the definitive treaty of 1783.—*ib.*

Florida, Cape, the southernmost point of land of the peninsula of East-Florida. It is 100 miles N. of the island of Cuba. N. lat. 25. 20. W. long. 80. 20.—*ib.*

Florida Keys, or *Martyr's Islands*, a number of rocks and sand banks, bounded W. by the gulf of Mexico, E. by that of Florida. The great sand bank extends from the peninsula of East-Florida inward, to the gulf of Mexico, in the form of a hook; its W. point is divided from the bank called the Dry Tortugas, by Tortuga channel.—*ib.*

Florida, Gulf of, is the channel between the peninsula of Florida and the Bahama islands, N. of the island of Cuba; and through which the Gulf Stream finds a passage, and runs to the N. E. along the American coast.—*ib.*

FLOWERTOWN, in Pennsylvania, is a small village about 12 miles N. of Philadelphia, in Montgomery co.—*ib.*

FLUENT, or Flowing Quantity, in the doctrine of fluxions, is the variable quantity which is considered as increasing and decreasing; or the fluent of a given fluxion, is that quantity whose fluxion being taken, according to the rules of that doctrine, shall be the same with the given fluxion. See Fluxions. *Encycl.*

FLUIDS, Motion in. See Hydrostatics and Resistance of Fluids, *Encycl.* and Motion in this *Supplement*.

FLUSHING, a town in Queen's co. New-York, situated on the N. W. part of Long Island, and on the S. side of Hell Gate; 7 miles E. by N. of New-York city. It contains 1607 inhabitants; of whom 210 are qualified electors, and 340 are slaves.—*Morse.*

FLUVANNA, a county of Virginia, bounded N. by Albemarle, N. E. by Louisa, E. by Goochland, W. by Amherst, and S. by Fluvanna or James river, which divides it from Buckingham. It is about 22 miles long, and 20 broad, and contains 3,921 inhabitants, including 1,466 slaves. There is great plenty of of marble, both white and variegated with blue, red and purple veins, found here, on James river, at the mouth of Rockfish; where it forms a large precipice, overhanging a navigable part of the river.—*ib.*

FOGEDAR, the military governor of a subordinate district in India, who has sometimes the additional office of collecting the revenues.

FOGGY *Cape*, on the N. W. coast of N. America, is situated on the S. eastern side of the peninsula of Alaska, and W. of Kilhtac island.—*Morse.*

FOGGY *Isle*, on the same side of the peninsula as the above, lies a short way S. by W. of Foggy Cape. —*ib.*

FOLIATE, a name given by some to a curve of the 2d order, expressed by the equation $x^3+y^3=axy$, being one species of defective hyperbolas, with one asymptote, and consisting of two infinite legs crossing each other, forming a sort of leaf. It is the 42d species of Newton's Lines of the 3d Order.

FOLLOWFIELD, a township in Washington co. Pennsylvania. East and West Followfield are also two townships, in Chester co. Pennsylvania.—*Morse.*

FONSECA, Gulf of, lies in New-Spain on the Pacific ocean, 40 miles S. E. of the town of St Miguel, and about 290 miles N. W. of Cape Blanco, on the western side of the gulf of Nicoya —*ib.*

FONTAIN, Belle, a settlement in the N. W. territory, situated on the E. side of the Mississippi, about 18 miles N. of St Phillips, and 23 below Cahokia.—*ib.*

FONT, or Fonte, Straits de, lie on the N. W. coast of N. America, in N. lat. 54. 35. W. long. 9. 55. There is a large island in the middle of the entrance. This is thought to be the same strait that De Fonte, a Spanish admiral, discovered in 1640, whose account of it has been long treated as fabulous. It has been seen by captains Gray and Ingraham, of Boston.—*ib.*

FORALONES, in the island of Gunra, and coast of Peru, in S. America, are old walls of some ancient building in the time of the Yncas, which serve here as light-houses for the shipping which sail from Callao to Paita, on the S. Sea coast.—*ib.*

FORCER, in mechanics, is properly a piston without a valve. For, by drawing up such a piston, the air is drawn up, and the water follows; then pushing the piston down again, the water, being prevented from descending by the lower valve, is forced up to any height above, by means of a side branch between the two.

FORDYCE (James, D. D.) so well known to serious readers by his sermons to young women and other specimens of pulpit eloquence, was born at Aberdeen in the year 1720. His father was a man much esteemed, and held, more than once, the office of chief magistrate in his native city; and his mother was a woman of good sense, amiable temper, and exemplary piety. This respectable pair had the singular felicity of transmitting superior talents to almost every individual of a numerous family; of one of which, viz. David Fordyce, the reader will find some account in the *Encyclopædia*.

The subject of this memoir, who was their fourth son, acquired, as well as his brother, the rudiments of classical learning at the grammar school of Aberdeen, whence he was removed to the Marischal college and university in the same city. Having completed a regular course of study both in philosophy and theology, he was licensed, when very young, according to the forms of the church of Scotland, to be a preacher of the gospel; and was soon afterwards preferred to the place of second minister in the collegiate church of Brechin in the county of Angus. After remaining there for some years, he received a presentation to the church of Alloa near Stirling; and though the inhabitants of that parish were prepossessed in favour of another minister whom they knew, and prejudiced against Mr Fordyce whom they did not know; so narrow minded and totally destitute of taste was his colleague in Brechin, that he judged it expedient to hazard the consequences of a removal. He was aware that he entered on his new charge under a considerable degree of popular odium; but he thought it more probable that he should be able to overcome that odium, than conciliate the affections of a sour fanatic. In this expectation he was not deceived. The prejudices of the good people in Alloa were very quickly removed, not more by the able and impressive manner in which he conducted the public services of the Lord's day, than by the amiable and condescending spirit with which he performed the more private duties of visiting and catechising in the different districts of his parish; duties which, as they were wont to be performed by the Scotch clergy, contributed much more than preaching to the religious instruction of the lower classes of the people.

It was during his residence at Alloa that Mr Fordyce first distinguished himself as an author by the successive publication of the three following sermons. The first, upon the eloquence of the pulpit, was annexed to "the Art of Preaching" by his brother David; the second, upon the methods of promoting edification by public institutions, was preached at the ordination of the Rev. Mr Gibson minister of St Ninian's, a neighbouring parish, in the year 1754, and published, with the charge and notes in 1755; and the third, upon the delusive and persecuting spirit of popery, was preached the same year before the synod of Stirling and Perth: and being published, came very quickly to a second edition. But the sermon which most strongly arrested the attention, both of the audience before which it was delivered, and of the public to which, in 1760, it was given from the press, was that on the *folly, infamy, and misery of unlawful pleasure*, preached before the General Assembly of the Church of Scotland. The choice of such a subject on such an occasion, excited the surprise of all his hearers, and tempted the younger part of them to smile at the very reading of the text; but this unseasonable mirth was soon converted into seriousness. The picture exhibited in this sermon is the work of a master; and we have been assured by a friend who heard it preached, that the spirit and elegance of the composition was so seconded by the solemnity and animation with which it was delivered, that it made a very striking impression, not only upon the more respectable part of the audience, but upon minds of noted levity: It raised indeed its writer's fame as a pulpit-orator to an unrivalled eminence among his brethren in Scotland.

About this time, and we believe in consequence of this sermon, Mr Fordyce received from the university of Glasgow a diploma, creating him Doctor in Divinity;

nity; and if there is yet any thing honourable in academical degrees, prostituted as they have long been by an undistinguishing distribution, the honour could not have been conferred with greater propriety on any man in the church to which he then belonged.

In that church he did not long remain. Soon after the publication of this singular sermon, and his consequent acquisition of academical honours, he accepted of an invitation from a society of Protestant dissenters, who had their place of meeting in Monkwell-street, London, to become colleague and successor to their pastor, who was then old and infirm, and who died indeed in the space of a few months. This gave occasion to the Doctor to display his oratory once more both from the pulpit and the press in a sermon on the death of Dr Lawrence. He was now sole pastor to the congregation of Monkwell-street; and preached for many years, with great powers of eloquence and fervor of piety, to an audience always crowded and often overflowing.

When a preacher obtains, with or without merit, an uncommon share of popularity, a considerable proportion of his hearers will ever consist of those, who are guided in their choice rather by curiosity and fashion, than by sound judgment. The attachments of such people are as capricious and variable as their minds; and they change their preacher as they change their dress, not from their own taste, for in general they have none; but from the desire of being where others are, of doing what others do, and of admiring what others admire. Dr Fordyce appreciated justly the value of such men's approbation, and knew it eventually by experience; but he was more than compensated for the loss of hearers of this description by the steady adherence of others, whose esteem was most desirable, because it was grounded upon the dictates of a sound understanding.

At last, about Christmas 1782, when his health, which had long been declining, rendered it necessary, in his own opinion, and in the opinion of his physicians, to discontinue his public services, he resigned his charge in Monkwell-street, and retired to a villa in Hampshire, in the neighbourhood of the Earl of Bute, who honoured him with his friendship, and to whose valuable library he had free access. Afterwards he removed to Bath, where having, with Christian patience, suffered much from an asthmatic complaint, to which he had been subject for some years, on the 1st of October 1796 he expired without a groan.

Were we to hazard an opinion of Dr Fordyce's intellectual powers from such a perusal of his works as we must acknowledge to have been hasty, we would say that he was a man of genius rather than of judgment; that his imagination was the predominant faculty of his mind; and that he was better fitted, by an address to the passions, to enforce the practice of virtue, than, by the exertions of his own understanding, to vindicate speculative truth, or to detect the sophistry of error. From this remark, we cannot be suspected of a wish to lessen his character in the public esteem; for his talents, as they appear to us, are surely of more value to a preacher than those which are perhaps better adapted to literary or scientific pursuits. In none of his work indeed do we perceive any evidence either of profound science, or of various erudition; though we doubt not but those works are every thing which their author intended them to be. Of his sermons to young women, which have attracted most general notice, it would be presumptuous in us to give a character; for though we sat down many years ago to read them, we could not get through; and we have never made a second attempt. As far as we can depend upon what we recollect of these far-famed discourses, the censure passed on them by Mrs Wolstoncraft seems to be just. Their author, however, was certainly qualified to excel, and actually did excel as a preacher. We have already mentioned with approbation three or four of his occasional sermons; but perhaps the finest specimen of pulpit oratory which ever fell from his pen, is the charge which he delivered at the ordination of his successor in the meeting of Monkwell-street. It is indeed one of the most valuable discourses of the kind that we have seen, and should be read with attention by every clergyman of every denomination, who wishes to discharge his duty with credit to himself and with advantage to his people.

The effect of Dr Fordyce's addresses from the pulpit was much heightened, not only by an action and an elocution, which he studied with care and practised with success; but by the figure of his person, which was peculiarly dignified, and by the expression of his countenance, which was animated at all times, but animated most of all when lighted up by the ardor of his soul in the service of God. By some of his hearers, it was observed that, on many occasions, he seemed not merely to speak, but to look conviction to the heart. His eye, indeed, was particularly bright and penetrating, and he had carefully attended to the effect which an orator may often produce upon an audience by the judicious use of that little, but invaluable organ.

With respect to his theological sentiments, we are assured (A) they were in no extreme, but liberal, rational, and manly. He seems to have been untainted by that rage of innovation, which of late has so completely disfigured the creed, as well religious as political, of the great body of English dissenters. The consequence was, that he lived on terms of friendship with men of very opposite sentiments; with Price a republican and Arian, and with Johnson, who, though he hated a whig and a Presbyterian, respected talents and worth wherever he found them.

We shall conclude this short sketch of Dr Fordyce's life and character with the following list of his works, of which some have been translated into several languages. 1. A Sermon and Charge, at the ordination of the Rev. Mr Gibson Minister of St Ninian's, 1754. 2. Another Ordination Sermon on the Eloquence of the Pulpit, annexed to his brother's "Art of Preaching," 1754. 3. A Sermon on the Spirit of Popery, 1754. 4. A Sermon on the Folly, Infamy, and Misery of Unlawful Pleasure, 1760. 5. A Sermon on the Death of Dr Lawrence, 1760. 6. Sermons to Young Women, 2 vols. 1765. 7. A Sermon on the Character

(A) By his successor in Monkwell-street, to whose sermon, preached on occasion of the Doctor's death, our readers are indebted for every thing valuable in this short memoir.

Character and Conduct of the Female Sex, 1776. 8. Addresses to young men, 2 vols. 1777. 9. A Charge at the Ordination of the Rev. James Lindsey, in Monkwell-street, 1783. 10. Addresses to the Deity, 1785. 11. Poems, 1786. 12. A Discourse on Pain, 1791. He also re-published, with an additional character, "The Temple of Virtue, a Dream," written by his brother David.

FORESTERTON, a village in Burlington co. New-Jersey, which lies between Ayerston and Evesham; about 15 miles E. of Philadelphia, and 11 S. of Burlington city.—*Morse*.

FOREST, a small island in the British territories, at the mouth of Lake Ontario, between which and Grand Island is a narrow channel. It lies 9 miles southerly of Fort Frontinac, and 6 N. westerly of Roebuck island in the same lake, and within the line of the United States.—*ib.*

FORKED DEER, a navigable river in Tennessee, which runs westerly into Mississippi river, between the Obian and Hatchy. It is about 76 yards wide, 7 miles from its mouth.—*ib.*

FORKS, a township in Northampton co. Pennsylvania.—*ib.*

FORMULA, a theorem or general rule or expression, for resolving certain particular cases of some problem, &c. So $\frac{1}{2}s + \frac{1}{2}d$ is a general formula for the greater of two quantities whose sum is s and difference d; and $\frac{1}{2}s - \frac{1}{2}d$ is the formula, or general value, for the less quantity. Also $\sqrt{dx - x^2}$ is the formula, or general value, of the ordinate to a circle, whose diameter is d, and absciss x.

FORSTER (John Reinhold, L.L.D.) professor of natural history in the university of Halle, member of the academy of sciences at Berlin, and of other learned societies, was born at Dirschau, in West Prussia, in the month of October 1729, and was formerly a Protestant clergyman at Dantzick. He had a numerous family, and the emoluments of his office were slender. He therefore quitted Dantzick, and went, first to Russia, and thence to England, in quest of a better settlement than his own country afforded. In the dissenting academy at Warrington he was appointed tutor in the modern languages, with the occasional office of lecturing in various branches of natural history. For the first department he was by no means well qualified; his extraordinary knowledge of languages, ancient and modern, being unaccompanied by a particle of taste; and his use of them being all barbarous, though fluent. As a natural historian, a critic, geographer, and antiquary, he ranked much higher; but, unfortunately, these were acquisitions of little value in his academical department.

At length he obtained the appointment of naturalist and *philosopher* (if the word may be so used) to the second voyage of discovery undertaken by Capt. Cook; and from 1772 to 1775 he accompanied that immortal navigator round the world. On his return he resided in London, till the improper conduct of himself and his son made it expedient for them both to leave the kingdom. Fortunately he received an invitation to Halle, where, for 18 years, he was a member of the philosophical and medical faculties. Among his works are: An Introduction to Mineralogy, or, An accurate Classification of Fossils and Minerals, &c. London, 1768, 8vo. A Catalogue of the Animals of North America, with short Directions for collecting, preserving, and transporting all kinds of Natural Curiosities, London, 1771, 8vo. Observations made during a Voyage round the World, on Physical Geography, &c. London, 1778. He was the author of a great many productions in English, Latin, or German, and of several papers in the Philosophical Transactions. He translated into English, Bougainville's Voyage round the World, and Kalm's, Bossu's, and Reidsel's Travels. He was employed likewise, when in England, in the Critical Review; and he wrote various detached papers on different subjects, which have been inserted in foreign journals and the transactions of learned academies.

He died at Halle on the 16th of December 1798, in the 70th year of his age.

FORSTER (George), the son of the preceding, was born at Dantzick, and accompanied his father to England when he was about twelve years of age. He was entered a student in the academy at Warrington, and soon acquired a very perfect use of the English tongue. He also distinguished himself greatly by his attainments in science and literature in general; adding to an excellent memory, quick parts and a fertile imagination. His temper was mild and amiable; in which he much differed from his father, one of the most quarrelsome and irritable of men; by which disposition, joined to a total want of prudence in common concerns, he lost almost all the friends his talents had acquired him, and involved himself and family in perpetual difficulties.

The case was very different with the subject of this memoir; for when Dr Forster was appointed naturalist to captain Cook, his son, through the interest of the friends whom his good nature had made, was associated with him in his office. The voyage continued during the space of three years; and on their return the two Forsters published jointly a botanical work in Latin, contained the characters of a number of new *genera* of plants, discovered by them in their circumnavigation. Thus far they acted properly in the service of government for the advancement of science; but in publishing another work their conduct was not proper.

The father had come under an engagement not to publish separately, from the authorised narrative, any account of the voyage; and this engagement he and his son were determined to violate. An account of the voyage, therefore, was published in English and German by *George*; and the language, which is correct and elegant, was undoubtedly his; but those who knew both him and his father, are satisfied that the matter proceeded from the joint stock of their observations and reflections. Several parts of the work, and particularly the elaborate investigations relative to the languages spoken by the natives of the South Sea Islands, and the speculations concerning their successive migrations, are thought to be strongly impressed with the genius of the elder Forster.

That a work thus surreptitiously ushered into the world was not patronised by those with whom the authors had so ungratefully broken faith, could excite no wonder, even though the publication itself had been otherwise unexceptionable; but this was far from being the case. It abounds with reflections injurious to the government whose servants they had been, and not just

to

to the navigators employed on voyages of discovery. The younger Forster, too, had some time before published a book replete with factious sentiments; and the coldness with which he and his father were both treated in consequence of such conduct, determined them to leave London.

We have already related all that we know of the father, who was recommended to our notice only by his connection with the illustrious Cook; and of the son, there is a short account in the Monthly Magazine, by Charles Pougens, fraught with those impious and seditious reflections which so frequently disgrace a miscellany, which would otherwise be highly valuable. According to this author, George Forster was desirous to settle in France. Avaricious of glory, and an idolator of liberty, Paris was the city most suitable to his taste and character of any in Europe. Notwithstanding this, he was soon constrained to leave it: the interest of his family demanded this sacrifice; for a learned man, who sails round the world, may enrich his memory, but he will not better his fortune. He was accordingly obliged to accept the place of professor of natural history in the university of Cassel. But his factious spirit accompanied him whithersoever he went. It is well known, that the petty princes of Germany have long been in the practice of hiring out their troops to more opulent sovereigns engaged in war. This practice, which we are not disposed to defend, not only scandalized our Cosmopolite, but so irritated his temper and offended his pride, because forsooth, the Prince of Hesse-Cassel would not by *him* be persuaded to relinquish it, that he did every thing in his power, we are told, to withdraw himself from a situation so unsuitable to a thinking being. Every thing in his power! Did the Prince retain him in the university contrary to his inclination? The university of Cassel must be contemptible indeed, if the prelections of such a man as George Forster were of such consequence to it.

He got away, however, and the senate of Poland having offered him a chair in the university of Wilna, Forster accepted of the invitation. But although this office was very lucrative, and the enlightened patriots of that country did not neglect to procure him all the literary succours of which he stood in need, he could not be long happy in a semi-barbarous nation, in which liberty was suffered to expire under the intrigues of Russia and Prussia.

On this, with wonderful consistency, the man who could not endure the despotism of Hesse, or even the aristocracy of England, accepted of the propositions of that friend to liberty Catharine II; who, jealous of every species of glory, wished to signalize her reign, by procuring to the Russian nation the honour of undertaking, after the example of England and France, a new voyage of discovery round the world. Unfortunately for the progress of knowledge, the war with the Ottoman Porte occasioned the miscarriage of this useful project.

But Forster could not long remain in obscurity. The different publications with which he occasionally enriched natural history and literature, encreased his reputation. The Elector of Mentz accordingly appointed him president of the university of the same name; and he was discharging the functions of his new office when the French troops took possession of the capital. This philosophical traveller, who had studied society under all the various aspects arising from different degrees of civilization; who had viewed man simple and happy at Otaheite;—an eater of human flesh in New-Zealand, corrupted by commerce in England, depraved in France by luxury and atheism, in Brabant by superstition, and in Poland by anarchy;—beheld with wild enthusiasm the dawnings of the French revolution, and was the first, says M. Pougens, to promulgate republicanism in Germany.

The *Mayencois*, who had formed themselves into a national convention, sent him to Paris, in order to solicit their *reunion* with the French republic. But, in the course of his mission, the city of Mentz was besieged and retaken by the Prussian troops. This event occasioned the loss of all his property; and what was still more disastrous, that of his numerous manuscripts, which fell into the hands of the Prince of Prussia.

Our biographer, after conducting his hero through these scenes of public life, proceeds to give us a view of his domestic habits and private principles. He tells us, that he formed a connection (whether a marriage or not, the studied ambiguity of his language leaves rather uncertain) with a young woman named *Theresa Hayne*, who, by the illumination of French philosophy, had divested herself of all the prejudices which, we trust, the ladies of this country still consider as their honour, as they are certainly the guardians of domestic peace. Miss Hayne was indignant at the very *name of duty*. With Eloisa she had taken it into her head, that

> Love, free as air, at sight of human ties,
> Spreads his light wings, and in a moment dies.

She was frank enough, however, says our author, to acknowledge the errors of her imagination; and from this expression, and his calling her afterwards Forster's wife, we are led to suppose that she was actually married to him. But their union, of whatever kind, was of short duration. Though the lady is said to have been passionately attached to celebrated names, the *name* of George Forster was not sufficient to satisfy her. He soon ceased, we are informed, to *please* her; she therefore transferred her affections to another; and, as was very natural for a woman who was indignant at the name of duty, she proved false to her husband's bed. Forster, however, pretended to be such a friend to the *modern* rights of men and women, that he defended the character of his Theresa against crowds who condemned her conduct. Nay, we are told, that he considered himself, and every other husband, who ceases to please, as the *adulterer of nature*. He therefore laboured strenuously to obtain a divorce, to enable Theresa Hayne to espouse the man whom she preferred to himself. Strange, however, to tell, the prejudices even of this Cosmopolite were too strong for his principles. While he was endeavouring to procure the divorce, he made preparations at the same time, by the study of the oriental languages, to undertake a journey to Thibet and Indostan, in order to remove from that part of the world, in which both his heart and his person had experienced so severe a shock. But the chagrin occasioned by his misfortunes, joined to a scorbutic affection,

tion, to which he had been long ſubject, and which he had contracted at ſea during the voyage of circumnavigation, abridged his life, and prevented him from realiſing this double project. He died at Paris, at the age of thirty-nine, on the 13th of February 1792.

This is a ſtrange tale; but we truſt it will not prove uſeleſs. The latter part of it at leaſt ſhows, that when men diveſt themſelves of the principles of religion, they ſoon degenerate from the dignity of philoſophers to the level of mere ſenſualiſts; and that the woman, who can, in defiance of decorum and honour, transfer her affections and her perſon from man to man, ranks no higher in the ſcale of being than a female brute of more than common ſagacity. It ſhews likewiſe, that the contempt of our modern ſages for thoſe partial attachments which unite individuals in one family, is a mere pretence; that the dictates of nature will be heard; and the laws of nature's God obeyed. George Forſter, though he was ſuch a zealous advocate for liberty and equality, as to vindicate the adultery of his wife; yet felt ſo ſenſibly the wound which her infidelity inflicted on his honour, that he could not ſurvive it, but periſhed, in conſequence, in the flower of his age.

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

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

FORT BALIZE, at the mouth of Miſſiſſippi river, lies 105 miles below the city of New-Orleans.—*Morse.*

Fort Blount, ſtands on Cumberland river, in the ſtate of Tenneſſee.—*ib.*

Fort Brewington, in New-York ſtate, is ſituated at the W. end of Oneida Lake, and on the N. ſide of Onondago river, at its mouth in the lake.—*ib.*

Fort Chartres, in the N. W. territory, is ſituated on the E. bank of Miſſiſſippi river, 6 miles W. by S. of St Phillips, and 19 W. N. W. of Kaſkaſkias village. —*ib.*

Fort Dauphin, a ſmall lake, or rather arm of Little Winnipeg lake, and weſt of it.—*ib.*

Fort Edward, a pleaſant village in Waſhington co. New-York, on the E. bank of Hudſon river, 49 miles N. of Albany. It has its name from the large fort built here in 1755; of which there are no remains but large mounds of earth.—*ib.*

Fort Anne, a village on the head-waters of Wood creek, in Waſhington co. New-York, 60 miles N. E. of Albany city. It has its name from a ſmall picket fort, erected in the reign of Queen Anne, of which there is no veſtige left.—*ib.*

Fort George, lies at the S. end of lake George, 62 miles N. of Albany. Here are the remains of the old forts, George, and William Henry. The ſituation is pleaſant, but there is hardly the appearance of a village.—*ib.*

Fortroyal, in the iſland of Grenada.—*ib.*

Fortroyal, one of the principal towns in the iſland of Martinico, in the Weſt-Indies. It is the ſeat of government in the iſland; its ſtreets are regular, the houſes agreeable, and the people gay and luxurious. The citadel which defends the town coſt the French £.325,000 ſterling. The harbor here is one of the beſt in the Weſt-Indies, and the ſhips of war winter in it. —*ib.*

FORTUNE, a large bay towards the S. W. part of Newfoundland iſland; acroſs the mouth of which lies Micklon iſland, and S. of it Peters iſland. This extenſive bay is interſperſed with ſmall iſles, and within it are many bays. It has great depth of water throughout.—*ib.*

FOSSIL-Meal, otherwiſe called *lac lunæ*, mineral argaric, and guhr, is, according the M. Fabbroni, a mixed earth, which exhales an argillaceous odour, and throws out a light whitiſh ſmoke when ſprinkled with water. It is abundant in Tuſcany, where it is employed for cleaning plate. It does not effervesce with acids; is infuſible in the fire, in which it loſes an eighth part of its weight, though it becomes ſcarcely diminiſhed in bulk; and, according to the analyſis made by M. Fabbroni, conſiſts of the following component parts: ſiliceous earth 55, magneſia 15, water 14, argil 12, lime 3, iron 1. With this earth, which is found near Caſteldelpiano in the territories of Sienna, M. Fabbroni compoſed bricks, which, either baked or unbaked, floated in water. Hence he infers, that the floating bricks, which Pliny mentions as peculiar to Maſſilua and Calento, two cities in Spain, muſt have been made of foſſil-meal. Bricks made of that ſubſtance reſiſt water exceedingly well, and unite perfectly with lime; they are ſubject to no alteration either by heat or cold; and about a twentieth part of argil may be added with advantage to their compoſition, without depriving them of the property of floating. M. Fabbroni tried their reſiſtance, and found it very little inferior to that of common bricks; but it is much greater in proportion to their lightneſs. One of theſe bricks, ſeven inches in length, four and a half in breadth, and one inch eight lines in thickneſs, weighed only $14\frac{1}{4}$th ounces? whereas a common brick weighed 5 pounds $6\frac{3}{4}$ths ounces.

Bricks of foſſil-meal may be of important benefit in the conſtruction of reverberating furnaces, as they are ſuch bad conductors of heat, that a perſon may bring one half of them to a red heat, while the other is held in the hand. They may be employed alſo for buildings that require to be light; for conſtructing cooking places on board ſhips; and alſo floating batteries, the parapets of which, if made of theſe bricks, would be proof againſt red hot bullets; and, laſtly, for conſtructing powder magazines.

FOSTER, a townſhip in Providence co. Rhode-Iſland, containing 2268 inhabitants; 17 miles weſterly of Providence, and 31 N. W. of Newport.—*Morse.*

FOULAHS or Foolahs, a people in Africa, inhabiting a country on the confines of the great deſert (ſee Sahara in this *Suppl.*) along the parallel of nine degrees north. They partake much of the negro form and complexion; but have neither the *jetty* colour, *thick* lips, nor *criſped* hair of the negroes. They have alſo a language diſtinct from the Mandinga, which is the prevailing one in this quarter. The Foulahs occupy, at leaſt as ſovereigns, ſeveral provinces or kingdoms, interſperſed throughout the tract comprehended between the mountainous border of the country of Sierra Leona on the weſt, and that of Tombuctoo on the eaſt; as alſo a large tract on the lower part of the Senegal river; and theſe provinces are inſulated from each other in a very remarkable manner. Their religion is Mahomedaniſm; but with a great mixture of Paganiſm, and with leſs intolerance than is practiſed by the Moors.

The

The principal of the Foulah ſtates is that within Sierra Leona; and of which Teemboo is the capital. The next in order appears to be that bordering on the ſouth of the Senegal river, and on the Jaloffs; this is properly named Siratik. Others of leſs note are Bondou, with Foota-Torra adjacent to it, lying between the rivers Gambia and Falemé; Foola-doo and Brooko along the upper part of the Senegal river; Waſſela beyond the upper part of the Niger; and Maſſina lower down on the ſame river, and joining to Tombuctoo on the weſt.

The kingdom of the Foulahs, ſituated between the upper part of the Gambia river, and the coaſt of Sierra Leona, and along the Rio Grande, is governed by a Mahometan ſovereign; but the bulk of the people appear to be Pagans. From the circumſtances of their long hair, their lips, and comparatively light colour, Major Rennel is decidedly of opinion, that the Foulahs are the Leucæthiops of Ptolemy and Pliny. The former, as he obſerves, places the Leucæthiops in the ſituation occupied by the Foulahs; and by the name which he gave them, he evidently meant to deſcribe a people *leſs* black than the generality of the Ethiopians. Hence it may be gathered, that this nation had been traded with, and that ſome notices reſpecting it had been communicated to Ptolemy. It may alſo be remarked, that the navigation of Hanno terminated on this coaſt; and as this was alſo the term of Ptolemy's knowledge, it may juſtly be ſuſpected, that this part of the coaſt was deſcribed from Carthaginian materials.

Thoſe who have peruſed the journal of Meſſrs Watt and Winterbottom through the Foulah country in 1794, and recollect how flattering a picture they give of the urbanity and hoſpitality of the Foulahs, will be gratified on finding that this nation was known and diſtinguiſhed from the reſt of the Ethiopians at a remote period of antiquity.

The contraſt between the Mooriſh and Negro characters is as great as that between the nature of their reſpective countries, or between their form and complexion. The Moors appear to poſſeſs the vices of the Arabs without their virtues; and to avail themſelves of an intolerant religion, to oppreſs ſtrangers: whilſt the Negroes, and eſpecially the Mandingas, unable to comprehend a doctrine that ſubſtitutes opinion or belief for the ſocial duties, are content to remain in their humble ſtate of ignorance. The hoſpitality ſhewn by theſe good people to Mr Park, a deſtitute and forlorn ſtranger, raiſes them very high in the ſcale of humanity: and I know of no fitter title, ſays Mr Rennel, to confer on them than that of the *Hindoos of Africa*; at the ſame time, by no means intending to degrade the Mahomedans of India by a compariſon with the African Moors.—See *Major Rennel's Geographical Illuſtrations of Mr Park's Journey, and of North Africa at large*, printed for the African Aſſociation.

FOXBOROUGH, a townſhip in Norfolk co. Maſſachuſetts, containing 674 inhabitants, 26 miles S. of Boſton. It was formerly a part of Dorcheſter, and was incorporated in 1778.—*Morſe.*

FOX, a river in the N. W. territory, which riſes in the S. and runs about 50 miles N. where it approaches very near to, and parallel with, Ouiſconſin, a N. eaſtern branch of the Miſſiſſippi river. From the Great Carrying place here, through lake Winnebago, it runs eaſterly, then N. E. to bay Puan, about 180 miles. From the carrying place to Winnebago it is navigable for canoes 4 or 5 miles. From bay Puan its current is gentle; from thence to Winnebago lake it is full of rocks and very rapid. Its breadth is between 70 and 100 yards. The land on its borders is good, thinly wooded with hickory, oak, and hazel.—*ib.*

Fox, a northern water of Illinois river, 34 miles below the mouth of Plein river.—*ib.*

FRAMINGHAM, a townſhip in Middleſex co. Maſſachuſetts, containing 1598 inhabitants. It was incorporated in 1700, and is 24 miles W. S. W. of Boſton.—*ib.*

FRANCAIS (Port des), the name given by Perouſe to a bay, or rather harbour, which he undoubtedly diſcovered on the north-weſt coaſt of America. It is ſituated, according to him, in 58° 37. N. Lat. and in 139° 50′ W. Long. from Paris. When the two frigates which he commanded approached it, as they were ſtretching along the coaſt from ſouth to north, he perceived from his ſhip a great reef of rocks behind which the ſea was very calm. This reef appeared to be about three or four hundred toiſes in length from eaſt to weſt, and to be terminated, at about two cables length, by the point of the continent, leaving a pretty large opening; ſo that Nature ſeemed to have made, at the extremity of America, a harbour like that of Toulon, only more vaſt in her deſigns and in her means: this new harbour was three or four leagues deep.

Some officers, who had been diſpatched in boats to reconnoitre this harbour, gave a report of it extremely favourable; and on the 3d of July 1786, the two frigates entered it, and anchored near its mouth in three fathoms and a half, rocky bottom. The bay, however, was quickly ſounded, and much better anchoring ground diſcovered at an iſland in the middle of it, where the ſhips might ride in 20 fathoms water with muddy bottom. This ground was taken poſſeſſion of, an obſervatory erected on the iſland, which was only a muſket ſhot from the ſhips, and a ſettlement formed for their ſtay in the harbour. From a report made by one of the officers who had penetrated towards the bottom of the bay, Perouſe had conceived the idea of finding perhaps a channel by which he might proceed into the interior of America; but he was diſappointed. The bottom of the bay, indeed, according to him, is one of the moſt extraordinary places in the world. It is a baſon of water, of a depth in the middle that could not be fathomed, bordered by peaked mountains of an exceſſive height, covered with ſnow, without a blade of graſs upon this immenſe collection of rocks, condemned by Nature to perpetual ſterility. "I never (ſays he) ſaw a breath of air ruffle the ſurface of this water; it is never troubled but by the fall of enormous pieces of ice, which continually detach themſelves from five different glaciers and which in falling make a noiſe that reſounds far in the mountains. The air is in this place ſo very calm, and the ſilence ſo profound, that the mere voice of a man may be heard half a league off, as well as the noiſe of ſome ſea birds which lay their eggs in the cavities of theſe rocks."

It was at the extremity of this bay that he was in hopes of finding a paſſage into the interior of America. He imagined that it might terminate in a great river, of which the courſe might lie between two mountains;

Francais. and that this river might take its fource in the great lakes to the northward of Canada. Two channels were indeed found, ftretching, the one to the eaft, and the other to the weft; but both were very foon terminated by immenfe glaciers.

In Port des Français the variation of the compafs is 28° eaft, and the dip of the needle 74°. The fea rifes there feven feet and a half at full and change of the moon, when it is high water at one o'clock. The fea breezes, or perhaps other caufes, act fo powerfully upon the current of the channel, that M. Peroufe faw the flood come in there like the moft rapid river; while, in other circumftances, at the fame period of the moon, it may be ftemmed by a boat. In this channel he loft two fhallops and twenty men. In his different excurfions, he found the high water mark to be about 15 feet above the furface of the fea. Thefe tides are probably incident to the bad feafon. When the winds blow with violence from the fouthward, the channel muft be impracticable, and at all times the currents render the entrance difficult; the going out of it alfo requires a combination of circumftances, which may retard the departure of a veffel many weeks; there is no getting under way but at the top of high water; the breeze from the weft to the north-weft does not often rife till toward eleven o'clock, which does not permit the taking advantage of the morning tide; finally, the eafterly winds, which are contrary, appeared to him to be more frequent than thofe from the weft, and the vaft height of the furrounding mountains never permits the land breezes, or thofe from the north, to penetrate into the road.

As this port poffeffes great advantages, M. Peroufe thought it a duty incumbent on him to make its inconveniences alfo known. It feemed to him that this anchorage is not convenient for thofe fhips which are fent out at a venture for trafficking in fkins; fuch fhips ought to anchor in a great many bays, and always make the fhorteft ftay poffible in any of them; becaufe the Indians have always difpofed of their whole ftock in the firft week, and all loft time is prejudicial to the interefts of the owners; but a nation which fhould form the project of eftablifhing factories fimilar to thofe of the Englifh in Hudfon's Bay, could not make choice of a place more proper for fuch a fettlement. A fimple battery of four heavy cannon, placed upon the point of the continent, would be fully adequate to the defence of fo narrow an entrance, which is alfo made fo difficult by the currents. This battery could not be turned or taken by land, becaufe the fea always breaks with fuch violence upon the coaft, that to difembark is impoffible. The fort, the magazines, and all the fettlements for commerce, fhould be raifed upon Cenotaph Ifland (A), the circumference of which is nearly a league: it is capable of being cultivated, and there is plenty of wood and water. The fhips not having their cargo to feek, but being certain of having it collected to a fingle point, would not be expofed to any delay: fome buoys, placed for the internal navigation of the bay, would make it extremely fafe and eafy. The fettlement would form pilots, who, better verfed than we are in the fet and ftrength of the current at particular times of tide, would enfure the entrance and departure of the fhips. Finally, continues the author, our traffic for otters fkins has been fo very confiderable, that I may fairly prefume there could not, in any part of America, be a greater quantity of them collected.

The climate of this coaft feemed to Peroufe much milder than that of Hudfon's Bay in the fame latitude. Pines were meafured of fix feet diameter, and 140 high; while thofe of the fame fpecies at Prince of Wales's Fort and Fort York are of a dimenfion fcarce fufficient for ftudding fail-booms. Vegetation is alfo very vigorous during three or four months of the year; and our author thinks, that Ruffian corn, as well as many common plants might thrive exceedingly at Port des Français, where was found great abundance of celery, lupine, the wild pea, yarrow, and andive. Among thefe pot herbs were feen almoft all thofe of the meadows and mountains of France; fuch as the angelica, the butter cup, the violet, and many fpecies of grafs proper for fodder. The woods abound in goofeberries, rafpberries, and ftrawberries; clufters of elder trees, the dwarf willow, different fpecies of briar which grow in the fhade, the gum poplar tree, the poplar, the fallow, the horn-beam; and, finally, fuperb pines, fit for the mafts of our largeft fhips. Not any of the vegetable productions of this country are unknown in Europe. M. de Martinière, in his different excurfions, met with only three plants which he thought new; and it is well known, that a botanift might do the fame in the vicinity of Paris.

The rivers were filled with trout and falmon; and as the Indians fold thefe fifh to the French in greater quantities than they could confume, they had very little fifhing in the bay, and that only with the line. They caught fome ling, a fingle thornback, fome plaice, *fletans* or *faitans*, of which fome were more than 100 pounds in weight (B), and a fifh refembling the whiting, but a little larger, which abounds on the coaft of Provence, where it is known by the name of *poor-prieft*. Peroufe calls thefe fifh *capelans*. In the woods they met with bears, martens, and fquirrels; but they faw no great variety of birds, though the individuals were very numerous.

"If the animal and vegetable productions of this country refemble thofe of a great many others, its appearance (fays our author) can be compared to nothing. The views which it prefents are more frightful than thofe of the Alps and the Pyrenees; but at the fame time fo picturefque, that they would deferve the vifits of the curious, were they not at the extremity of the world. The primitive mountains of granite or fchiftus, perpetually covered with fnow, upon which are neither trees nor plants, have their foundation in the fea, and form upon the fhore a kind of quay; their flope is fo rapid, that after the firft two or three hundred toifes, the wild goats cannot climb them; and all the

(A) This name was given to the ifland in the bay from the monument erected on it to the memory of their unfortunate companions.

(B) This is a flat fifh, longer and not fo fquare as the turbet. Its back is covered with fmall fcales; and thofe which are taken in Europe are much lefs than the fletans of Port des Français.

Francais. the gullies which separate them are immense glaciers, of which the tops cannot be discerned, while the base is washed by the sea. At a cable's length from the land there is no bottom at less than 160 fathoms. The sides of the harbour are formed by secondary mountains, the elevation of which does not exceed from 800 to 900 toises; they are covered with pines, and overspread with verdure, and the snow is only seen on their summits: they appeared to be entirely formed of schistus, which is in the commencement of a state of decomposition; they are extremely difficult to climb, but not altogether inaccessible.

"Nature assigns inhabitants to so frightful a country, who as widely differ from the people of civilized countries as the scene which has just been described differs from our cultivated plains; as rude and barbarous as their soil is rocky and barren, they inhabit this land only to destroy its population: at war with all the animals, they despise the vegetable substances which grow around them. I have seen (says our author) women and children eat some raspberries and strawberries; but these are undoubtedly viands far too insipid for men, who live upon the earth like vultures in the air, or wolves and tigers in the forests.

"Their arts are somewhat advanced, and in this respect civilization has made considerable progress; but that which softens their ferocity, and polishes their manners, is yet in its infancy. The mode of life they pursue excluding all kind of subordination, they are continually agitated by fear or revenge; prone to anger, and easily irritated, they are continually attacking each other dagger in hand. Exposed in the winter to perish for want, because the chase cannot be successful, they live during the summer in the greatest abundance, as they can catch in less than an hour a sufficient quantity of fish for the support of their family; they remain idle during the rest of the day, which they pass at play, to which they are as much addicted as some of the inhabitants in our great cities. This gaming is the great source of their quarrels. If to all these destructive vices they should unfortunately add a knowledge of the use of any inebriating liquor, M. Perouse does not hesitate to pronounce, that this colony would be entirely annihilated."

Like all other savages, they are incorrigible thieves; and when they assumed a mild and placid appearance, the Frenchmen were sure that they had stolen something. Iron, of which they appeared to know the use, and of course the value, most excited their cupidity; and when our navigators were engaged in caressing a child, the father was sure to seize the opportunity of taking up, and concealing under his skin-garment, every thing of that metal which lay within his reach, and was not too heavy to be carried off.

M. Rollin, surgeon major of one of the frigates, thus describes these people. "They have very little similarity to the Californians; they are taller, stouter, of a more agreeable figure, and greater vivacity of expression: they are also much their superiors in courage and sense. They have rather a low forehead, but more open than that of the Southern Americans; their eyes are black and very animated; their eyebrows much fuller; their nose of the usual size, and well formed, except being a little widened at the extremity; their lips thinner; their mouth moderately large; their teeth fine and very even; their chin and ears very regular. Francais.

"The women also have an equal advantage over those of the preceding tribes; they have much more mildness in their features, and grace in their limbs—Their countenance would be even very agreeable, if, in order to set it off, they did not make use of a strange custom of wearing in the lower lip an elliptical piece of wood, lightly grooved on its circumference and both its sides, and which is commonly half an inch thick, two in diameter, and three in length.

"This singular ornament, besides being a great deformity, is the cause of a very troublesome as well as disgusting involuntary flow of saliva. This appendage is peculiar to the women; and female children are made to undergo the preparatory operations from the time of their birth. For this purpose, the lower lip is pierced with a kind of pin of copper or gold, which is either left in the opening, or its place supplied with a ring of the same material, till the period of puberty. The aperture is then gradually enlarged, by substituting first a small piece of wood of the form mentioned above, then a larger one; and so on, increasing its size by degrees till it reaches the dimensions just stated.

"This extraordinary custom shows the great power of dilatation in the lip, and may encourage medical practitioners in their attempts to remedy deformities of this part by the use of the knife.

"The general colour of these people is olive, a fainter tinge of which is apparent in their nails, which they suffer to grow very long; the hue of the skin, however, varies in different individuals, and in various parts of the same individual, according to their exposure to the action of the air and sun.

"Their hair is, in general, neither so coarse nor black as that of the South Americans. Chesnut coloured hair is by no means unfrequent among them. Their beard is also fuller, and their armpits and parts of sex better provided with hair.

"The perfect evenness of their teeth led me at first to suspect that it was the effect of art; but after an attentive and minute examination, I could perceive no wearing away of the enamel, and I saw that this regularity is natural. They tattoo and paint their face and body, and bore their ears and the cartilage of their nose.

"Some writers have imagined, that the custom of painting the face and body, so generally adopted by the Africans, Americans, and West-Indians, is only intended as a preservative against noxious insects. I think, however, that I am warranted in asserting its sole end to be ornament. I found it to prevail among the inhabitants of Easter Island and the natives of *Port des Français* without observing among them either venomous insects or reptiles. Besides, I remarked, that they wore paint only when they paid us a visit; for they made no use of it when in their own houses."

M. Perouse himself speaks not so favourably of the women as M. Rollin. "They are (he says) the most disgusting of any on the earth, covered with stinking skins, which are frequently untanned; and yet they failed not to excite desires in some persons, in fact of no small consequence: they at first started many difficulties, giving assurances by their gestures that they ran the risk of their lives; but being overcome by presents,

ſents, they had no objection to the ſun being a witneſs, and abſolutely refuſed to retire into the wood." There can be no doubt that this planet is the god of theſe people, ſince they frequently addreſſed themſelves to it in their prayers; but our voyagers ſaw neither temple nor prieſt, nor the leaſt trace of public worſhip at ſtated times. They burn their dead.

FRANCESTOWN, an interior townſhip in Hillſborough co. New-Hampſhire, on the E. ſide of Contecook river, about 21 miles to the S. W. of Concord. It was incorporated in 1772, and contained in 1775, 200 inhabitants, in 1790, 982.—*Morſe.*

FRANCISBOROUGH, a ſettlement in York co. diſtrict of Maine, containing 311 inhabitants.—*ib.*

FRANCIS, St a lake, or extenſion of the river St Lawrence, between Kingſton and Montreal, through which paſſes the line dividing Upper from Lower Canada.—*ib.*

Francis, St a river in the province of Lower Canada, which riſes from lake Memphremagog, and runs northward into the river St Lawrence. It is not all the way navigable; elſe it would afford an important communication from the northern parts of Vermont to the markets of Montreal and Quebec.—*ib.*

Francis, St a ſmall river in Louiſiana, which runs a S. E. courſe into the Miſſiſſippi, 108 miles above Arkanſas river, and 70 miles above Margot river, on the E. ſide of the Miſſiſſippi. It is remarkable for nothing but the general rendezvous for the hunters from New-Orleans, who winter there, and collect ſalt meat, ſuet, and bear's oil, for the ſupply of that city. Kappas Old fort formerly ſtood at the mouth of this river, on the ſouthern ſide. It was built by the French during their wars with the Chickaſaw Indians.

Alſo, the name of a ſmall river in the N. W. territory, which runs a S. W. by W. courſe into Miſſiſſippi, between Cold and Rum rivers, 60 miles above St Anthony's Falls. The country a little above it is hilly, and the ſoil pretty good. To the N. E. are the ſmall lakes called the Thouſand lakes. The Miſſiſſippi here is not above 90 yards wide.—*ib.*

Francis, St in Brazil, S. America, a long and large river which runs N. eaſterly, and thence S. E. till it empties into the ocean, N. E. of the town of Seregeppe del Rey. It has a number of towns and ſettlements, chiefly on its head waters.—*ib.*

FRANCOIS, Cape St a juriſdiction, city, and port in the N. weſtern part of the iſland of St Domingo. This juriſdiction is in the North diviſion of the iſland, in what was called the French part of it; and contains 13 pariſhes. Its exports from Jan. 1, 1789, to Dec. 31, of the ſame year, were as follow: 31,187,636lb. white ſugar, 7,267,531lb. brown ſugar, 32,545,524lb. coffee, 269,240lb. cotton, 245,177lb. indigo; tanned hides, molaſſes, ſpirits, &c. to the value of 21,789 livres. Total value of duties on exportation, 253,590 dollars, 37 cents. Cape François exceeds Port au Prince in the value of its productions, the elegance of its buildings, and the advantageous ſituation of its port. The city, which is the governor's reſidence in time of war, is ſituated on a cape at the edge of a large plain, 20 leagues long, and on an average 4 broad, between the ſea and the mountains. There are few lands better watered, but there is not a river that will admit a ſloop above 3 miles. This ſpace is cut through by ſtraight roads, 40 feet broad, uninterruptedly lined with hedges of lime and lemon trees, intermixed with long avenues of lofty trees, leading to plantations which produce a greater quantity of ſugar than any ſpot of the ſame ſize in the world. The town, which is ſituated in the moſt unhealthy place of this extenſive and beautiful plain, had, ſome years ſince, ſeveral elegant public buildings, as the governor's houſe, the barracks, the magazine, and two hoſpitals, called the *houſes of Providence*, founded for the benevolent and humane purpoſe of ſupporting thoſe Europeans who came thither without money or merchandize. The harbour is admirably well ſituated for ſhips which come from Europe, being only open to the N. from whence ſhips receive no damage, its entrance being ſprinkled over with reefs that break the force of the waves. Before its deſtruction in 1793, this city contained about 8000 inhabitants; whites, people of colour, and ſlaves.—*ib.*

Francois, Old Cape, the north-eaſternmoſt point of the iſland of St Domingo or Hiſpaniola; having Balſamo bay N. W. and Scotch bay S. S. E.—*ib.*

FRANCONIA, a townſhip in Grafton co. New-Hampſhire, 14 miles N. E. of Haverhill (N. H.) on Connecticut river. Incorporated in 1764, firſt called Morriſtown. It contains 72 inhabitants.—*ib.*

FRANKFORT, a townſhip in Hancock co. diſtrict of Maine, on the W. ſide of Penobſcot bay. It has a few houſes, regularly built, and lies 8 miles W. of Penobſcot, 123 W. of Paſſamaquoddy, and 238 N. E. of Boſton. The townſhip contains 891 inhabitants.—*ib.*

Frankfort, or *Frankford*, a pleaſant, thriving village, in Philadelphia co. Pennſylvania, ſeated on the N. E. ſide of a creek of the ſame name, a mile and an half from Delaware river. It contains about 50 houſes, chiefly of ſtone, an Epiſcopal and a German church; on elevated ground, about 5 miles N. E. of Philadelphia.—*ib.*

Frankfort, a new townſhip in Herkemer co. New-York, E. of Whiteſtown, adjoining.—*ib.*

Frankfort, a thriving village in Hampſhire co. Virginia, on a creek which empties into Potowmack river. It is 13 miles N. W. of Rumney, 4 miles S. of the Potowmack, and 10 S. S. E. of Fort Cumberland.—*ib.*

Frankfort, the capital of Pendleton co. Virginia, is ſituated on the W. ſide of a S. branch of Potowmack river. It contains a court-houſe, gaol, and about 30 houſes; 180 miles N. W. of Richmond.—*ib.*

Frankfort, the metropolis of Kentucky, is ſituated in Franklin co. on the N. E. bank of Kentucky river, about 50 miles from its confluence with the Ohio. It is a flouriſhing town, regularly laid out, and has a number of handſome houſes. The ſtate houſe is a handſome ſtone building. Here is alſo a tobacco warehouſe. It is 30 miles N. of Harrodſburg, 40 N. by W. of Danville, 125 from Louiſville, and 790 W. by S. of Philadelphia. N. lat. 38. 14. W. long. 95. 28.—*ib.*

FRANKLIN (Dr Benjamin), the celebrated American philoſopher and ſtateſman, was born at Boſton in 1706 of reſpectable, but not wealthy parents. The promptitude with which, from his infancy, he had learned to read was ſuch, that he ſaid he did not remember to have been ever without this acquirement.

At eight years of age he was sent to a grammar school, his father having intended him for the church, but contemplating the expence of a collegiate education, recalled him, within a year, and sent him to learn arithmetic and writing: he soon wrote well, but made no progress in arithmetic. At ten he was called home to assist his father in his business of soap boiler and tallow chandler, a business which he disliked, and two years afterwards was bound apprentice to his brother who was a printer. In this employment he made great proficiency, and having access to more books than formerly, he devoted much of his leisure time to reading. He acknowledged that the perusal of Shaftesbury and Collins made him a sceptic completely, having been previously so with respect to many doctrines of christianity, and that he found the Socratic mode of reasoning enabled him to embarrass even persons of superior understanding, and to obtain for him victories which neither his cause nor his arguments merited. During his apprenticeship he wrote several pieces for the newspaper which were approved, but kept himself unknown. After frequent disputes with his brother, he determined to leave Boston, where in consequence of his indiscreet disputes about religion he had begun to be looked upon by pious men with horror as an apostate or an atheist. He privately got on board a sloop and soon arrived in New-York, where he applied for employment to Mr Bradford, who could not employ him, but advised him to go to Philadelphia, where after a very unpleasant and dangerous journey he at last arrived, and with some difficulty got employment with one Keimer, with whom he continued for some time, till by the advice of Sir William Keith, then governor of Pennsylvania, he sailed for England, where he arrived in 1724. Disappointed by not having letters of recommendation from the governor, he applied for and obtained employment as a journeyman Printer, where he improved his knowledge and saved some money. Here he published his Dissertation on Liberty and necessity, and associated with Lyons, Mandeville and others of that class. After nearly two years residence in London he returned to Philadelphia with a Mr Denham as his clerk and assistant in a store. On Mr Denham's death Franklin returned to Keimer in capacity of foreman, which continued with little interruption till he set up a printing-office himself. In this period of the history of his life written by himself he gives the following statement of his principles.

"Before I relate the particulars of my entrance into business, it may be proper to inform you what was at that time the state of my mind as to moral principles, that you may see the degree of influence they had upon the subsequent events of my life.

My parents had given me betimes religious impressions; and I received from my infancy a pious education in the principles of Calvinism. But scarcely was I arrived at fifteen years of age, when, after having doubted in turn of different tenets, according as I found them combated in the different books that I read, I began to doubt of revelation itself. Some volumes against deism fell into my hands. They were said to be the substance of sermons preached at Boyle's lecture. It happened that they produced on me an effect precisely the reverse of what was intended by the writers; for the arguments of the deists, which were cited in order to be refuted, appeared to me much more forcible than the refutation itself. In a word, I soon became a perfect deist. My arguments perverted some other young persons; particularly Collins and Ralph. But in the sequel, when I recollected that they had both used me extremely ill, without the smallest remorse; when I considered the behaviour of Keith, another freethinker, and my own conduct towards Vernon and Miss Read, which at times gave me much uneasiness, I was led to suspect that this doctrine, though it might be true, was not very useful. I began to entertain a less favourable opinion of my London pamphlet, to which I had prefixed, as a motto, the following lines of Dryden;

> Whatever is, is right; tho' purblind man,
> Sees but part of the chain the nearest link,
> His eyes not carrying to the equal beam
> That poises all above.

and of which the object was to prove, from the attributes of God, his goodness, wisdom, and power, that there could be no such thing as evil in the world; that vice and virtue did not in reality exist and were nothing more than vain distinctions. I no longer regarded it as so blameless a work as I had formerly imagined; and I suspected that some error must have imperceptibly have glided into my argument, by which all the inferences I had drawn from it had been affected as frequently happens in metaphysical reasonings. In a word, I was at last convinced that truth, probity, and sincerity, in transactions between man and man, were of the utmost importance to the happiness of life; and I resolved from that moment, and wrote the resolution in my journal, to practise them as long as I lived.

Revelation indeed, as such, had no influence on my mind; but I was of opinion that, though certain actions could not be bad merely because revelation prohibited them, or good because it enjoined them, yet it was probable that those actions were prohibited because they were bad for us, or enjoined because advantageous in their nature, all things considered. This persuasion, Divine Providence, or some guardian angel, and perhaps a concurrence of favourable circumstances co-operating, preserved me from all immorality, or gross and *voluntary* injustice, to which my want of religion was calculated to expose me, in the dangerous period of youth and in the hazardous situations in which I sometimes found myself, among strangers, and at a distance from the eye and admonitions of my father. I may say *voluntary*, because the errors into which I had fallen, had been in a manner the forced result either of my own inexperience, or the dishonesty of others. Thus, before I entered on my new career, I had imbibed solid principles, and a character of probity. I knew their value; and I made a solemn engagement with myself never to depart from them."

He now began business in partnership with Mr Meredith which lasted till 1729, when Franklin took the whole business into his own hands. In the mean time he had united the majority of well informed persons of his acquaintance into a club, known by the name of the *Junto*, for the purpose of mutual improvement, which met every Friday evening to consider questions of morality, politicks, or philosophy, which became a very useful institution and which continued almost forty years. On entering into buſineſs by himſelf he found himſelf in embarraſſed circumſtances from which he was relieved by the generous aſſiſtance of William Coleman and Robert Grace, whoſe kindneſs made a deep impreſſion on his mind. He now opened a ſmall ſtationer's ſhop, was induſtrious, ſteady, and ſucceſsful, and in 1730 he married the daughter of Mr Read, who was now a widow. Having had frequent occaſion to quote books in the club, he ſtarted the idea of eſtabliſhing a public library, which was carried into effect in 1731 and became the foundation of that noble inſtitution which was incorporated in 1742, and now does honour to the city of Philadelphia. This inſtitution was greatly encouraged by the friends of literature in America and in Great Britain. The Penn family diſtinguiſhed themſelves by their donations, and the late Peter Collinſon, beſides liberal donations from himſelf and obtained from others, voluntarily undertook to manage the buſineſs of the company in London for which his extenſive knowledge and zeal for the promotion of ſcience eminently qualified him, recommending ſuitable books, purchaſing, and ſhipping them for thirty years, which he communicated to the directors every improvement and diſcovery in the arts, agriculture and philoſophy.

In 1732 Franklin began to publiſh Poor Richard's Almanack, remarkable for numerous and valuable conciſe maxims, tending to promote induſtry, and frugality: the demand for it was ſuch that 10,000 have been ſold in one year. Theſe maxims have been collected in an addreſs entitled, The Way to Wealth, which has appeared in various publications.

In 1736 Franklin was choſen clerk to the General Aſſembly of Pennſylvania, and in 1737 he was appointed poſt-maſter: in 1738 he formed the firſt Fire Company in Philadelphia, and ſome time after ſuggeſted the plan of an aſſociation for inſuring houſes from loſs by fire, which has been a very valuable inſtitution.

In 1744 during a war between France and Britain, ſome French and Indians had made inroads upon the frontiers of Pennſylvania, whoſe inhabitants were unprovided for ſuch an attack. The governor recommended to the Aſſembly to paſs a militia law, but owing to ſome diſputes between the governor and Aſſembly it was not done, the ſituation of the Province was alarming, and deſtitute of the means of defence. At this criſis Franklin ſtepped forth and propoſed to a meeting of the citizens of Philadelphia, a voluntary aſſociation for the defence of the Province. This was approved of and ſigned by 1200 perſons immediately, and in a ſhort time the number increaſed to 10,000. Franklin was choſen colonel of the Philadelphia regiment but choſe to decline the honour.

In the year 1745 Mr Collinſon ſent to the Library Company of Philadelphia an account of the experiments in electricity which had at that time engaged the attention of the philoſophers in Europe. Mr Kinnerſley and others applied themſelves to the ſubject, and Franklin ſoon made a diſtinguiſhed figure in this courſe, his experiments and diſcoveries are ſo numerous, and ſo well known as to render an account of them in this place ſuperfluous. The practical uſe of his diſcoveries in the application of pointed conductors for the purpoſe of ſecuring houſes from injury by lightning is well known and in general uſe in America, and in many places in Europe.

In 1747 he became a member of the General Aſſembly of Pennſylvania, where his influence was very conſiderable. He ſeldom ſpoke, and never attempted oratory, but frequently by a ſingle obſervation determined the fate of a queſtion. Perceiving that the beſt way of ſecuring permanently the rights of the people was, by the general diffuſion of knowledge and information to all claſſes, he drew up a plan of an Academy to be erected in the city of Philadelphia, not only adapted to an infant colony, but alſo as a foundation on which poſterity might erect a more extenſive ſeminary. The conſtitution was drawn up and ſigned in 1749, and in 1750 the Latin and Greek, Mathematical and Engliſh ſchools were opened, and a Charity ſchool for 60 boys and 30 girls. This inſtitution was incorporated in 1753, and an additional charter was obtained in 1755. In 1752 he had joined in the ſcheme ſuggeſted by Dr Bond, and on application to the Aſſembly obtained from the public £.2000 for eſtabliſhing the Hoſpital for the poor when viſited by diſeaſe. In 1753 he was appointed deputy poſt-maſter general for the Britiſh Colonies, and in his hands this department was ſo well adminiſtered that its annual produce was ſaid to be more than double that of Ireland.

In 1754 Franklin, as commiſſioner from Pennſylvania, met at Albany with the commiſſioners of ſeveral of the other colonies, and produced a plan which has been called the Albany Plan of Union for the defence and general government of the colonies. After ſeveral days diſcuſſion it was unanimouſly agreed to, and a copy of it tranſmitted to each colonial Aſſembly, and one to the king's Council. The fate of it was ſingular: it was rejected by the miniſtry of Great Britain, becauſe it gave too much power to the repreſentatives of the people, and it was rejected by all the aſſemblies as giving to the preſident general, the repreſentative of the Crown, an influence greater than appeared to them proper in a plan of government intended for freemen.

The defeat of Braddock ſpread a very great alarm through the colonies. Franklin introduced into the Aſſembly a bill for organizing a militia, the bill paſſed and he was appointed colonel of a regiment in Philadelphia of 1200 men; the frontier being invaded, he repaired by order of the governor, with a body of men, to the place at which their preſence was neceſſary, built a fort, and placed a garriſon in ſuch a poſture as to withſtand the inroads to which the inhabitants had been expoſed. In 1757 he was appointed agent for the province of Pennſylvania to preſent to the king a petition for redreſs from the attention of the proprietaries to their private intereſt, who would not conſent that their eſtates ſhould be taxed to bear a ſhare of the public burdens. Agreeably to the inſtructions which he had received from the legiſlature he endeavoured to prevail on the proprietaries to give up the point in conteſt, finding them obſtinate, he laid his petition before the council, where after much oppoſition it was agreed that the proprietary eſtates ſhould pay their due proportion of taxes on Mr Franklin engaging that their burdens ſhould not exceed the due proportion. After tranquillity had been re-eſtabliſhed by his abilities and integrity as agent for Pennſylvania, his extensive knowledge of the situation of the colonies occasioned his appointment as agent for Massachusetts, Maryland, and Georgia, in which situation his conduct rendered him dear to his countrymen. He had now the rewards of literary and philosophical merit abundantly bestowed on him, by being admitted fellow of many learned societies. The degree of Doctor of Laws was conferred on him by the Universities of St Andrews, Edinburgh, and Oxford, and his correspondence sought for by the most eminent philosophers of Europe. During this period he shewed in a pamphlet the advantages which would accrue from the conquest of Canada, which was shortly after accomplished. He continued his philosophical researches and experiments with great success, and after a variety of experiments on Mr Puckeridge's discoveries he formed that elegant instrument which he called the Harmonica, and in his return in 1762, observed the effect of oil on the surface of the ocean.

Having received the thanks of the Assembly of Pennsylvania, and a vote of £.5000 for his services, he resumed his seat as a member of that body, with as much popularity as before.

In 1764 he was again sent to London as provincial agent, and in 1766 was examined at the bar of the House of Commons respecting the repeal of the stamp act. The same year he visited Holland and Germany, where he was well received by men of science, as he was also in France in the following year. Several letters from Hutchinson, Oliver and others came into the hands of Dr Franklin, containing violent invectives against the leading characters in Massachusetts, and strenuously advising vigorous measures to compel the people to obedience, these he sent to the legislature, by whom they were published, attested copies were sent to Great Britain, with a petition to the king to remove the writers from office. Dr Franklin declared that he had sent the letters, but refused to give information of the manner in which they came to his hands; the petition was rejected. The measures which the ministry pursued in laying taxes on the colonies Dr Franklin used his utmost endeavours to induce them to change but without success, and finding all his efforts to restore harmony useless he returned to America in 1775. Just after the commencement of hostilities, he visited Canada to persuade the citizens to join in the common cause, but did not succeed. In 1776 he was joined with Mr Adams and Mr Rutledge to learn the extent of the powers of those commissioners who came with Lord Howe, but finding that they were only empowered to grant pardons on submission, nothing could be done. He gave his voice decidedly for independence, and had great influence in bringing over others to the same views. The public mind had been in some measure prepared for this by Paine's pamphlet *Common Sense*: there was good reason to believe that Dr Franklin had a considerable share in this work. The same year he was chosen president of the Convention which met in Philadelphia to form a new constitution for Pennsylvania. In the latter end of the year he was appointed to assist in the negociations which had been set on foot in France by Silas Deane, but nothing could be accomplished till the news of the capture of Burgoyne's army by the Americans decided the conduct of France: to this also was owing the facility with which loans in Holland and France were negociated. He was one of those who signed the provisional articles of peace in Nov. 1782, and the definitive treaty on the 30th September 1783. He was one of the commissioners appointed to examine Mesmer's Animal Magnetism in 1784. In 1785 he arrived in Philadelphia, where he was chosen member of the supreme executive council, and shortly afterward was elected President of it.

In 1787 he was appointed delegate for Pennsylvania in the grand convention and signed the constitution of the United States. He was a member of several political and benevolent societies. His infirmities increasing prevented his regular attendance in the council chamber, and in 1788 he retired from public life. He was attacked with a calculous complaint in 1781 which continued to his death, which took place on the 17th of April 1790, at the age of Eighty-four years and three months.

The following epitaph on him, was written by himself many years previous to his death;

THE BODY
of
Benjamin Franklin, Printer,
(Like the cover of an old book,
Its contents torn out
And stript of its lettering and gilding)
Lies here food for worms;
Yet the work itself shall not be lost,
For it will (as he believed) appear once more,
In a new
And more beautiful edition,
Corrected and amended
by
The Author.

Franklin, Fort, is in Alleghany co. Pennsylvania, near the post called Venango, and was erected in 1787 in order to defend the frontiers of Pennsylvania from the depredations of the neighbouring Indians. It is seated on the S. W. bank of Alleghany river, opposite the mouth of French creek. N. lat. 41. 1. 40. W. long. 79. 41.; 53 miles S. S. E. of Presque Isle, and 63 northward of Pittsburg.—*Morse.*

Franklin *Co.* the north-westernmost in Vermont, bounded N. by Lower Canada, and W. by lake Champlain. It was lately taken from Chittenden co. and contains 20 townships.—*ib.*

Franklin *Co.* in Pennsylvania, bounded N. by Mifflin, N. E. by Cumberland, E. by York, S. by Washington co. in Maryland, W. by Bedford co. and N. W. by Hunterdon. It is computed to contain 800 square miles, equal to 512,000 acres. It lies chiefly between the N. and S. Mountains, and comprehends the middle part of the beautiful and rich valley of Conegocheague; which is watered by the creek of its name, which falls into Potowmack at Williams Port in Maryland. This county exhibits a most luxuriant landscape in summer, from the top of South Mountain. Iron ore is found here sufficient already to furnish work for a furnace and forge. The county is divided into 11 townships, which contain 15,655 inhabitants, of whom 330 are slaves.—*ib.*

Franklin *Co.* in Kentucky, is bounded N. by Scott co.

co. N. W. and W. by Shelby, S. E. by Fayette, and S. by Woodford. Chief town, Frankfort.—*ib.*

FRANKLIN *Co.* in Halifax district, N. Carolina, contains 7559 inhabitants, of whom 2717 are slaves. It is bounded N. by Greenville, S. by Johnston, N. E. by Warren, S. W. by Wake, and W. by Orange co. Chief town, Lewisburg.—*ib.*

FRANKLIN *Co.* in Virginia, is bounded N. by Bedford, N. W. by Botetourt, W. by Montgomery, S. W. by Henry, S. by Patrick, and E. by Campbell co. It is about 40 miles long, and 25 broad, and contains 6842 inhabitants, including 1073 slaves. A range of the Alleghany Mountains passes through it on the N. W. It is consequently hilly in general.—*ib.*

FRANKLIN *Co.* in Georgia, is situated in the Upper District, bounded E. and N. E. by Tugulo river, which separates it from the state of S. Carolina; W. and N. W. by the country of the Cherokees; S. by the head branches of Broad river, and S. E. by Elbert co. It contains 1041 inhabitants, of whom 156 are slaves. The court-house is 17 miles from Hatton's Ford on Tugulo river, 25 from Elberton, and 77 from Washington.—*ib.*

FRANKLIN, a township in Norfolk co. Massachusetts; taken from Wrentham, and incorporated in 1778, and contains 17,000 acres of land. It has 1101 inhabitants; is bounded N. by Charles river, which separates it from Medway, and lies 30 miles S. of Boston.—*ib.*

FRANKLIN, a small isle at the mouth of St George's river in Lincoln co. Maine; 4 leagues southward of Thomaston.—*ib.*

FRANKLIN, a new township in Dutchess co. New-York. By the state census of 1796, it appears there are 210 of its inhabitants qualified to be electors.—Also, a new township in Delaware county, of whose inhabitants 239 are electors. It lies S. W. from, and borders on Harpersfield, and its W. line runs along the S. eastern bank of Susquehanna river. This town was divided by an act of the Legislature, 1797.—*ib.*

FRANKLIN, a township in Westmoreland co. Pennsylvania.—Also, 3 others in the same state, viz. in York co. Fayette co. and in Washington co.—*ib.*

FRANKLIN, a township, the northernmost in New-London co. Connecticut, 6 miles N. W. of Norwich. It contains above 1000 inhabitants, who are chiefly wealthy farmers.—*ib.*

FRANKSTOWN, a township in Huntingdon co. Pennsylvania, situated on the Frankstown branch of Juniatta river, 20 miles W. of Huntingdon.—*ib.*

FRAYLES, an island near the coast of New-Andalusia, Terra Firma.—*ib.*

FREDERICA, a village in Kent co. state of Delaware, situated between the two main branches of Mother Kill, a stream which falls into Delaware 7 miles from the town, and 3 S. E. of Jame's creek, which leads up to Dover. It contains about 40 houses, and lies 12 miles E. of Dover, and 88 from Philadelphia.—*ib.*

FREDERICA, a town of Glynn co. in Georgia, is situated on St Simon's island, in a very pleasant situation, and was built by General Oglethorpe. The fortress was beautiful and regular, but is now in ruins. The town contains but few houses, which stand on an eminence, upon a branch of Alatamaha river, which washes the W. side of this agreeable island, and forms a bay before the town, affording a safe and commodious harbor for vessels of the largest burden, which may lie along the wharf. It was settled by some Scotch highlanders, about the year 1735, who accepted of an establishment both here and at Darien, to defend the colony, if needful, against the neighbouring Spaniards. N. lat. 31. 15. W. long. 80.—*ib.*

FREDERICK *Co.* in Maryland, is bounded N. by Pennsylvania, W. and N. W. by Washington, E. by Baltimore, and S. W. by Potowmack river. On the Monocacy river and its branches are about 37 gristmills, a furnace, iron forge, and a glass manufactory, called the Etna glass works, which are in a thriving state. This county is about 30 miles each way, reckoning from the extreme parts. The Cotoctiny Mountain extends from the Potowmack in a N. direction through this county into Pennsylvania, between the South Mountain and Monocacy Creek; the eastern parts are generally level. It contains 30,791 inhabitants, including 3,641 slaves. Chief town, Frederick-town.—*ib.*

FREDERICK *Co.* in Virginia, is bounded N. by Berkley, S. by Shanandoah, W. by Hampshire, and E. by Shanandoah river, which separates it from Loudon co. It is 30 miles in length, and 20 in breadth, and contains 19,681 inhabitants, of whom 4,250 are slaves. Iron ore is found here in great plenty; and works have been erected which produce 160 tons of bar iron, and 650 tons of pig, annually. In one year 300 tons of bar iron were manufactured. Pots and other utensils, cast thinner than usual of this iron, may be safely thrown into or out of the waggon, in which they are transported. Both this and Berkley co. has a good soil. Between the waters of Opeckan creek and the Shanandoah is the richest limestone land in the eastern parts of the state.

Near the North Mountain in this county is a curious cave, by some called *Zancy's Cave*. Its entrance is on the top of an extensive ridge. You descend 30 or 40 feet as into a well, from whence the cave then extends, nearly horizontally, 400 feet into the earth, preserving a breadth of from 20 to 50 feet, and a height of from 5 to 12 feet. After entering this cave a few feet, the mercury, which, in the open air, was at 50. rose to 57. of Fahrenheit's thermometer. After this may be added the Natural Well on the lands of Mr. Lewis. It is somewhat larger than a common well, and rises as near the surface of the earth as in the neighbouring artificial wells; and is of a depth, as yet unknown. It is used with a bucket and windlass as an ordinary well. It is said there is a current in it tending sensibly downwards. Chief town, Winchester.—*ib.*

FREDERICK *House*, a trading station in Upper Canada, on the head water of Abbitibbe river. N. lat. 48. 35. W. long. 82. 6.—*ib.*

FREDERICK, a fort in Washington co. Maryland, situated on the N. E. bank of Potowmack river, near the S. line of Pennsylvania.—*ib.*

FREDERICK, a towship in Montgomery co. Pennsylvania.—*ib.*

FREDERICK, a town on the N. side of Sassafras river, in Cecil co. Maryland, and separated by that river from George Town in Kent co. It lies 6 miles S. W. of Warwick, and 14 E. of Grove point in Chesapeak bay. N. lat. 39. 22. 30.—*ib.*

FREDERICKSBURG, a post town in Spotsylvania co. Virginia; situated on the S. W. bank of Rappahannock river, 110 miles from its mouth in Chesapeak bay. It is an incorporated town, and regularly laid out into several streets, the chief of which runs parallel with the river, and in all contains upwards of 200 houses, two tobacco warehouses, and several stores of well assorted goods. Its public buildings are an Episcopal church, an academy, court-house and gaol. It is a place of considerable trade and contains about 2000 inhabitants, of whom 587 are slaves. A forge in this neighborhood made, sometime ago, about 300 tons of bar iron in a year, from pigs imported from Maryland. It is 50 miles S. S. W. of Alexandria, 68 N. by E. of Richmond, 102 S. W. of Baltimore, and 205 S. W. of Philadelphia. N. lat. 38. 22. W. long 77. 36.—*ib.*

FREDERICKSTOWN, a township in Dutchess co. New-York, which contains 5932 inhabitants, of whom 188 are qualified to be electors, and 63 are slaves.—*ib.*

FREDERICKTON, a considerable township in the province of New-Brunswick, 90 miles up St John's river, which is thus far navigable for sloops.—*ib.*

FREDERICKTOWN, a post town of Maryland, and capital of Frederick co. situated on both sides of Carrolls' creek, a small stream that empties into Monocacy river over which are two bridges. The streets are regularly laid out, intersecting each other at right angles. The dwelling-houses, chiefly of stone and brick, are about 700 in number, many of which are handsome and commodious. The public edifices are, one church for Presbyterians, two for German Lutherans and Calvinists, and one for Baptists, an elegant court-house, a gaol, and a brick market-house. It is a very flourishing town, and has considerable trade with the back country. The Etna glass works are situated 4 miles above the town, on Tuskarora creek. Fredericktown is 4 miles E. of Cotoctin mountain, 47 W. by N. of Baltimore, 24 E. of Sharpsburg, and 148 S. W. by W. of Philadelphia, N. lat. 39. 24.—*ib.*

FREEHOLD, a town in Monmouth co. New-Jersey, 15 miles W. of Shrewsbury, and 20 S. E. by S. of New-Brunswick. In this town was fought the obstinate battle called the Monmouth battle, on the 28th of June, 1778. There is an academy in this town. Freehold contains 3785 inhabitants, of whom 627 are slaves.—*ib.*

FREEHOLD, a township in Albany co. New-York, containing 1822 inhabitants, of whom 562 are qualified electors, and 5 are slaves.—*ib.*

FREEPORT, a township in Cumberland co. district of Maine, situated at the head of Casco bay; adjoining to Durham on the N. E. and to North Yarmouth on the S. W.; about 10 miles N. E. of Portland, and 140 N. by E. of Boston. It was incorporated in 1789, and contains 1330 inhabitants.—*ib.*

FREESTONE-GAP, a place so called, in Tennessee, 25 miles from Hawkin's court-house, and 35 from Cumberland mountain.—*ib.*

FREETOWN, a thriving township in Bristol co. Massachusetts, incorporated in 1683, contains 2202 inhabitants, and lies 50 miles southerly of Boston.—*ib.*

FRE'GATES FRANÇAISE *Basse de*, the name given by La Perouse to a dangerous reef of sunken rocks which he discovered in the Pacific ocean. On the north-west extremity of this reef they perceived an islet or split rock from 20 to 25 fathoms in height and about 50 toises in diameter. From this islet the reef extends more than four leagues to the south-east; and upon the extremity of the point in that direction, the frigates had almost struck before the breakers were observed. This was during a fine clear night and smooth sea. With great propriety, the Commodore returned in the morning to ascertain the geographical situation of this unknown rock; and he estimated the islet to be in 23° 45′ N. Lat. and 168° 10′ W. Long. from Paris.

FRENCH, a small river in Massachusetts, has its source in a small pond, on the borders of Leicester and Spencer, in Worcester co. and runs through Oxford and joins Quinebauge river, in Thompson township, in Connecticut. It derives its name from the French Protestants, who obtained a settlement in the town of Oxford, after the revocation of the edict of Nantz, in 1685.—*Morse.*

FRENCH BROAD, a navigable river in Tennessee, which rises on the S. E. side of the Great Iron and Bald mountains, in N. Carolina. It is formed by two main branches, which receive several streams in their course. These unite about 58 miles from the source of the Nolachucky, the eastern branch; thence it flows N. westerly about 25 miles, and joins the Holston 11 miles above Knoxville, and is 400 or 500 yards wide. The navigation of this branch is much interrupted by rocks, as is also the Tennessee branch, which joins the main river 50 miles below this.

A large, clear, medicinal spring, said to be efficacious in curing many diseases, has been lately discovered on the waters of this river, about 30 miles in a direct line from its mouth. The water is so hot, that a patient at first going into it can scarcely support it. Nearer the mouth of the river, a valuable lead mine has been discovered.—*ib.*

FRENCH *Creek*, a N. western water of Alleghany river, into which it falls along the N. side of Fort Franklin, 80 miles N. by E. of Pittsburg. It affords the nearest passage to lake Erie. It is navigable with small boats to Le Beuf, by a very crooked channel; the portage thence to Presque Isle, from an adjoining peninsula, is 15 miles. This is the usual route from Quebec to Ohio.—*ib.*

FRENCH *Lick*, in Tennessee, is the name of a salt spring, near which the town of Nashville now stands. —*ib.*

FRENCH *Town*, in Cecil co. Maryland, lies on the E. side of Elk river, a mile S. of Elkton, from which it is separated by Elk creek. Elk ferry is 6 miles below this.—*ib.*

FRENCHMAN'S *Bay*, lies on the sea coast of Lincoln co. Maine, and is formed by Mount Desert island on the westward, and the peninsula of Goldsborough township on the eastward —Round Mount Desert island it has an inland circular communication with Blue Hill bay.—*ib.*

FRENEUSE *Lake*, a large collection of water, through which St John's river in New-Brunswick, passes. In some maps this appears only as a dilatation of the river; but in others it appears as a large lake of very irregular figure, and receiving considerable streams from the circumjacent country.—*ib.*

Friction.

FRICTION, in mechanics, is a subject of great importance both to the practical engineer and to the speculative philosopher. It is therefore our duty to correct, in this Supplement, the mistakes into which we fell when treating of that subject in the *Encyclopædia.* What we have there taught of friction (see MECHANICS Sect. II. § 8.) is taken from Ferguson; but it has been shewn by Mr Vince, that the experiments from which his conclusions were drawn were not properly instituted. That eminent mathematician and philosopher therefore entered upon the investigation of the subject anew, and endeavoured, by a set of experiments, to determine the following questions:

1. Whether friction be a uniformly retarding force?
2. The quantity of friction?
3. Whether the friction varies in proportion to the pressure or weight?
4. Whether the friction be the same on whichever of its surfaces a body moves?

1. With respect to the first of these questions, the author truly observes, that if friction be a uniform force, the difference between it and the given force of the moving power employed to overcome it must also be uniform; and that therefore the moving power, if it be a body descending by its own weight, must descend with a uniformly accelerated velocity, just as when there was no friction. The spaces described from the beginning of the motion will indeed be diminished in any given time on account of the friction; but still they must be to each other as the squares of the times employed. See DYNAMICS in this *Supplement.*

2. A plane was therefore adjusted parallel to the horizon, at the extremity of which was placed a pulley, which could be elevated or depressed in order to render the string which connected the body and the moving force parallel to the plane. A scale accurately divided was placed by the side of the pulley perpendicular to the horizon, by the side of which the moving force descended; upon the scale was placed a moveable stage, which could be adjusted to the space through which the moving force descended in any given time; which time was measured by a well-regulated pendulum clock vibrating seconds. Every thing being thus prepared, the following experiments were made to ascertain the law of friction.

3. *Exp.* 1. A body was placed upon the horizontal plane, and a moving force applied, which, from repeated trials, was found to descend $52\frac{1}{2}$ inches in 4″; for by the beat of the clock, and the sound of the moving force when it arrived at the stage, the space could be very accurately adjusted to the time: The stage was then removed to that point to which the moving force would descend in 3″, upon supposition, that the spaces described by the moving power were as the squares of the times; and the space was found to agree very accurately with the time: the stage was then removed to that point to which the moving force ought to descend 2″ upon the same supposition, and the descent was found to agree exactly with the time: lastly, the stage was adjusted to that point to which the moving force ought to descend in 1″, upon the same supposition, and the space was observed to agree with the time. Now, in order to find whether a difference in the time of descent could be observed by removing the stage a little above and below the positions which corresponded to the above times the experiment was tried, and the descent was always found too soon in the former, and too late in the latter case; by which the author was assured that the spaces first mentioned corresponded exactly to the times. And, for the greater certainty, each descent was repeated eight or ten times; and every caution used in this experiment was also made use of in all the following.

Exp. 2. A second body was laid upon the horizontal plane, and a moving force applied which descended $41\frac{3}{5}$ inches in 3″; the stage was then adjusted to the space corresponding to 2″, upon supposition that the spaces descended through were as the squares of the times, and it was found to agree accurately with the time; the stage was then adjusted to the space corresponding to 1″, upon the same supposition, and it was found to agree with the time.

Exp. 3. A third body was laid upon the horizontal plane, and a moving force applied, which descended $59\frac{5}{8}$ inches in 4″; the stage was then adjusted to the space corresponding to 3″, upon supposition that the spaces descended through were as the squares of the times, and it was found to agree with the time; the stage was then adjusted to the space corresponding to 2″, upon the same supposition, and it was found to agree with the time; the stage was then adjusted to the space corresponding to 1″, and was found to agree with the time.

Exp. 4. A fourth body was then taken and laid upon the horizontal plane, and a moving force applied, which descended 55 inches in 4″; the stage was then adjusted to the space through which it ought to descend in 3″, upon supposition that the spaces descended through were as the squares of the times, and it was found to agree with the time; the stage was then adjusted to the space corresponding to 2″, upon the same supposition, and was found to agree with the time; lastly, the stage was adjusted to the space corresponding to 1″, and it was found to agree exactly with the time.

Besides these experiments, a great number of others were made with hard bodies, or those whose parts so firmly cohered as not to be moved *inter se* by the friction; and, in each experiment, bodies of very different degrees of friction were chosen, and the results all agreed with those related above; we may therefore conclude, that the *friction of hard bodies in motion is a uniformly retarding force.*

But to determine whether the same was true for bodies when covered with cloth, woollen, &c. experiments were made in order to ascertain it; when it was found, in all cases, that the retarding force increased with the velocity; but, upon covering bodies with paper, the consequences were found to agree with those related above.

4. Having proved that the retarding force of all hard bodies arising from friction is uniform, the quantity of friction, considered as equivalent to a weight without inertia drawing the body on the horizontal plane backwards, or acting contrary to the moving force, may be immediately deduced from the foregoing experiments. For let M = the moving force expressed by its weight; F = the friction; W = the weight of the body upon the horizontal plane; S = the space through which the moving force descended in the time *t* expressed in seconds; $r = 16\frac{1}{12}$ feet; then the whole accelerative

force (the force of gravity being unity) will be $\frac{M - F}{M + W}$; hence, by the laws of uniformly accelerated motions, $\frac{M - F}{M + W} \times rt^2 = S$, consequently $F = M - \frac{\overline{M \times W} \times S}{rt^2}$ To exemplify this, let us take the case of the last experiment, where $M = 7$, $W = 25\frac{3}{4}$, $S = 4\frac{7}{12}$ feet, $t = 4''$; hence $F = 7 - \frac{32\frac{3}{4} \times 4\frac{7}{12}}{16\frac{1}{12} \times 16} = 6.417$; consequently the friction was to the weight of the rubbing body as 6.4167 to 25.75. And the great accuracy of determining the friction by this method is manifest from hence, that if an error of 1 inch had been made in the descent (and experiments carefully made may always determine the space to a much greater exactness), it would not have affected the conclusion $\frac{1}{600}$dth part of the whole.

5. We come in the next place to determine, whether friction, *cæteris paribus*, varies in proportion to the weight or pressure. Now if the whole quantity of the friction of a body, measured by a weight without inertia equivalent to the friction drawing the body backwards, increases in proportion to its weight, it is manifest, that the retardation of the velocity of the body arising from the friction will not be altered; for the retardation varies as $\frac{\text{Quantity of friction}}{\text{Quantity of matter}}$; hence, if a body be put in motion upon the horizontal plane by any moving force, if both the weight of the body and the moving force be increased in the same ratio, the acceleration arising from that moving force will remain the same, because the accelerative force varies as the moving force divided by the whole quantity of matter, and both are increased in the same ratio; and if the quantity of friction increases also as the weight, then the retardation arising from the friction will, from what has been said, remain the same, and therefore the whole acceleration of the body will not be altered; consequently the body ought, upon this supposition, still to describe the same space in the same time. Hence, by observing the spaces described in the same time, when both the body and the moving force are increased in the same ratio, we may determine whether the friction increases in proportion to the weight. The following experiments were therefore made in order to ascertain this matter:

Exp. 1. A body weighing 10 oz. by a moving force of 4 oz. described in 2′ a space of 51 inches; by loading the body with 10 oz. and the moving force with 4 oz. it described 56 inches in 2″; and by loading the body again with 10 oz. and the moving force with 4 oz. it described 63 inches in 2″.

Exp. 2. A body, whose weight was 16 oz. by a moving force of 5 oz. described a space of 49 inches in 3″; and by loading the body with 64 oz. and the moving force with 20 oz. the space described in the same time was 64 inches.

Exp, 3. A body weighing 6 oz. by a moving force of $2\frac{1}{2}$ oz. described 28 inches in 2″; and by loading the body with 24 oz. and the moving force with 10 oz. the space described in the same time was 54 inches.

Exp. 4. A body weighing 8 oz. by a moving force of 4 oz. described $33\frac{1}{2}$ inches in 2″; and by loading the body with 8 oz. and the moving force with 4 oz. the space described in the same time was 47 inches.

Exp. 5. A body whose weight was 9 oz. by a moving force of $4\frac{1}{2}$ oz. described 48 inches in 2′; and by loading the body with 9 oz. and the moving force with $4\frac{1}{2}$ oz. the space described in the same time was 60 inches.

Exp. 6. A body weighing 10 oz. by a moving force of 3 oz. described 20 inches in 2″; by loading the body with 10 oz. and the moving force with 3 oz. the space described in the same time was 31 inches; and by loading the body again with 30 oz. and the moving force with 9 oz. the space described was 34 inches in 2″.

From these experiments, and many others which it is not necessary here to relate, it appears, that the space described is always increased by increasing the weight of the body and the accelerative force in the same ratio; and as the acceleration arising from the moving force continued the same, it is manifest, that the retardation arising from the friction must have been diminished, for the whole accelerative force must have been increased on account of the increase of the space described in the same time; and hence (as the retardation from friction varies as $\frac{\text{Quantity of friction}}{\text{Quantity of matter}}$) *the quantity of friction increases in a less ratio than the quantity of matter or weight of the body.*

6. We come now to the last thing which it was proposed to determine, that is, whether the friction varies by varying the surface on which the body moves. Let us call two of the surfaces A and *a*, the former being the greater, and the latter the less. Now the weight on every given part of *a* is as much greater than the weight on an equal part of A, as A is greater than *a*; if therefore the friction was in proportion to the weight, *cæteris paribus*, it is manifest, that the friction on *a* would be equal to the friction on A, the whole friction being, upon such a supposition, as the weight on any given part of each surface multiplied into the number of such parts or into the whole area, which products, from the proportion above, are equal. But from the last experiments it has been proved, that the friction on any given surface increases in a less ratio than the weight; consequently the friction on any given part of *a* has a less ratio to the friction on an equal part of A than A has to *a*, and hence the friction on *a* is less than the friction on A, that is, the smallest surface has always the least friction.

As this conclusion is contrary to the generally received opinion, Mr Vince thought it proper to confirm it by a set of experiments made with different bodies of exactly the same degree of roughness on their two surfaces.

Exp. 1. A body was taken whose flat surface was to its edge as 22 : 9, and with the same moving force the body described on its flat side $33\frac{1}{2}$ inches in 2″, and on its edge 47 inches in the same time.

Exp. 2. A second body was taken whose flat surface was to its edge as 32 : 3, and with the same moving force it described on its flat side 32 inches in 2″, and on its edge it described $37\frac{1}{2}$ inches in the same time.

Exp. 3. He took another body and covered one of its surfaces, whose length was 9 inches, with a fine rough paper, and by applying a moving force, it described 25 inches in 2″; he then took off some paper from the

Friction. the middle, leaving only $\frac{3}{8}$ of an inch at the two ends, and with the same moving force it described 40 inches in the same time.

Exp. 4. Another body was taken which had one of its surfaces, whose length was 9 inches, covered with a fine rough paper, and by applying a moving force it described 42 inches in 2″; some of the paper was then taken off from the middle, leaving only $1\frac{1}{8}$ inches at the two ends, and with the same moving force it described 54 inches in 2″; he then took off more paper, leaving only $\frac{1}{7}$ of an inch at the two ends, and the body then described, by the same moving force, 60 inches in the same time.

In the two last experiments the paper which was taken off the surface was laid on the body, that its weight might not be altered.

Exp. 5. A body was taken whose flat surface was to its edge as 30 : 17; the *flat* side was laid upon the horizontal plane, a moving force was applied, and the stage was fixed in order to stop the moving force, in consequence of which the body would then go on with the velocity acquired until the friction had destroyed all its motion; when it appeared from a mean of 12 trials that the body moved, after its acceleration ceased, $5\frac{2}{5}$ inches before it stopped. The *edge* was then applied, and the moving force descended through the same space; and it was found, from a mean of the same number of trials, that the space described was $7\frac{1}{7}$ inches before the body lost all its motion, after it ceased to be accelerated.

Exp. 6. Another body was then taken whose flat surface was to its edge as 60 : 19, and, by proceeding as before, on the flat surface it described, at a mean of 12 trials $5\frac{1}{8}$ inches, and on the edge $6\frac{1}{14}$ inches, before it stopped, after the acceleration ceased.

Exp. 7. Another body was taken whose flat surface was to its edge as 26 : 3, and the spaces described on these two surfaces, after the acceleration ended, were, at a mean of ten trials, $4\frac{1}{7}$ and $7\frac{7}{10}$ inches respectively.

From all these different experiments it appears, that the smallest surface had always the least friction, which agrees with the consequence deduced from the consideration that the friction does not increase in so great a ratio as the weight; we may therefore conclude, that *the friction of a body does not continue the same when it has different surfaces applied to the plane on which it moves, but that the smallest surface will have the least friction.*

To the experiments instituted by Mr Ferguson and others, from which conclusions have been drawn so different from these, our author makes the following objections: It was their object to find what moving force would *just* put a body at rest in motion; and having, as they thought, found it, they thence concluded, that the accelerative force was then equal to the friction. But it is manifest, as Mr Vince observes, that any force which will put a body in motion must be *greater* than the force which opposes its motion, otherwise it could not overcome it; and hence, if there were no other objection than this, it is evident, that the friction could not be very accurately obtained: but there is another objection which totally destroys the experiment so far as it tends to shew the quantity of friction, which is the strong cohesion of the body to the plane when it lies at rest; and this is confirmed by the following experiments. 1*st*, A body of $12\frac{1}{4}$ oz. was laid upon an horizontal plane, and then loaded with a weight of 8lb. and such a moving force was applied as would, when the body was just *put* in motion, continue that motion without any acceleration; in which case the friction must be just equal to the accelerative force. The body was then stopped, when it appeared, that the same moving force which had *kept* the body in motion before, would not *put* it in motion, and it was found necessary to take off $4\frac{1}{2}$ oz. from the body before the same moving force *would* put it in motion; it appears therefore, that this body, when laid upon the plane, at rest, acquired a very strong cohesion to it. 2*dly*, A body whose weight was 16 oz. was laid at rest upon the horizontal plane, and it was found that a moving force of 6 oz. would just *put* it in motion; but that a moving force of 4 oz. *would*, when it was just put in motion, continue that motion without any acceleration, and therefore the accelerative force must *then* have been equal to the friction, and not when the moving force of 6 oz. was applied.

From these experiments therefore it appears, how very considerable the cohesion was in proportion to the friction when the body was in motion; it being, in the latter case, almost $\frac{1}{3}$d, and in the former it was found to be very nearly equal to the whole friction. All the conclusions therefore deduced from the experiments, which have been instituted to determine the friction from the force necessary to *put* a body in motion, have manifestly been totally false; as such experiments only shew the resistance which arises from the cohesion and friction conjointly.

Our author concludes this part of his subject with the following remark upon n° 5: "It appears from all the experiments (says he) which I have made, that the proportion of the increase of the friction to the increase of the weight was different in all the different bodies which were made use of; no general rule therefore can be established to determine this for *all* bodies, and the experiments which I have hitherto made have not been sufficient to determine it for the *same* body."

He then proceeds to establish a theory upon the principles which he has deduced from his experiments. That theory is comprehended in five propositions, of which the object of the first is "to find the time of descent, and the number of revolutions made by a cylinder rolling down an inclined plane in consequence of its friction.

II. "To determine the space through which a body, projected on an horizontal plane with a given velocity, will move before it stops, or before its motion becomes uniform.

III. "To find the centre of friction.

IV. "To determine, from the given velocity with which a body begins to revolve about the centre of its base, the number of revolutions which that body will make before all its motion be destroyed.

V. "To find the nature of the curve described by any point of a body affected by friction when it descends down any inclined plane."

To give the solutions of these problems, with the corollaries deduced from them, would swell this article to very little purpose; for they would be unintelligible to the mere mechanic, and the mathematician will either solve them for himself, or have recourse to the original

 memoir,

memoir, where he will find solutions at once elegant and perspicuous.

FRIEDBURG, a Moravian settlement in Wachovia, or Surry co. N. Carolina.—*Morse.*

FRIEDENSHUETTEN, a Moravian settlement, whose name signifies *Tents of Peace*, situated on Susquehanna river, in Pennsylvania, about 24 miles below Tioga point; established by the United Brethren in 1765. It then consisted of 13 Indian huts, and upwards of 40 houses, built after the European manner, with a neat chapel. Next to the houses the ground was laid out in gardens; and between the settlement and the river about 250 acres were divided into regular plantations of Indian corn.—*ib.*

FRIEDENSTADT, or *Town of Peace*, a Moravian settlement which was established between Great Beaver and Yellow creeks; about 40 miles N. W. of Pittsburg. It was abandoned in 1773.—*ib.*

FRIGORIFIC MIXTURES, are those which experience has taught philosophers to employ for the purpose of producing artificial cold. Some of these mixtures are enumerated under the title COLD (*Encycl*), and a much more accurate list of them is given, together with the principle upon which they produce their effect, in the article CHEMISTRY, n° 282. (*Suppl.*) There is one mixture, however, not mentioned in that list, which was employed by Seguin, and seems, on many accounts, to be the most eligible that has yet been proposed. Considering the muriats (see CHEMISTRY-*Index-Suppl.*) as a class of salts best suited for the purpose, he gave the decided preference to muriat of lime in chrystals; and his method was to mix the crystals, previously pulverised, with an equal weight of uncompressed snow.

By means of this mixture Mr W. H. Pepys junior, of the London Philosophical Society, with the assistance of some friends, froze, on the 8th of February 1799, 56 lbs. averdupoise of mercury into a solid mass. The mercury was put into a strong bladder and well secured at the mouth, the temperature of the laboratory at the time being + 33°. A mixture consisting of muriat of lime 2 lb. at + 33°, and the same weight of snow at + 32° gave — 42° (A). The mercury was put as gently as possible into this mixture (to prevent a rupture of the bladder), by means of a cloth held at the four corners. When the cold mixture had robbed the mercury of so much of its heat as to have its own temperature thereby raised from — 42° to + 5, another mixture, the same in every respect as the last, was made, which gave, on trial with the thermometer, — 43°. The mercury was now received into the cloth, and put gently into this new mixture, where it was left to be cooled still lower than before.

In the mean time five pounds of muriat of lime, in a large pail made of tinned iron, and japanned inside and outside, was placed in a cooling mixture in an earthenware pan. The mixture in the pan, which consisted of 4lb. of muriat of lime and a like quantity of snow, of the same temperature as the former, in one hour reduced the 5 lb. of muriat in the pail to — 15°. The mixture was then emptied out of the earthen pan, and four large corks, at proper distances, placed on its bottom, to serve as rests for the japanned pail which was now put into the pan. The corks answered the purpose of insulating the inner vessel, while the exterior one kept off the surrounding atmosphere, and preserved the air between the two at a low temperature.

To the 5 lb. of muriat of lime which had been cooled, as already noticed, to — 15°, and which still remained in the metallic vessel, was now added snow, uncompressed and free from moisture, at the usual temperature of + 32°. In less than three minutes the mixture gave a temperature of — 62° : a degree of cold which perhaps was never before produced in this country, being 94° below the freezing point of water.

The mercury, which by immersion in the second cooling mixture to which it was exposed, was, by this time reduced to — 30°, was now, by the means employed before, cautiously put into the last made mixture of the temperature of — 62°. A hoop, with net-work fastened to its upper edge, and of such a breadth in the rim that the net work, when loaded with the bladder of mercury could not reach its lower edge, was at the bottom of the mixture, to prevent the bladder from coming in contact with the vessel; by which means the mercury was suspended in the middle of the mixture. As soon as the bladder was safely deposited on the net-work, the vessels were carefully covered over with a cloth, to impede the passage of heat from the surrounding atmosphere into the freezing materials. The condensation of moisture from the atmosphere by the agency of so low a temperature was greater than could have been expected: It floated like steam over the vessels, and, but for the interposed covering, would have given the mixture more temperature than was desirable.

After one hour and forty minutes they found, by means of a searcher introduced for the purpose, that the mercury was solid and fixed. The temperature of the mixture at this time was — 46, that is 16° higher than when the mercury was put into it.

Our young philosophers having neglected to sling the hoop and net-work in such a manner as might have enabled them to lift it out of the mixture at once, with the bladder and its contents, were obliged to turn out the whole contents of the pail into a large evaporating capsule made of iron. This was not effected without the mercury striking against its bottom and being fractured, though it received a considerable increase of temperature from the capsule. The fracture was similar to that of zinc, but with parts more cubical. The larger pieces were kept for some minutes before fusion took place, while others were twisted and bent into various forms, to the no small gratification and surprise of those who had never witnessed or expected to see such an effect produced on so fusible a metal.

In experiments of the kind here described, all the exterior vessels should be of earthen-ware or wood, which being bad conductors of heat, prevent the ingredients from receiving heat from the atmosphere and surrounding objects with the same facility that they would through metals; and, for a similar reason, the interior vessels are best of metal, that they may allow the

(A) The thermometer made use of in this experiment was filled with tinged alcohol, and accurately divided according to Fahrenheit's scale.

the heat to paſs more readily from the ſubſtance to be cooled into the frigorific mixture employed for that purpoſe.

Muriat of lime is certainly the moſt powerful, and at the ſame time the moſt economical ſubſtance that can be employed for producing artificial cold; for its firſt coſt is a mere trifle, being a reſiduum from many chemical proceſſes, as the diſtillation of pure ammonia, &c. and often thrown away: beſides, it may be repeatedly uſed for ſimilar experiments, nothing being neceſſary for this purpoſe but filtration and evaporation to bring it to its firſt ſtate. The evaporation ſhould be carried on till the ſolution becomes as thick as a ſtrong ſyrup, and upon cooling the whole will be cryſtalliſed: it muſt then be powdered, put up in dry bottles, well corked, and covered with bladder or cement to prevent liquefaction; which otherwiſe would ſoon take place, owing to the great affinity the muriat has for moiſture.

The powerful effects produced by the frigorific mixture of muriat of lime and ſnow, preſent a wide field for experiments to determine the poſſibility of fixing ſome of the gaſes by intenſe cold. And we are happy to be informed by Mr Pepys, that, as ſoon as an opportunity offers, he and his friends mean to make ſome experiments with that view, and to communicate the reſult of them to the editor of the valuable miſcellany* from which we have taken this account of his experiment on mercury.

* *The Philoſophical Magazine.*

FRIO, a ſmall iſland on the coaſt of the Brazils, ſituated in 32° 2′ ſouth lat. and 41° 31′ 45″ weſt lon. The land of Frio is high, with a hollow in the middle, which gives it, at a diſtance, the reſemblance of two ſeparate iſlands. The paſſage between the iſland and the continent is about a mile broad, and ſeemed to Sir Eraſmus Gower to be clear from ſhoals.

FRONTINAC, Fort, a fortreſs in Canada, ſituated at the head of a fine bay or harbor, on the N. W. ſide of the outlet of Lake Ontario, where all ſorts of veſſels may ride in ſafety. It is a league from the mouth of the lake, and a ſhort diſtance S. of Kingſton, and about 300 miles from Quebec. The winter about this place is much ſhorter than at Quebec; and the ſoil is ſo well cultivated, as to produce all ſorts of European and Indian corn, and fruits. Here is one of the moſt charming proſpects in the world, during ſpring and ſummer. The St Lawrence and the mouth of Lake Ontario, contain a number of beautiful and fertile iſlands of different magnitudes, and well wooded, and the bay often preſents to the view veſſels at anchor, and others paſſing to and from the lake. But the misfortune is, that the advantageous communication between this lake, Montreal and Quebec, is ſomewhat difficult and dangerous, on account of the river being full of rocks and water falls. This, together with the ambuſcades of the Iroquois Indians, induced the French to abandon and deſtroy the ſtrong works they had erected here. This happened in 1689. After this they retook and repaired the place. At length the Britiſh, under col. Bradſtreet, took it in 1759, to whom it was confirmed at the peace in 1763.

A river has lately been ſurveyed by the deputy ſurveyor general of Canada, from its entrance into the lake at Kenty, near Cadaraqui, to its ſource in lake St Clie; from which there is an eaſy and ſhort portage acroſs N. W. to the N. E. angle of Lake Huron, and another that is neither long nor difficult, to the ſouthward, to the old ſettlement of Toronto. This is a ſhort route from Fort Frontenac to Michillimackinack. —*Morſe.*

FROST, as is well known in Scotland, is particularly deſtructive to the bloſſom of fruit trees; and the following method of ſecuring ſuch trees from being damaged by early froſts may be acceptable to many of our readers. A rope is to be interwoven among the branches of the tree, and one end of it brought down ſo as to be immerſed in a bucket of water. The rope, it is ſaid, will act as a conductor, and convey the effects of the froſt from the tree to the water. This idea is not new, for the following paſſage may be found in Colerus: "If you dig a trench around the root of a tree, and fill it with water, or keep the roots moiſt till it has bloomed, it will not be injured by the froſt. Or, in ſpring, ſuſpend a veſſel filled with water from the tree. If you wiſh to preſerve the bloom from being hurt by the froſt, place a veſſel of water below it, and the froſt will fall into it." *Philoſophical Magazine*, n° 11.

FROWSAC *Channel*, or the Gut of Canſo, a ſtrait between Nova-Scotia and Cape Breton Iſland, 5 French leagues long, and one broad.—*Morſe.*

FRYDUFFRIN, a townſhip in Cheſter co. Pennſylvania.—*ib.*

FRYING PAN, a dangerous ſhoal ſo called from its form. It lies at the entrance of Cape Fear river, in North Carolina; the S. part of it is in N. lat. 33. 32. 6 miles from Cape Fear pitch, and 24 S. E. by S. from the light-houſe on Bald Head.

FRYSBURGH, or *Fryburg*, a townſhip pleaſantly ſituated in York co. in the diſtrict of Maine, in a bow formed by the N. branch of Great Oſſipee river. It was incorporated in 1777, has a flouriſhing academy, and contains 447 inhabitants. This is the ancient Indian village Peckwalket, through which the upper part of Saco meanders; 60 miles from the ſea, and 120 N. by E. of Boſton. N. lat. 44. 2. W. long. 70. 47. 30.—*ib.*

FUCA, Straits of Juan de, lie on the N. W. coaſt of N. America. The entrance lies between Cape Flattery on the S. ſide, in N. lat. 48. 25. W. long. 124. 52. to the oppoſite coaſt of the Quadras iſles, in N. lat. 48. 53. 30. It communicates with Pintard's ſound, and thus forms Quadras iſles; in the S. eaſtern coaſt of which lies Nootka ſound. The Spaniards, jealous of their right to the American coaſt, eſtabliſhed a ſettlement at this place.—*ib.*

FUEL, whatever is proper to burn, or make a fire, either for warming a room or dreſſing victuals. The fuel moſt generally uſed in Great Britain is pit coal, which is a very expenſive article; and that expence is greatly increaſed by the waſte of coal occaſioned by the injudicious manner in which fires in open chimneys are commonly managed. The enormous waſte of fuel in London, for inſtance, may be eſtimated by the vaſt dark cloud which continually hangs over that great metropolis, and frequently overſhadows the whole country far and wide; for this denſe cloud is certainly compoſed almoſt entirely of unconſumed coal, which has eſcaped by the chimneys, and continues to ſail about in the air, till, having loſt the heat which gave it volatility, it falls in a dry ſhower of extremely fine black duſt to the ground, Fuel.

ground, obscuring the atmosphere in its descent, and frequently changing the brightest day into more than Egyptian darkness.

"I never (says Count Rumford) view from a distance, as I come into town, this black cloud which hangs over London, without wishing to be able to compute the immense number of chaldrons of coals of which it is composed; for could this be ascertained, I am persuaded so striking a fact would awaken the curiosity, and excite the astonishment of all ranks of the inhabitants; and perhaps turn their minds to an object of economy to which they have hitherto paid little attention."

The object to which the benevolent author more particularly wishes to direct the public attention, is the lighting of a coal fire, in which more wood should be employed than is commonly used, and fewer coals; and as soon as the fire burns bright, and the coals are well lighted, and not before, more coals should be added to increase the fire to its proper size.

Kindling balls, composed of equal parts of coal,—charcoal,—and clay, the two former reduced to a fine powder, well mixed and kneaded together, with the clay moistened with water, and then formed into balls of the size of hens eggs, and thoroughly dried, might be used with great advantage instead of wood for kindling fires. These kindling balls may be made so inflammable as to take fire in an instant and with the smallest spark, by dipping them in a strong solution of nitre and then drying them again: and they would neither be expensive nor liable to be spoiled by long keeping. Perhaps a quantity of pure charcoal, reduced to a very fine powder, and mixed with the solution of nitre in which they are dipped, would render them still more inflammable.

The Count thinks that the fires which are made in the open chimneys of elegant apartments might be greatly improved by preparing the fuel; for nothing (says he) was ever more dirty, inelegant, and disgusting than a common coal fire.

Fire balls, of the size of goose eggs, composed of coal and charcoal in powder, mixed up with a due proportion of wet clay, and well dried, would make a much more cleanly, and in all respects a pleasanter fire than can be made with crude coals; and, he believes, would not be more expensive fuel. In Flanders, and in several parts of Germany, and particularly in the duchies of Juliers and Bergen, where coals are used as fuel, the coals are always prepared before they are used, by pounding them to a powder, and mixing them up with an equal weight of clay, and a sufficient quantity of water to form the whole into a mass, which is kneaded together and formed into cakes; which cakes are afterwards well dried, and kept in a dry place for use. And it has been found, by long experience, that the expence attending this preparation is amply repaid by the improvement of the fuel. The coals, thus mixed with clay, not only burn longer, but give much more heat than when they are burnt in their crude state.

It will doubtless appear extraordinary to those who have not considered the subject with some attention, that the quantity of heat produced in the combustion of any given quantity of coals should be increased by mixing the coals with clay, which is certainly an incombustible body; but the phenomenon may be explained in a satisfactory manner.

The heat generated in the combustion of any small particle of coal existing under two distinct forms, namely, in that which is combined with the flame and smoke which rise from the fire, and which, if means are not found to stop it, goes off immediately by the chimney and is lost, and the radiant heat which is sent off from the fire in all directions in right lines:—It is therefore reasonable to conclude, that the particles of clay, which are surrounded on all sides by the flame, arrest a part at least of the combined heat, and prevent its escape; and this combined heat, so arrested, heating the clay red hot, is retained in it, and being changed by this operation to radiant heat, is afterwards emitted, and may be directed and employed to useful purposes. In the composition of fire balls, the Count thinks it probable that a certain proportion of chaff, of straw cut very fine, or even of saw dust, might be employed with great advantage.

Fulling.

FULLING OF WOOLLEN CLOTHS (see the method of performing the operation under the article FULLING, *Encycl.*) depends, like FELTING, so entirely upon the structure of wool and hair, that the following observations, which are not unimportant, will be intelligible to every reader who has perused that article in this *Supplement*.

The asperities with which the surface of wool is every where surrounded, and the disposition which it has to assume a progressive motion towards the root, render the spinning of wool, and making it into cloth, difficult operations. In order to spin wool, and afterwards to weave it, we are obliged to cover its fibres with a coating of oil, which, filling the cavities, renders the asperities less sensible; in the same way as oil, when rubbed over the surface of a very fine file, renders it still less rough. When the piece of cloth is finished, it must be cleansed from this oil; which, besides giving it a disagreeable smell, would cause it to soil whatever it came in contact with, and would prevent its taking the colour which is intended to be given to it by the dyer. To deprive it of the oil, it is carried to the fulling-mill, where it is beat with hammers in a trough full of water, in which some clay has been mixed; the clay combines with the oil, which it separates from the cloth, and both together are washed away by the fresh water which is brought to it by the machine; thus, after a certain time, the oil is entirely washed out of the cloth.

But the scouring of the cloth is not the only object in fulling it; the alternate pressure given by the mallets to the piece of cloth, occasions, especially when the scouring is pretty far advanced, an effect analogous to that which is produced upon hats by the hands of the hatter; the fibres of wool which compose one of the threads, whether of the warp or the woof, assume a progressive movement, introduce themselves among those of the threads nearest to them, then into those which follow; and thus, by degrees, all the threads, both of the warp and the woof become felted together. The cloth, after having, by the above means, become shortened in all its dimensions, partakes both of the nature of cloth and of that of felt; it may be cut without being subject to ravel, and, on that account, we are not obliged to hem the edges of the pieces of which clothes are made. Lastly, As the threads of the warp and those of the woof are no longer so distinct and separated from each other, the cloth, which has acquired a greater degree of thickness, forms a warmer clothing. Knit worsted

also

also is, by fulling, rendered less apt to run, in case a stitch should drop in it.

FULMINATING GOLD. } See CHEMISTRY *Suppl.*
FULMINATING Silver. } nos 849 and 850.

Mr Berthollett, the inventor of fulminating silver, having contented himself with a general and concise description of this subject, many practical chemists have failed in their attempts to prepare it; and others, forming their opinions from the specimens which they had made, have been exposed to great danger: as will appear from the following relation:

An ounce of fine silver was dissolved in the course of eight hours in an ounce of pure nitrous acid, of the London Pharmacopœia, diluted previously with three ounces of distilled water in a glass matrass. The solution being poured off, the residuary black powder and the matrass were washed with seven or eight ounces of warm distilled water, and this was added to the solution. The black powder, being gold, was rejected; some gold being thus separable from any silver of commerce.

To the foregoing diluted solution, pure lime-water prepared with distilled water was added gradually; for the solution ought not to be poured into the lime water. When about thirty pints of lime-water had been expended, and the precipitate had subsided, more lime-water was added, by successive pints, as long as it caused any precipitation. For it was deemed fitter that the precipitation should not be perfected, than that an excess of lime-water should be used; the earthy pellicle of the excessive lime-water being apt to mix with the precipitate. The clear liquor being poured away, the precipitate was poured off, and washed into a filter.

When the saline liquor had drained from it, two ounces of distilled water were poured on the magma; and when this water had passed, fresh portions were successively added and passed, until the whole quantity of water thus expended in washing away the nitrous calcareous salt amounted to a quart.

The filter being then unfolded, to let the magma of oxyd of silver spread on the flattened paper, it was placed on a chalk-stone to accelerate the exsiccation, and was gradually dried in the open air; a cap of paper being placed loosely over it to exclude the dust.

When the weather served, the cap was removed, to expose the oxyd to the rays of the sun; although this was not deemed neccessary; and exsiccation was promoted by cutting the oxyd into thin slices. When perfectly dry it weighed 1 oz. 4 dwts. and about one-fifth of it was considered as oxygen.

When aqua ammoniæ puræ of any pharmacopœia is used with this oxyd, either in the small quantity which blackens it completely, or in a greater quantity, the black matter which subsides, and which has been represented by systematic writers as the fulminating compound, has no such property, any farther than may be owing to the matter deposited from the alkaline solution during the exsiccation.

The alkaline liquor containing the fulminating silver ought to be poured off from the insoluble powder, and exposed in a shallow vessel to the air. In consequence of the exhalation, black shining crystals form on the surface only, and soon join to form a pellicle. As this pellicle adheres a little to the sides of the vessel, or maintains its figure, the liquor may be poured off by a gentle inclination of the vessel.

This liquor will yield another pellicle in the same way; but the third or fourth pellicle will be paler than the former, and weaker in the explosion. The first pellicles, when slowly dried, explode by the touch of a feather, or by their being heated to about 96°.

The quantity of water in the ordinary aqua ammoniæ puræ renders it less active in the solution of the oxyd, and is an impediment to the speedy formation and separation of the fulminating silver; and an experimenter who has often used twenty grains of the oxyd to produce successive pellicles of fulminating silver, which may be separately exploded with safety, and who has perceived that the pellicles never explode whilst wet, if they be not heated, would, in all probability, resolve on the following improvement, and expose himself to the unforeseen danger of it.

Distilled water was impregnated with as much pure ammoniac, as it could easily retain under the ordinary temperature of the air. A quantity of this strong ammoniacal liquor, equal in bulk to a quarter of an ounce of water, was placed in a small bottle, and 24 grains of the oxyd of silver, ground to fine powder, were added. The bottle, being almost filled, was corked, to prevent the formation of that film which usually appeared in consequence of the exhalation of the ammoniac in other experiments.

During the solution of the oxyd, bubbles of the gaseous kind arose from it, and the solution acquired a blue colour. As no film appeared, the bottle was agitated three or four times in the course of as many hours, in order to promote the solution of a small quantity of blackened oxyd which remained at the bottom. The experimenter considering this as an ample provision for twenty different charges, to be exploded in different circumstances, in the presence of the society, intended to pour off the solution into as many small vessels, and to weigh the residuary black powder, after allowing two hours more for the solution.

On the sixth hour he took his usual precaution of wearing spectacles; and observing that a small quantity of black powder still remained undissolved, and that no film was yet formed at the surface, he took the bottle by the neck to shake it, knowing that it might explode by the heat of his hand, if he were to grasp it, and that the explosion in this circumstance might wound him dangerously.

In the instant of shaking, it exploded with a report that stunned him. The bottle was blown into fragments so small as to appear like glass coarsely powdered. The hand which held it was impressed as by the blow of a great hammer, and lost the sense of feeling for some seconds; and about 52 small grains of glass were lodged, many of them deeply, in the skin of the palm and fingers. The liquor stained his whole dress, and every part of the skin that it touched. Thus it appeared that fulminating silver may be made which will explode even when cold and wet, by the mere disturbance of the arrangement of its parts, in the aqueous fluid.

In subsequent experiments, privately and carefully conducted, it seemed that the property of exploding in the cold liquor, by mere commotion, depended on the unusual quantity or proximity of the explosive molecules in a given bulk of the liquor. And the flat bottoms, as well as the sides, of the thick vessels of glass or pot-

ters-

ters-ware, whether they ſtood on boards or iron plates, were always beaten to ſmall fragments.

This afforded a curious inſtance of the poſſible equilibrium between the powers tending to retain the caloric and thoſe which effect the expulſion of it; and experiments and conſiderations of this kind ſeemed to promiſe a true ſolution of the phenomena of Rupert's drops.

FUNCTION, a term uſed in analytics for an algebraical expreſſion any how compounded of a certain letter or quantity with other quantities or numbers; and the expreſſion is ſaid to be a function of that letter or quantity. Thus $a - 4x$, or $ax + 3x^2$, or $2x - a\sqrt{a^2 - x^2}$, or x^c, or c^x, is each of them a function of the quantity x.

FUNDY, a large bay in N. America, which opens between the iſlands in Penobſcot bay, in Lincoln co. Maine, and Cape Sable, the S. weſtern point of Nova-Scotia. It extends about 200 miles in a N. E. direction; and with Verte bay, which puſhes into the land in a S. W. direction from the ſtraits of Northumberland, forms a very narrow iſthmus, which unites Nova-Scotia to the continent; and where the diviſion line runs between that province and New-Brunſwick. From its mouth up to Paſſamaquoddy bay, on its N. W. ſide, ſituated between the province of New-Brunſwick and the diſtrict of Maine, are a number of bays and iſlands on both ſides, and thus far it contracts its breadth gradually. It is 12 leagues acroſs from St John's, in New-Brunſwick, to the Gut of Annapolis, in Nov-Scotia; where the tides are rapid, and riſe 30 feet. Above this it preſerves nearly an equal breadth, until its waters are formed into two arms, by a peninſula, the weſtern point of which is called Cape Chignecto. At the head of the N. eaſtern arm, called Chignecto channel, which, with bay Verte forms the iſthmus, the tides riſe 60 feet. In the Baſin of Minas, which is the E. arm or branch of this bay, the tides riſe 40 feet. Theſe tides are ſo rapid as to overtake animals feeding on the ſhore.—*Morse.*

FURD-Y-HUCKEECUT, in Bengal, ſignifies a paper of deſcription.

Furd-y-Sowal, paper of requeſt.

FUST, in architecture, the ſhaft of a column, or the part comprehended between the baſe and the capital, called alſo the naked.

G.

GABORI, a bay on the S. E. coaſt of Cape Breton iſland. The entrance into it, which is not more than 20 leagues from the iſles of St. Pierre, is between iſlands and rocks about a league in breadth. The bay is 2 leagues deep, and affords good anchorage.—*Morse.*

GABRIEL, ST an iſland in the great river La Plata, S. America, diſcovered by Sebaſtian Cabot, in the year 1526.—*ib.*

GAGE's *Town*, a ſettlement in Sunbury co. New-Brunſwick; on the lands granted to general Gage, on the W. ſide of St John's river, on the northern ſhore of the bay of Fundy. The general's grant conſiſts of 20,000 acres of land; the up-land of which is in general very bad. There is ſome intervale on the river ſide, on which are a few ſettlers; excluſive of theſe ſettlements, there is very little good land of any kind.—*ib.*

GAGUEDI, a tree peculiar to Lamalmon, in Abyſſinia, is thus deſcribed by Mr Bruce. The leaves are long, and broader as they approach the end. The point is obtuſe. They are of a dead green, not unlike the willow, and placed alternately one above the other on the ſtalk. The calix is compoſed of many broad ſcales lying one above the other, which operates by the preſſure upon one another, and keeps the calix ſhut before the flower arrives at perfection. The flower is monopetolous, or made of one leaf; it is divided at the top into four ſegments; where theſe end, it is covered with a tuſt of down, reſembling hair, and this is the caſe at the top alſo. When the flower is young and unripe, they are laid regularly ſo as to incloſe one another in a circle. As they grow old and expand, they ſeem to loſe their regular form, and become more confuſed, till at laſt, when arrived at its full perfection, they range themſelves parallel to the lips of the calix, and perpendicular to the ſtamina, in the ſame order as a roſe. The common receptacle of the flower is oblong, and very capacious, of a yellow colour, and covered with ſmall leaves like hair. The ſtile is plain, ſimple, and upright, and covered at the bottom with a tuſt of down, and is below the common receptacle of the flower.

Our author ſays that he has obſerved, in the middle of a very hot day, that the flowers unbend themſelves more, the calix ſeems to expand, and the whole flower to turn itſelf towards the ſun in the ſame manner as does the ſun-flower. When the branch is cut, the flower dries, as it were inſtantaneouſly, ſo that it ſeems to contain very little humidity.

GALEN, a military townſhip in the ſtate of New-York, ſituated on Canadaque creek, 12 miles N. W. of the N. end of Cayuga lake, and 13 S. by E. of Great Sodus. It is bounded S. by Junius.—*Morse.*

GALETS, an iſland at the E. end of lake Ontario, and in the ſtate of New-York, 5 miles S. weſtward of Roebuck iſland, 5 northerly of Point Gaverſe, and 31 S. E. of Point au Goelans.—*ib.*

GALETTE, LA, a neck of land in the river St. Lawrence, in Canada. From the point oppoſite to l'iſle de Montreal, a road might be made to Galette, ſo as to ſave 40 leagues of navigation, which the falls

Galibis || Gallan.

render almoſt impracticable, and always very tedious. The land about La Galette is very good; and in two days time a barque may ſail thence to Niagara, with a good wind. La Galette is a league and a half above the fall called les Galots.—*ib.*

GALIBIS, or *Charaibes*, a nation of Indians inhabiting near New-Andaluſia, in S. America; from which the Charaibes of the Weſt-Indies are thought to be deſcended.—*ib.*

GALICIA, an audience in Old Mexico or New-Spain, containing 7 provinces. Guadalaxera is the capital city.—*ib.*

GALIPAGO *Iſles*, the name of ſeveral uninhabited iſles in the South Sea, on both ſides the equator, not far from the coaſt of Terra Firma; belonging to Spain. They lie between 3. N. and 4. S. lat. and between 83. 40. and 89. 30. W. long. There are only 9 of them of any conſiderable ſize; ſome of which are 7 or 8 leagues long, and 3 or 4 broad. Dampier ſaw 14 or 15 of them. The chief of theſe are Norfolk, neareſt the continent, Wenmore among the N. weſternmoſt and Albemarle the weſternmoſt of all. A number of ſmall iſles lie W. from theſe, on both ſides the equator; one of which, Gallego iſland lies in the 1ſt degree of N. lat. and 102 of W. long. Many of theſe iſles are well wooded, and ſome have a deep black mould. Vaſt quantities of the fineſt turtle are to be found among theſe iſlands, where they live the greateſt part of the year; yet they are ſaid to go from thence over to the main to lay their eggs, which is at leaſt 100 leagues diſtant.—*ib.*

GALLAN, St a ſmall iſland on the coaſt of Peru, in lat. 14. S. 5 miles N. of the high land *Morro Veijo*, or Old Man's Head; between which iſland and the high land, is a moſt elegible ſtation to cruize for veſſels bound for Callao, N. or S.—*ib.*

Galliopolis || Galloway.

GALLIOPOLIS, a poſt town in the N. W. territory, ſituated on a bend of the Ohio, and nearly oppoſite to the mouth of the Great Kanhaway. It is ſaid to contain about 100 houſes, all inhabited by French people. It is 140 miles eaſtward of Columbia, 300 S. W. of Pittſburg, and 559 S. W. of Philadelphia. N. lat. 39. 2. W. long 83. 9.

This town is ſaid to be on the decline, their right to the lands not being ſufficiently ſecured.—*ib.*

GALOTS, the loweſt of the falls on the river St Lawrence in Canada. Between the neck of land La Galette and les Galots is an excellent country, and no where can there be ſeen finer foreſts.—*ib.*

Galots, l'isle aux, an iſland in the river St Lawrence, in Canada; 3 leagues beyond l'iſle aux Chevres, in N. lat. 43. 33.—*ib.*

GALLO, an iſland in the province of Popayan, S. America, in N. lat. 2. 40. Captain Dampier ſays it is ſituated in a deep bay, and that off this iſland there is not above 4 or 5 fathom water; but at Segnetta, which is on the N. ſide, a veſſel may ride in deep water, free from any danger. The iſland is high, provided with wood and good water, and having good ſandy bays, where a ſhip may be cleaned.——Alſo, the name of an iſland of the S. ſea, near the coaſt of Peru, which was the firſt place poſſeſſed by the Spaniards, when they attempted the conqueſt of Peru.—*ib.*

GALLOWAY, a townſhip in Glouceſter co. New-Jerſey.—*ib.*

GALVANISM.

1 Galvaniſm improperly called *animal electricity*.

GALVANISM, is the name now commonly given to the influence diſcovered nearly eight years ago by the celebrated Galvani, profeſſor of anatomy at Bologna, and which, by him and ſome other authors, has been called *animal electricity*. We prefer the former name, becauſe we think it by no means proved, that the phenomena diſcovered by Galvani depend either upon the electric fluid, or upon any law of animal life. While that is the caſe, it is ſurely better to diſtinguiſh a new branch of ſcience by the name of the inventor, than to give it an appellation which probably may, and, in our opinion, certainly does, lead to an erroneous theory.

M. Galvani was engaged in a ſet of experiments, the object of which was to demonſtrate, if poſſible, the dependence of muſcular motion upon electricity. In the courſe of this inveſtigation, he had met with ſeveral new and ſtriking appearances which were certainly electrical; ſoon after which, a fortunate accident led to the diſcovery of the phenomena which conſtitute the chief ſubject of this article. The ſtrong reſemblance which theſe bore to the electrical facts which he had before obſerved, led almoſt irreſiſtibly to the concluſion that they all depended upon the ſame cauſe. This opinion he immediately adopted; and his ſubſequent experiments and reaſonings were naturally directed to ſupport it. The ſplendor of his diſcovery dazzled the imaginations of thoſe who proſecuted the enquiry; and for ſome time his theory, in ſo far at leaſt as it attributed the whole to the agency of the electric fluid, was ſanctioned by univerſal approbation. Of late, however, this opinion has rather loſt ground; and there are now many philoſophers who conſider the phenomena as totally unconnected with electricity.

2 Diſcovery of galvaniſm.

3 Object of this article

We propoſe, in the *firſt* place, to enumerate the chief facts which have been aſcertained on the ſubject; we ſhall then enquire, whether or not the cauſe of the appearances be the electric fluid; and, *thirdly*, we ſhall examine how far it has been proved, that this cauſe is neceſſarily connected with animal life.

Whilſt Galvani was one day employed in diſſecting a frog, in a room where ſome of his friends were amuſing themſelves with electrical experiments, one of them having happened to draw a ſpark from the conductor at the ſame time that the profeſſor touched one of the nerves of the animal, its whole body was inſtantly ſhaken by a violent convulſion. Aſtoniſhed at the phenomenon, and at firſt imagining that it might be owing to his having wounded the nerve, he pricked it with the point of his knife, to aſſure himſelf whether or not this was the caſe, but no motion of the frog's body was produced. He now touched the nerve with the inſtrument as at firſt, and directed a ſpark to be taken at the ſame

same time from the machine, on which the contractions were renewed. Upon a third trial, the animal remained motionless; but observing that he held his knife by the handle, which was made of ivory, he changed it for a metallic one, and immediately the movements took place, which never was the case when he used an electric substance.

After having made a great many similar experiments with the electrical machine, he resolved to prosecute the subject with atmospheric electricity. With this view he raised a conductor on the roof of his house, from which he brought an iron wire into his room. To this he attached metal conductors, connected with the nerves of the animals destined to be the subjects of his experiments; and to their legs he fastened wires which reached the floor. These experiments were not confined to frogs alone. Different animals, both of cold and warm blood, were subjected to them; and in all of them considerable movements were excited whenever it lightned. These preceded thunder, and corresponded with its intensity and repetition; and even when no lightning appeared, the movements took place when any stormy cloud passed over the apparatus. That all these appearances were produced by the electric fluid, was obvious.

Having soon after this suspended some frogs from the iron palisades which surrounded his garden, by means of metallic hooks fixed in the spines of their backs, he observed that their muscles contracted frequently and involuntarily as if from a shock of electricity. Not doubting that the contractions depended on the electric fluid, he at first suspected that they were connected with changes in the state of the atmosphere. He soon found, however, that this was not the case; and having varied, in many different ways, the circumstances in which the frogs were placed, he at length discovered that he could produce the movements at pleasure by touching the animals with two different metals, which, at the same time, touched one another either immediately or by the intervention of some other substance capable of conducting electricity.

All the experiments that have yet been made may be reduced to the following, which will give the otherwise uninformed reader a precise notion of the subject.

Lay bare about an inch of a great nerve, leading to any limb or muscle. Let that end of the bared part which is farthest from the limb be in close contact with a bit of zinc. Touch the zinc with a bit of silver, while another part of the silver touches, either the naked nerve, if not dry, or, whether it be dry or not, the limb or muscle to which it leads. Violent contractions are produced in the limb or muscle, but not in any muscle on the other side of the zinc.

Or, touch the bared nerve with a piece of zinc, and touch, with a piece of silver, either the bared nerve, or the limb; no convulsion is observed, till the zinc and silver are also made to touch each other.

4 Has engaged much scientific attention.

A fact so new, illustrated by many experiments and much ingenious reasoning, which Professor Galvani soon published, could not fail to attract the attention of physiologists all over Europe; and the result of a vast number of experiments, equally cruel and surprising, has been from time to time laid before the public by Valli, Fowler, Monro, Volta, Humboldt, and others.

Frogs, unhappily for themselves, have been found the most convenient subjects for these experiments, as they retain their muscular irritability and susceptibility of the galvanic influence very long. Many hours after they have been decapitated, or have had their brain and spinal marrow destroyed, strong convulsions can be produced in them by the application of the metals. A leg separated from the body will often continue capable of excitement for several days. Nay, very distinct movements have been produced in frogs pretty far advanced in the process of putrefaction. Different kinds of fishes, and many other animals both of cold and warm blood, have been subjected to similar experiments, and have exhibited the same phenomena; but the warm blooded animals lose their susceptibility of galvanism, as of every other stimulus, very soon after death.

5 The metals.

Almost any two metals will produce the movements; but, it is believed, the most powerful are the following, in the order in which they are here placed: 1. Zinc; 2. Tin; 3. Lead; in conjunction with, 1. Gold; 2. Silver; 3. Molybdena; 4. Steel; 5. Copper. Upon this point, however, authors are not perfectly agreed.

6 Animal and excitatory arcs.

The process by which these singular phenomena are produced, consists in effecting, by the use of the exciting apparatus, a mutual communication between any two points of contact, more or less distant from one another, in a system of nervous and muscular organs. The sphere of this mutual communication may be regarded as a complete circle, divided into two parts. That part of it which consists of the organs of the animal under the experiment, has been called *the animal arc*; that which is formed by the galvanic instruments has been called *the excitatory arc*. The latter usually consists of more pieces than one; of which some are named *stays*, *braces*, &c. others *communicators*, from their respective uses.

7 Experiments of the French Institute.

A very numerous train of experiments on galvanism has been made by a committee of the Physical and Mathematical Class of the National Institute of France; and as their report comprehends a vast number of the most important facts which are yet known on the subject, we shall present our readers with the substance of it (A).

The immense mass of matter which resulted from the experiments of the committee, is, in their report, presented, not in the order in which the experiments were made, but in a sort of classification, by means of which a more distinct knowledge of the subject is obtained at one view. The facts are arranged under these six heads. *1st*, Results of the different combinations and dispositions of the parts of the *animal arc*. *2d*, Account of what has been observed of the nature and the different dispositions of the *excitatory arc*. *3d*, Circumstances not entering into the composition of the galvanic circle, which, nevertheless, by their influence, modify, alter, or entirely prevent the success of the experiments. *4th*, Means proposed for varying, diminishing, or restoring the sensibility to galvanism. *5th*, Attempts to compare the

(A) The members of the committee were, M. M. Coulomb, Sabbatier, Pelletan, Charles, Fourcroy, Vauquelin, Guyton, *alias* Morveau, and Hallé. M. M. Venturi, De Modene, and M. Humboldt, assisted in the experiment.

the phenomena of galvaniſm with thoſe of electricity. *6th*, Additional experiments, performed by M. Humboldt, in the preſence of the members of the committee; which have a reference to ſeveral of the proofs ſtated in the foregoing articles.

8 On the animal arc.

I. To the number of twenty experiments were made on the *animal arc*. The firſt ſeven of theſe were directed to aſcertain the relations between the nerves and thoſe muſcles over which they are diſtributed. In the laſt thirteen, the nerves were cut aſunder, or ſubjected to ligatures; the ſection or ligature being always between the extremities of the arc. Nerves taken from different animals, or from different parts of the ſame animal, and joined in one and the ſame arc, were among the particular ſubjects of theſe experiments; as were alſo the ſolitary nerve, and the ſolitary muſcle, included between the extremities of the *excitatory arc*. There were interpoſed, too, in the courſe of theſe experiments, portions of nerves, and of muſcles, diſtinct from thoſe parts. And, in ſome of the experiments, the animal was without the ſkin and the epidermis.

The following are inferences which have been deduced from theſe experiments:

9 Inferences.

1. The animal arc may conſiſt either of nerves and muſcles together, or of nerves alone, without muſcles. (B).

2. Nerves are, therefore, the eſſential part of the animal arc; for the muſcles are always more or leſs interſected by the nerves; and are, conſequently, in part, a nervous organ.

3. All the parts of the animal arc muſt be either mutually continuous, or at leaſt contiguous to one another. But even contiguity is ſufficient to enable the galvanic phænomena to take place.

4. The ſection or ligature of a nerve interrupts not the galvanic phænomena, if the parts which are cut aſunder or bound up ſtill remain in cloſe contiguity to one another.

5. No diverſity of the parts forming the animal arc, though theſe be taken from different parts of the ſame animal, or even from different animals, will have power to impair its galvanic ſuſceptibility, provided only that theſe parts be ſtill mutually contiguous.

6. If the *integrity* or galvanic ſuſceptibility of the animal arc be ſuſpended by the ſeparation of any of its parts to ſome diſtance from one another, it may be reſtored by the interpoſition of ſome ſubſtances, not of an animal nature, between the divided parts. Metallic

ſubſtances

(B) We are ſtrongly inclined to doubt the truth of this propoſition. Dr Fowler was at firſt led to think that contractions could be excited in a limb without the metals having any communication with it, except through the medium of the nerve. Recollecting, however, that a very ſmall quantity of moiſture ſerves as a conductor of galvaniſm, he ſuſpected, and our opinion perfectly coincides with his, that in every caſe where contractions are produced in a limb, without any apparent communication between the metals and the muſcles, except through the medium of a nerve, the communication is in fact completed by the moiſture upon the ſurface of the nerve. In this caſe, the animal arc may be conſidered as conſiſting of three pieces, diſpoſed in the following order; the nerve, the muſcle, and the water adhering to the ſurface of the nerve. The latter, indeed, ought rather to be conſidered as a part of the excitatory arc. "When a nerve (ſays Dr Fowler,), which for ſome time has been detached from ſurrounding parts, is either carfully wiped quite dry with a piece of fine muſlin, or (leſt this ſhould be thought to injure its ſtructure) ſuffered to remain ſuſpended till its moiſture has evaporated, no contractions can be excited in the muſcles, to which it is diſtributed, by touching it alone with any two metals in contact with each other; but if it be again moiſtened with a few drops of water, contractions inſtantly take place. And, in this way, by alternately drying and moiſtening the nerve, contractions may at pleaſure be alternately ſuſpended and renewed for a conſiderable time. It may, indeed, be contended, that the moiſture ſoftened, and thus reſtored elaſticity and free expanſion to the dried cellular membrane ſurrounding the fibres, of which the trunk of a nerve is compoſed; and thus, by removing conſtraint, gave free play to their organization.

"But from obſerving, that in every other inſtance where contractions are produced by the mutual contact of the metals, a conducting ſubſtance is interpoſed between them and the muſcles as well as between them and the nerve; I think it would be unphiloſophical not to allow, that, in the inſtance in queſtion, the moiſture, adhering to the ſurface of the nerve, formed that requiſite communication between the metals and the muſcles." We know of no accurate experiment by which it has ever been ſhewn, that contractions can be produced in a limb without a communication being eſtabliſhed between the metals and nerve, and again between the muſcles and the metals, either directly, or through ſome medium capable of conducting galvaniſm.

To remove the only objection which can be made to Dr Fowler's experiment, and of which we have ſeen that he was himſelf aware, namely, that the nerve while dry is incapable of performing its functions, we repeated it in the following manner: A ſmall, but vigorous and lively, male frog was decapitated, and the ſciatic nerve being laid bare from the knee upwards, was cut through where it paſſes out of the pelvis. Fifteen minutes after the head was cut off, the nerve having been cautiouſly ſeparated from the ſurrounding parts, and coated with tinfoil in the uſual manner, a ſilver probe was applied to it and its coating, without any other communication with the muſcles, and ſtrong contractions took place in the leg. The nerve was now very carefully dried with a piece of fine linen, and the probe was applied as before to the tinfoil and the nerve; no movement whatever took place. Things remaining preciſely in this ſituation, one end of the probe being ſtill in contact with the nerve and its coating, the other end was applied to the muſcles of the thigh, and the leg immediately contracted as ſtrongly as ever. Upon moiſtening the nerve, the contractions were again produced by applying the probe to the nerve and tinfoil alone. We find from this experiment, which we have ſeveral times repeated with the utmoſt care, and with the ſame reſult, that the dry nerve retained its functions completely. This appears to us perfectly deciſive of the queſtion.

subſtances are in particular fit for this uſe. But the mutual contiguity of all the ſubſtances entering into the compoſition of the arc muſt ever be carefully preſerved. Mr Humboldt diſcovered that a bit of freſh morel'e *Helvella mitra Linn.*) will ſupply the place of a part of the nerve.

7. The muſcular organs which indicate, by contraction, the preſence of the galvanic influence, are always thoſe in which the nerves of a complete animal arc have their ultimate termination.

From this it follows, that the muſcles affected by galvaniſm are always thoſe correſponding to that extremity of the arc which is the moſt remote from the origin of the nerves of which it is compoſed.

8. When all the nerves of the animal arc originate towards one of its extremities, then only theſe muſcles which correſpond with the oppoſite extremity are ſuſceptible of galvanic convulſions.

9. When an animal arc conſiſts of more than one ſyſtem of different nerves, which have all their origin about the middle of the arc, then will the muſcles of theſe ſeveral ſyſtems of nerves be moved alike at both the extremities of the arc.

10. It ſeems likewiſe to appear, from a variety of theſe experiments, that the opinion of thoſe is inadmiſſible, who aſcribe the phænomena of galvaniſm to the concurrence of two different and reciprocally correſponding influences, one belonging to the nerve, the other to the muſcle, and who compare the relations between the nerve and the muſcle, in theſe phænomena, to thoſe between the interior and the exterior coating of the Leyden phial.

11. It appears, laſtly, that the covering of the epidermis, in the entire animal body, acts as an obſtacle to the deciſive diſplay of the effects of galvaniſm; and that, though from its extreme tenuity, it may not altogether prevent theſe effects, yet it cannot but very materially diminiſh them.

10 Experiments on the excitatory arc.

II. The *Excitatory Arc* is uſually formed of three different pieces made of different metals. Of theſe, one muſt be in contact with the nerve; the other muſt touch the muſcle; and the third muſt form the mean of communication between theſe two. This arrangement, though not indiſpenſably neceſſary, is at leaſt the moſt convenient.

In reſpect to the excitatory arc, the committee examined, 1ſt, The application of metallic ſubſtances to form it: in reſpect to which they endeavoured to aſcertain the number and the diverſity of the pieces of metal, of which this arc may be compoſed; the metallic mixtures or alloys which are capable of being employed for this uſe; the particular degree of the friction of one metal upon another, which is favourable to the exhibition of the phænomena, the different ſtates, in reſpect to galvaniſm, of metals differently mineralized. 2dly, The effects of the uſe of carbonic ſubſtances in forming the excitatory arc. 3dly, The effects in the ſame formation, of bodies, which are either non-conductors, or elſe very imperfect conductors of electricity, ſuch as jet, aſphaltus, ſulphur, amber, ſealing-wax, diamond, &c. 4thly, The conſequences of the interpoſition of water, and of ſubſtances moiſtened with water, between the different parts of the excitatory arc. In forming their excitatory arcs, too, they made themſelves the chord of the arc; they introduced into it animal ſubſtances which had loſt their vitality; they rubbed the ſupporters with the dry fingers, ſo as to mark them with nothing but the traces of the perſpiration from the ſkin. They made, likewiſe, ſome experiments for the purpoſe of aſcertaining the relations between, on the one hand, the extent and magnitude of the ſurfaces of the parts compoſing the arc, and on the other, the effects produced by its energy. From their experiments they have alſo drawn ſome inferences concerning the relative efficiencies of the ſeveral conſtituent parts of the exciting arc. It is impoſſible for us here to relate in detail all this train of experiments. The following corollaries expreſs the ſubſtance of thoſe general truths, which their authors were led to infer from them.

11 Inferences.

1. The excitatory arc poſſeſſes the greateſt power of galvaniſm, when it is compoſed of at leaſt three diſtinct pieces; each of a peculiar nature: the metals, water, and humid ſubſtances, carbonaceous matters, and animal ſubſtances, ſtripped of the epidermis, being the only materials out of which theſe pieces may be formed.

2. Nevertheleſs the excitatory arc appears to be not deſtitute of exciting energy, even when it conſiſts but of one piece or of ſeveral pieces, all of one proper ſubſtance (c). In general it muſt be owned, identity of nature in the conſtituent pieces, and particularly in the ſupports

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(c) We do not think it has ever been proved, that one piece of metal, or ſeveral pieces of the ſame metal, are capable of forming the excitatory arc. It is admitted on all hands, that the ſlighteſt alloy communicates galvanic energy to a piece of metal; that is, renders it capable of forming the excitatory arc. It is alſo known, that metallic oxyds are much leſs perfect conductors of galvaniſm than their correſponding reguli, to make uſe of an antiquated expreſſion. It appears to us, that in all caſes where one metal appears to act, more eſpecially where friction with the fingers, or breathing on a piece of metal formerly inert, give it galvanic powers; in all theſe caſes, we think it probable that a ſlight degree of oxydation, produced in ſome part of the ſurface of the metal, gives it activity by deſtroying the homogeneity of its nature. We do not find that this circumſtance has been in general ſufficiently attended to. Dr Wells having diſcovered that charcoal acts powerfully as an exciter when applied along with a metal, found that by friction it alſo can be rendered capable of acting ſingly. What change is thus produced in it we can only conjecture; but that it is ſomething which deſtroys the identity of its ſtructure, rendering it in ſome meaſure a heterogeneous ſubſtance, muſt be admitted.

Candour forces us to acknowledge, that in one of M. Humboldt's experiments, it ſeems very difficult to point out any want of homogeneity in the exciting arc. He put into a china cup ſome mercury exactly purified; he placed the whole near a warm ſtove, in order that the entire maſs might aſſume an equal temperature: the ſurface was clear, without the appearance of oxydation, humidity, or duſt. A thigh of a frog, prepared in ſuch a manner supports forming the extremities of the arc, diminishes, in a very sensible manner, its galvanic energy.

3. The slightest difference of nature induced upon the parts, whether by any feeble alloy, or by friction with extraneous substances, is at any time sufficient to communicate to the excitatory arc that full power in which the identity of its composition may have made it defective.

4. As the animal arc is susceptible of being in part made up of metallic substances, or such others as are adapted to enter into the composition of the excitatory arc; so, on the other hand, the excitatory arc admits of being in part formed of these substances which are the proper components of the animal arc.

5. The energies of both the excitatory and the animal arcs are alike suspended by the separation of their component parts, or at least by the separation of these parts to a certain distance.

6. Even the smallest degree of moisture is sufficient to join the parts of the excitatory arc, and to determine their effects upon the animal arc.

7. The influence of the state of the atmosphere, and of surrounding circumstances, upon the success of the experiments of galvanism, is, consequently, very great. In order, therefore, to perform these experiments with due accuracy, the state of the hygrometer, and of other meteorological instruments, must be vigilantly inspected during their progress; and the influence of the persons making the experiment upon the sphere within which it is made, must likewise be carefully attended to.

8. The experiments which were made to ascertain the nature of the animal arc, together with those made upon the excitatory arc, with a view to the comparison of the effects of the flesh of animals, with or without the epidermis, and of the different effects of this epidermis, when it is wet, and when it is dry, appear to suggest to us, that the epidermis is one of those substances which diminish or interrupt the efficacy of the excitatory arc. The epidermis is, as well as the hairs and bristles of animal bodies, among the number of those substances which deserve the appellation of *idioelectrics*.

9. Examine the substances which are fit for the formation of the excitatory arc, and you will find that the greater part of those which have been successfully put to this use are substances capable of acting as conductors of the electrical fluid; but that the substances which interrupt the operation of galvanism are generally such as are well known also to resist the transmission of electricity.

10. Lastly, it appears, that the galvanic energy depends, not only upon the nature and arrangement of the component parts of the excitatory arc, but on their extent too, and on the magnitudes of their transmitting surfaces.

12 Experiments relating to circumstances different from the arcs.

III. The committee appear to have used no less care and discernment in experiments upon those circumstances which, though different from the structure of the galvanic circle and its two constituent arcs, have, however, *a decisive influence upon the exhibition of the phænomena of galvanism*. Some curious observations were made on the differences in the state of the parts exposed to the galvanic action. It was ascertained, that frogs fresh from the ditches did by no means exhibit the same phænomena as those which had been during some days preserved in the house; nor did the limbs of animals, when recently stripped of the skin, present the same appearances as after they had been subjected to a variety of galvanic experiments; nor were the same effects to be produced upon the parts of animal bodies which, after a certain number of trials, had been left for a while at rest, and then taken up again, as upon those which had been subjected to one continued train of experiments. The committee next examined the variations in the success of the experiments upon a strong lively frog, which may be produced by varying the mode in which the *communicator* is carried from the one *supporter* to the other: when the communicator is brought into contact with the supporter, or is withdrawn from actual contact with it; when the *communicator* is brought slowly, or when it is brought rapidly, into contact with the *supporter*; the effects are nearly the same: and a smart convulsion is, in all these cases produced at the moment of the commencement of the mutual contact, or of its cessation. But when the frog is fatigued, the effects are different. These successive experiments likewise affect the results of one another, by means even of their succession solely. And they are also naturally subject to be influenced by the nature of the media amidst which they are performed; such as common air, water, an electrical atmosphere. The following are the inferences which have been deduced from this class of these experiments.

13 Inferences.

1. In many cases the galvanic energy is excited by exercise, is exhausted by continued motion, is renovated by rest.

2. The multiplicity of the causes by which the experiments of galvanism are liable to be influenced to success or failure, is so great, that we cannot, as yet, be too cautious in either rejecting or believing these accounts which we hear of the success of any such experiments; unless when we are able accurately to appreciate all the influencing circumstances.

3. This is remarkably confirmed by a fact, which the committee have related in their paper, and which respects the continuation of the galvanic spasm.

The communicator being supported by the hand, and resting, seemingly, without change of position, still upon

a manner that a crural nerve and a bundle of muscular fibres of the same length hung down separately, was suspended by two silken threads above the mercury. When the nerve alone touched the surface of the metal, no irritation was manifested; but as soon as the muscular bundle and the nerve touched the mercury together, they fell into convulsions so brisk, that the skin was extended as in an attack of tetanus. This is by far the most decisive experiment which has been tried on the same side of the question; but as it must be admitted, that in most cases two metals are absolutely necessary, and that a single metal often derives activity from circumstances so slight, that we could not *a priori* have expected that they were capable of producing any change: we feel ourselves compelled to conclude, that in M. Humboldt's experiment some similar very slight circumstance had escaped unobserved; perhaps some gilding, or ornaments with metallic colours, in a state of oxydation.

upon the same point of contact, there is known to take place a real change in the galvanic contact, although the communicator have remained thus apparently motionless.

From this, it may be farther inferred, that the smallest possible change in the relative situations of the parts of the galvanic circle and the excitatory arc, is capable of producing an effect upon the susceptible animal, and of occasioning mistakes in regard to the success of the experiment, if the utmost care be not taken to notice and estimate every variation that can happen.

4. The truth of the foregoing proposition is farther confirmed by the experiments upon the manner in which the galvanic movements are affected by the advancing or the withdrawing of the communicator. For these experiments fully evince the necessity for the most vigilant observation of every movement in the process of an experiment, not only collectively, but in their succession, and at the different periods of the operation.

5. It should seem that there are, in the formation of the excitatory arc, independently of its modes of acting in the galvanic operations, certain enervating, and certain exciting dispositions; of which some not only augment or diminish the energy in the present instance, but, besides, dispose the animal to a greater or a smaller susceptibility, under subsequent experiments.

6. In order to accuracy of experiment, and to the correct ascertaining of the effects of an experiment, it is of great importance to know the precise state of the animal, the manner in which it has been preserved and sustained to the present moment, the state of the atmosphere, particularly as it is indicated by the hygrometer, by the barometer, the thermometer, and the electrometer.

7. It were to be wished, that in making a statement of experiments of different sorts, these should be arranged in the order of their efficacy, and that there might thus be formed a *galvanic scale*, which should help us to determine the precise degree of the galvanic susceptibility of any animal in this or that particular state or position, should direct us in subjecting every such animal only to experiments suitable to its particular susceptibility; should enable us to estimate, from the *efficacy* or *inefficacy* of our experiments, the galvanic value of the circumstances in which we every day find ourselves, and should enable us to judge when the success or miscarriage of an experiment can afford room for certain conclusions absolutely negative or affirmative.

14 Experiments on the galvanic susceptibility of animal bodies, &c.

IV. In their experiments upon *the means of varying, diminishing, and removing the susceptibility of animal bodies* to the influence of galvanism, the committee examined, 1st, the influence of electricity upon that susceptibility; 2d, the effects of the muscular organs, and of certain liquors, such as alcohol, the oxygenated muriatic acid, the solutions of potash and opium, upon the galvanic properties; 3d, and at the medical school of Paris they made a number of experiments, in order to ascertain what new modifications the galvanic energy undergoes in various cases of suffocation or asphyxia. These last-mentioned experiments were made upon hot-blooded animals, of which some were reduced into the state of asphyxia by submersion, some by strangulation, some by the action of gases, while others were killed *in vacuo* by the discharge of the electric spark. In that suffocation which was produced by sulphurated hydrogenous gas, by carbonic vapours, and by submersion, in which the animal was suspended by the hinder feet, the galvanic susceptibility was entirely destroyed. The galvanic susceptibility was only suspended by suffocation produced by the pure carbonic acid confined under mercury. It was diminished, but not destroyed, in those cases of suffocation, which were occasioned by sulphurated hydrogenous gas that had lost a portion of its sulphur by gas ammoniac, gas azote, or such gases as had been exhausted of their pure air by respiration; and the same thing was found to take place in animals which had perished by total submersion. But the galvanic susceptibility survived unaltered in suffocations brought on by submersion in mercury, by pure hydrogenous gas, by carbonated hydrogenous gas, by oxygenated muriatic acid, by sulphureous acid; as also when the suffocation was occasioned by strangulation, by the abstraction of the air in the air-pump, or by discharges from an electrical battery. The results of the experiments at the medical school suggested the following reflections:

15 Reflections

1. Though it be true that all cases of suffocation resemble one another in the privation of respirable air, and in the suspension of the functions of respiration, and of the circulation of the blood; yet, in their other circumstances, they are subject to great differences, arising from diversity of nature in the substances by which they are occasioned.

2. Of these causes, some appear to act with a more thorough efficacy, penetrating at once all parts of the nervous and muscular systems. Others again seem to act but superficially, producing only pulmonary asphyxia, with its immediate effects.

3. One of the most remarkable changes not confined to the organs of respiration, consists in the alterations produced on the galvanic susceptibility. In that respect the various cases of asphyxia differ greatly one from another.

4. The state of the irritability of the muscles, when examined by means of bodies, the mechanical action of which causes the muscles to contract by irritating them, is far from always corresponding to the state of their galvanic susceptibility.

5. Lastly, the causes of suffocation or asphyxia, do not act upon all parts of the muscular system in the same manner; but the heart is very often found in a state extremely different from that of the other muscles.

16 Comparison of the phenomena of galvanism with those of electricity.

V. *The comparison between the phænomena of galvanism and those of electricity* is perhaps one of the most interesting objects of attention in the whole body of animal physiology. It is well known that Galvani was accidentally led to his discovery by observing the motions of some frogs, at a certain distance from an electrical machine discharging sparks. The committee from the institute made, therefore, some attempts to ascertain the relations between electricity and galvanism. Having first paid due attention to the susceptibility of animals toward the influence of electricity, they then sought to discover to what precise degree animals divested of the natural covering of the epidermis were liable to be affected by the variations of the electrical fluid in the atmosphere around them. Next, comparing the susceptibility of electricity with the susceptibility of of galvaniſm, they perceived that quantities of the electrical fluid, ſuch as are ſtill capable of being very accurately meaſured by the electrometer, are, however, often too weak to act upon a frog that retains the moſt perfect ſenſibility to all the energy of galvaniſm. The members of the committee purpoſe to proſecute farther their experiments upon this part of the ſubject.

17 Reſults of ſome experiments by Humboldt.

VI. The following are the general reſults of the experiments made by M. Humboldt in the preſence of the committee:

1. There is no truth in the aſſertion of certain phyſiologiſts, that the experiments of galvaniſm fail when tried upon the heart and thoſe other muſcles of which the contractions depend not upon volition; for theſe organs have been found to be actually ſubject to the influence of galvaniſm (D).

2. The effects of galvaniſm are liable to be interrupted by the conſtriction of a nerve, whenever both the nerve and the conſtricting ligature are enveloped in the fleſh of the animal body (E).

3. The powers of the exciting arc may be renovated or deſtroyed, even though its ſupporters remain the ſame, and although the extremities of the arc be unchanged. Only the relations of the intermediate matters require to be altered.

4. There are atmoſpheres of galvaniſm.

5. There are ſubſtances which, though in an eminent manner conductors of electricity, yet interrupt the motions of galvaniſm.

M. Humboldt had performed alſo other experiments, which, when he attempted to repeat them before the committee, could not be brought to ſucceed, on account, as was ſuppoſed, of the ſeaſon of the year.

Such are the principal reſults of this valuable train of experiments upon galvaniſm. From them, our readers will perceive that this intereſting ſubject is ſtill very imperfectly underſtood, and will form ſome idea of the importance of the diſcoveries which a diligent proſecution of it promiſes to the philoſopher and the phyſician.

18 Effects of galvaniſm upon ſome of the organs of ſenſe.

The effects of galvaniſm upon ſome of the organs of ſenſe are no leſs ſtriking than thoſe which we have ſeen it capable of producing upon the muſcles.

If the upper and under ſurfaces of the tongue be coated with two different metals, and theſe be brought into contact with each other, a peculiar ſenſation, reſembling taſte, is produced in the tongue the moment that the metals touch each other. With the greater number of metals this ſenſation is ſcarcely perceptible; but with zinc and gold, zinc and ſilver, or zinc and molybdena, it is very ſtrong and diſagreeable. Dr Fowler thinks it is ſtrongeſt with zinc and gold; to us it appears a good deal ſtronger with zinc and ſilver. It is ſenſibly ſtronger when the zinc is applied to the upper, and the ſilver to the under ſurface of the tongue, than when this order is inverted. The ſenſation is moſt diſtinct when the tongue is of the ordinary temperature, and the metals of the ſame temperature with the tongue, Any conſiderable increaſe or diminution of heat in either greatly leſſens the effect. Mr Sulzer of Berlin, in his *Theorie des Plaiſirs*, p. 155 (publiſhed in 1767), takes notice of the diſagreeable taſte produced by ſilver and lead in contact upon the tongue. This is the firſt inſtance of galvaniſm that has been made public.

To enſure complete ſucceſs to the experiment, the metals ought to be allowed to remain ſome time in contact with the tongue before they are made to touch each other, that the taſte of the metals themſelves may not be confounded with the ſenſation produced by their mere contact. Whatever has a tendency to blunt the ſenſibility of the tongue, as opium, alcohol, acids, and the like, diminiſhes the effect of the metals.

It is difficult to deſcribe the ſenſation thus produced accurately. It has been called *ſubacid*; but we think it more nearly reſembles the effect produced by allowing a grain or two of nitre to lie upon the tongue for ſome time, than any other taſte with which we are acquainted. Joined to this, there is evidently a metallic taſte, which varies with the metal employed; but we are inclined to conſider this as the ordinary effect of the metals upon the tongue, which cannot be perfectly diſtinguiſhed from that occaſioned by their mutual contact.

This taſte can alſo be produced by applying one of the metals to the tongue, and the other to any part of the Schneiderian membrane. Profeſſor Robiſon has made many experiments of this kind, the reſult of which is contained in a letter to Dr Fowler. "I find (ſays he), that if a piece of zinc be applied to the tongue, and be in contact with a piece of ſilver which touches any part of the lining of the mouth, noſtrils, ear, urethra, or anus, the ſenſation reſembling taſte is felt on the tongue. If the experiment be inverted, by applying the ſilver to the tongue, the irritation produced by the zinc is not ſenſible, except in the mouth and the urethra, and is very ſlight. I find the irritation by the zinc ſtrongeſt when the contact is very ſlight, and confined to a narrow ſpace, and when the contact of the ſilver is very extenſive, as when the tongue is applied to the cavity of a ſilver ſpoon. When the zinc touches in an extenſive ſurface, the irritation produced by a narrow contact of the ſilver is very diſtinct, eſpecially on the upper ſide of the tongue, and along its margin. This irritation ſeems to be mere pungency, without any reſemblance to taſte, and it leaves a laſting impreſſion like that made by cauſtic alkali.

"When a rod of zinc, and one of ſilver, are applied to the root of the mouth, as far back as poſſible, the irritations produced by bringing their outer ends into contact are very ſtrong, and that by the zinc reſembles taſte in the ſame manner as when applied to the tongue."

M. Volta found, that when a tin cup, filled with an alkaline liquor, is held in one or both hands previouſly moiſtened with water, if the point of the tongue is dipped in the liquor, an acid taſte is perceived. This is at firſt diſtinct and pretty ſtrong, but gradually yields to the alkaline taſte of the liquor. The acid taſte is ſtill more remarkable, when, inſtead of an alkaline liquor, an inſipid mucilage is made uſe of. The ſame philoſopher found, that when a cup made of tin, or what is better, of zinc, was filled with water, and placed upon a ſilver ſupport, if the point of the tongue was applied to the water, it was found quite inſipid, till he laid hold of the ſilver ſupport, with the hand well

(D) This was demonſtrated ſix years ago by Dr Fowler.

(E) Dr Valli made this obſervation ſoon after the diſcovery of galvaniſm.

well moistened, when a very distinct and very strong acid taste was immediately perceived.

If one of the metals be applied to the tongue, and the other to the ball of the eye, a pale luminous flash is perceived when they are brought into contact with each other, and the sensation resembling taste is at the same time produced in the tongue. A flash is, in like manner, produced when one of the metals is applied to the eye, and the other to any part of the palate, fauces, or inside of the cheek. This experiment requires a good deal of attention in the performance; care must be taken not to press the piece of metal against the ball of the eye, lest a flash should be produced by the mere mechanical pressure. It should be cautiously introduced between the eye-lids, till it just touch any part of the ball; and it should be allowed to remain in that situation for some time before it is brought into contact with the other piece of metal, that the parts may be so far accustomed to it as to admit of the sensations produced being properly attended to. The experiment succeeds very well with tin and silver; but the flash is more bright when zinc and gold are used. The piece of metal which is applied to the ball of the eye must be finely polished, otherwise the mechanical irritation is sometimes so great as to prevent the flash from being perceived. Dr Robison has observed, that the brightness of the flash corresponds with the extent of contact of the metal with the tongue, palate, fauces, or cheek.

If a piece of one of the metals be placed as high up as possible between the gums and the upper lip, and the other in a similar situation with respect to the under lip, a very vivid flash of light is observed at the moment that they are brought into contact, and another at the instant of their separation. While they remain in contact, no flash is observed.

When a rod of silver is thrust as far as possible up one of the nostrils, and then brought into contact with a piece of zinc placed upon the tongue, a very strong flash of light is produced in the corresponding eye at the instant of contact. We have sometimes imagined, that the flash in this experiment was produced before the metals actually touched; but in this we may have been deceived.

The following curious experiment was first made by Professor Robison: "Put a plate of zinc into one cheek, and a plate of silver (a crown piece) into the other, at a little distance from each other. Apply the cheeks to them as extensively as possible. Thrust in a rod of zinc between the zinc and the cheek, and a rod of silver between the silver and the other cheek. Bring their outer ends slowly into contact, and a smart convulsive twitch will be felt in the parts of the gums situated between them, accompanied by bright flashes in the eyes. And these will be distinctly perceived before contact, and a second time on separating the ends of the rods, or when they have again attained what may be called *the striking distance*. If the rods be alternated, no effect whatever is produced."—The flashes produced in this last experiment are rather more vivid than any which we have been able to excite by the other methods. The convulsive twitches are very distinct, and somewhat painful, but quite different from the sensation produced by an electric shock. If the edges of the tongue be allowed to touch the plates of metal in the cheeks, the sensation resembling taste is felt very strongly; but this does not in the least impair the other effects of the experiment.

No method has yet, we believe, been discovered of applying the galvanic influence so as to affect the senses of smelling or hearing. We have tried many experiments with this view, chiefly on the organs of smelling, but hitherto without any success (F). Neither has the sense of touch been affected by it, unless, indeed, the following experiment be considered in that view: Let a small portion of the cuticle be removed from any part of the body by a sharp knife, and carry the incision to such a depth that the blood shall just begin to ooze from the cutis vera. Let a piece of zinc be applied here, and a piece of silver to the tongue; when they are brought into contact, a very smart irritation will be felt at the wound.

Some very singular facts of this kind have been discovered by M. Humboldt, who had the resolution to make himself the subject of many well-devised experiments. One of the most remarkable of these is the following: He caused two blistering plasters to be applied on the deltoid muscle of both his own shoulders. When the left blister was opened, a liquor flowed out, which left no other appearance on the skin than a slight varnish, which disappeared by washing. The wound was afterwards left to dry up: this precaution was necessary, in order that the acrid humour which the galvanic irritation would produce, might not be attributed to the idiosyncrisis of the vessels. This painful operation was scarcely commenced on the wound, by the application of zinc and silver, before the serous humour was discharged in abundance; its colour became visibly dark in a few seconds, and left on the parts of the skin where it passed traces of a brown inflamed red. This humour having descended towards the pit of the stomach, and stopped there, caused a redness of more than an inch in surface. The humour, when traced along the epidermis, left stains, which, after having been washed, appeared of a bluish red. The inflamed places, having been imprudently washed with cold water, increased so much in colour and extent, that M. Humboldt, as well as his physician, Dr Schalleru, who assisted at these experiments, entertained some apprehension for the consequences.

Having now taken notice of the principal facts that are hitherto known in galvanism, we proceed to consider some of the leading opinions on the subject.

19 Phenomena of galvanism supposed to result from electricity;

The first writers upon the discovery of Galvani seem almost universally to have taken it for granted, that the phenomena

(F) Professor Robison has long ago observed, that the flavour of a pinch of snuff taken from a box made of tin-plate, which has been long in use, so that the tin coating is removed in many places, is extremely different from that of snuff when taken from a new box, or a box lined with tinfoil. The same difference is observed when we rub a piece of pure tin, or of pure iron and a half worn tinned plate, with the finger. Also, if we rub a cast-steel razor, and a common table knife consisting of iron and steel welded together. This is surely owing to a cause of the same kind.

phenomena depend on the electric fluid; and leaving this very important queſtion behind them, proceeded to explain how this fluid produces ſuch effects. The celebrated diſcoverer of this influence himſelf conſiders a muſcle as the perfect prototype of a Leyden phial. When a muſcle contracts, upon a connection being formed, by means of one or more metals between its external ſurface and the nerve which penetrates it, M. Galvani contends, that, previouſly to this effect, the inner and outer parts of the muſcle contain different quantities of the electric fluid; that the nerve is conſequently in the ſame ſtate, with reſpect to that fluid, as the internal ſubſtance of the muſcle; and that, upon the application of one or more metals between its outer ſurface and the nerve, an electrical diſcharge takes place, which is the cauſe of the contraction of the muſcle. Thus the nerve is ſuppoſed to perform the office of the wire connected with the internal ſurface of the phial; and the excitatory arc is conſidered merely as a conductor.

This theory appears to us juſt as incapable of explaining the phenomena of galvaniſm as it is inconſiſtent with the known laws which regulate the motions of the electric fluid. We ſhall not conſider it minutely; for we hope it will ſoon appear highly probable, if not certain, that the electric fluid has no ſhare in the production of the phenomena in queſtion. If this be the caſe, all the different modifications of that theory muſt of courſe fall to the ground. At preſent we ſhall content ourſelves with aſking the following queſtions:

20 This ſuppoſition ill founded.

1. How is it poſſible for the electric fluid to be condenſed in a muſcle, which is wholly ſurrounded by ſubſtances capable of conducting that fluid?

2. If we ſuppoſe there is ſome non-deſcript non-conducting ſubſtance placed between the external and internal parts of a muſcle, which may admit of the one being poſitively, and the other negatively electrified at the ſame time; how comes it to paſs that a diſcharge does not take place, and a conſequent contraction enſue, when any ſubſtance whatever, capable of conducting the electric fluid, is interpoſed between the nerve and the external ſurface of the muſcle? For example, when the nerve and muſcle are laid bare, and the animal thrown into water; or when the nerve is cut through, and the end applied to the external ſurface of the muſcles.

3. How does it happen, when one diſcharge actually takes place, in conſequence of the application of the excitatory arc, that the balance is not inſtantly reſtored? That this does not happen, appears by the ſame muſcle and nerve being capable of producing many hundreds of ſimilar, and equally ſtrong diſcharges, without any apparent means of the equilibrium being again diſturbed.

We have never ſeen any anſwers to theſe queſtions which appeared to us at all ſatisfactory; and till we have ſeen them anſwered, we muſt be excuſed for diſbelieving M. Galvani's theory.

One of the earlieſt writers, and one of the moſt aſſiduous inveſtigators of the phenomena of galvaniſm, is Dr Valli. He differs in opinion from Galvani upon ſeveral points; but agrees with him in thinking electricity and galvaniſm the ſame. Let us conſider the proofs by which he ſupports this doctrine.

"I have aſſerted (ſays he) that the nervous fluid is the ſame with electricity, and with good reaſon; for

"Subſtances which conduct electricity are conductors likewiſe of the nervous fluid. 21 Proofs by which Valli endeavours to ſupport it,

"Subſtances which are not conductors of electricity do not conduct the nervous fluid.

"Non-conducting bodies, which acquire by heat the property of conducting electricity, preſerve it likewiſe for the nervous fluid.

"Cold, at a certain degree, renders water a non-conductor of electricity, as well as of the nervous fluid.

"The velocity of the nervous fluid is, as far as we can calculate, the ſame with that of electricity.

"The obſtacles which the nerves, under certain circumſtances oppoſe to electricity, they preſent likewiſe to the nervous fluid.

"Attraction is a property of the electric fluid, and this attraction has been diſcovered in the nervous fluid.

"We here ſee the greateſt analogy between theſe fluids; nay, I may even add, the characters of their identity."

That there is a conſiderable analogy between ſome of the effects of the electric fluid and ſome of the phenomena of galvaniſm, we readily admit; but that "the characters of their identity" are any where to be found, we abſolutely deny. In the above paſſage, Dr Valli conſiders it as certain, that the nervous fluid is the cauſe of the phenomena diſcovered by Galvani. But it has never been demonſtrated irrefragably, that any ſuch thing as a nervous fluid exiſts, and ſtill leſs that this is the ſame with the influence diſcovered by Galvani.

That bodies are, in general, conductors or non-conductors of galvaniſm, according as they are conductors or non-conductors of electricity, we believe to be true: but this rule is by no means without exception, as it certainly would be, if galvaniſm and electricity were the ſame. There is an experiment of Dr Fowler's, which ſeems to ſhew, that water is a more powerful conductor of galvaniſm than mercury; though the reverſe is generally allowed as to electricity. 22 Inconcluſive and

If the abdomen of a frog be filled with water, and a ſilver probe paſſed through it ſo as to touch the ſciatic nerves, no contractions are produced; neither do they appear when the probe is touched above the ſurface of the water with a piece of zinc. But if the zinc be applied to the probe at the ſurface of the water, contractions are produced as vigorous as if both the metals touched the nerve. Here the water ſerves as a conducting medium between the nerves and the point where the metals touch each other: but if the abdomen be filled with mercury inſtead of water, no contractions are produced by applying the ſilver probe to the nerves, and touching the probe with the zinc at the ſurface of the mercury. We do not ſee how this experiment can be accounted for, except by allowing that water is a more powerful conductor of galvaniſm than mercury.

If this experiment ſhould be thought inconcluſive, we have the authority of M. Humboldt, and of the committee of the National Inſtitute of France, for ſaying, that there are ſubſtances which, though in an eminent manner conductors of electricity, yet interrupt the motions of galvaniſm. This is certainly ſufficient to take away all weight from Dr Valli's two firſt reaſons for conſidering theſe two fluids as the ſame, viz. that all conductors of electricity are likewiſe conductors of galvaniſm; and that all bodies which do not conduct the former are alſo non conductors of the latter. Theſe two are by far the most important of his reasons; and if they were true in their full extent, they would certainly shew a very striking analogy, though they would by no means deserve the appellation of "characters of identity."

As to the Doctor's two next propositions, which regard the effects of heat and cold in rendering bodies conductors or non-conductors, they are, in fact, only branches of the two first; and as we have seen that these are not universally true, we might admit that they are correct in this particular without weakening our argument. For this reason we shall not consider them minutely; but we may observe that Dr Fowler's experiments shew, that boiling water, and water cooled down to the freezing point, both conduct this influence as well as water at the ordinary temperature of the atmosphere. If any change in the conducting power takes place beyond these points, it may with greater probability be ascribed to the changes of form which the water undergoes than to the increase or diminution of its temperature.

We confess ourselves perfectly ignorant of any data upon which Dr Valli could found a calculation, the result of which could shew that the velocity of the nervous fluid is the same with that of electricity. Suppose we should take it into our heads to assert that the velocity of galvanism is the same with that of light, we apprehend our author could not easily demonstrate the contrary. Neither, in all probability, would he consider this assertion of ours as a sufficient proof that galvanism and light are the same.

With regard to the next proposition, that "the obstacles which the nerves, under certain circumstances, oppose to electricity, they present likewise to the nervous fluid;" we may remark, that any obstacle which destroys the functions of a nerve completely, will prevent the muscles which are supplied by that nerve from contracting upon the application of any stimulus whatever (G). It does not, however, by any means follow, that the passage of either the galvanic or the electric fluid is prevented. The nerves may still be very good conductors of both, though the muscle is deprived of all power of contracting. That there are obstacles, however, which the nerves, under certain circumstances, present to the passage of electricity, but which they do not under the same circumstances present to galvanism, we think abundantly demonstrated by Dr Valli's own experiments.

23 Inconsistent with his own experiments,

"I have frequently observed (says he) that the legs, of which the nerves had been tied at a certain distance from the muscles, did not feel the action of a certain quantity of artificial electricity, although they were violently convulsed by exciting that which was inherent and peculiar to them." What then was the cause of the difference observed in these cases between the effects of galvanism and electricity? Was it, that the quantity or degree of the former exceeded that of the latter? Be it so.

Dr Valli informs us, that in his experiments, an electric charge which could flash through a thickness of air equal to .035 of an inch, produced no movement in the leg of a frog of which the crural nerve was tied, while the other leg, of which the nerve was left free, underwent considerable movements.

That the influence discovered by Galvani can pass through an exceeding thin plate of air, is certain, as it is transmitted from link to link of a chain, where no considerable force is used to bring the links into contact. Dr Robison's experiment, too, in which the flashes of light are distinctly observed before the rods of silver and zinc touch each other, is another proof of the same fact; and, if we be not deceived, the same thing takes place when a rod of silver thrust up the nostril is applied to a piece of zinc in contact with the tongue. But that it will only pass through an exceeding thin plate of air, any man may convince himself by an experiment, first tried by Dr Fowler, which is easily repeated. If a stick of sealing-wax be coated with tinfoil, it will be found a very good conductor; but if, with a sharp pen knife, an almost imperceptible division be made across the tinfoil, even this interruption of continuity in the conductor will be found sufficient effectually to bar the passage of galvanism.

We find, then, that a quantity of the electric fluid which can pass through a plate of air of the thickness of .035 of an inch, is obstructed by a ligature upon a nerve, while the galvanic influence passes readily along a nerve included in a ligature, but is obstructed completely by making an almost imperceptible division in a good conductor. The plate of air in this case surely is not near .035 of an inch in thickness. It results incontestibly, from a comparison of these two experiments, that there is, between these two agents, some other difference besides the mere degree of intensity.

We come now to the last reason which our author assigns for his belief that galvanism, or, as he chooses to call it, the *nervous fluid*, is the same with electricity. It will be found a very important one. That property by which bodies charged with the electric fluid attract or repel other bodies, according as they are in the same or the opposite state of electricity from themselves, is so striking, and at the same time so universal, that it has been very properly adopted as the measure of this fluid. If it were true, then, that the galvanic influence possessed the same properties of attraction and repulsion as the electric fluid, this circumstance would certainly increase the analogy between them very much. As we have already seen, however, that they differ in other essential points, even if it were true that they agreed in this, it could constitute no proof of their identity. But if, on the other hand, we should find, that this assertion of our author is founded on error, and that the galvanic influence possesses in no degree whatever those properties of attraction and repulsion which have always been justly considered as essential characteristics of the electric fluid, we shall then be fully justified in asserting, that these two agents, however much they may resemble each other in some less important particulars, are in their nature totally distinct and unconnected.

Let

(G) We do not here mean that contraction which muscles are susceptible of long after death, upon having their fibres mechanically irritated, which is produced by what physiologists have called the *vis insita*, and which is perfectly known to our cooks, as it was to their predecessors in the Roman kitchens, as the foundation of the art of crimping. We at present confine ourselves to contraction produced through the medium of the nerves.

24 And with the knowledge of electricity. Let us examine the proofs by which Dr Valli's assertion is supported. He tells us, that he observed the hairs of a mouse, attached to the nerves of frogs, by the tinfoil with which he surrounded them, alternately attracted and repelled by each other, whenever another metal was so applied as to excite contractions in the frogs. We are very far from meaning to insinuate that Dr Valli did not see, or think he saw, what he thus describes; but that the motion of the hairs must have arisen from some cause, different from that to which he ascribed it, cannot admit of a doubt; for hairs, in such a state of electricity as he supposes, never attract, but always repel each other.

Dr Fowler, who has paid particular attention to this part of his subject, has many times repeated this experiment, both in the manner described by Dr Valli and with every variation in the disposition of the hairs which he could devise: but whether they were placed on the metals, the nerves, or the muscles, or upon all at the same time, he has never in any instance been able to observe them agitated in the slightest degree. He has made similar experiments upon a dog, and upon a large and lively skate, by disposing, in the same way that Valli did the hairs of a mouse, flakes of the finest flax, swan-down, and gold leaf: but although the contractions produced in the skate, by the contact of the metals, were so strong as to make the animal bound from the table, not the least appearance of electricity was indicated. He next suspended from a stick of glass, fixed in the cieling of a close room, some threads, five feet in length, of the flax used in the former experiment; and brought some frogs recently killed, and insulated upon glass, as near to them as possible without touching: but the threads were in no wise affected by the contractions produced in the frogs.

25 Reasoning of Dr Wells on the same subject, In a very ingenious paper upon galvanism by Dr Wells, which is published in the London Philosophical Transactions for 1795, that gentleman maintains the opinion, that the influence discovered by Galvani is electrical. He admits, that it is not attended with those appearances of attraction and repulsion which are held to be the tests of the presence of electricity; but he contends, that "neither ought signs of attraction and repulsion to be in this case presented on the supposition that the influence is electrical; since it is necessary, for the exhibition of such appearances, that bodies, after becoming electrical, should remain so during some sensible portion of time; it being well known, for example, that the passage of the charge of a Leyden phial, from one of its surfaces to the other, does not affect the most delicate electrometer, suspended from a wire, or other substance, which forms the communication between them."

26 Inconclusive likewise. That the charge of a Leyden phial does not, in passing along a wire, affect an electrometer, is certain; and it is equally true, that we have no means of applying an electrometer to a quantity of galvanism in a state of rest in a body. If this influence ever exists in such a state, we have no test by which we can discover its presence; and it is only from the effects which it produces *in transitu* that we know of its existence. But the electric fluid, in passing from link to link of a chain, sensibly affects an electrometer; and in Dr Fowler's experiment with the skate, for example, as more than one piece of metal is employed as an exciter, the fluid, in passing from one piece to another, should have affected the light substances which were placed upon them. This appears to us a sufficient answer to the objection started by Dr Wells: but the same objection having been lately made to us by a gentleman from whom we shall always receive every suggestion with uncommon deference, we thought it worth while to try the following experiment:

Three hours after a frog had been decapitated, it shewed strong signs of galvanic susceptibility. One of the sciatic nerves being coated with tinfoil in the usual manner, the leg was laid upon a plate of zinc. A gentleman was desired to lay hold of the nerve and its coating with the fingers of one hand, which had been previously dipped in water, while with the other hand, also wet, he held the end of a small brass chain about two inches in length. Another gentleman now took hold of the other end of the chain, and with a silver probe, held in his other hand, touched the plate of zinc. The influence being thus made to pass through the chain, the leg contracted vigorously; but a very sensible electrometer, held so near to the chain as almost to touch it, was neither attracted nor repelled. In performing this experiment, it was necessary to have the hands wet, as the dry cuticle tends much to obstruct the passage of galvanism; but the utmost care was taken that the chain should be perfectly dry, otherwise the influence might have been transmitted by the moisture upon its surface without passing through the chain itself.

To avoid the possibility of this happening, the experiment was varied in the following manner: The frog's leg was laid upon a plate of zinc, and the nerve upon a plate of silver. A gentleman now took a silver probe, and one end of the brass chain in contact with it, in one hand; and in the other hand he held the other end of the chain in contact with a rod of zinc. He now touched the silver plate with the rod of silver, and the zinc plate with the rod of zinc. As the influence was not now to be made to pass through his body, there was no necessity for his hands being wet; the whole excitatory arc was therefore made completely dry. In this way very strong contractions were excited in the leg, and still the electrometer was not affected in the smallest degree when brought near the chain.

It is proper to observe, that Dr Valli, in his assertion that attraction is a property of galvanism, does not rest entirely upon his own observation; a committee of the Academy of Sciences at Paris performed the following experiment along with him: "They placed a prepared frog in a vessel which contained the electrometer of M. Coulomb, charged negatively and positively by turns. In both cases, in exciting the animal in the common way, the ball of the electrometer was attracted." It appears to us that Dr Valli and the committee have been deceived, by the friction produced by the motion of the animals under their experiments having excited so much electricity as to affect the electrometer. The first time we tried the experiment abovementioned with the brass chain, we were almost misled by a similar circumstance. Instead of an artificial electrometer, which we happened not to have at hand, we made use of a very long and slender human hair; and we found that it was strongly attracted by the chain. Upon an attentive examination, however, we found that this did not arise from the action of the influence passing through the chain, but from the state of the hair itself, which was ſo highly electrical as to be ſtrongly attracted by every conducting ſubſtance which it approached. Upon ſubſtituting another hair, which ſhewed no mark of being either poſitively or negatively electrified, it was neither attracted nor repelled by the chain. From the above, or ſome ſimilar circumſtance, it is probable that Dr Valli's miſtake has originated; but we are confident, that whoever will repeat the experiment with ſufficient attention, will find the reſult preciſely as we have deſcribed it.

Perhaps it may ſtill be ſaid, that although we have never been able to diſcover attraction and repulſion as properties of galvaniſm, this may ariſe from our not being able to accumulate this influence in ſufficient quantity. To this reaſoning, if reaſoning it can be called, we oppoſe the following conſiderations, which ſtate a diſſimilarity in the phenomena of electricity and galvaniſm, that ſeems abſolutely irreconcilable with the identity of the cauſe.

27 Demonſtration, that the phenomena of galvaniſm and of electricity reſult not from the ſame cauſe.

Nothing is more completely eſtabliſhed in the ſcience of electricity than this, that all thoſe appearances which we call *attractions*, *repulſions*, *abſtractions*, and *accumulation of electric fluid*, are preciſely ſimilar to what would be the appearances, if electricity were a fluid, whoſe particles repel each other, and attract the particles of other matter, according to a certain law (See Electricity, *Suppl.*). Of all thoſe phenomena, the moſt remarkable is the accumulation of electric energy (to give it no more definite name), by means of thin idio-electrics, coated with non-electrics; ſuch, namely, as are exhibited by the Leyden phial, the condenſer, the doubler, &c.

If the phenomena of galvaniſm are produced by the paſſage of electric fluid from one extremity of the excitatory arc to the other, this paſſage will be regulated by the known laws of electricity. It may therefore be accumulated (*in tranſitu*) by means of an apparatus ſimilar to the coated pane, or to the condenſer. Profeſſor Robiſon, with this view, made the following experiments:

1. He made a part of the conductor to his condenſer, or collector of atmoſpheric electricity, conſiſt of a long glaſs rod, on one ſide of which was faſtened (with varniſh) a very narrow ſlip of tinfoil; there was a fine point at one end of this rod, and a gold leaf electrometer at the other. This apparatus was inſulated at one end of a room 19 feet long, having a window in the middle of each ſide. A ſmall electric machine was placed at the other end. On a dry day, with a gentle breeze in a direction acroſs the room, both windows were opened a little way, ſo that there was a continual ſtream of air acroſs the room. The machine was worked; and after a ſhort time had elapſed, the electrometer began to diverge, gradually opened, and at laſt ſtruck the conducting ſlips on each ſide, and then collapſed, and again began to diverge. The windows were ſhut; and immediately, without working the machine, the electrometer diverged rapidly, and touched the ſides of the phial every minute and half. This continued ſo long, that there ſeemed to be no end to it. The Profeſſor now made a cut acroſs the tinfoil with a very ſharp knife; the electrometer now diverged very feebly, and 7½ minutes elapſed before it touched the ſides. He paſſed the knife a ſecond time through the cut. This widened it (though ſcarcely ſenſible to the eye), becauſe the knife had been blunted by the glaſs in the firſt operation. All divergency of the electrometer was now at an end; and although the machine was worked till the electric ſmell was ſenſible at the door to a perſon who happened to come in at this time, no tendency to divergence was obſerved. (*N. B.* the top of the electrometer had no conducting ſubſtance about it, except the ſlip of tinfoil).

The cut, being examined with a microſcope furniſhed with a micrometer, was $\frac{31}{1000}$th of an inch. It was now filled up, by binding over it another ſlip of tinfoil. A plate of talc, whoſe thickneſs did not exceed the 900th of an inch, was coated on one ſide in a circle of 1½ inch diameter. The electrometer was removed, and the coated ſide of the talc was put into cloſe contact with the ſlip of tinfoil on the glaſs rod. A ſtand of tin, whoſe top was a plate of 1½ inch diameter, ſmeared over with mercury, was placed in contact with the other ſide of the talc, and they were preſſed into very cloſe and continuous contact.

The machine being now worked, the coated talc received a charge in about 5 minutes ſufficient to give a very ſmart ſhock: and this was repeated with great regularity every five or ſix minutes. The windows were now thrown open, and the room cleared of its former contents of air, till none of thoſe preſent could perceive any electric ſmell. The machine was now worked again. But after half an hour, only a very faint twitch was felt; but enough to ſhew that an accumulation was taking place. The windows were now half ſhut. After working the machine about five minutes, a faint twitch was obtained; after a quarter of an hour more, there was a moderate ſhock.

In this ſtate of things, the apparatus was examined as a condenſer, by firſt taking out the ſharp point by an inſulating handle, and then removing the tin ſtand. Examined in this way, it appeared plainly that, even when all the windows were open, the accumulation began almoſt as ſoon as the machine was worked. Nay, it was found, on another day equally favourable, that a plate of talc $\frac{47}{1000}$ or $\frac{50}{1000}$ of an inch thick, took a charge, although a cut of $\frac{31}{1000}$ wide did not allow the electricity to fly acroſs it. This is perfectly ſimilar to all our experiments on coated glaſs. The thickneſs which admits an accumulation is almoſt incomparably greater than the diſtance to which a ſpark will fly, or a concuſſion is producible, in the ſame intenſity of electricity.

2. The above deſcribed apparatus was inſulated, and a wire connected with each end. To one wire was joined a thin plate of lac, coated on the ſide next the wire; and to the other a piece of moiſt leather covered with tin-foil. Theſe plates were rubbed together by means of inſulating handles. The plate of coated talc quickly took a charge.

The ſame plate of talc, and afterwards another plate not more than half as thick, was now made part of the excitatory arc, and ſometimes part of the animal arc. Sometimes plates of varniſh, incomparably thinner than either of theſe, were employed. But all Profeſſor Robiſon's attempts to produce an accumulation of galvanic energy in this way were fruitleſs. The ſecond form of the electrical experiment was adopted, as having a ſomewhat greater reſemblance to the ſuppoſed procedure of galvaniſm; but the well-informed electrician will eaſily perceive,

perceive, that the firſt form is far more delicate and deciſive.

The internal procedure in the electric and galvanic convulſions is therefore ſo different, nay, oppoſite, that we cannot bring ourſelves to think that the appearances are operations of the ſame agent (H).

We have now gone over all the points of reſemblance which, in Dr Valli's opinion, conſtitute the characters of the identity of galvaniſm and electricity. We think that, without going farther, we might ſafely reſt our aſſertion, that theſe two agents are perfectly diſtinct and unconnected with each other. But there are ſeveral other circumſtances which merit attention.

28 Farther conſiderations on electricity and galvaniſm.

No electrical phenomenon can take place between two bodies, unleſs theſe bodies be in oppoſite ſtates of electricity with regard to each other. Now, how are we to account for the accumulation of electricity in any body, or part of a body, ſurrounded on all hands by conducting ſubſtances? The experiments of Galvani ſucceed equally well, whether the ſubjects of them be inſulated or ſurrounded by conductors; whether performed in the drieſt air or under water (I); whether, by means of an electrical machine, we charge the animal and the metals till every part of them ſtrongly affect the electrometer, or whether we reverſe the experiment and electriſy them negatively, ſtill no change is produced in the force or frequency of the actions excited by the application of the metals. Is there any electrical experiment which could continue to give the ſame reſult in ſuch oppoſite circumſtances? or is there any poſſibility of accounting for it conſiſtently with the known laws of the electric fluid?

The writers on this ſubject who adopt the electric theory, inſtead of attempting to explain how the electric fluid can be condenſed in a body ſurrounded by conducting ſubſtances, have recourſe to the analogy of the gymnotus, torpedo, and other fiſhes of the ſame kind. Here, ſay they, we have in fact the electric fluid accumulated in ſuch a ſituation, and there is no reaſoning againſt facts. We anſwer, that theſe animals are all furniſhed with organs of a very peculiar ſtructure, which may poſſibly be fitted for the purpoſe of ſuch a condenſation. Beſides, we apprehend it has never been inconteſtibly proved that theſe ſingular animals derive their powers from the electric fluid. Without wiſhing to enter into this queſtion, which is foreign to our preſent ſubject, we may remark, that Mr Walſh diſcovered, that the ſhock of the torpedo would not paſs through a ſmall braſs chain; a circumſtance in which it differs remarkably both from electricity and from the influence diſcovered by Galvani.

It were worth while to try Profeſſor Robiſon's methods of accumulation in the examination of the convulſions occaſioned by the torpedo. The Profeſſor ſuſpects that the popular horror at the lamprey, and the accounts of cramps and pains produced by it, have their ſource in ſome ſimilar powers of that animal.

Dr Valli's reaſoning on this part of the ſubject is very curious. He takes it for granted that the gymnotus owes its influence to the electric fluid. Then, though the gymnotus gives ſhocks and emits ſparks, while the torpedo only gives ſhocks without emitting ſparks, he ſays it would be abſurd to aſſert that the torpedo derives its influence from a cauſe different from the gymnotus. Again, though the influence diſcovered by Galvani neither gives ſhocks nor emits ſparks, it would ſtill be abſurd to maintain that it is not the ſame as the electric fluid, and as the influence of the gymnotus and torpedo. To diſſent from any part of this very logical deduction, he declares would be contrary to the laws of philoſophiſing! *Riſum teneatis?*

Afraid, probably, that his readers might be tempted to offend againſt theſe new laws, he proceeds to ſtrengthen them by the analogy of animals and vegetables retaining an uniform temperature *in media*, warmer or colder than their own bodies; from which he argues that they may alſo have a power of accumulating electricity, and retaining it in a particular part, though their whole bodies are conductors. But the caſes are in no reſpect ſimilar. Neither animals nor vegetables accumulate caloric in any particular part of their bodies in preference to any other part. They have no power of *retaining* caloric in their bodies more ſtrongly than any other bodies do; for if they are placed in a medium colder than themſelves, they are continually imparting caloric to that medium. Neither is there the ſmalleſt proof, from any experiments yet publiſhed, that when placed in a medium warmer than themſelves, they do not continually abſorb caloric from it. The exiſtence of a frigorific power in animals appears to us exceedingly problematical; but if it were proved to exiſt, it would by no means demonſtrate that animals or vegetables have a faculty of declining to abſorb caloric from bodies warmer than themſelves. It is readily admitted, that animals and vegetables have a power, within certain limits, of preſerving their temperature higher than that of the ſurrounding medium; nor is there any thing ſurpriſing in this, as the caloric, which they are continually receiving by the decompoſition of oxygenous gas, is diſſipated ſlowly. But if we ſhould allow that animals have a ſimilar faculty of generating the electric fluid; from the nature of that fluid it muſt be continually communicated, not only to every part of the bodies of the animals themſelves, the whole of which are conductors, but to every conducting ſubſtance contiguous to them: and this muſt take place, not ſlowly, like the diſſipation of caloric, but inſtantaneouſly, ſo as to render any ſenſible accumulation impoſſible.

29 Difference in their mode of excitement,

Galvaniſm differs from electricity in nothing more remarkably than in the mode of its excitement and diſcharge.

(H) What if it were called *metallorgaſm*, which tranſlates exactly metallic irritation, or metallegerſiſm, from μεταλλον, and εγερσις *excitatio*.

(I) Dr Fowler mentions an exception to this. "When the ſeparated leg of a frog was held under water, and formed part of the circuit through which this influence had to paſs in order to excite another leg, it never contracted; although it did, and ſtrongly, when held above the ſurface." In this caſe it is plain, that the frog's leg had in fact formed no part of the circuit through which the influence paſſed; the influence had been tranſmitted by the water in which the leg was held.

charge. To produce the phenomena discovered by Galvani, no operation at all similar to the friction of an electric upon a conducting substance is necessary (I). The nerves and muscles have only to be laid bare, and a communication formed between them by means of the excitatory arc, when the contractions immediately ensue. In the case of electricity, a single discharge having restored the equilibrium, no farther effects can be produced till this has been again destroyed by some means capable of producing a condensation in one quarter, and a comparative rarefaction in another. The fact is very different with regard to galvanism; for with it the number of shocks which may be given appears to be infinite. Nay, they frequently become stronger in proportion as they have been longer continued: this influence differing extremely in this particular, too, from the electric fluid, which, besides being itself exhausted, never fails in a remarkable manner to exhaust the contractile power of the muscles.

30 And in the duration of their effects.

The permanence of the effects of galvanism is still more striking in the experiments upon the organ of taste. When the metals are applied to the tongue, the sensation produced is not sudden and transient; but so long as the metals are in contact with the tongue and with each other, so long does the taste continue; and, after some time, it becomes insufferably disagreeable. M. Volta, who adopts the electric theory with various modifications, sensible of the permanence of the effect, in his curious experiments abovementioned supposes, that a stream of electricity passes from the tin cup to the liquor, from this to the tongue of the person making the experiment, then through his body, and returns through the water upon his hands to the cup; and thus he supposes the fluid to move perpetually in a circle. It is surely unnecessary for us to observe, that the supposition of a stream of electricity, continually moving in a circle in this manner, is wholly inconsistent with the laws which appear in every case to regulate the motions of that fluid. The same observation applies to the manner in which he explains most of the other phenomena of galvanism.

The electric fluid cannot be put in motion but by destroying the equilibrium to which it perpetually tends; but whenever this is destroyed, all that is required to produce a discharge is, that a single conducting substance be placed between the two points in which it is unequally distributed. Here again there is a very wide distinction between this fluid and the influence discovered by Galvani. M. Volta divides all conductors of galvanism into two classes; 1st, Dry conductors, comprehending metals, pyrites, some other minerals, and charcoal; and, 2d, Moist conductors. He asserts, that it is absolutely necessary, in order to the production of the phenomena, that two conductors of the first class touch each other immediately on one hand, while at their other extremities they touch conductors of the second class. Whether this be admitted or not, we have already stated our opinion that the action of two different substances is absolutely necessary in order to excite contractions: and although it is contended by some writers that a single piece of metal has sometimes been found sufficient, yet even they must allow that, in by far the greater number of cases, it has been found necessary to make use of two metals, and that the effect is even heightened in general by employing three. In the whole science of electricity, we do not know a single fact which bears the slightest analogy to this. Never in a single instance has it been found, that the effects of a Leyden phial have been increased by using a conductor formed of two or more metals in procuring the discharge.

31 Some men non-conductors of galvanism.

Before leaving the subject of conductors, we may take notice of a very curious and important fact mentioned by Dr Valli. "Amongst men," says he, "there are some individuals who are good conductors, others who are less so; and some again who appear to be almost non-conductors. I was one day carrying on, with three of my friends, some experiments upon frogs. A frog was put in water, and we each by turn essayed its power. Two of us excited strong convulsions, the third only feeble ones, and the fourth none at all. This experiment was repeated frequently with the same result. This is not the only example I could adduce of the reality of this fact, but I do not think it necessary to dwell any longer upon it." We have met with one individual who is not sensible of any peculiar sensation when the metals are applied to his tongue. This seems in some measure to corroborate Dr Valli's observation. It is apprehended, however, that all men are equally good conductors of electricity.

There is still another very marked distinction between the effects of galvanism and electricity. No shock at all resembling that produced by the electric fluid has ever been felt by any person whose body was made a part of the chain conducting the galvanic influence, while a very small quantity of the electric fluid is immediately felt (K). In Dr Robison's experiment with the plates of zinc and silver in the cheeks, there is no doubt a convulsive twitch distinctly felt in the gums; but, as we have already observed, the sensation thus produced

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(I) It is true, as we have noticed above, that galvanic energy is sometimes communicated to a conducting substance by rubbing it upon some other substance; but this has no resemblance to the excitement of electricity by friction. The galvanic energy is communicated in this case to a *conducting* substance, and it succeeds as readily when both the bodies are of this class as when one of them is an idio-electric. But no electric phenomenon has ever been produced by the friction of two conducting bodies upon each other; one of them must be an idio-electric, and it is in this one that the excitement takes place.

(K) There is an exception to this rule which ought to be taken notice of. M. Cotugno informs us, that when he was one day employed in dissecting a live mouse, he received a sensible shock from the animal. But as neither he nor any other person has ever been similarly affected in any other instance, it seems pretty certain that he was deceived into the belief of a shock from the sensation produced by the struggles of the animal he dissected.

produced is quite different from that which is felt from an electric shock (L).

There is an experiment related by Dr Valli, which seems to shew that nothing like an electric shock is felt, even when this influence is transmitted through a nerve so as to excite convulsions. Having laid bare the nerves of a fowl's wing, without cutting them, and without killing the fowl, upon applying the metals very smart movements were produced, but the animal remained perfectly tranquil. Nor was this owing to the fowl being in a state of insensibility; for when the nerves were pricked or irritated it screamed violently. But all animals shew signs of great uneasiness from an electric shock.

In general, it must be confessed, that animals under experiments of this kind seem restless and uneasy. The great distinction of which we speak at present, consists in this, that the electric fluid produces a shock and uneasy sensation when any part of the body is introduced into the conducting chain; while the influence discovered by Galvani, on the contrary, when merely transmitted through the body in this manner, gives no shock, nor any sensation whatever, insomuch that we are not sensible of its passage. If this influence be made to act directly on a nerve, there is, no doubt, some kind of irritation produced, as appears from the effect of the metals upon the tongue, the eye, and other nervous parts: but still this action bears no analogy to that of the electric fluid; as the application of the metals to the organs of sense, produces in each organ the peculiar sensation for which it is constructed, as taste in the tongue, light in the eye, &c. so when nerves intended merely for muscular motion are subjected to the action of galvanism, the effect produced is motion in the muscles on which they are distributed.

If this view of the matter be just, it will explain why no shock is felt when the human body is made a part of the conducting chain. In that case the influence does not, in all probability, act directly upon any nerve; and we see that this influence possesses no power, like the electric fluid, of producing a convulsive shock, when merely passed through any part of the body; but it has this peculiar property, when passed directly through a nerve, it excites that nerve to perform the function for which it was intended by nature. To this it will no doubt be objected, that contractions may be excited in different parts of a frog without any division being made in its skin; and here it may be supposed that the influence is not made to pass directly through a nerve. But it ought to be recollected that the skin of these animals is abundantly supplied with nerves, whose trunks communicate at different places with those which supply the muscles; and that the contractions are always strong and easily excited, in proportion as they are applied near to the course of any of the nerves which go to the muscles. But though we had no doubt that the influence might be transmitted through the bodies of these animals, as well as through the human body, without any contractions being produced, we have thought it worth while to ascertain the fact by the following experiment.

A frog was prepared in the usual manner by coating its sciatic nerve with tinfoil, and laying the leg upon a plate of zinc. Another frog, in a very vigorous state had its fore legs and chest attached to a rod of silver, and its posterior extremities to a rod of zinc. The silver rod was applied to the tinfoil and nerve of the prepared frog, and the zinc rod to the plate of zinc upon which the leg was laid. Immediately very strong contractions took place in the leg; but no motion, nor the slightest mark of uneasiness, appeared in the other frog, through the body of which the influence must have passed. It is necessary in this experiment to dry the body of the frog which is to serve as a conductor very carefully, otherwise the influence might be transmitted by the water upon its surface without passing through its body.

There is an experiment mentioned by Dr Fowler, which shews a striking difference between electricity and galvanism. It was instituted with a view to ascertain the effects of the latter upon the blood vessels. The Doctor relates it as follows: "Having laid bare and separated from surrounding parts and from each other, the crural artery and nerve in the thigh of a full grown frog, I cut out the whole of the nerve between the pelvis and the knee: I then insinuated beneath the artery a thin plate of sealing-wax, spread upon paper, and broad enough to keep a large portion of the artery completely apart from the rest of the thigh. The blood still continued to flow through the whole course of the artery in an undiminished stream. The artery, thus partially insulated, was touched with silver and zinc, which were then brought into contact with each other; but no contraction whatever was produced in any muscle of the limb. This experiment was frequently repeated upon several different frogs, both in whom the nerve was, and in whom it was not divided. The result was uniformly the same. But vivid contractions were produced in the whole limb when an e-

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(L) "No one (says M. Humboldt) can speak more decidedly on this subject than myself, having made several experiments on my own person, the seat of which, in some instances, was the socket of a tooth which I had caused to be extracted; in others, certain wounds which I made in my hand; and in others, the excoriations produced by four blistering plasters." The following is the result of these painful experiments. The galvanic irritation is always painful, and the more so in proportion as the irritated part is more injured, and the time of irritation more prolonged. The first strokes are felt but slightly; the five or six following are much more sensible, and even scarcely to be endured, until the irritated nerve becomes insensible from continued stimulus. The sensation does not at all resemble that which is caused by the electric commotion, and the electric bath; it is a peculiar kind of pain which is neither sharp, pungent, penetrating, nor by intermissions, like that which is caused by the electric fluid. We may distinguish a violent stroke, a regular pressure, accompanied by an unintermitting glow, which is incomparably more active when the wound is covered with a plate of silver and irritated by a rod of zinc, than when the plate of zinc is placed on the wound, and the silver pincers are used to establish the communication.

lectric spark, or even a full stream of the aura was passed into the artery."

Before taking leave of this branch of our subject, it may be proper to take notice of one fact, which may be thought to militate against the doctrine we have endeavoured to establish. It is said that a frog, exhausted and brought near to a charged electrophorus, has been found to resume its susceptibility. We think this fact may be accounted for without admitting any connection between galvanism and electricity, merely by supposing that the irritability of the muscles, which had been exhausted, was restored by the application of a moderate stimulus, (the electric fluid), of a kind different from those by which it had been exhausted. Such of our readers as are acquainted with the writings of modern physiologists on the subject of muscular irritability, will know that facts of this kind are very common. Thus it has been found by M. Humboldt, that the oxygenated muriatic acid has often restored irritability. To this explanation it will no doubt be objected, that the application of other stimuli, as alcohol and a solution of potash, instead of restoring, totally destroy the susceptibility of galvanism. Suspecting, that although these substances in a concentrated state destroy the susceptibility, yet that when sufficiently diluted, they might be found to have the opposite effect, we tried the following experiment, which confirmed our conjecture.

A frog, 57 hours after it had been decapitated, had ceased for above an hour to be capable of excitement by the application of the metals in any way that could be devised. A few drops of alcohol being diluted with about a tea-spoonful of water, the nerve and the muscles which had been laid bare, as well as the whole skin of the animal, were wet with it. Upon the application of an excitatory arc, composed of four pieces, gold, zinc, silver, and tinfoil, a few very slight contractions of the toes were distinctly observed. After this, no means that we could think of produced the smallest excitement. Alcohol was now applied in a more concentrated state, but without any effect. The same four pieces of metal which produced the contractions of the toes, had been used before the diluted alcohol was applied, but without effect. We have not tried the application of potash much diluted.

From what has been said, we think we are fully warranted in saying, that although some of the phænomena discovered by Galvani bear a striking resemblance to some of those produced by the electric fluid; yet there are others, and these not the least important, which differ so widely from any effects which have ever been seen to arise from that fluid, that they must derive their origin from some other cause. Our readers may probably think that we have dedicated too much time to this question; but as we conceive it to be the most important point which can be discussed on this subject, we thought it worth while to consider it at some length; and we were the more convinced of the necessity of doing so, from this consideration, that there are still some writers of high authority who maintain the hypothesis, that galvanism and electricity are the same.

32 The galvanic influence probably foreign from animals.

The next question that occurs to us with regard to the nature of galvanism is, whether or not it depends upon any law of animal life? To us it appears rather more probable, that the influence which incites the muscles of animals to contract in the experiments of Galvani, is something quite foreign to the animals themselves; as much so as the electric fluid of the Leyden phial is to the animal which receives a shock from it, in both cases the body of the animal acting as a mere conductor. Upon this question, however, we confess that we have neither facts nor arguments to adduce sufficient to warrant our drawing any certain conclusion. It will doubtless be asked, if this influence be something foreign to the bodies of animals, why do we never find it acting anywhere but in their bodies? why is it not, like the electric fluid, capable of being made evident to the senses by its effects upon inanimate matter? The only answer which we are in a condition to give to this question is, that it may very possibly be capable of producing important effects upon inanimate matter, nay, these effects may be the subject of our daily observation; but for want of our being sufficiently acquainted with galvanism to point out the relation between these effects and their cause, the effects themselves are either not explained at all, or ascribed perhaps to some other power, with which they have no connection. In like manner, the electric fluid has doubtless been producing most important effects from the beginning of time; but, prior to the discovery of that fluid, these were either not explained at all, or considered as originating from some cause which, in fact, had no share in their production.

The great difficulty is to obtain some test by which we may detect the galvanic influence when actually present in inanimate matter. Hitherto we have no such test; nor should we know that such an influence exists, but for the effects which it produces upon the bodies of animals through the medium of their nerves. If we had any means of ascertaining its existence, either in a separate state, or conjoined with inanimate matter, the science would make a rapid progress, as it would be easy to diversify experiments so as to discover its nature and effects. To detect it in a separate state is, in all probability, impossible; but that the zeal and ingenuity of philosophers will one day be able to discover some test of its presence in inanimate matter, there seems no reason to doubt.

We have made many experiments with a view to discover such a test, but hitherto without the smallest success. In the trials we have already made, our views have been chiefly confined to the discovery of some chemical effects of this influence upon inanimate matter. M. Volta and other writers, having considered the sensation produced by it upon the tongue as similar to that occasioned by acids, we were not without hopes that it would be found to resemble that class of substances in some of its other properties. We have therefore transmitted it through liquids tinged with the most delicate vegetable colours; but no change in these colours has been effected by the transmission of many galvanic shocks. We have also tried, in the same way, alkaline liquors, without any effect. We next dissolved in water different neutral salts, and other compound bodies, of which the parts are held together by the weakest affinities; but no change has been observed to be produced in them by the transmission of this influence. Our want of success, however, shall not deter us from continuing our efforts; we shall vary the nature of our experiments

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in every way that ſhall occur to us as likely to be attended with advantage; and if we ſhould ultimately fail, we truſt that others will be more fortunate. Every new fact which is diſcovered upon the ſubject tends to facilitate this inveſtigation, by furniſhing us with new guides to direct the courſe of our experiments.

33
Dr Fowler heſitates on this point,

Dr Fowler is of opinion, that this influence, whatever it may be, is not derived from the metals alone, but that the animals at leaſt contribute to its production, as well as indicate its preſence; and he ſeems to have been led to adopt this theory chiefly from two conſiderations, neither of which appears to us to have much weight. They are the following: The neceſſity of a communication between the metals and the muſcles, as well as between the metals and the nerves; and the obſervation, that animals have a more complete controul over its effects than one would expect them to have over an influence wholly external to them. But the communication between the metals and the muſcles may be neceſſary to the contraction of the latter, tho' not to the production of galvaniſm; which, however, for want of any obvious effect, is not obſerved. That animals have ſome controul over the effects of galvaniſm upon themſelves, may be very true; but this circumſtance does not appear to us capable of proving any thing, as they have a controul over the effects of other ſtimuli in the ſame way. Thus, an animal of any reſolution can bear, without betraying any uneaſy ſenſation, a blow which, inflicted unexpectedly, would have produced a convulſive ſtart. The will does not in any degree controul the effects produced by galvaniſm upon our ſenſes of taſte, ſeeing, &c.; that is, the ſenſations are produced, though we may have reſolution not to betray them. But, ſays Dr Fowler, the will is not able to controul the effects of electricity, when the electricity is otherwiſe ſufficiently ſtrong to excite muſcles to contraction. This argument may tend to ſhew, that galvaniſm differs from electricity; but as it muſt be admitted, that we can reſiſt the contractions naturally produced by the application of other foreign ſtimuli, it by no means proves that animals have any power of preventing the excitement or tranſmiſſion of galvaniſm. Beſides, though we cannot prevent an involuntary contraction of our muſcles from taking place when an electric ſhock of conſiderable ſtrength is paſſed through them, yet any man may with his hand draw ſparks from the prime conductor of an electric machine without ſhrinking, though even theſe ſparks would, if he were off his guard, produce a convulſive ſtart.

34
We think without reaſon.

If the galvanic influence exiſted ready formed in the muſcles or nerves of animals, the only thing requiſite to the production of the contractions would be to make a communication between the nerves and muſcles, by means of any ſingle ſubſtance capable of conducting this influence; as water, for example: but the reverſe is known to be true. It may be ſaid, however, that, although there is no proof that any influence naturally reſides in the nerves or muſcles capable of producing the effects mentioned by M. Galvani, theſe ſubſtances may ſtill, by ſome power independent of the properties they poſſeſs in common with dead matter *contribute* to the excitement of the influence, which is ſo well known to exiſt in them after a certain application of metals. Upon this part of the ſubject, the obſervations of Dr Wells will be found to merit conſiderable attention.

"It is known (ſays that gentleman), that if a muſcle and its nerve be covered with two pieces of the ſame metal, no motion will take place upon connecting thoſe pieces by means of one or more different metals. After making this experiment one day, I accidentally applied the metal I had uſed as the connector, and which I ſtill held in one hand, to the coating of the muſcle only, while with the other hand I touched the ſimilar coating of the nerve, and was ſurpriſed to find that the muſcle was immediately thrown into contraction. Having produced motions in this way ſufficiently often to place the fact beyond doubt, I next began to conſider its relations to other facts formerly known. I very ſoon perceived, that the immediate exciting cauſe of theſe motions could not be derived from the action of the metals upon the muſcle and nerve to which they were applied; otherwiſe it muſt have been admitted, that my body, and a metal formed together a better conductor of the exciting influence than a metal alone; the contrary of which I had known, from many experiments, to be the caſe. The only ſource, therefore, to which it could poſſibly be referred, was the action of the metals upon my own body. It then occurred to me, that a proper opportunity now offered itſelf of determining whether animals contribute to the production of this influence by means of any other property than their moiſture. With this view, I employed various moiſt ſubſtances, in which there could be no ſuſpicion of life to conſtitute, with one or more metals, different from that of the coatings of the muſcle and nerve, a connecting medium between theſe coatings, and found that they produced the ſame effect as my body. A ſingle drop of water was even ſufficient for this purpoſe; though in general, the greater the quantity of the moiſture which was uſed, the more readily and powerfully were contractions of the muſcle excited. But if the mutual operation of metals and moiſture be fully adequate to the excitement of an influence capable of occaſioning muſcles to contract, it follows, as an immediate conſequence, that animals act by their moiſture alone in giving origin to the ſame influence in M. Galvani's experiments, unleſs we are to admit more cauſes of an effect than what are ſufficient for its production." We do not quote the above reaſoning as perfectly concluſive, for it by no means appears to us to be ſo; but it certainly gives ſome probability to the opinion, that galvaniſm is, as M. Volta ſuppoſes, the reſult of the action of two dry conductors, which touch each other immediately on one hand, while at their other extremities they touch conductors of what he calls the ſecond claſs, (that is, moiſture, for all the conductors of the ſecond claſs contain water), and that the bodies of animals act merely as moiſture.

One of M. Humboldt's experiments related above, appears to us to ſtrengthen the concluſion, that the influence diſcovered by Galvani is ſomething perfectly foreign to the bodies of animals. Can it be ſuppoſed that any ſubſtance which naturally reſides in our bodies, ſhould, in a few ſeconds after it is put in motion, convert the ſimple ſerous diſcharge of a bliſter into a dark coloured fluid, of a nature ſo acrid as to irritate and violently inflame the ſkin wherever it touches it? We do not ſay that this is impoſſible, for we are too little acquainted with the laws of ſecretion to ſay with certainty

tainty what may, or what may not, produce such a change; but we know no similar alteration produced *in a few seconds*, by a mere change of action in the vessels themselves.

35 The cause which produces the galvanic effects unknown.

We shall not undertake to determine the nature of the cause which produces such astonishing effects. We think it is certainly not the electric fluid, and probably something which resides or is formed in the excitatory arc, but we consider our knowledge of galvanism as still in its infancy, and our stock of facts as infinitely too small to admit of our forming a just theory on the subject. Fortunately, however, the discovery of Galvani has attracted so much the attention of philosophers in every part of Europe, that new facts may be expected to come to light every day; and we hope the time is not very distant, when these may be so classed, as to entitle the subject to be ranked among the sciences.

While this article was in the press, we were favoured by a friend with an account of some German dissertations on the subject, which we are obliged to insert in this irregular manner.

Mr Creve, surgeon in Wurtzburg, had an opportunity of observing the galvanic irritation on the leg of a boy, which had been amputated far above the knee in the hospital of that city. Immediately after the amputation, Mr Creve laid bare the crural nerve (kniekehlnerven) and surrounded it with a slip of tinfoil. He touched, at once the tinfoil and the nerve with a French crownpiece. In that instant the most violent convulsions took place in the leg both above and below the knee. The remainder of the thighbone bent with force toward the calf; the foot was more bent than extended. All these motions were made with much force and rapidity. None were produced when the tinfoil was taken away, or when a steel pincer was used in place of a piece of silver, or when the tin or silver was covered with blood: but they were renewed when these obstacles were removed. These phenomena continued till 38 minutes after the amputation, when the limb became cold.

Dr Christopher Heinrich Pfaff (*in Dissertatione de Electricitate Animali*, Stutgardt, 1793: see also Gren's *Journal der Physik*, T. viii. p. 196, &c.) has classed the phenomena in a very orderly and perspicuous manner; and the result of the numerous experiments made by himself and others corresponds very nearly with our inferences in the preceding pages.

I. *Phenomena of muscular contraction.*

The general form of his experiments is the same with that which we have placed at the beginning of this article; but the following varieties were observed:

The nerve being coated with tinfoil, it was always observed that the contractions were stronger when the silver first touched the muscle, and then the coating. If it touched the coating first, the effects were always, and very sensibly, weaker.

They were still stronger when the silver did not touch the muscle at all, but only the nerve and its coating.

When the contractions were weaker at the beginning, they also ceased sooner.

No contraction ensued from touching the coating only, or the nerve only, or the muscle only, with the silver.

Continuing the contact did not occasion any repetition of the contractions, except in some cases, where the silver was drawn along different parts of the coating, while its other end remained in contact with the nerve.

The contractions took place only in the muscles to which the nerve led.

Their strength and duration were greater when the surfaces of contact were greater, and when the two metals touched each other in points or sharp edges.

A ligature, with a silk thread below the coating (that is, between the coating and the muscle, or part of the nerve touched by the silver), prevented all contraction; but not if the ligature was between the coating and the brain. If the nerve was cut through below the coating, and the parts separated a quarter of an inch, no contraction followed by touching the coating and the nerve or muscle: but it took place, if the parts were brought into contact; or even if a piece of any other nerve was put between the parts.

If a considerable part of a bared nerve was insulated and coated, partly with tinfoil and partly with silver, contractions were produced in the muscle to which it led whenever the two metals were brought into contact.

If one crural nerve be coated with tin, and the other with silver, contractions are produced in both legs by bringing the metals into contact.

If the nerve be dry under the coating, or when the silver touches it, or in both places, we have no contractions; but they begin as soon as we moisten the nerve.

Dr Pfaff infers from these phenomena, that the nerve alone is subject to the irritation produced by the two metals.

If the prepared frog be immersed in water, so that the coating touches the water, contractions are produced by touching the coating above water with the silver, while another part of the silver touches the nerve, or the muscle, or even dips pretty deep in the water.

No such thing happens in oil; or, at best, the contractions are very slight.

Dr Pfaff could not produce contractions without employing two metals, or a metal and charcoal.

A very thin covering of muscular flesh on the nerve did not altogether prevent the contractions, and in many cases did not sensibly diminish them.

If a piece of silver be laid on the muscles of the breast or belly, and be brought into contact with the tin-coating on the lumbal region, only the muscles of the breast or belly are affected, but not those of the legs.

Dr Pfaff says, that the involuntary muscles are not affected by galvanism; and refers for convincing proofs to a dissertation by Dr Ludwig, shewing that the heart is not furnished with nerves, (*Scriptor. neurolog. minor. select.* vol. 2.).

II. *Irritation of the Organs of Sense.*

Here Dr Pfaff's dissertation contains nothing remarkable.

III.

III. *Conjectures as to the Cause.*

Dr Pfaff uses the same arguments that we have employed to refute the opinion of a similarity between the animal organs and the Leyden phial, and the opinion that electricity is the agent. He mentions the opinion of those who maintain that the agent is a fluid put into motion by means of its relation to the metals only, in their action on each other, and who consider the animal as merely serving as a conductor; and also serving, by its irritability, to give us the information of the presence of such a fluid, in the same manner as another kind of irritation, somewhat analogous to it, indicates the presence and agency of the electric fluid. It may therefore be called the Metallic Irritation; a term which will sufficiently distinguish it.

But Dr Pfaff seems rather to think that the agent resides in the animal, and that the metals are the conductors (See a dissertation, entitled, *Farther Contributions to the Knowledge of Animal Electricity*, in *Gren's Journal der Physik*, T. viii. p. 377). This fluid he conceives to be intimately blended with the *principle of life*; nay, perhaps, to be the same. He mentions a thought of Professor Kielmayer, "that it may resemble the magnetic fluid in its manner of acting, giving connection to the distant particles of a nerve, as we observe a magnet give an instantaneous connection to each of a parcel of iron filings; all of which it would arrange in a certain precise manner, if they were sufficiently moveable, by giving momentary polarity to each." This somewhat resembles Newton's hypothetical whim read to the Royal Society, describing what may be done by means of an æther (See *Birche's History of the Royal Society*).

But all this is vague conjecture, and merits little attention. This will be better bestowed on an observation of M. Humboldt of Jena, "that a bit of fresh morelle (the *Helvella mitra* of Linnæus) may be substituted for a bit of nerve in the animal arc in these experiments." This is the only vegetable substance yet discovered to have this property. If the nerve be laid on the morelle, we have only to touch the morelle with the zinc, and the muscular contractions immediately follow.

GALWAY, a township in the new county of Saratoga, in New-York. By the state census of 1796, it appears that 491 of its inhabitants are qualified to be electors.—*Morse.*

GAMBLE's *Station*, a fort about 12 miles from Knoxville, in Tennessee.—*ib.*

GAMMON, Point, anciently called Point Gilbert, by Gosnold, forms the eastern side of the harbor of Hyanis or Hyennes, in Barnstable co. Massachusetts. —*ib.*

GARAZU, a town in Brazil, and province of Pernambuco, 25 miles N. of Olinda.—*ib.*

GARDECAUT, or Guard du Cord, in a watch, is that which stops the fusee when wound up, and for that end is driven up by the spring. Some call it Guard-cock; others Guard du Gut.

GARDEN (Francis), better known to the public by the title of *Lord Gardenstone*, was born at Edinburgh June 24th, in the year 1721. His father was Alexander Garden of Troup; an opulent landholder in Aberdeenshire; his mother was Jane, daughter of Sir Francis Grant of Cullen, S.C.I.

After passing through the usual course of liberal education at the school and the university, he betook himself to the study of law for his profession. In the year 1744 he was admitted a member of the Faculty of Advocates, and called to the Scottish bar.

In his practice as an advocate he soon began to be distinguished, by a strong, native rectitude of understanding; by that vivacity of apprehension and imagination, which is commonly denominated *Genius*; by manly candour in argument, often more persuasive than subtlety and sophistical artifice; by powers which, with diligence, might easily attain to the highest eminence of the profession. But the same strength, openness, and ardour of mind, which distinguished him so advantageously among the pleaders at the bar, tended to give him a fondness for the gay enjoyments of convivial intercourse, which was unfavourable to his progress in juridical erudition. Shining in the social and convivial circle, he became less solicitously ambitious than he might otherwise have been, of the character of an eloquent advocate, or of a profound and learned lawyer. The vivacity of his genius was averse from austere and plodding study, while it was captivated by the fascinations of polite learning, and of the fine arts. Nor did he always escape those excesses in the pursuit of pleasure into which the temptations of opening life are apt, occasionally, to seduce the most liberal and ingenuous youth. But his cheerful conviviality, his wit, humour, taste, good-nature, and benevolence of heart, rendered him the delight of all his acquaintance. He became his Majesty's Solicitor July 3d, 1764.

At length the worth of his character, and his abilities as a lawyer, recommended him to the office of a Judge in the Courts of Session and Justiciary, the supreme judicatures, civil and criminal, for Scotland. His place in the Court of Session he continued to occupy till his death; but had, some years before, resigned the office of a Commissioner of Justiciary, and in recompence got a pension of 200l. per annum. Clear discernment, strong good sense, conscientious honesty, and amiable benevolence, remarkably distinguished all his opinions and conduct as a judge.

We not unfrequently see the gay young men of the present age, to turn, as they advance towards middle life, from the headlong pursuit of pleasure to a sordid and contracted selfishness, which excludes even those few good qualities that seemed to accompany their first thoughtless days. Their life is divided between sensuality and that anxious *inhumane* avarice and ambition whose ultimate object is, to provide gratifications to sensuality and pride. The kindling light of rectitude, and the first sparks of generous humanity, are extinguished in their hearts, as soon as those ebullitions of youthful passion and inexperience are over, by which

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the useful efficiency of their early good qualities was prevented. Hardly have they become tolerably well acquainted with mankind, when the milk of human kindness is turned into gall and venom in their hearts.

It was far otherwise with Lord Gardenstone. As he advanced in years, humanity, taste, public spirit, became still more and more eminently the predominant principles in his mind.—He pitied the condition of the peasantry, depressed rather by their ignorance of the most skilful modes of labour, and by their remoteness from the sphere of improvement, than by any tyranny or extortion of their landlords. He admired, protected, and cultivated the polite arts. He was the ardent votary of political liberty, and friendly to every thing that promised a feasible amelioration of public economy, and the principles of government.

In the year 1762 he purchased the estate of Johnston, in the county of Kincardine. Within a few years after he began to attempt a plan of the most liberal improvement of the value of this estate, by an extension of the village of Laurencekirk, adjoining. He offered leases of small farms, and of ground for building upon, which were to last for the term of one hundred years; and of which the conditions were extremely inviting to the labourers and tradesmen of the surrounding country. These offers were eagerly listened to. More desirous to make the attempt beneficial to the country than to derive profit from it to himself, he was induced, within a few years, to reduce his ground-rents to one-half of the original rate.—Weavers, joiners, shoe-makers, and other artisans in a considerable number, resorted to settle in the rising village. His Lordship's earnestness for the success of his project, and to promote the prosperity of the good people whom he had received under his protection, led him to engage in several undertakings by the failure of which; he incurred considerable losses. Projects of a print-field, and of manufactures of linen and of stockings, attempted with sanguine hopes in the new village, and chiefly at his Lordship's risk and expence, misgave in such a manner as might well have finally disgusted a man of less steady and ardent philanthropy with every such engagement. But the village still continued to advance. It grew up under his Lordship's eye, and was the favourite object of his care. In the year 1779, he procured it to be erected into a burgh of barony; having a magistracy, an annual fair, and a weekly market. He provided in it a good inn for the reception of travellers; and with an uncommon attention to the entertainment of the guests who might resort to it, furnished this inn with a library of books for their amusement. He invited an artist for drawing, from the continent, to settle at Laurencekirk. He had the pleasure of seeing a considerable linen manufacture at length fixed in it. A bleachfield was also established as a natural counterpart to the linen-manufacture. Before his Lordship's death, he saw his plan of improving the condition of the labourers, by the formation of a new village at Laurencekirk, crowned with success beyond his most sanguine hopes. He has acknowledged, with an amiable frankness, in a memoir concerning this village, "That he had tried, in some measure, a variety of the pleasures which mankind pursue; but never relished any so much as the pleasure arising from the progress of this village."

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In the year 1785, upon the death of his elder brother Alexander Garden of Troup M. P. for Aberdeenshire, Lord Gardenstone succeeded to the possession of the family estates, which were very considerable. Until this time his Lordship's income had never been more than adequate to the liberal expence into which his rank and the generosity of his nature, unavoidably led him. But the addition of a fortune of about three thousand pounds a-year to his former revenue, gave him the power of performing many acts of beneficence with which he could not before gratify his good heart. It was happy, likewise, that his succession to this ample income, at a period when the vigour of his constitution was rapidly yielding to the infirmities of old age, enabled him to seek relief, by a partial cessation from business, by travel, and by other means, which could not have been easily compatible with the previous state of his fortune.

In the month of Sept. 1786, he set out from London for Dover, and passed over into France. After visiting Paris, he proceeded to Provence, and spent the winter months in the genial climate of Hieres. In the spring of 1787 he returned northwards, visiting Geneva, Switzerland, the Netherlands, and the Dutch provinces, and passing through Germany into Italy. With a fond curiosity, attentive alike to the wonders of nature, to the noble monuments of the arts, and to the awful remains of ancient grandeur, with which Italy abounds, he visited all its great cities, and surveyed almost every remarkable and famous scene that it exhibits.

His first object, in these travels, was to obtain the restoration of his declining health by the influence of a milder climate, by gentle, continued, and varied exercise; by that pleasing exhilaration of the temper and spirits which is the best medicine to health, and is most successfully produced by frequent change of place, and of the objects of attention. But the curiosities of nature and art, in those countries through which he travelled, could not fail to attract, in a powerful manner, the curiosity of a mind cultivated and ingenious as his. He, whose breast glowed with the most ardent philanthropy, could not view the varied works and manners of a diversity of nations of his fellow men, without being deeply interested by all those circumstances which might appear to mark their fortunes as happy or wretched. He eagerly collected specimens of the spars, the shells, the strata of rocks, and the veins of metals, in the several countries through which he passed. He amassed also cameos, medals, and paintings. He enquired into science, literature, and local institutions. He wrote down his observations, from time to time; not indeed with the minute care of a pedant, or the ostentatious labour of a man travelling with a design to publish an account of his travels; but simply to aid memory and imagination in the future remembrance of objects useful or agreeable.

After an absence of about three years, he returned to his native country. The last years were spent in the discharge of the duties of his office as a judge; in social intercourse with his friends, among whom was the venerable Lord Monboddo, and others of the most respectable characters which that country has to boast of; in the performance of a thousand generous offices of benevolence and humanity; in cherishing those fine arts, of which he was an eminent admirer and judge;

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and above all, in promoting the comfort, and encouraging the induſtry of his dependants, and in lending his aid to every rational attempt at the improvement of public economy and public virtue.

St Bernard's Well, in the neighbourhood of Edinburgh, had been, long ſince, diſtinguiſhed for the medicinal virtues of its waters. But various circumſtances had alſo concurred of late to throw it into neglect. Yet its waters being ſtrongly mineralized by a ſulphurated hydrogenous gas, were, by this means, unqueſtionably qualified to operate, with highly beneficial effects, in the cure of various diſeaſes. The qualities of this mineral water falling under Lord Gardenſtone's notice, he was induced to purchaſe the property of the well, to direct it to be cleared from ſurrounding obſtacles, which contaminated the virtues of the water, or made it inacceſſible; to erect a beautiful and commodious edifice over it; and to appoint proper perſons to diſtribute the water, for a very trivial compenſation, to the public. The well lies at a diſtance from Edinburgh, which is very convenient for a ſummer morning's walk. Within the few years which have paſſed ſince Lord Gardenſtone's benevolent care brought it into notice, it has attracted many of the inhabitants of that city to viſit in the mornings of ſpring and ſummer. And, undoubtedly, the agreeable exerciſe to which they have thus been allured, and the ſalutary effects of the water, have contributed, in no mean degree, to diſpel diſeaſe, and to confirm or re-eſtabliſh health. Such monuments are worthy to preſerve the memory of a patriotic and a good man!

As an amuſement for the laſt two or three years of his life, when his increaſing infirmities precluded him from more active exerciſe, and from mingling ſo frequently in the ſociety of his friends as was agreeable to his ſocial and convivial temper, he bethought himſelf of reviſing ſome of the *jeux d'eſprit*, and light fugitive pieces, in which he had indulged the gaity of his fancy in his earlier days; and a ſmall volume of poems was publiſhed, in which the beſt pieces are, upon good authority, aſcribed to Lord Gardenſtone. He reviſed alſo the memorandums which he had made upon his travels, and permitted them to be ſent to preſs. The two former volumes were publiſhed one after another while his Lordſhip was yet alive; the third after his death. They met with a very favourable reception in the world, and were honoured with the high approbation of the moſt reſpectable writers of periodical criticiſm. They convey much agreeable information, and beſpeak an elegant, enlightened and amiable mind. The laſt volume is filled chiefly with memorandums of his Lordſhip's travels in Italy; and contains many intereſting criticiſms upon ſome of the nobleſt productions of the fine arts of painting and ſculpture.

His Lordſhip's health had long been declining; and he died a bachelor on the 22d of July 1793, lamented by his relations and friends, by his tenants and humble dependants, and by all true patriots and good men to whom his merits and virtues were known.

Such is the account of Lord Gardenſtone's life, which was prefixed to the third volume of his travelling memorandums; and though it was no doubt an effuſion of fond friendſhip, we believe that the praiſe which it beſtows on his Lordſhip is not much exaggerated. In the latter years of his life, it muſt indeed be confeſſed, that he contracted intimacies with men unworthy of his regard; and that his attachment to liberty made him form expectations from the French revolution, which even the events which he ſaw ought to have repreſſed. But his mind was by that time weakened by diſeaſe; and it would be very unjuſt to balance the imprudencies of one or two years againſt the meritorious actions of a whole life. Beſides his travelling memorandums and his poems, his Lordſhip publiſhed *a Letter to the Inhabitants of Laurencekirk*, the moſt valuable, in our opinion, of all his publications; for it contains perhaps the moſt ſalutary advices which were ever offered to the inhabitants of a manufacturing town, for the regulation of their conduct towards each other. That the people of Laurencekirk have followed theſe advices, it would give us pleaſure to learn on good authority.

Gardner || Gaſpee.

GARDNER, a townſhip in Worceſter co. Maſſachuſetts, incorporated in 1785. It contains about 14,000 acres, well watered, chiefly by Otter river. The road from Connecticut river, through Peterſham, Gerry, and Templeton on to Boſton, paſſes through it. It contains 531 inhabitants, and is 26 miles N. by W. of Worceſter, and 60 N. W. of Boſton.—*Morſe.*

GARDNER'*s Iſland*, or *Iſle of Wight*, lies at the E. end of Long-Iſland, in New-York ſtate, ſheltered within Oyſter Pond and Montauk points; 10 miles N. W. of the latter, and as far S. W. of Plumb Iſland. It contains about 3000 acres of fertile land, the property of one perſon, and yields excellent graſs, wheat and corn. Fine ſheep and cattle are raiſed on it. It is annexed to Eaſt Hampton, and lies 40 miles ſouth-weſterly of Newport, Rhode Iſland.—*ib.*

GAS. See that article, *Encycl.* and CHEMISTRY—*Index* in this *Supplement*. We have introduced the word here, to notice ſome experiments made by Profeſſor Jacquin of Vienna, at the deſire of Dr Chladni, on the different gaſes as the vehicle of ſounds. A glaſs bell was furniſhed with a metallic ſtopper cemented to a neck at the top: and in the bore of this cock, within the glaſs, a ſmall flute or pewter (etain) about ſix inches in length was fixed. The glaſs being then placed on the ſhelf of the pneumatic veſſel, and filled with any particular kind of gas, a bladder alſo filled with the ſame gas, and provided with a cock, was adapted to the external aperture of the cock belonging to the bell-glaſs. In this diſpoſition of the apparatus, the flute was made to ſound by gently preſſing the bladder. Comparative experiments were made with atmoſpheric air, oxygen, hydrogen, carbonic acid, and nitrous gas. The intenſity of the ſound did not vary; but when compared with that produced by atmoſpheric air, the oxygen gas gave a ſound half a tone lower; azotic gas, prepared by different methods conſtantly gave a ſound half a tone lower; hydrogen gas gave nine or eleven tones higher; carbonic acid gas gave one-third lower, and nitrous gas alſo very nearly a third lower. A mixture of oxygen gas and azote, in the proportions of the atmoſpheric air, afforded the tone of this laſt: that is to ſay, it was half a tone higher than each of the component parts alone. When the two gaſes were not uniformly mixed, the ſound was abominably harſh. Chladni intends to give a fuller account of theſe intereſting experiments. *Journal de Phyſique*, Vol. IV. N. S. p. 57.

GASPEE, or *Nanquit Point*, 7 miles S. of Providence

Gaspesia || Geneva.

dence (Rhode Island) projecting from the western shore of Providence river, remarkable as being the place where the British armed schooner, called the Gaspee, was burnt, June 10, 1772, by about 60 men from Providence, painted like Narraganset Indians. For the cause of this transaction, see Gordon's Hist. of the Amer. Rev. vol. I. p. 311.—*Morse.*

GASPESIA, a tract of country on the S. side of the mouth of St Lawrence river, and on the N. side of Chaleurs bay, in Lower Canada. Its E. extremity is Cape Rosiers. The Indians called Gaspesians inhabit here.—*ib.*

GATES *Co.* in Edenton eastern district, N. Carolina, is bounded N. by the state of Virginia, S. by Chowan co. It contains 5392 inhabitants, including 2219 slaves. Chief town, Hertford.—*ib.*

GAY *Head*, is a kind of peninsula on Martha's Vineyard, between 3 and 4 miles in length and 2 in breadth, and almost separated from the other part of the island by a large pond. The Indians inhabiting this part, when lately numbered, amounted to 203. The soil is good, and only requires cultivation to produce most vegetables in perfection. There are evident marks of there having been volcanoes formerly on this peninsula. The marks of 4 or 5 craters are plainly to be seen. The most southerly and probably the most ancient, as it is grown over with grass, now called the Devil's Den, is at least 20 rods over at the top, 14½ at the bottom, and full 130 feet at the sides, except that which is next the sea, where it is open. A man now alive relates that his mother could remember when it was common to see a light upon Gay Head in the night time. Others say, their ancestors have told them, that the whalemen used to guide themselves in the night by the lights that were seen upon Gay Head. The sea has made such encroachments here, that, within 30 years, it has swept off 15 or 20 rods. The extremity of Gay Head is the S. W. point of the Vineyard. N. lat. 41. 20. W. long. from Greenwich 70. 50.—*ib.*

GAZONS, in fortification, turfs, or pieces of fresh earth covered with grass, cut in form of a wedge, about a foot long, and half a foot thick, to line or face the outside of works made of earth, to keep them up, and prevent their mouldering.

GENESSEE *Country*, a large tract of land in the state of New-York, bounded N. and N. W. by lake Ontario, S. by Pennsylvania, E. by the western part of the military townships, in Onondago co. and W. by lake Erie and Niagara river. It is a rich tract of country, and well watered by lakes and rivers; one of the latter, Genessee river, gives name to this tract. It is generally flat, the rivers sluggish, the soil moist, and the lakes numerous.—*Morse.*

GENEVA, a lake in Upper Canada, which forms the W. extremity of lake Ontario; to which it is joined by a short and narrow strait.—*ib.*

GENEVA, a post town in Onondago co. New-York, on the great road from Albany to Niagara, situated on the bank of the N. W. corner of Seneca lake, about 74 miles W. of Oneida castle, and 92 W. of Whitestown. The Friends settlement lies about 18 miles below this. Here were 20 log-houses, and a few other buildings several years ago, which have much increased since.—*ib.*

Genevieve || George's.

GENEVIEVE, ST or *Missire*, a village in Louisiana, on the western bank of the Mississippi, nearly opposite to the village of Kaskaskias, 12 miles southerly of Fort Chartres. It contained about 20 years ago, upwards of 100 houses, and 460 inhabitants, besides negroes. —*ib.*

GEOCENTRIC PLACE of a planet, is the place where it appears to us from the earth; or it is a point in the ecliptic, to which a planet, seen from the earth, is referred.

GEOCENTRIC *Latitude* of a planet, is its latitude as seen from the earth, or the inclination of a line connecting the planet and the earth to the plane of the earth's (or true) ecliptic: Or it is the angle which the said line (connecting the planet and the earth) makes with a line drawn to meet a perpendicular let fall from the planet to the plane of the ecliptic.

GEOCENTRIC *Longitude* of a planet, is the distance measured on the ecliptic, in the order of the signs, between the geocentric place and the first point of Aries.

GEOMETRICAL METHOD OF THE ANCIENTS. The ancients established the higher parts of their geometry on the same principles as the elements of that science, by demonstrations of the same kind: and they were careful not to suppose any thing done, till by a previous problem they had shewn that it could be done by actually performing it. Much less did they suppose any thing to be done that cannot be conceived; such as the line or series to be actually continued to infinity, or a magnitude diminished till it become infinitely less than what it is. The elements into which they resolved magnitudes were finite, and such as might be conceived to be real. Unbounded liberties have of late been introduced; by which geometry, which ought to be perfectly clear, is filled with mysteries.

GEOMETRICAL *Solution* of a problem, is when the problem is directly resolved according to the strict rules and principles of geometry, and by lines that are truly geometrical. This expression is used in contradistinction to an arithmetical, or a mechanical, or instrumental solution, the problem being resolved only by a ruler and compasses.

The same term is likewise used in opposition to all indirect and inadequate kinds of solutions, as by approximation, infinite series, &c. So we have no geometrical way of finding the quadrature of the circle, the duplicature of the cube, or two mean proportionals, though there are mechanical ways, and others, by infinite series, &c.

GEORGE'S, ST a cape and islands nearly opposite to the river Apalachicola, on the coast of E. Florida. Cape St George's lies about 6 leagues to the eastward of Cape Blaize, being an elbow of the largest of St George's islands, in N. lat. 29 38. There is a large shoal running out from it a considerable way, but how far has not yet been ascertained. The coast between it and Cape Blaize, forms a kind of hollow bay, with deep soundings and a soft bottom. There are two islands to the N. W. of St George's Cape; that nearest to it is small, and remarkable for a clump of straggling trees on the middle of it; the other is pretty large, and of a triangular form, and reaches within 3 leagues of Cape Blaize, having a passage at each end of it for small craft into the bay, between these islands and

George ‖ George's. and the river Apalachicola; but this bay is full of shoals and oyster-banks, and not above two or three feet water at most, in any of the branches of that river.—*Morse.*

George, Fort, was situated on Point Comfort, at the mouth of James river, and 5 miles N. E. of Craney island, at the mouth of Elizabeth river, in Virginia.—*ib.*

George, Fort King, an ancient fort in Georgia, which stood 5 miles N. E. of the town of Darien, in Liberty co. situated at the head of a creek which flows into the ocean opposite Sapelo island. It is now in ruins.—*ib.*

George, Lake, in East Florida, is a dilatation of the river St Juan, or St John, and called also Great Lake. It is about 15 miles wide, and generally about 15 or 20 feet deep, excepting at the entrance of the river, where lies a bar, which carries 8 or 9 feet water. The lake is beautified with two or three fertile islands. The largest is about 2 miles broad, and commands a most delightful and extensive prospect of the waters, islands, E. and W. shores of the lake, the capes, the bay and mount Royal; and to the S. the view is very extensive. Here are evident marks of a large town of the aborigines, and the island appears to have been once the chosen residence of an Indian prince. On the scite of this ancient town stands a very pompous Indian mount, or conical pyramid of earth, from which runs in a straight line, a grand avenue or Indian highway, through a magnificent grove of magnolias, live oaks, palms and orange trees, terminating at the verge of a large, green, level savanna. From fragments dug up it appears to have been a thickly inhabited town.—*ib.*

George, Lake, lies to the southward of lake Champlain, and its waters lie about 100 feet higher. The portage between the two lakes is a mile and a half; but with a small expense might be reduced to 60 yards; and with one or two locks might be made navigable through, for batteaux. It is a most clear, beautiful collection of water; 36 miles long, and from 1 to 7 wide. It embosoms more than 200 islands, some say 365; very few of which are any thing more than barren rocks, covered with heath, and a few cedar, spruce and hemlock trees, and shrubs, and abundance of rattle-snakes. On each side it is skirted by prodigious mountains; from which large quantities of red cedar are annually carried to New-York for ship-timber. The lake is full of fishes, and some of the best kind, as the black or Oswego bass, also large speckled trouts. It was called lake Sacrament by the French, who, in former times, were at the pains to procure this water for sacramental uses in all their churches in Canada: hence probably it derived its name. The remains of Fort George stand at the S. end of the lake, about 14 miles N. by W. of Fort Edward, on Hudson river. The famous fort of Ticonderoga, which stood on the N. side of the outlet of the lake, where it discharges its waters into lake Champlain, is now in ruins.—*ib.*

Georges, St an island and parish belonging to the Bermuda isles, in the West-Indies. N. lat. 32. 45. W. long. 63. 30.—*ib.*

George's St a large and deep bay on the W. side of Newfoundland island. N. lat. 48 12.—*ib.*

George's Bank, St a fishing bank in the Atlantic ocean, E. of Cape Cod, in Massachusetts. It extends from N. to S. between 41. 15. and 42. 22. N. lat. and between 67. 50. and 68. 40. W. long.—*ib.* George's.

George's Key, St was one of the principal British settlements in the bay of Honduras. It was taken by the Spaniards during the American war, but retaken by the British soon after.

The British settlements on the Mosquito shore, and in the bay of Honduras, were surrendered to the crown of Spain, at the Spanish convention, signed at London, the 14th of July, 1786.—*ib.*

George's River, St in St Mary's co. Maryland, is a very broad but short creek, whose mouth lies between Piney Point and St Mary's river, on the N. bank of the Potowmack, opposite the island of the same name.—*ib.*

George's River, St in Lincoln co. district of Maine, or rather an arm of the sea, lies about 2 leagues S. W. of Penobscot bay. Four leagues from the mouth of this river stands Thomaston. This river is navigable for brigs and ships of a large burden up to the narrows; and from thence about 4 miles higher, to nearly the head of the tide, for sloops and schooners of 80 or 90 tons. It is about half a league wide up to the narrows. Of late several considerable vessels have been built in this river, which are employed in coasting, and sometimes in foreign voyages. There are now owned in this river, though it does not in all exceed 4 leagues in length, 1 brig, 2 topsail schooners, and 9 sloops: In all about 1100 tons. The navigation, however, is generally interrupted in winter, when not only the streams through the country, but the salt water rivers are locked up until spring. Fish abound here, of almost all kinds, in their season; and even lobsters, oysters, clams, and other delicacies of the aqueous kind, are plenty in this river.—*ib.*

George's, St a village nearly in the centre of Newcastle co. Delaware, on a creek of its own name, which falls into Delaware river, 4 miles below, a little above Reedy Island. It is 17 miles S. by W. of Wilmington, and 45 S. W. of Philadelphia.—*ib.*

Georges, St the capital of the island of Grenada, in the West-Indies; formerly called Fort Royale, which name the fort still retains. It is situated on a spacious bay, on the W. or lee-side of the island, not far from the S. end, and possesses one of the safest and most commodious harbors in the British W. Indies, which has lately been fortified at a very great expense, and declared a free port. This town was destroyed by a dreadful fire in 1771, and on November 1, 1775, it met with the like misfortune; and the loss was valued at £.500,000 The town now makes a very handsome appearance, has a spacious square or parade; the houses are built of brick, and tiled or slated; some few are built of stone, excepting the warehouses and dwelling-houses round the harbor, which are mostly wooden buildings. These are in a great measure separated from the town by a very steep and rocky hill, the houses on which, with the trees which serve for shade, have a romantic appearance. The town is computed to contain about 2000 inhabitants, many of whom are wealthy merchants. This was its situation before the insurrection of the negroes; of its present state we have not authentic information.—*ib.*

GEORGE-

GEORGETOWN, the chief town of Suffex co. Delaware, is fituated 16 miles W. S. W. of Lewiftown, and 103 S. of Philadelphia. It contains about 30 houfes and has lately been made the feat of the county courts.—*ib.*

Georgetown, a poft town in Maryland, fituated in Kent co. on the E. fide of Chefapeak bay, of about 30 houfes. It is 9 miles from the mouth of the river Saffafras, being feated on the S. fide oppofite to Frederic, 60 N. E. of Chefter, and 65 S. W. of Philadelphia.—*ib.*

Georgetown, a village of Fayette co. Pennfylvania, fituated on the S. E. fide of Monongahela river, at the mouth of George's creek. Here a number of boats are annually built for the trade and emigration to the weftern country. It lies 16 miles S. W. of Union.—*ib.*

Georgetown, a poft town and port of entry, in Montgomery co. Maryland, and in the territory of Columbia. It is pleafantly fituated on a number of fmall hills, upon the northern bank of Potowmack river; bounded eaftward by Rock creek, which feparates it from Wafhington city, and lies 4 miles from the capitol, and 8 N. of Alexandria. It contains about 230 houfes, feveral of which are elegant and commodious. The Roman Catholics have eftablifhed a college here, for the promotion of general literature, which is at prefent in a very flourifhing ftate. The building being found inadequate to contain the number of ftudents that applied, a large addition has been made to it. Georgetown carries on a fmall trade with Europe and the W. Indies. The exports in one year, ending Sept. 30, 1794, amounted to the value of 128,924 dollars. It is 46 miles S. W. by W. of Baltimore, and 148 S. W. of Philadelphia.—*ib.*

Georgetown, in Lincoln co. diftrict of Maine, is fituated on both fides of Kenebeck river. It was incorporated in 1716, is the oldeft town in the county, and contains 1333 inhabitants. It is bounded foutherly by the ocean, wefterly by the towns of Harpfwell and Brunfwick, N. wefterly by Bath, and eafterly by Woolwich; being entirely furrounded by navigable waters, excepting about 2 miles of land, which divides the waters of Winnagance creek, a part of the Kennebeck, from an arm or influx of Cafco bay, called Stephen's river.

The entrance at the mouth of Kennebeck river, is guided on the E. by Parker's ifland, belonging to this townfhip. It contains about 28,000 acres of land and falt marfh, and is inhabited by more than one third part of the people of the townfhip. This was the fpot on which the Europeans firft attempted to colonize New-England, in the year 1607. It is a part of what was called Sagadahock; and the patentees of the Plymouth company began here to lay the foundation of a great ftate. They fent over a number of civil and military officers, and about 100 people. By various misfortunes they were forced to give up the fettlement, and in 1608, the whole number who furvived the winter returned to England.

There was a tradition among the Norridgewalk Indians, that thefe planters invited a number of the natives, who had come to trade with them, to draw a fmall cannon by a rope, and that when they were ranged in a line, the white people difcharged the piece, and thereby killed and wounded feveral of them. The refentment of the natives at this treacherous murder, obliged the Europeans to reimbark the next fummer. Georgetown is 15 miles S. of Pownalborough, and 170 N. by E. of Bofton.—*ib.*

Georgetown, a poft town of Georgia, in the co. of Oglethorpe, 50 miles S. W. of Augufta, furrounded by a poor country; but, neverthelefs, exhibits marks of growing profperity.—*ib.*

Georgetown, a large maritime diftrict in the lower country of S. Carolina, fituated in the S. E. corner of the ftate; bounded N. E. by the ftate of N Carolina, S. E. by the ocean, S. W. by Santee river, which divides it from Charlefton diftrict, and N. W. by Camden and Cheraw diftricts. It is about 112 miles from N. to S. and 63 from E. to W. and is divided into the parifhes of All Saints, Prince George, and Prince Frederick. It contains, according to the cenfus of 1790, 22,122 inhabitants, of whom 13,131 are flaves. It fends to the ftate legiflature 10 reprefentatives and 3 fenators, and pays taxes to the amount of £.3585-12-6. —*ib.*

Georgetown, a poft town, port of entry, and capital of the above diftrict, is fituated on a fpot near which feveral ftreams unite their waters, and form a broad ftream called Winyaw bay, 12 miles from the fea. Its fituation connects it with an extenfive back country of both the Carolinas, and would be a place of vaft importance, were it not for a bar at the entrance of Winyaw bay, which interrupts the entrance of veffels drawing above 11 feet water, and is in many refpects a dangerous place. It contains above 300 houfes, built chiefly of wood. The public buildings are a court-houfe, gaol, and academy; 3 churches, of which the Epifcopalians, Baptifts, and Methodifts have one each. There is here a fmall trade to the Weft-Indies. The exports for one year, ending Sept. 30, 1795, were to the value of 21,511 dollars. It is 60 miles N. E. by N. of Charlefton, 127 S. W. of Wilmington, N. Carolina, and 681 from Philadelphia. N. lat. 33. 24. W. long. 79. 35.—*ib.*

GEORGIA WESTERN TERRITORY. Under this name is included all that part of the State of Georgia which lies weft of the head waters of thofe rivers which fall into the Atlantic Ocean. This extenfive tract of country embraces fome of the fineft land in the United States, is interfected with a great number of noble rivers, which may be feen by an infpection of the map, and is inhabited (except fuch parts wherein the Indian title has been extinguifhed) by three nations of Indians, viz. the Mufkogulge or Creek, the Chactaws, and Chicafaws. The Cherokees alfo have a title to a fmall portion of the northern part of this territory, on the Tenneffee river. Thefe nations together can furnifh between 8 and 9000 warriors. About 2000 families of white people inhabit thofe parts of this territory where the Indian title has been extinguifhed, chiefly at the Natchez, and the Yazoo river, on the banks of the Miffiffippi, and a confiderable number on the Tombigbee river, and fcattered among the Creek Indians. This territory, for reafons which will hereafter appear, has lately become an object of much public attention and inquiry, in Europe, as well as in the United States; and on this account, the following defcription of it and ftatement of facts relative

to

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to the sale of certain parts of it, and the claims of the United States, &c. have been collected and arranged with great care from the most authentic sources that can be obtained, and given under this head for the information of the public (A). This Territory, lying between the 31st and 35th degrees of N. latitude, is not subject to the extremes of heat or cold; the climate is temperate and delightful through the year; and except in low grounds, and in the neighbourhood of stagnant waters, is very healthful. White frosts, and sometimes thin ice, have been seen as far S. as the 31st degree of latitude; but snow is very uncommon in any part of this territory. A person residing at the Natchez writes to his friend, in the eastern part of Georgia, that "this country affords the best spring water; every person almost is in blooming health." (B) Others who have visited it, say of that part of the territory which borders on the Mississippi, that "the water is good for 20 miles back from the river, and the country healthy and pleasant, and of all others that they have seen the most desirable." Mr Hutchins, speaking of the same tract, says, "the climate is healthy and temperate, the country delightful and well watered, and the prospect is beautiful and extensive; variegated by many inequalities, and fine meadows, separated by innumerable copses, the trees of which are of different kinds, but mostly of walnut and oak. The elevated, open, and airy situation of this country, renders it less liable to fevers and agues (the only disorders ever known in its neighbourhood) than some other parts bordering on the Mississippi, where the want of a sufficient descent to convey the waters off, occasions numbers of stagnant ponds whose exhalations infect the air." Another traveller describes the country between the Tombigbee and the Coosa and Alabama as being healthy, well watered with many pleasant rivulets, affording delightful situations for settlements, and the water pure and very good.

To give a just view of the rivers, and to ascertain the advantages derived from them to this Territory, it is necessary to trace them from their mouths in the Gulf of Mexico. The Mississippi bounds this territory on the W. The free navigation of this noble river is now enjoyed by the inhabitants of the United States. It empties, by several mouths of different depths, from 9 to 16 feet, into the Gulf of Mexico, in about lat. 29 N. The bars at the mouth of this river frequently shift; after passing them into the river, there is from 3 to 10 fathoms of water, as far as the S. W. pass; and thence to the Missouri, a distance of 1,142 computed miles, from 12, 15, 20, and 30 fathoms is the general depth.

In ascending the Mississippi there are extensive natural meadows, with a prospect of the Gulf of Mexico on each side, the distance of 32 miles, to a place called Detour-aux-Plaquemines, in W. Florida. Thence 20 miles to the settlements, the banks are low and marshy, generally overflowed and covered with thick wood, palmetto bushes, &c. apparently impenetrable by man or beast. Thence to Detour-des Anglois, at the bend of the river, the banks are well inhabited; as also from hence to New-Orleans 18 miles, which distance there is a good road for carriages. Vessels pass from the mouth of this river to New-Orleans 105 miles, in 7 or 8 days, commonly; sometimes in 3 or 4.

From New-Orleans, the capital of Louisiana, there is an easy communication with West Florida by Bayouk Creek, which is a water of lake Ponchartrain, navigable for vessels drawing four feet water, six miles up from the lake, to a landing-place two miles from New-Orleans For nearly 50 miles, as you proceed up the river, both its banks are settled and highly cultivated, in part by emigrants from Germany, who furnish the market with indigo of a superior quality, cotton, rice, beans, myrtle wax, and lumber. In 1762, some rich planters attempted the cultivation of canes and the making of sugar, and erected mills for the purpose. This sugar was of an excellent quality, and, some of the crops were large; but some winters proving so severe as to kill the canes, no dependence can be placed on the culture of that article.

The settlements of the Acadians, which were begun in the year 1763, extend on both sides of the river, from the Germans, to the river Ibberville, which is 99 miles

(A) The sources whence the author has derived his information, in drawing up the following account, are Capt. Thomas Hutchins's "Historical narrative and topographical description of Louisiana and West-Florida," comprehending also many of the rivers and settlements in the Georgia Western Territory; published in 1784. Private letters and journals; minutes taken from verbal descriptions of gentlemen of veracity and intelligence who have resided in that country. The journals and laws of the State of Georgia—State papers, and Reports both printed and M. S. of Congress, and of Agents of the several companies who have purchased lands in this territory.

(B) The letter here alluded to contains the following paragraphs: "Our navigation is excellent: our high lands preferable to Beach Island, (1) when in its bloom; stock is as easy come at as where you are: lands are rising fast, and I expect will be very high in a few years. The canes in common, on the high lands, larger than in the river-swamps, [meaning in the eastern part of Georgia] from 30 to 35 feet high, and upwards, and in many places stand so thick, that one can scarcely walk a mile in half an hour. Some families must be coming to this most flourishing country in the world. I wish you to advise any of my relations you see to come with all haste: if they can get here, and are turned out naked in the world, in one year they might be fixed again. I am sure could I have time to say as much as I wish to say, you would be with me this fall. I could venture to almost promise, if you would be wise and come, to make good any deficiencies you might find in the place." The author is in possession of the original letter, above mentioned, which has every mark of authenticity; and the above extracts are inserted, as containing the simple, honest description of a plain farmer; on which more dependence is to be placed, than on the most elaborate and elegant descriptions of interested narrators.

(1) Alluding to a remarkably fertile island in the eastern part of Georgia, in the neighbourhood of the writer's correspondent, and with which both were well acquainted.

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miles above New-Orleans, and 270 from Pensacola, by way of lakes Ponchartrain and Maurepas.

At Point Coupee, 35 miles above the Ibberville, are settlements extending 20 miles on the W. side of the river, which, 30 years ago, had 2,000 white inhabitants, and 7,000 slaves, who were employed in the cultivation of tobacco, indigo, Indian corn, &c. for the New-Orleans market, which they furnished also with poultry, and abundance of squared timber, staves, &c.

Mr Hutchins, from his personal knowledge, describes the country on both sides of the Mississippi, between the latitudes 30 and 31, bordering on Georgia, as follows:

"Although this country might produce all the valuable articles raised in other parts of the globe, situated in the same latitudes, yet the inhabitants principally cultivate indigo, rice, tobacco, Indian corn, and some wheat; and they raise large flocks of black cattle, horses, mules, hogs, sheep and poultry. The sheep are said to make the sweetest mutton in the world. The black cattle, when fat enough for sale, which they commonly are the year round, are driven across the country to New-Orleans, where there is always a good market.

This country is principally timbered with all the different kinds of oak, but mostly with live-oak, of the largest and best quality, uncommonly large cypress, black walnut, hickory, white ash, cherry, plum, poplar trees, and grape vines; here is found also a great variety of shrubs and medicinal roots. The lands bordering the rivers and lakes, are generally well wooded, but at a small distance from them are very extensive natural meadows, or savannas, of the most luxuriant soil, composed of a black mould, about one and a half feet deep, very loose and rich, occasioned in part, by the frequent burning of the savannas; below the black mould is a stiff clay of different colours. It is said, this clay, after being exposed some time to the sun, becomes so hard, that it is difficult either to break or bend, but when wet by a light shower of rain, it slackens in the same manner as lime does when exposed to moisture, and becomes loose and moulders away, after which it is found excellent for vegetation."

After passing the 31st degree of N. lat. from W. Florida into Georgia, you enter what is called the *Natchez Country*, bordering on the Mississippi. Fort Rosalie, in this country, is in lat. 31 40, 243 miles above New-Orleans.

"The soil of this country is superior to any of the lands on the borders of the river Mississippi, for the production of many articles. Its situation being higher, affords a greater variety of soil, and is in a more favourable climate for the growth of wheat, rye, barley, oats, &c. than the country lower down, and nearer to the sea. The soil also produces in equal abundance, Indian corn, rice, hemp, flax, indigo, cotton, pot-herbs, pulse of every kind, and pasturage; and the tobacco made here, is esteemed preferable to any cultivated in other parts of America. Hops grow wild; all kinds of European fruits arrive to great perfection, and no part of the known world is more favourable for the raising of every kind of stock. The rising grounds, which are cloathed with grass and other herbs of the finest verdure, are well adapted to the culture of vines: the mulberry trees are very numerous, and the winters sufficiently moderate for the breed of silk worms. Clay of different colours, fit for glass works and pottery, is found here in great abundance; and also a variety of stately timber, fit for house and ship building, &c."

Another gentleman, well informed, (c) says, "The lands on the Mississippi, extending eastward about 20 miles, are hilly, without stones or sand, extremely rich, of a deep black soil, covered thick with canes, white and black oak, walnut, hickory, ash, some sugar maple, beech, and dogwood; that there are very few streams or springs of water; that the water is not good, and tastes as if impregnated with sulphur; that the country is much infested with insects; that the land is high and bluff three-fourths of the distance along the river Mississippi, and a part overflowed and drowned." But it is apprehended that this description is not perfectly just, so far as it applies to the scarcity and badness of the water; as a gentleman of respectable character, who resided 9 months at the Natchez, says, "The lands on the Mississippi are more level, and better watered, than is above represented; and that the water is good, and the country healthy and remarkably pleasant."

This country was once famous for its inhabitants, the Natchez Indians; who, from their great numbers, and the improved state of society among them, were considered as the most civilized Indians on the continent of America. Nothing now remains of this nation but their name, by which their country continues to be called. The district of the Natchez, as well as all along the eastern bank of the Mississippi to the river Ibberville, was settling very fast by emigrations from the northern States, till the capture of the British troops on the Mississippi, 1779, put an entire stop to it.

"From fort Rosalie to the Petit Goufre is 31½ miles. There is a firm rock on the east side of the Mississippi for near a mile, which seems to be of the nature of lime-stone. The land near the river is much broken and very high, with a good soil, and several plantations on it. From the Petit Goufre to Stoney river, is 4½ miles. From the mouth to what is called the fork of this river, is computed to be 21 miles. In this distance there are several quarries of stone, and the land has a clay soil, with gravel on the surface of the ground. On the north side of this river, the land in general is low and rich; that on the south side is much higher, but broken into hills and vales; but here the low lands are not often overflowed; both sides are shaded with a variety of useful timber. At the fork, the river parts almost at right angles, and the lands between and on each side of them are said to be clay and marl soil, not so uneven as the lands on this river lower down. From Stony river to Loufa Chitto, or Big Black river, is 10 miles. This river, at the mouth, is about 30 yards wide, but within, from 30 to 50 yards, and is said to be navigable for canoes 30 or 40 leagues. About a mile

(c) Mr Isaac Perry, of Burk county, Georgia.

mile and a half up this river, the high lands are cloſe on the right, and are much broken. A mile and a half further, the high lands appear again on the right, where there are ſeveral ſprings of water, but none as yet have been diſcovered on the left. At about 8 miles further, the high lands are near the river, on the left, and appear to be the ſame range that comes from the Yazoo cliffs. At ſix miles further, the high lands are near the river on both ſides, and continue for two or three miles, but broken and full of ſprings of water. This land on the left was choſen by Gen. Putnam, Capt. Enos, Mr Lyman, and other New-England adventurers, as a proper place for a town; and, by order of the governor and council of Weſt-Florida, in 1773, it was reſerved for the capital. The country round is very fit for ſettlements. For four or five miles above this place, on both ſides of the river, the land is rich, and not ſo much drowned, nor ſo uneven, as ſome parts lower down. About ſix miles and a half further, there is a rapid water, ſtones and gravel bottom, 160 yards in length; and in one place a firm rock almoſt acroſs the river, and as much of it bare, when the water is at a moderate height, as confines the ſtream to nearly 20 feet; and the channel is about four feet deep.

From the Louſa Chitto to the Yazoo Cliffs, is 40 miles. From this cliff the high lands lie north-eaſtward and ſouth-ſouth-eaſtward, bearing off from the river, full of cane and rich ſoil, even on the very higheſt ridges. Juſt at the S. end of the cliffs, the bank is low, where the water of the Miſſiſſippi, when high, flows back and runs between the bank and high land, which ranges nearly northerly and ſouth-ſouth eaſterly to the Louſa Chitto, occaſioning much wet ground, cypreſs ſwamp, and ſtagnant ponds. From the Cliffs, is ſeven miles and a half to the river Yazoo. The mouth of this river is upwards of 100 yards in width, and was found by Mr Gaul to be in lat. 32 37, and by Mr Purcell in 32 28 N. The water of the Miſſiſſippi, when the river is high, runs up the Yazoo ſeveral miles, and empties itſelf again by a number of channels, which direct their courſe acroſs the country, and fall in above the Walnut Hills. The Yazoo runs from the N. E. and glides through a healthy, fertile and pleaſant country, greatly reſembling that about the Natchez, particularly in the luxuriancy and diverſity of its ſoil, variety of timber, temperature of climate, and delightful ſituation. It is remarkably well watered by ſprings and brooks; many of the latter afford convenient ſeats for mills. Further up this river the canes are leſs frequent, and ſmaller in ſize, and at the diſtance of 20 miles there are ſcarcely any. Here the country is clear of underwood, and well watered, and the ſoil very rich, which continues to the Chactaw and Chickaſaw towns, on the eaſtern and north-weſtern branches of Yazoo river. Theſe branches unite 50 miles from the Miſſiſſippi, following the courſe of the river; the navigation to their junction, commonly called the Fork, is practicable with very large boats in the ſpring ſeaſon, and with ſmaller ones a conſiderable way further, with the interruption of but one fall, where they are obliged to make a ſhort portage, 20 miles up the N. W. branch, and 70 miles from the Miſſiſſippi. The country in which the Chactaw and Chickaſaw towns are ſituated, is ſaid to be as healthy as any part of the continent, the natives ſcarcely ever being ſick. Such of them as frequent the Miſſiſſippi, leave its banks as the ſummer approaches, leſt they might partake of the fevers that ſometimes viſit the low, ſwampy lands bordering upon that river. Wheat, it is ſaid, yields better at the Yazoo than at the Natchez, owing probably to its more northern ſituation. One very conſiderable advantage will attend the ſettlers on the river Yazoo, which thoſe at the Natchez will be deprived of, without going to a great expenſe; that is, the building with ſtone, there being great plenty near the Yazoo, but none has yet been diſcovered nearer to the Natchez than the Petit Goufre, or Little Whirlpool, a diſtance of about 31 miles. Between this place and the Balize, there is not a ſtone to be ſeen any where near the river. Though the quantity of good land on the Miſſiſſippi and its branches, from the Bay of Mexico to the river Ohio, a diſtance of nearly one thouſand miles, is vaſtly great, and the conveniences attending it; ſo likewiſe we may eſteem that in the neighbourhood of the Natchez, and of the river Yazoo, the flower of it all.

About a mile and a half up the Yazoo river, on the N. ſide, there is a large creek, which communicates with the Miſſiſſippi above the river St Francis, about 100 leagues higher up, by the courſe of the river. It paſſes through ſeveral lakes by the way. At the diſtance of 12 miles from the mouth of the river Yazoo, on the S. ſide, are the Yazoo hills. There is a cliff of ſolid rock at the landing place, on which are a variety of broken pieces of ſea ſhells, and ſome entire. Four miles further up, is the place called the Ball Ground, near which a church, fort St Peter, and a French ſettlement, formerly ſtood. They were deſtroyed by the Yazoo Indians in 1729. That nation is now entirely extinct." [*Hutchins.*]

From about 20 miles eaſtward of the Miſſiſſippi, to Half way or Pearl river, the diſtance of about 60 miles, (ſome ſay leſs) is "a fine, level country, very fertile, and better watered than nearer the Miſſiſſippi. There is ſome mixture of ſand with loam, the timber the ſame, with the addition of black-jack, and poſt-oak. This tract is interſperſed with what the French call *Prairies* or *Savannas*, which are extenſive intervals of 1,000 and 2,000 acres of excellent land, of a deep black ſoil, free of all timber and trees. It is this kind of land which the Indians cultivate. From the Miſſiſſippi to this river, there are no Indians. To a tract of this country, extending along the Miſſiſſippi from the 31ſt degree of latitude to the Yazoo river, at the S. end, 30 miles wide, and narrowing as you proceed northerly to the width of 15 miles, the Indian title has been extinguiſhed. It was at firſt purchaſed by the Engliſh; but they, not having completed the payment for it, before it fell into the hands of the Spaniards, they, (the Spaniards) in the year 1792, paid the balance. At Walnut Hills, the Spaniards have a fort, which, according to treaty, is to be given up (if not already done) to the United States. To the country N. of the Yazoo, the Indian title is not yet extinguiſhed. About one half of the ſouthern part, a diſtance of about 50 miles up the Yazoo, is owned by the Chactaws, the northern half by the Chickaſaws." The gentleman who gives the above information, and who was in this country in the year 1792, ſays, "that the Yazoo is about 50 yards wide; is boatable 100 miles; that he croſſed the country by different routes, 3 or 4 times from the Miſſiſippi to the Tombigbee; paſſed over the Yazoo ſeveral times; went up and down the river on the ſhore, and ſays that the lands to the E of the Yazoo (the diſtance of about 100 miles) are very excellent"

Pearl river is about 40 yards wide; a branch of it paſſing E. of the Natchez and neareſt, in Coxe's map, bears the name of Buffaloe river. On the E. ſide of Pearl river, commence the Chactaw ſettlements, and extend thick to the Chickataw Hay river; thence, about 40 miles eaſtward, the ſettlements are ſparſe, and extend near to the Tombigbee. This is a numerous nation, containing about 3000 hunters, a peaceable and friendly people. The country inhabited by theſe Indians is noted in Coxe's map, to be "poor and barren land, covered generally with long leafed pine." Other accounts repreſent it as much the ſame as that between the Miſſiſippi and Pearl rivers, with the addition of ſome pine land, and better watered. The ſtreams on which the Chactaws are ſettled, as laid down on Coxe's map, are, proceeding from W. to E. the Homachitta, (called by Purcell Hoſtaphatcha) Chactaw, and Souhawtee, which unite, and the main ſtream retains the name of Homachitta till it empties into the Gulf of Mexico. This is probably the ſame river that Hutchins calls Paſcagoula. The head branches of this river ſpread extenſively through the northern part of this Territory, chiefly weſtward of the Chactaw nation. White, or Bluff river, on Coxe's map, appears to riſe in about lat. 33. N. takes a courſe to the E. of the Chactaws, and empties into the Tombigbee, ſome diſtance below the head of the tide water, and is laid down as about the ſize of Pearl river.

From the compact ſettlements of the Chactaws eaſtward to the weſtern branches of the Tombigbee, the land is tolerably good; the timber generally oak and pine, with ſome hickory, well watered and level. Of this kind is the country a diſtance of about 40 miles W. of the weſtern branches of the Tombigbee; thence to the Tombigbee, the land is more uneven, interſperſed with large ſavannas, and the whole generally good land, and pretty well watered; the water, however, has a limy taſte. The natural growth much the ſame as on the Miſſiſippi. The intervale, or as they call it in this country, the *bottom lands*, are generally about a mile wide on the river, extremely rich, and thickly overgrown with canes. This general deſcription will apply to the whole tract belonging to the "Georgia Miſſiſſippi Company." Mr Coxe, on his map, remarks that, "On the Tombigbee and Alabama rivers there are bodies of fine rich land, but low down, towards Mobile Bay, unhealthy."

We have now arrived eaſtward to the Mobile, the principal river in this territory. "On the bar at the entrance of the bay of Mobile, there is only about 15 or 16 feet water; two-thirds of the way through the bay, towards the town of Mobile, there is from 2 to 3 fathoms; and the deepeſt water to be depended on in the upper part of the bay is only 10 or 12 feet, and in many places not ſo much. Large veſſels cannot go within 7 miles of the town." [*Hutchins.*] "This bay is about 30 miles long, and from 10 to 12 wide. The tide flows 60 or 70 miles above this bay, and is ſo far navigable for ſea veſſels. Thence 150 or 200 miles north, is good boat navigation, ſmooth water, generally 100 to 150 yards wide, and 8 to 10 feet deep." [*M. S. Minutes from Mr Perry*] "The bay of Mobile terminates a little to the north eaſtward of the town, in a number of marſhes and lagoons; which ſubject the people to fevers and agues, in the hot ſeaſon.(A) The river Mobile, as you aſcend it, divides into 2 principal branches, about 40 miles above the town; one of which, called the Tanſaw, falls into the eaſt part of the bay; the other empties itſelf cloſe by the town, where it has a bar of 7 feet; but there is a branch a little to the eaſtward of this, called Spaniſh river, where there is a channel of 9 or 10 feet, when the water is high; but this joins Mobile river about 2 leagues above the town. Two or three leagues above the Tanſaw branch, the Alabama river falls into Mobile river, after running from the north-eaſt a courſe of about 130 miles; that is, from Alabama fort, ſituated at the confluence of the Cooſa, and Talipooſee, both very conſiderable rivers; on which and their branches are the chief ſettlements of the Upper Creek Indians. The French fort at Alabama was evacuated 1763, and has not ſince been garriſoned. Above the confluence of Alabama and Mobile, the latter is called the Tombigbee river, from the fort of Tombigbee, ſituated on the weſt ſide of it, about 96 leagues above the town of Mobile. The ſource of this river is reckoned to be about 40 leagues higher up, in the country of the Chickaſaws. The fort of Tombigbee was taken poſſeſſion of by the Engliſh, but abandoned again in 1767, by order of the commandant of Penſacola. The river is navigable for ſloops and ſchooners about 35 leagues above the town of Mobile. The banks, where low, are partly overflowed in the rainy ſeaſons, which adds greatly to the ſoil, and adapts it particularly to the cultivation of rice. The ſides of the river are covered in many places with large canes, ſo thick that they are almoſt impenetrable; there is alſo plenty of remarkable large red and white cedar, cypreſs, elm, aſh, hickory, and various kinds of oak. Several people have ſettled on this river, who find the ſoil to anſwer beyond expectation. The lands near the mouth of the Mobile river are generally low; as you proceed upwards, the land grows higher, and may with propriety be divided into three ſtages. Firſt, low rice lands, on or near the banks of the river, of a moſt excellent quality. Secondly, what are called by the people of the country, ſecond low lands, or level flat cane lands, about 4 or 5 feet higher than the low rice lands. And, thirdly, the high upland or open country. The firſt, or low lands, extend about an half or three-quarters of a mile from the river, and may almoſt every where be eaſily drained and turned into moſt excellent rice fields, and are capable of being laid under water at almoſt all ſeaſons of the year. They are a deep black mud or ſlime, which have in a ſucceſſion of time been accumulated, or formed by the overflowing of the river. The ſecond low grounds being, in general, formed by a regular riſing of about

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(A) Mr Coxe, in his map, extends Mobile Bay ſome diſtance north of the 31ſt degree of latitude. Other accounts ſay this bay does not extend into the State of Georgia.

Georgia Western Territory.

4 or 5 feet higher than the low lands, appear to have been originally the edge of the river. The second class or kind of land is in general extremely rich, and covered with large timber and thick strong canes, extending in width upon an average three-quarters of a mile, and in general a perfect level. It is excellent for all kinds of grain, and well calculated for the culture of indigo, hemp, flax, or tobacco. At the extremity of these second grounds, you come to what is called the high or uplands, which is covered with pine, oak, and hickory, and other kinds of large timber. The soil is of a good quality, but much inferior to the second or low land. It answers well for raising Indian corn, potatoes, and every thing else that delights in a dry soil. Further out in the country again, on the west side of this river, you come to a pine barren, with extensive reed swamps and natural meadows or savannas, which afford excellent ranges for innumerable herds of cattle. On the east of the river Mobile, towards the river Alabama, is one entire extended rich cane country, not inferior, perhaps, to any in America. Whenever portages are made between the Mobile and Tennessee river, or their branches, which are probably but a few miles apart, the Mobile will be the first river for commerce (the Mississippi excepted) in this part of the world, as it affords the shortest and most direct communication to the sea." [*Hutchins.*]

In addition to, and confirmation of, the above account of Capt. Hutchins, several other gentlemen of intelligence who have been in this country, say that "the Tombigbee is navigable for sea vessels 60 miles into the State of Georgia;" (B) others, that "it is navigable in boats of 20 tons up to the junction of 10 and 20 Mile Creek. The Alabama and Coosa are navigable for boats of 40 tons, as high as the big shoals of Coosa river. The principal rivers which meander through this tract of country, are Seprey's and Cane Brake rivers, both which fall into the Tombigbee, and are navigable for boats as high as the 33d degree of latitude; and the Cawhawbon river, which falls into Alabama river, below the junction of Coosa and Oakfuskee, are boatable as far N. as the rivers last mentioned. The soil on the E. side of Tombigbee, is of a reddish cast, producing naturally oak, hickory, and abundance of very high grass. The country appears well calculated for the culture of wheat, corn, rye, oats, and barley. The bottoms or intervales on the rivers are not subject to inundations, and are exceedingly rich. The country is well watered with good wholesome water. Further north, the country becomes uneven and somewhat hilly, that part particularly which divides the waters of Tombigbee from Tennessee river, but as you descend to a lower latitude, the country is more level; and down about the mouth of Cane Brake river, and thence across to the Alabama, is almost one entire cane brake."

"The ridge which divides the Tombigbee and Alabama rivers is stony, and the soil inferior to that on the rivers; of this description also is the country lying between the Cawhawbon and Alabama rivers; but the bottom lands on the water courses are exceedingly rich. The country is pleasant and healthy, being generally overgrown with high grass, well calculated for farming, particularly for raising cattle. There are many extensive and rich bottoms of cane land on the Alabama. The river which falls into the Tombigbee next above Seprey's river, has much rich land on its banks, and is boatable some distance in small boats, and spreads into many branches, through a pleasant, healthy, and well watered country." [*Coxe's M. S. Letter.*] As you advance eastward of the Alabama, in the Territory we are describing, you come first to the Escambia river, and then to the Chatta Hatcha, or Pea river, which Capt. Hutchins thus describes—"The river Escambia is the most considerable that falls into the Bay of Pensacola. The Chatta Hatcha or Pea river, which also heads in the Georgia Western Territory, empties from the N. E. into Rose bay, which is 30 miles long and from 4 to 6 broad. The bar at the entrance into the bay has only 7 or 8 feet water, at deepest; but, after crossing the bar, has 16 or 17 feet. The mouths of the river (for almost all the southern rivers have several mouths) are so shoal, that only a small boat or canoe can pass them. Mr Hutchins ascended this river about 75 miles, and found that its banks very much resembled those of Escambia. Further east are the Appalachicola, Flint, and Alabama rivers, which are described under their respective heads.

The northern parts of this Territory are watered by the great bend of the Tennessee, and its tributary streams. This noble river bends southward as far as latitude 34. 15 according to Capt. Hutchins' map, and divides, into nearly equal parts, the purchase of the *Tennessee Company*. North of the Tennessee, in this purchase, there is not an Indian inhabitant. From the south, the Tennessee, in its course through Georgia, receives, besides smaller streams, the Hiwassee, Chiccamauga, and Occochappo or Bear Creek. Travellers speak of the lands on the bend of the Tennessee, in terms of the highest commendation.

Of the Territory described above, the State of Georgia, by act of their legislature, passed Jan. 7, 1795, sold about twenty-two millions of acres to four different companies, whose names and the limits of their respective purchases, as defined by the act, follow.

1. "All that tract or parcel of land including islands, beginning on Mobile bay, where the lat. 31. N. of the equator intersects the same, running thence up the said bay to the mouth of the lake Tensaw; thence up the said lake Tensaw, to the Alabama river, including Curreys and all other islands therein; thence up the said river Alabama, to the junction of the Coosa and Oakfuskee rivers; thence up the Coosa river, above the Big Shoals, to where it intersects the latitude of 34. N. of the equator; thence a due W. course to the Mississippi river; thence down the middle of the said river, to the latitude of 32. 40.; thence a due E. course to the Dan or Tombigbee river; thence down the middle of the said river to its junction with the Alabama river; thence down the middle of the said river to Mobile Bay; thence down the said Mobile Bay, to the place of beginning, shall be sold unto James

(B) Col. Hammond, late surveyor gen. of Georgia.

James Gunn, Matthew M'Alliſter, and George Walker, and their aſſociates, called *The Georgia Company.*"

2. "All that tract of country, including iſlands, within the following boundaries, viz. beginning on the river Miſſiſſippi, at 31. 18. N. lat. thence a due E. courſe to the middle of Dan or Tombigbee river; thence up the middle of the ſaid river to N. lat. 32. 40; thence a due W. courſe along the Georgia Company line, to the river Miſſiſſippi; thence down the middle of the ſame, to the place of beginning, ſhall be ſold to Nicholas Long, Thomas Glaſſcock, Ambroſe Gordon, and Thomas Cummings, and their aſſociates, called *The Georgia Miſſiſſippi Company.*"

3. "All that tract of country, including iſlands, within the following boundaries, viz. beginning at the Miſſiſſippi river, where the northern boundary line of the State ſtrikes the ſame; thence along the ſaid northern boundary line, due E. to the Tenneſſee river; thence along the ſaid Tenneſſee river, to the mouth of Bear Creek; thence up Bear Creek, to where the parallel of latitude 25 Britiſh ſtatute miles S. of the northern boundary line of the State interſects the ſame; thence along the laſt mentioned parallel of latitude, acroſs Tombigbee or Twenty Mile Creek, due W. to the Miſſiſſippi river; thence up the middle of the ſaid river, to the beginning, ſhall be ſold to John B. Scott, John C. Nightingale, and Wade Hampton, called *The Upper Miſſiſſippi Company.*"

4. "All that tract of land, including iſlands, within the following boundaries, viz. beginning at the mouth of Bear Creek, on the S. ſide of Tenneſſee river; thence up the ſaid creek to the moſt ſouthern ſource thereof; thence due S. to lat. 34. 10. N. thence due E. 120 miles; thence a due N. courſe to the Great Tenneſſee river; thence up the middle of the ſaid river to the northern boundary line of the State; thence a due W. courſe along the ſaid line to where it interſects the Great Tenneſſee river, below the Muſcle Shoals; thence up the ſaid river to the place of beginning, ſhall be ſold to Zachariah Cox, Mathias Maher, and their aſſociates, called *The Tenneſſee Company.*"

The ſame law enacts alſo, "that all lands lying weſtward and ſouthward of the eaſtern boundary of the ſeveral Companies' purchaſes, and not included therein, eſtimated at one fourth of the whole lands lying weſtward and ſouthward of the eaſtern boundary of the ſaid purchaſes, and ſuppoſed to contain 7,250 000 acres, ſhall be, and the ſame is hereby declared to be reſerved and ſet apart to, and for the uſe and benefit of this State, to be granted out, or otherwiſe diſpoſed of, as future legiſlatures may direct." [*Act of Georgia Legiſlature of Jan. 7th, 1795.*]

The purchaſe-mony, amounting to 500,000 dollars, was duly paid by the reſpective Companies, into the State treaſury of Georgia, agreeably to the terms of the act. This land was ſoon after ſold by the original Companies, to various gentlemen, principally in the Middle and Eaſtern States. The ſale of this territory excited a warm and violent oppoſition in Georgia. The act authoriſing this ſale, was by certain leading men in the State, declared to be "an uſurped act,—repugnant to the principles of the Federal Conſtitution, and of the Conſtitution of Georgia—oppoſed to the good of the ſtate, and obtained by fraud, atrocious ſpeculation, corruption and colluſion." In conſequence of theſe repreſentations, a determination was formed by a powerful party, to ſet aſide and annul, at the ſucceeding ſeſſion of the legiſlature, this offenſive, "uſurped act." Efforts were accordingly made, and with ſucceſs, to obtain a legiſlature ſuited to the accompliſhment of their deſigns. Accordingly, on the 13th of Feb. 1796, an act was paſſed declaring the above-mentioned "uſurped act" null and void; and all the grants, rights and claims ariſing there-from, of no validity or effect; and that the ſaid territory was the ſole property of the State." To complete the utter annihilation of this odious act, as far as poſſible, the legiſlature ordered, that, in their preſence, and that of the public officers of the State, the ſeveral records, documents and deeds, in the ſeveral public offices, ſhould be "expunged from the faces and indexes of the books of record of the State; and the enrolled law, or uſurped act, publickly burnt." All this was accompliſhed three days after the paſſing of the act. Theſe unprecedented proceedings were attended and followed with moſt diſagreeable and tumultuary effects. The original purchaſers of theſe lands, the then holders, and all thoſe who had been intermediately concerned, who had by this time become a numerous and reſpectable body, ſcattered through the United States, were, for the moment, thrown into an unpleaſant dilemma, and for a time this buſineſs was the general topic of converſation. The title to the lands purchaſed by the above named companies, has been ſtill further embarraſſed by a claim brought forward in behalf of the United States.—*ib.*

GEORGIA, a townſhip in Franklin co. Vermont, contains 340 inhabitants. It is ſituated on Lake Champlain, oppoſite to the N. end of South Hero Iſland, and joins Milton on the S. and St Alban's on the north. La Moille river croſſes the extremity of the S. E. corner of this townſhip.—*ib.*

GEORGIA, *Southern*, a cluſter of barren iſlands, in the South Sea, and E. of the coaſt of Terra del Fuego; about lat. 54. 35. S. and long. 36. 30. W. One of them is between 50 and 60 leagues in length. —*ib.*

GEORGIUM SIDUS (ſee ASTRONOMY-*Index*, *Encycl*,) has no fewer than ſix ſatellites revolving round it, all diſcovered by Dr Herſchel. Of the two which he firſt diſcovered, one was found to revolve in 8 days 17 h. 1 m. 17 ſec. at the diſtance of 33″ from its primary; and the other in 13 d. 11 h. 5 m. 1,5 ſec. at the diſtance of 44″,23. The planes of their orbits form ſuch large angles with that of the planet itſelf, and conſequently of the ecliptic, as to be almoſt perpendicular to it. To this remarkable departure from the analogy of the old planets, another ſtill more ſingular has been lately announced. They move in a retrograde direction! The new ſatellites revolve as follows, the periodical times being inferred from their greateſt elongations: The interior ſatellite in 5 d. 21 h. 25 m. at the diſtance of 25″,5. A ſatellite intermediate between the two old ones in 10 d. 23 h. 4m. at the diſtance of 38″,57. The neareſt exterior ſatellite at about double the diſtance of the fartheſt old one, and conſequently its periodical time 38 d. 1 h. 49 m. And the moſt diſtant ſatellite full four times as far from its primary as the

the old ſecond ſatellite. Whence it will take at leaſt 107 d. 16 h. 40 m. to complete its revolution. Whether the motions of theſe four be direct or retrograde, is, we ſuppoſe, not yet determined.

From ſome obſervations of the Doctor, with an excellent ſeven-feet teleſcope, certain appearances reſembling that of two rings ſurrounding the planet, and croſſing each other at right angles, were ſeen on ſeveral different days. They were not altered in poſition by turning the ſpeculum in its cell; but (ſays Mr Nicholſon) there is little doubt that they were optical deceptions, becauſe they kept their poſition with reſpect to the tube, after the relative poſition of the parallel had been much changed by the earth's rotation, and becauſe they did not appear with larger teleſcopes applied during the courſe of ten years. The diſk of the Georgium Sidus is flattened. It therefore revolves with conſiderable rapidity on its axis. From the very faint light of the ſatellites, they are obſerved to diſappear in thoſe parts of their orbits which bring them apparently neareſt the planet. This does not ariſe from an atmoſphere; for the effect is the ſame, whether the ſatellite be within or beyond the planet.

GERARD (Alexander, D. D.) was the eldeſt ſon of the reverend Gilbert Gerard miniſter of Chapel-Garioch, in the county of Aberdeen. He was born on the 22d of February, 1728, and received the firſt rudiments of his education at the pariſh ſchool of Foveran in the ſame county.

It may perhaps be proper to inform our readers, that in every pariſh in Scotland there is a ſchool where, for very ſmall fees, the youth of the pariſh are not only taught to read the Engliſh language, to write, and to perform the elementary operations of arithmetic, but are alſo inſtructed in the Greek and Latin languages. Of theſe ſchools, many of the maſters were, about ſixty years ago, eminent for claſſical learning; and it ſeems that Mr Forbes, the maſter of the ſchool of Foveran poſſeſſed ſuch fame as a teacher, that Mr Gerard judged it more expedient to commit his ſon to his care than to have him educated at the ſchool of his own pariſh, and under his own immediate inſpection. The attainments which that ſon afterwards made in literature, evince that his judgment was correct, and that the ſchoolmaſter of Foveran deſerved the fame which he enjoyed.

Young Gerard, however, did not remain long at Foveran. His father died when he was but ten years old; and his mother removing ſoon afterwards with her family to Aberdeen, he was of courſe put to the grammar-ſchool in that city; but ſo ſolid was the foundation which had been already laid, that in two years time he was deemed fit for the univerſity, and was accordingly entered a ſtudent in Mariſchal college. Such rapid progreſs ſupplies the place of that teſtimony which we have not been able to procure, reſpecting his early attachment to literature.

After completing the uſual academical courſe of four years in the ſtudy of Greek, Latin, mathematics, and philoſophy, he was admitted to the degree of maſter of arts; and immediately afterwards commenced the ſtudy of theology, which he proſecuted in the univerſities of Aberdeen and Edinburgh. In 1748, when he had little more than completed his twentieth year, he was licenced to preach in the church of Scotland, and two years afterwards was choſen aſſiſtant to Mr David Fordyce profeſſor of philoſophy in the Mariſchal college and univerſity of Aberdeen. In this capacity he performed the duties of the abſent profeſſor till the 7th of July 1752, when he was appointed ſucceſſor to Mr Fordyce who had been drowned, on the coaſt of Holland, as has been already related in the Encyclopædia.

At that period it was the practice in the Mariſchal college, as it continued to be in the King's, for the ſame profeſſor to carry forward a claſs of ſtudents for three ſucceſſive years, through all the different branches of philoſophy which were taught in the college. Theſe were, LOGIC, ONTOLOGY, PNEUMATICS, MORALS, POLITICS, and NATURAL PHILOSOPHY; and Mr Gerard carried one claſs through this extenſive courſe. MATHEMATICS and the GREEK language were taught by ſeparate profeſſors.

About the year 1754, a very material alteration was made in the *order* of teaching philoſophy in the univerſity of Aberdeen; and in the Mariſchal college each profeſſor was reſtricted to one department of ſcience. The principal and profeſſors in that college, juſtly obſerving that the public is intereſted in every thing which relates to education, thought it incumbent upon them to lay before that public the reaſons which had determined them to deviate from the arrangement which they had hitherto obſerved; and they employed profeſſor Gerard to draw up theſe reaſons. This taſk he performed in a ſmall pamphlet, which, being printed by the appointment of the college, appears to have given very general ſatisfaction.

This, indeed, it could hardly fail to do; for the judicious author points out very clearly the inconveniences of the old, and the advantages of the new plan of academical ſtudy. Having obſerved, that the philoſophy which had ſo long kept poſſeſſion of the ſchools, conſiſted, in a great meaſure, of verbal ſubtleties and theories ill-grounded, though ingeniouſly deviſed, he proceeds to contraſt it with the philoſophy of Bacon and Locke, and to ſhow of how little value the former is when compared with the latter. He then enters on a brief examination of the ſcholaſtic logic, and proves, to the conviction of every impartial judge, that the art of ſyllogizing, though a proper enough introduction to a philoſophy which was built on general principles, either taken for granted, or founded on very narrow and inadequate obſervation, is by no means fitted to aſſiſt the mind in the cultivation of that ſcience which is deduced by induction from particular facts. "The only baſis of philoſophy (ſays he) is now acknowledged to be an accurate and extenſive hiſtory of nature, exhibiting an exact view of the various phenomena, for which philoſophy is to account, and on which it is to found its reaſonings. This being the reformed ſtate of philoſophy, great inconveniences muſt be found in proſecuting the ſcholaſtic order of the ſciences. The ſtudent muſt make a tranſition at once from words and languages to philoſophy, without being previouſly introduced to the knowledge of facts, the ſole foundation of, and preparation for it; he muſt be hurried at the firſt into the moſt abſtruſe, difficult, and ſubtle parts of it; he muſt be put upon examining the nature, foundation and different kinds of evidence and reaſoning, before he is acquainted with any ſpecimens of theſe kinds by by which they may be illustrated. And in proportion as philosophy is more improved, and more thoroughly reformed, these inconveniences must become more sensible.

"The view of these (continues he) induced the masters of the Marischal college to think of altering the hitherto received order; and after the most mature deliberation, made them at last resolve, that their students should, after being instructed in languages and classical learning, be made acquainted with the elements of history, natural and civil, of geography and chronology, accompanied with the elements of mathematics; that they should then proceed to natural philosophy; and, last of all, to morals, politics, logic, and metaphysics."

In vindicating this arrangement, he labours with great earnestness, and we think with complete success, to shew the propriety of making logic the last branch of academical study. "All sciences (says he), all departments of knowledge whatever, must be premised as a ground-work to genuine logic. History has one kind of evidence, mathematics another, natural philosophy one still different, the philosophy of human nature another distinct from all these; the subordinate branches of these several parts have still minuter peculiarities in the evidence appropriated to them. An unprejudiced mind will in each of these be convinced by that species of argument which is peculiar to it, though it does not reflect *how* it comes to be convinced. By being conversant in *them*, one is prepared for the study of *logic*; for *they* supply him with a fund of materials; in *them* the different kinds of evidence and argument are exemplified; from *them* only those illustrations can be taken, without which *its* rules and precepts must be unintelligible.

"All just conclusions concerning the works of nature must be founded on an induction of particulars. And as in *natural philosophy* these particulars are supplied by observations and experiments on *natural bodies*; so in *logic*, the particulars, of which an induction must be made, are to be learned only from the body of *arts and sciences*. These are the subjects on which observations must be made, in order to lay down rules for investigating and proving the truths of which they are made up; just as the genuine performances of any art are what must be considered and observed in laying down the rules of that art. No solid precept can be formed in logic, except by examining arts and sciences, and attending to the method of reasoning used in them, and to the evidence that accompanies it. In proportion as they are cultivated, and no farther, logic may be improved. And what is true of the invention of logic, is true likewise of the study of it. It can be understood no farther, than the several sciences which it reviews and criticises are previously understood. Accordingly we find, that all the systems of logic which have not been compiled from a careful review and examination of the several sciences, consist more of ingenious subtleties than of useful precepts assisting to the mind in the various parts of knowledge. And when logic has been learned before the other sciences, the substantial parts of it have been scarce attended to, or made any use of, in the prosecution of them; nor so much as understood, but in as far as the mind was gradually opened, and brought to recollect them in its progress through the sciences.

"Logic is precisely the same to *philosophy* that works of criticism are to *poetry*. The rules of criticism are formed by an accurate scrutiny and examination of the best works of poetry. To one who had never read a poem, these rules would be obscure and useless; he could not comprehend them, far less would he be able to form a judgment of their justness, and of the reasons on which they are founded. If one peruses the best poetical performances, he will acquire some degree of taste, though he has never professedly studied the rules of criticism; and he will, at the same time, lay in materials, and obtain a stock of examples, which may render these rules intelligible to him, and enable him to judge whether they are just or not. And by afterwards studying these rules, he improves, refines, and corrects his taste, perceives the principles on which he has founded all his judgments, though he did not in the mean time think of them, and gains additional security against his judging wrong. This may illustrate what has been said of the place which logic ought to hold among the sciences. The observations made in it, both concerning the methods of invention and of probation, are founded on, and deduced from, the several sciences in which these methods are used. Neither the observations themselves, nor the reasons on which they are built, can be fully comprehended by one absolutely ignorant of these sciences. In studying the particular sciences, reason will spontaneously exert itself: if the proper and natural method of reasoning is used, the mind will, by the native force of its faculties, perceive the evidence, and be convinced by it, though it does not reflect *how* this comes to pass, nor explicitly consider according to what general rules the understanding is exerted. By afterwards studying these rules, one will be farther fitted for prosecuting the several sciences: the knowledge of the grounds and laws of evidence will give him the security of *reflection*, against employing wrong methods of proof and improper kinds of evidence, additional to that of *instinct* and *natural genius*. And thus logic will greatly contribute to improvement in knowledge; and more so, when it is used as a *review* of the method taken in the prosecution of science, of the foundations gone upon, and of the general rules that have been observed, than when it is applied as an *introduction* to the elements of science; for in the former case, its rules can be perfectly understood, sufficiently illustrated and put in practice as they are learned, which in the latter is quite impossible."

Having thus vindicated the new arrangement with respect to the place which it assigns to the study of logic, he proceeds to inquire in what order the other sciences should succeed each other. "Ethics (says he) or moral philosophy is founded as well as logic on pneumatics, and must therefore come after it. The constitution of man, and his several active powers, must be explained, before his business, his duty, and his happiness, can be discovered. Jurisprudence and politics, taking a more complex view of man than morals, by considering his various states, as well as his nature and powers, cannot, with any propriety, be introduced till morals have first been studied.

"It only remains then to determine whether natural philosophy or pneumatology ought, in the order of teaching, to have the preference. And many considerations seem to require that the former should be studied

died first. If it were not, pneumatology would be too far disjoined from the practical sciences founded on it; one of which, logic, ought, as we have seen, to be taught last of all. Besides, we ought always to begin with the easiest and most obvious subjects, and to proceed gradually to the most difficult; and in order to this, we ought to comply as much as possible with the natural openings and progress of the human mind. Now it is evident, that the mind receives first of all impressions and ideas of those sensible things with which it is surrounded. It is not till after it has exercised its faculties about them that it reflects on its own operations, or acquires perceptions of them. We are from our earliest infancy accustomed to observe external things, though often transiently and inattentively; they lie always in our view, they force themselves upon us, and we cannot avoid regarding them more or less. But we seldom attend to the operations of our minds in our earlier years; it is late before we acquire distinct notions of them, or can easily and readily make them the objects of our contemplation. Farther, external sensation, by which bodies are perceived, is a more palpable kind of evidence than internal, from which all our knowledge of spirits is derived; it strikes and affects us more. The philosophy of spirits, as well as that of bodies, is founded solely on experiments and observations; but in the latter it is much easier to make these than in the former: we can put *bodies* in any situation that we please, and observe at leisure their effects on one another: but the phenomena of the *mind* are of a less constant nature; we must catch them in an instant, and be content to glean them up, by observing their effects as they accidentally discover themselves in the several circumstances of life. The reasonings also by which conclusions are deduced concerning mind are of a more abstruse and difficult nature than those employed in the science of bodies; the ideas about which they are conversant are apter to be confounded with one another, and are with greater difficulty kept distinct. On all these accounts, natural philosophy must be to young minds easier than pneumatology, and consequently should be taught first."

For this long digression, if such it shall be deemed, we are persuaded that those who retain any attachment to the place where their minds were first imbued with the principles of science, will think no apology requisite, when they are informed, that the plan of education, which is here so ably defended, was about the same period adopted by both colleges in the university of Aberdeen; that the writer of this article had his own education in the King's college; and that in the prosperity of that college he still feels himself deeply interested. Let it be remembered, too, that the publication from which this extract has been made, furnishes a proof of professor Gerard's abilities, and of the estimation in which he was held by his colleagues at a very early period of life; and then surely the digression will not be thought impertinent.

He was now professor of moral philosophy and logic, and of these sciences alone: but though his *plan of education in the Marischal College* shews the order in which his lectures were arranged, we have not been able to learn on what foundation he built his system of ethics. As Hutcheson's Moral Philosophy was then much read and admired, it will not detract from Mr Gerard's merits to suppose, that, with his predecessor Mr Fordyce, he was an advocate for the *moral sense* of that author; for there are but three or four foundations on which a system of ethics can be raised; and it may be doubted whether there be one of them which is not as old as the age of Plato. It would indeed be ridiculous in any modern (A) to aim at giving a *new* foundation to moral virtue; for virtue must have been practised upon some steady principle from the earliest period of human society; and the most eminent professor will find sufficient room for the display of all his learning and ingenuity in illustrating the principle which his own judgment has led him to adopt.

Of this professor Gerard was fully sensible; and whilst he was conscientiously discharging his duty to his pupils, he neglected no opportunity of improving himself. He was member of a literary society at Aberdeen, of which the respectability will not be questioned, when it is known that it consisted of such men as the late Doctors Blackwell, Gregory, Reid and Campbell, with Dr Beattie, and many others of perhaps equal talents, though not known to the world as authors (B). This society met regularly during the winter, we believe once every fortnight; the members communicated their sentiments with the utmost freedom; every novel opinion was sure to be canvassed on all sides with impartiality; the understandings of the members were thus mutually whetted; and hence originated Reid's *Inquiry into the Human Mind*, Gregory's *Comparative View*, Gerard's *Essay on Genius*, Beattie's *Essay on Truth*, and Campbell's *Philosophy of Rhetoric*.

On the 5th of September 1759 Mr Gerard was ordained a minister of the Church of Scotland; on the 11th of June 1760, he was appointed professor of divinity in the Marischal college, and minister of the Grayfriars church in Aberdeen; and at the same time, as we suppose, created doctor in divinity.

On the 18th of June 1771 he resigned his Professorship in Marischal college, together with his church-living, and was preferred to the theological chair in the university of King's College, then become vacant by the death of professor Lumisden. In that station he continued, prosecuting his studies, beloved by his colleagues, and revered by his pupils, till his birth-day 1795; when, having just completed his 67th year, he died without a groan. His death was occasioned by a

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(A) The friends of Mr Godwin, who affect to call his political justice the *new* philosophy, will, of course, think this a rash assertion; but were it worth while, it would be no very difficult task to produce, from the atheistical writers of ancient Greece, something similar even to his wildest paradoxes. Dr Gerard was too well acquainted with the subject, and too warm a friend to genuine virtue, to pretend to *novelty* in moral science.

(B) Such as Professor Thomas G[illegible]on, who read lectures in the King's College for 63 or 64 years, and whose learning was equalled only by his virtues.

Gerard.

schirrous tumour, which began to appear on his face in the year 1794, but without confining him to the house, or, except for a very few weeks, interrupting his usual pursuits. It impaired, however, his health, and gradually undermined his constitution. Of this he was very soon sensible; but he saw his dissolution approaching with the utmost composure and resignation, and preserved to all about him so much of that equanimity and placidness of temper which had marked the whole course of his life, that of him may truly be said,

> Multis illi multos annos precantibus
> Diri carcinomatis veneno contabuit,
> Nexibusque vitæ paulatim resolutis,
> E terris, meliora sperans, emigravit.

Were we to hazard an opinion of Dr Gerard's intellectual powers, from having attentively perused his works, we would say that he possessed great rectitude of judgment, rather than any remarkable vigour of mind; that he was capable, by intense study, of becoming master of almost any subject, though perhaps he had not the imagination requisite for making discoveries in science; and that his attainments were solid rather than brilliant. What he knew, he knew thoroughly; but to us, his knowledge seems to have been the reward of labour.

By one, to whom he was well known, and who himself stands high in the republic of letters*, we are assured that he had improved his memory to such a degree, that, in little more than an hour, he could get by heart any sermon of ordinary length; though far from availing himself of this talent, as many would have done, he composed with care all the sermons that he preached. In early life he made it a rule not to study after supper; and from that rule he never deviated, but amused himself after that time, either with the conversation of his family, or with any light reading that came in his way; and he was generally in bed by half past eleven. He seems not to have approved of early more than of late study; for though, for a few years, when as professor of philosophy he had various sciences to teach, he rose regularly, during winter, at five in the morning, he discontinued that practice as soon as he had it in his power, and did not enter upon serious study till after breakfast, generally about 10 o'clock. He was indeed very laborious through the day, and could with difficulty be persuaded to take any bodily exercise; but being remarkably temperate in eating and drinking, he enjoyed very good health, which was only occasionally interrupted by those stomach complaints, to which men of sedentary lives are often subject.

* Dr Beattie.

The fruits of this incessant study were, besides the lectures which he read to his different classes, 1*st*, *An Essay on Taste*, to which, in 1756, was adjudged the gold medal by the Philosophical Society of Edinburgh (See SOCIETIES, *Encycl.*), which had proposed *Taste* as the subject for a prize. Of this essay there has been a second and a third edition; of which the last, which was published in 1780, is considerably enlarged and improved. 2*d*, *Dissertations on the Genius and Evidences of Christianity*, published in 1766. 3*d*, *An Essay on Genius*, published in 1774. 4*th*, Two volumes of *Sermons*; of which the first was published in 1780, and the second in 1782. 5*th*, A part of his theological course, entitled *The Pastoral Care*, which was published in 1799 by his son Dr Gilbert Gerard, who succeeded him as professor of divinity in the King's college and university of Aberdeen. Besides these works Dr Gerard published many single sermons, which were preached on occasional subjects.

Of this amiable and respectable instructor of youth, we have been favoured with the following character, drawn by a man of talents and virtue†, who was first his pupil, and afterwards his friend; and though it made part of a funeral sermon, we believe that, by those who were most intimately acquainted with Dr Gerard, the panegyric which it contains will not be deemed extravagant.

† *The Rev. Skene Ogilvie, Old Aberdeen.*

" In domestic life, his conduct was amiable and exemplary. He possessed, in a high degree, that kindness of heart and affability of manner which interested him at all times in the happiness of his dependants, preserved good humour in his house, and endeared him to his family. He knew how to check improprieties without harshness, and when and how to indulge without impairing his authority. His natural good sense, steadiness and prudence, prevented him from being thrown into confusion by the adverse incidents of life; and enabled him, in pressing emergencies, to adopt wise measures, and to administer salutary counsel. His tender sympathy soothed the troubled hour of sorrow; his rational and friendly advice guided his family thro' the perplexities of life, and he feelingly rejoiced in all their innocent enjoyments. His attachments were not confined to his family or his relatives; he was susceptible of warm friendship. In selecting the objects of it he was cautious, always preferring those whose merits entitled them to confidence and regard. His attachment, slowly formed, was not to be shaken by every oblique insinuation, or by every idle report to the prejudice of his friend. Steady in his professions of regard, he was capable of considerable and disinterested exertions to serve those whom he really esteemed. To his judicious advice they had ready access; and his best efforts to promote their good they could always command. As a member of society, his house was ever the seat of hospitality, and his door was always open to the stranger. In entertaining his friends, he equally avoided the extravagance and ostentation which did not become his character or suit his fortune, and the rigid economy which marks the conduct of those who give with a reluctant and a sparing hand. He neither anxiously courted, nor affectedly shunned learned conversation. While he never obtruded upon company subjects which, by the display of superior knowledge or abilities, were calculated to gratify his own vanity at the expence of hurting others, he always studied, as far as propriety would admit, to adapt his conversation to the temper and inclinations of his associates. To please the young, and to promote their harmless festivity, was ever his delight; with cheerfulness he descended to their trivial amusements, and in his presence they felt no restraints but those which virtue and decency impose. Though he often left for a little studies in which he was keenly engaged, to enjoy the conversation of a friend, he never suffered his love of society, one of his strongest passions, to induce him to sacrifice any important literary pursuit, or to neglect any necessary business.

" As

"As a clergyman, the office which he held for several years in Marischal college rendered it his duty to be a daily preacher, and gave him a seat in the ecclesiastical courts. But the unavoidable labour of preparing prelections for his theological pupils, did not prevent his unremitting attention to his public exhibitions in the pulpit. These were marked by that distinctness of arrangement, that justness of reasoning, and that accuracy of composition, which effectually secured the approbation of the ablest judges; while by their plainness and simplicity, they failed not of promoting the edification of the meanest capacities. To the low arts of acquiring popularity he never stooped: But his prudence, his good sense, his exemplary conduct, and his ministerial diligence, established his respectability and usefulness, and procured him the full confidence and esteem of his colleagues. Possessing more than ordinary excellence, envy never led him to depreciate the merits of other preachers. Though one of the best of judges, he was always one of the most candid hearers. When by his translation to the university of King's college, he was released from the labour of constant preaching, far from shewing any aversion to discharge the most public ministerial duties, he was always obedient to presbyterial appointments; and while health and strength remained, willing to oblige his clerical friends by appearing in their pulpits. Nor in private life did he ever lose sight of the character of a clergyman. Having in a publication ably defended its respectability, in opposition to the scoffs and sneers and sophism of modern sceptics; he considered it as his honour, in his life and conversation to display its dignity and importance; and to shew that the gravity of a Christian pastor is perfectly consistent with the good breeding of a gentleman, and with the cheerfulness, affability, and ease of an agreeable companion.

"As a man of letters, his attainments were far above those at which the generality of students arrive. In his literary pursuits, he had all the advantages of a judgment uncommonly clear and distinct, aided, from his earliest years, by the most indefatigable and persevering study. The well-earned reputation with which, before he was promoted to the theological chair, he taught in Marischal college different sciences, incontestibly proves that his powers, not confined to one subject, justly entitled him to eminence in several branches of literature. His publications, several of which have been translated into other languages, promise fair to extend his fame, and to hand it down to generations yet unborn; and his unremitting labours promised still a farther contribution to the general stock of learning.

"As a professor of divinity, he will be long and gratefully remembered by his numerous pupils. This was his peculiar department, and in this he shone. Possessing large stores of theological knowledge, he was judicious in selecting his subjects, happy and successful in his manner of communicating instruction. He had the merit of introducing a new, and in many respects a better plan of theological education, than those on which it had been formerly conducted. Liberal, but not loose, in his sentiments, his great aim was, not to impose by his authority upon his pupils any favourite system of opinions; but to impress them with a sense of the importance of the ministerial office, to teach them the proper manner of discharging all its duties, and to enable them, by the knowledge of Scripture, to form a just and impartial judgment on controverted subjects. Solicitous for their improvement, he was ever ready to encourage rising merit by his warmest approbation; and reluctant to damp even unsuccessful efforts of genius by deserved censure. Having a constant eye to what is practically useful, rather than to unedifying speculation, he enjoined no duty which he was unwilling to exemplify in his own conduct. Hence that strict regard to the ministerial character which he uniformly displayed, and hence his uncommon punctuality in attending the public ordinances of religion."

GERARDSTOWN, a neat little town, situated in Berkely co. Virginia, containing about 30 or 40 houses; 10 miles from Martinsburg, and 254 from Philadelphia.—*Morse.*

GERMAN, a township in Fayette co. Pennsylvania.—*ib.*

German Flats, the chief township of Herkemer co. taken from that of Montgomery, in New-York. By the census of 1790, it contained 1307 inhabitants, including 20 slaves; by the State census of 1796, 4194 inhabitants, of whom 684 are electors. It lies on the south side of Mohawk river, opposite Herkemer. It is 24 miles E. of Whitestown, and 60 miles west of Schenectady.—*ib.*

GERMANTOWN, (N. Y.) in Columbia co. containing 516 inhabitants. In 1796, it had 75 qualified voters.—*ib.*

Germantown, in Philadelphia co. Pennsylvania, is situated 7 miles north of Philadelphia city, and was esteemed the second town in the country, until several inland towns eclipsed it, by superior establishments and number of inhabitants. It is a corporation, consisting chiefly of High and Low Dutch, and contains about 250 houses, chiefly of stone, some of which are large, elegant and commodious; built chiefly on one street, about two miles in length. The public buildings are a German Calvinist and Lutheran church, a Friend's meeting-house, and an academy. Knit stockings, of cotton, thread and worsted, are manufactured here by individuals to a considerable extent, and of an excellent quality. It is an ancient town, pleasantly situated, and by its vicinity to the metropolis, well adapted for manufactures. Here is the principal congregation of the Mennonists, and the mother of that sect in America. They derive their name from Menno Simon, a learned man of Witmars, in Germany, one of the reformers, born in 1505. Some of his followers came into Pennsylvania, from New-York, in 1692. There are about 4000 of them in the State. They do not, like the Tunkers, believe in general salvation; yet, like them, they will neither swear nor fight, nor bear any civil office, nor go to law, nor take interest for money, though many break that rule. They use great plainness in their dress, &c. and practise many of the rites of the primitive Christian church. This town is also rendered famous, by the battle fought in it, on the 4th of Oct. 1777.—*ib.*

Germantown, a post-town and the capital of Stokes co. N. Carolina. It is situated near the Town Fork of Dan river, and contains a court-house, gaol, and about 30 houses. It is 528 miles S. W. by S. of Philadelphia.—*ib.*

Germantown, the chief town of Hyde co. in Newbern district, N. Carolina.—*ib.*

GERMANY, a township in York co. Pennsylvania.—*ib.*

GERMINATION, among botanists, is a very interesting subject on which the late discoveries in chemistry have thrown much light since the article Germination was published in the *Encyclopædia*. In the year 1793, Mr Humboldt discovered that simple metallic substances are unfavourable to the germination of plants, and that metallic oxyds favour it in proportion to their degree of oxydation. This discovery induced him to search for a substance with which oxygen might be so weakly combined as to be easily separated, and he made choice of oxygenated muriatic acid gas mixed with water. Cresses (*lepidium sativum*) in the oxygenated muriatic acid shewed germs at the end of six hours, and in common water at the end of 32 hours. The action of the first fluid on the vegetable fibres is announced by an enormous quantity of air bubbles which cover the seeds, a phenomenon not exhibited by water till at the end of from 30 to 45 minutes. These experiments announced in Humboldt's *Flora Subterranea Fribergensis*, and in his Aphorisms on the chemical physiology of Plants, have been repeated by others (A). They were made at a temperature of from 12 to 15 Reaumur. In the summer of 1796, Humboldt began a new series of experiments, and found that by joining the stimulus of caloric to that of oxygen he was enabled still more to accelerate the progress of vegetation. He took the seeds of garden cresses (*lepidium sativum*), peas, (*pisum sativum*), French beans (*phaseolus vulgaris*), garden lettuce (*lactuca sativa*), mignonette (*reseda odorata*); equal quantities of which were thrown into pure water and the oxygenated muriatic acid at a temperature of 88° F. Cresses exhibited germs in three hours in the oxygenated muriatic acid, while none were seen in water till the end of 26 hours. In the muriatic, nitric (B), or sulphuric acid, pure or mixed with water, there was no germ at all: the oxygen seemed there to be too intimately united with bases of azot or sulphur, to be disengaged by the affinities presented by the fibres of the vegetable. The author announces, that his discoveries may one day be of great benefit in the cultivation of plants. His experiments have been repeated with great industry and zeal by several distinguished philosophers. Professor Pohl at Dresden caused to germinate in oxygenated muriatic acid the seed of a new kind of *euphorbia* taken from Bocconi's collection of dried plants, 110 or 120 years old. Jacquin and Vander Schott at Vienna threw into oxygenated muriatic acid all the old seeds which had been kept 20 or 30 years at the botanical garden, every attempt to produce vegetation in which had been fruitless, and the greater part of them were stimulated with success. Even the hardest seeds yielded to this agent. Among those which germinated were the yellow bonduc or nickar tree (*guilandina bonduc*), the pigeon cytisus or pigeon pea (*cytisus cajan*), the *dodonæa angustifolia*, the climbing mimosa (*mimosa scandens*), and new kinds of the *homæa*.—There are now shewn at Vienna very valuable plants which are entirely owing to the oxygenated muriatic acid, and which are at present from five to eight inches in height. Humboldt caused to germinate the *clusia rosea*, the seeds of which had been brought from the Bahama islands by Boose, and which before had resisted every effort to make them vegetate. For this purpose he employed a new process, which seems likely to be much easier for gardeners who have not an opportunity of procuring oxygenated muriatic acid: He formed a paste by mixing the seeds with the black oxyd of manganese, and then poured over it the muriatic acid diluted with water. Three cubic inches of water were mixed with half a cubic inch of the muriatic acid. The vessel which contains this mixture must be covered, but not closely shut; else it might readily burst. At the temperature of 95° the muriatic acid becomes strongly oxydated; the oxygenated muriatic gas which is disengaged passes through the seeds; and it is during this passage that irritation of the vegetable fibres takes place.—*Philosophical Magazine.*

GERRY, a township in Worcester co. Massachusetts. It was incorporated in 1786 and contains 14,000 acres of land, on which are 740 inhabitants. It is 30 miles N. W. of Worcester, and 65 N. W. by W. of Boston. —*Morse.*

GESCHE el Aube, or Gir Gir, a species of grass growing plentifully near *Ras el Feel* on the borders of Abyssinia. It begins, says Mr Bruce, to shoot in the end of April, when it first feels the humidity of the air. It advances then speedily to its full height, which is about 3 feet 4 inches. It is ripe in the beginning of May, and decays, if not destroyed by fire, very soon afterwards.

The leaf is long, pointed, narrow, and of a feeble texture. The stock from which it shoots produces leaves in great abundance, which soon turn yellow and fall to the ground. The goats, the only cattle these miserable people have, are very fond of it, and for it abandon all other food while it is within their reach. On the leaves of some plants our author saw a very small glutinous juice, like to what we see upon the leaves of the lime or the plane, but in much less quantity; this is of the taste of sugar.

From the root of the branch arises a number of stalks, sometimes two, but never, as far as he had seen, more than three. The flower and seed are defended by a wonderful perfection and quantity of small parts. The head when in its maturity is of a purplish brown. This

(A) See Uslar's Fragments of Phytology, Plenck's Physiology, Villdenow's Dendrology, and *Dictionaire de Physique* par Gehler.

(B) The nitric acid, however, diluted with a great deal of water, accelerates germination also, according to the experiments of Candolle, a young naturalist, who has applied with great success to vegetable physiology. This phenomena is the more interesting, as chemistry affords other analogies of the oxygenated muriatic acid and the nitric acid. Professor Pfass at Kiel, by pursuing Humboldt's experiments, has found that frogs suffocated in oxygenated muriatic acid gas increase in irritability, while those which perish in carbonic acid gas are less sensible of galvanism.

Gettysburgh ‖ Gheyssiquas.

This species of grass was one of the acquisitions of our author's travels. It was not before known in Europe, nor when he published his book had the seed produced a plant any where but in the garden of the French king.

GETTYSBURGH, a small town in York co. Pennsylvania, situated at the head of Rock Creek, one of the head waters of the Monococy, and contains about 30 houses. It is 9 miles north of the Maryland line. 8 miles from Millerstown, 15 from Abbotstown, 36 from Williamsport in Maryland, and 118 W. by S. of Philadelphia.—*Morse.*

GHEYSSIQUAS, a nation of Hottentots which inhabits a district of South Africa bordering on the country of Caffraria. M. Vaillant visited a horde of this people at no great distance from Orange river, as he was returning from his last African excursion to the Cape, and was shewn by them a chain of mountains to the east which extending to a distance was lost in the north, and which, inhabited by their principal tribes, separated them from the Caffres, or at least from the Briquas and Bremas, whom they consider as tribes of Caffres.

With respect to such characteristics as are not original and derived from nature, as the form of their dress, weapons, instruments of music, fondness for hunting and dancing and the like, the Gheyssiquas do not differ from the surrounding nations, except in having adopted a particular colour for their ornaments. All the ornaments of the Gheyssiquas are white, and composed of the bones of a sheep's leg or foot, to which they give a dazzling whiteness by processes peculiar to themselves. Thus, as they fabricate their own necklaces and other articles of luxury, and have no occasion to purchase the materials, they have no dependance on the colonies with respect to trade, except for a few necessary articles which they want in common with other savages. Accordingly this nation is less known and less visited than any other.

The women are well made, lively, and always ready to laugh or dance: yet, with all the gaiety of their disposition, they have the reservedness of manners to which polished nations give the names of modesty and decorum, and which, in so warm a climate and with such ardent constitutions, appears to be a virtue of no easy attainment.

Our author says that he no where met with a nation so truly generous. Though he had nothing to give in exchange, yet during two days that he staid with them, he had bowls of milk brought to him as presents, night and morning, from every hut. The chief even obliged him to accept a lamb; and though our traveller's attendants were not destitute of provisions, he would give them also several sheep with which to regale themselves; a degree of generosity of which a proper estimate can be formed only by those who know something of savage manners and savage penury.

The practice of semi-castration prevails among the Gheyssiquas, and among them only of all the Hottentot tribes; and it prevails in all their hordes without exception. Our author convinced himself of this fact by his own eyes; for the men were so complaisant, that, if he had chosen, he might have inspected the whole horde. Many travellers have written upon the subject of this whimsical operation; but they do not agree either as to its origin, the motives that lead to its invention, or the nations by whom it is practised. Kolben, who says that it commonly consists in the extraction of the left testicle, represents it as a religious ceremony, a general and sacred law, with all the Hottentots indiscriminately; but this is unquestionably false. (See HOTTENTOTS, *Encycl.*) Others attribute it to the desire of the Gheyssiquas to render themselves more fleet in running, an effect which it surely is not calculated to produce; and some have said that its intention is to prevent the too abundant propagation of the species. Yet Kolben, though he seems inclined to this last opinion, affirms, that twins are not the less common on account of the operation. According to those whom M Vaillant questioned on the subject, it is merely a mark of distinction which their ancestors, being at war with the neighbouring nations, invented for the purpose of knowing one another; but, as he himself admits, this is a very improbable account of the matter, as they would surely have adopted, like the Loangoes, Pomboes, and Cormantins, marks of distinction more easily discerned. Be this as it may, the operation among the Gheyssiquas is performed by the father, commonly at the birth of the child, though sometimes not till he has completed his third year.

Gheyssiquas ‖ Ghirgong.

GHIRGONG, the capital of *Asam* in Hindostan is, according to Mr Pennant, situated in latitude 26° 30′ north. He does not state its longitude. It has four gates, and the city is encompassed with a bound hedge of bamboos. The Rajah's palace is surrounded by a causey, planted on each side with a close hedge of bamboos, which serves instead of a wall. On the outside there is a ditch, which is always full of water. The Rajah's seat is adorned with lattice work and carving. Within and without have been placed plates of brass, so well polished, that when the rays of the sun strike upon them they shine like mirrors. It is an ascertained fact, that 3000 carpenters and 12,000 labourers were constantly employed in this work during two years before it was finished. *Pennant's View of Hindostan.*

The Asiatic Researches speak much of the wealth of Asam, and of the plenty and excellency of its natural productions, and that it abounds in all metals but tin. Gold is found in every part of the country by washing the sand of the rivers, and is one of the sources of revenue; 12,000, some say 20,000 people, are employed in that work, each of whom has from the Rajah a certain wages Its gum lac is excellent, and it is very productive of silk.

Among the fruits which this country produces are mangoes, plantains, jacks, oranges, citrons, limes, pine apples, and puniala, a species of tamarind, which has such an excellent flavour, that every person who tastes it prefers it to the plum. There are also cocoa-nut trees, pepper vines, and the areca trees. The sugar cane excels in softness and sweetness, and is of three colours, red, black and white. There is ginger free from fibres, and betel vines. The strength of vegetation and fertility of the soil are such, that whatever seed is sown or slips planted they always thrive. The environs of Ghirgong furnish small apricots, yams, and pomegranates; but as these articles are wild, and not amilted by cultivation and engraftment, they are very indifferent. The principal crop in this country consists in rice and lentiles. Wheat and barley are never sown; lignum

aloes

aloes is also a production of this country. The silks are excellent, and resemble those of China, but they manufacture very few more than are required for use. They are successful in embroidering with flowers and in weaving velvet.—One of their great forests is inhabited by abundance of elephants: 6 or 700 may be taken in a year, but they are neglected by the natives, who have neither horses, camels nor asses, such as are brought from other countries.

According to our author, "the people of Asam are a base unprincipled nation, and have no fixed religion. They follow no rule but that of their own inclination, and make their own vicious minds the test of the propriety of their actions. They do not adopt any mode of worship practised either by heathens or Mahomedans, nor do they concur with any of the known sects which prevail among mankind; unlike the pagans of Hindostan, they do not reject victuals which have been dressed by Moslems, and they abstain from no flesh except human. They even eat animals that have died a natural death."

On this passage, one of the ablest of our literary journalists observes, that in justice to the people of Asam, we must remark, that the above account, extracted from the memoirs of Mir Jumla's expedition into that country, was composed by a rigid Mahomedan, at the court of that fanatical tyrant Aurengzebe. The author and his master saw, in the Asamese, only idolaters; and, in idolaters, the meanest of mankind. Their diet, though less restricted than that of the Hindoos of Bengal, is by no means promiscuous; and their religion does not in any way differ from that of Hindostan, as might easily be proved by their coins, inscribed with the names of Hindoo deities.

GIBBON (Edward Esq.), the celebrated historian of the Decline and Fall of the Roman Empire, was born at Putney in the county of Surry on the 27th of April 1737. He was the first child of the marriage of Edward Gibbon, Esq; and Judith Porten, the youngest daughter of a merchant of London.

The family of Gibbon appears to be ancient and honourable; and our author delights to trace his pedigree from John Gibbon architect to King Edward III. who possessed lands in the hundred and parish of Rolvenden, in the district which is now called the *Weald* of Kent. In that district the elder branch of the family still adheres to its native soil, without much increase or diminution of property; but the fortunes of the younger branch, from which sprung the subject of this memoir, were fluctuating. It is not, however, with his family, but with himself, that we are concerned.

So feeble was his constitution, and so precarious his life during his childish years, that at the baptism of each of his brothers (and they were five in number) his father's prudence successively repeated the name of Edward, that, in case of the death of the eldest son, this patronymic appellation might still be perpetuated in the family. His brothers and a sister were all snatched away in their infancy; and, in terms of affectionate gratitude, he attributes his own preservation to the more than maternal care of a maiden aunt, his mother's eldest sister. "Many anxious and solitary days (says he) did that dear and excellent woman consume in the patient trial of every mode of relief and amusement. Many wakeful nights did she sit by my bed side in trembling expectation that each hour would be my last. Suffice it to say, that while every practitioner from Sloane and Ward to the Chevalier Taylor was successively summoned to torture or relieve me, the care of my mind was too frequently neglected for that of my health. Compassion always suggested an excuse for the indulgence of the master, or the idleness of the pupil; and the chain of my education was broken as often as I was called from the school of learning to the bed of sickness."

His education seems indeed to have been far from systematical. At the age of seven he was delivered into the hands of Mr John Kirkby, who exercised about eighteen months the office of his domestic tutor, and of whom he writes in terms of respect. This man had been an indigent curate in Cumberland, and when forced by distress to leave his native country, he was introduced by his learning and his virtue to the family of Mr Gibbon, from whom he might have found at least a temporary shelter, had not an act of indiscretion again driven him into the world. One day reading prayers in the parish church, he most unluckily forgot the name of King George; and his patron, a loyal subject, dismissed him with some reluctance and a decent reward. As our author describes his ancestors as hereditary Tories, and some of them as Jacobites, we think it not improbable that Mr Kirkby may have been accustomed to omit the name of the King when reading prayers in the family; for otherwise he would have pronounced it mechanically in the church.

Be this as it may, our author, upon the dismission of his tutor, was sent to Kingston upon Thames, to a school of seventy boys kept by Dr Woodeson and his assistants. He does not represent himself either as happy or as having made great progress at that school. The want of strength and activity disqualified him for the sports of the field; his companions reviled him for the sins of his Tory ancestors; and his studies were frequently interrupted by sickness. After a real or nominal residence of near two years at Kingston, he was finally recalled (Dec. 1747) by the death of his mother. By this time he was well acquainted with Pope's Homer, the Arabian Nights Entertainments, Dryden's Virgil, and a translation of Ovid's Metamorphoses; and the entertainment which he received from these books gave him a taste for desultory reading.

After living a year with his maternal aunt, during which period he read many books on religious subjects too deep for the comprehension of a boy, he was in January 1749 entered in Westminster school, of which Dr John Nicoll was at that time head master. "There (says he) in the space of two years, interrupted by danger and debility, I painfully climbed into the third form; and my riper age was left to acquire the beauties of the Latin, and the rudiments of the Greek tongue. Instead of audaciously mingling in the sports, the quarrels, and the connections of our little world, I was still cherished at home under the maternal wing of my aunt, who now lived in College street; and my removal from Westminster long preceded the approach of manhood."

He was first carried to Bath for the recovery of his health; then to Winchester, where he lived in the house of a physician, then to Bath again, where he read with a clergyman some odes of Horace and some episodes of Virgil; after which an unsuccessful trial was made to renew his attendance at Westminster school. "It might now be

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be apprehended (says he) that I should continue for life an illiterate cripple; but as I approached my sixteenth year, nature displayed in my favour her mysterious energies: my constitution was fortified and fixed; and my disorders, instead of growing with my growth, and strengthening with my strength, most wonderfully vanished. In consequence of this he was carried to Oxford; and before he had accomplished his fifteenth year, was, on April 3, 1752, matriculated a gentleman commoner of Magdalen college.

For the honour of that celebrated university, we would fain hope that the account which Mr Gibbon gives of Magdalen college is greatly exaggerated. He represents his tutors as wholly regardless of his morals or his studies. Speaking of the first and best of them, for he had two, he says, "No plan of study was recommended for my use; no exercises were prescribed for his inspection; and, at the most precious season of youth, whole days and weeks were suffered to elapse without labour or amusement, without advice or account." We shall make no other remark on this passage than that from gentlemen, who must have been contemporary with Mr Gibbon at Magdalen, we have received different accounts of the college; and it is surely a very singular circumstance, that at this period of idleness, our author should have become enamoured of Sir John Marsham's *Canon Chronicus*, and have conceived the idea of writing an *Essay on the age of Sesostris*. Such, however, was the case. Not only was the essay planned, but part of it was written; and though he never finished it, he declares, that his solution of some difficulties in chronology was not devoid of ingenuity; but he goes on to vilify Oxford. "It might at least be expected (says he), that an ecclesiastical school should inculcate the orthodox principles of religion. But our venerable mother had contrived to unite the opposite extremes of bigotry and indifference: an heretic, or unbeliever, was a monster in her eyes; but she was *always*, or *often*, or *sometimes* (A), remiss in the spiritual education of her own children. Without a single lecture, either public or private, either Christian or Protestant, without any academical subscription, without any Episcopal confirmation, I was left by the dim light of my catechism to grope my way to the chapel and communion table, where I was admitted, without a question, how far, or by what means, I might be qualified to receive the sacrament. Such almost incredible neglect was productive of the worst mischiefs. From my childhood I had been fond of religious disputation; nor had the elastic spring been totally broken by the weight of the atmosphere of Oxford. The blind activity of idleness urged me to advance without armour into the dangerous mazes of controversy; and, at the age of sixteen, I bewildered myself in the errors of the church of Rome."

Thus anxious is our author to account for his reconciliation to the Romish church by the negligence of the tutors of his college. This event took place on the 8th of June 1753, when, at the feet of a priest in London, he solemnly, though privately, abjured the errors of heresy. An elaborate controversial epistle, approved by his director, and addressed to his father, announced and justified the step he had taken; and the old gentleman, in the first sally of passion, divulging the secret, the gates of Magdalen college were shut against the convert. It was necessary therefore to form a new plan of education; and our young Catholic, by the advice of Mr Elliot (afterwards Lord Elliot), was settled, on the 30th of June, under the roof and tuition of Mr Pavilliard, a Calvinist minister at Lausanne in Switzerland.

Gibbon.

He represents his situation there as at first extremely uncomfortable. He could not avoid contrasting a small chamber, ill contrived and ill furnished, with his elegant apartment in Magdalen college; and M. Pavilliard being entrusted with the management of his expences, he felt himself degraded from the rank of gentleman commoner to that of a school-boy. He began, however, gradually to be reconciled to his fate; and his love of reading returned, which, he says, had been chilled by the air of Oxford. He rapidly acquired the French language; and of his tutor, he says, "My obligations to the lessons of Mr Pavilliard gratitude will not suffer me to forget. He was endued with a clear head and a warm heart; his innate benevolence had assuaged the spirit of the church; he was rational, because he was moderate: in the course of his studies he had acquired a just though superficial knowledge of most branches of literature; by long practice he was skilled in the arts of teaching; and he laboured with assiduous patience to know the character, gain the affection, and open the mind of his English pupil."

Under the tuition of this amiable preceptor he describes his progress in the French and Latin classics, in history, geography, logic and metaphysics, as uncommonly rapid; and he allows to the same man a handsome share of the honour of reclaiming him from the errors of popery. The various discriminating articles of the Romish creed disappeared like a dream; and after a full conviction, on Christmas day 1754, he received the sacrament in the church of Lausanne. Thus had our author communicated with three different societies of Christians before the completion of his eighteenth year; and as such changes from church to church are always dangerous, we need not wonder, that, in a mind so ill furnished as Mr Gibbon's then was for theological investigations, they paved the way for his last change to Deism. At present, however, he suspended his religious inquiries, acquiescing (as he says) with implicit belief in the tenets and mysteries which are adopted by the general consent of Catholics and Protestants.

He continued to prosecute his studies with ardour. Under Mr Pavilliard he learned the Greek alphabet, the grammar, and the pronunciation of the language according to the French accent, and soon made himself master of the works of Homer, Herodotus, and Xenophon. During two winters he attended the private lectures of M. de Traytorrens, who explained the elements of algebra and geometry as far as the conic sections of the Marquis de l'Hôpital; but in mathematics he was content (he says) to receive the passive impression of his professor's lectures, without any active exercise of his own powers. In the writings of Grotius and Puffendorf he studied the duties of a man, the rights of a citizen,

(A) Surely *always* and *sometimes* are words of very different import: why are they used then, in this sentence as synonymous?

Gibbon. Gibbon.

tizen, the theory of justice, and the laws of peace and war, which have had some influence on the practice of modern Europe. "Locke's treatise on government, (says he) instructed me in whig principles, which are founded rather in reason than experience; but my delight was in the frequent perusal of Montesquieu, whose energy of style and boldness of hypothesis were powerful to awaken and stimulate the genius of the age."

We have been thus minute in our account of Mr Gibbon's studies, because it furnishes perhaps the most useful lesson which can be drawn from the whole history of his life. His education had been rendered irregular, and had been often interrupted by ill-health and a feeble constitution; but as soon as he was able, and had an opportunity, he applied with ardour to the cultivation of letters, and his works bear witness that his labour was crowned with success. "This part of his story therefore (to use the words of Johnson) well deserves to be remembered. It may afford useful admonition and powerful encouragement to men whose abilities have been made, for a time, useless, and who, having lost one part of life in idleness, are tempted to throw away the remainder in despair."

In the year 1757 Voltaire arrived at Lausanne, and our young student's desire to see the man who was at once a poet, an historian, and, as he deemed himself, the prince of philosophers, was ardent, and easily gratified. He was received by the vain and arrogant Frenchman with civility as an English youth, but could not boast of any peculiar notice or distinction. "The highest gratification (says he) which I received from Voltaire's residence at Lausanne, was the uncommon circumstance of hearing a great poet declaim his own productions on the stage. His declamation was fashioned to the pomp and cadence of the old stage; and he expressed the enthusiasm of poetry rather than the feelings of Nature."

About this time Mr Gibbon became enamoured of Mademoiselle Susan Curchod, the daughter of the minister of Crassy, in the mountains which separate the Pays de Vaud from the county of Burgundy. In terms of rapture he describes this lady as possessed of every accomplishment which could adorn her sex. She listened to the voice of truth and passion; her parents honourably encouraged the connection; and our author indulged in the dream of felicity: but on his return to England, he discovered that his father would not hear of this strange connection, and that without his consent he was destitute and helpless. "After a painful struggle (says he) I yielded to my fate. I sighed as a lover, I obeyed as a son, and my wound was insensibly healed by time, absence, and the habits of a new life." The lady consoled herself by giving her hand to M. Neckar, then a rich banker of Paris, afterwards the minister, and at last one of the destroyers of the French monarchy.

In the spring of the year 1758 our author was recalled to England. On his arrival in London he hastened to the house of his aunt, Mrs Porten, who had been the guardian of his tender years; for though his father was in town awaiting his arrival, he knew not how he should be received by a parent who had parted with him in anger, and given him a stepmother in his absence. His reception was more agreeable than he expected. His father received him as a man and a friend; and the manners of Mrs Gibbon were such, that, after some reserve on his side, she and he easily adopted the tender names and genuine characters of mother and son; and, by the indulgence of these parents, he was left at liberty to consult his own taste or reason in the choice of place, of company, and of amusements. In London he had few acquaintances, and hardly any friends; and being accustomed to a very small society at Lausanne, he preferred the retirement of the country to the bustle of that over-grown metropolis, where he found hardly any entertainment but in the theatres.

Before he left Lausanne he had begun a work on the study of ancient literature, which was suggested by the desire of justifying and praising the object of a favourite pursuit. "In France (says he), to which my ideas were confined, the learning and language of Greece and Rome were neglected by a philosophic age. The guardian of those studies, the Academy of Inscriptions, was degraded to the lowest rank among the three royal societies of Paris: the new appellation of *Erudits* was contemptuously applied to the successors of Lipsius and Casaubon; and I was provoked to hear*, that the exercise of the memory, their sole merit, had been superseded by the nobler faculties of the imagination and the judgment. I was ambitious of proving by my own example, as well as by my precepts, that all the faculties of the mind may be exercised and displayed by the study of ancient literature." This laudable ambition continued; and in his father's house at Beriton in Hampshire he finished his *Essai sur l'Etude de la Literature;* which, after being revised by Mallet the poet and Dr Maty of the British museum, was, in 1761, published in a small 12mo volume.

* See *Le Discours Preliminaire par D'Alembert à l'Encyclopedie.*

The subjects of taste, criticism, and philosophy, which in this work came under our young author's consideration, could hardly promise much novelty of remark. Some former observations, however, he appears to have placed in a new and pleasing point of view; advancing, moreover, some ingenious conjectures, and displaying no inconsiderable erudition. Yet, by his own account, he was at this time almost a stranger to the writers of Greece; and when he quotes them, it is probable that the quotations are given at second hand. To this essay was prefixed a dedication to his father in the English language, which exhibits the author himself in a very amiable light; but if his reputation had depended solely upon this youthful attempt, the name of Gibbon would have been lost in oblivion. Yet he seems, even in his riper years, to have been delighted with it himself, and to have considered its merits as equal to those of his later productions; but Milton, it is said, preferred the Paradise Regained to the Paradise Lost.

Before the publication of this essay, the author, at his own desire, had been appointed a captain in the South-Hampshire militia, in which he served upwards of two years. At first, the company of rustic and illiterate officers, and the bustle of a military life were extremely disagreeable to him, as they interrupted his studies; but he admits, that his military services, his bloodless and inglorious campaigns, as he calls them, were, on the whole, beneficial, as they brought him acquainted with English manners, English parties, and English principles, to which his foreign education and reserved temper had hitherto kept him an entire stranger. In the camp and in quarters he had even found leisure, after the first seven or eight months of his service, to read a great deal of Greek, Gibbon. Greek, and to plan different historical works, to the composition of which he seems to have thought that he was born with an innate propensity. He always talks of himself as a philosopher; but surely a more unphilosophical persuasion than this has seldom been admitted.

At the end of the war he went again abroad, and reached Paris on the 28th of January 1763, only 36 days after the disbanding of the militia, in which he had borne the commission of a captain. In that metropolis he staid not long. He visited palaces, churches, gardens, and theatres, and was introduced to D'Alembert and Diderot, then considered as at the head of French science. From Paris he proceeded to Switzerland, and once more took up his residence at his favourite Lausanne. Voltaire's impieties had forced him from that town to his own castle at Ferney, where our author once visited him, without (he says) courting his more intimate acquaintance.

The society in which Mr Gibbon most delighted during his second residence at Lausanne was a very singular one. "It consisted of fifteen or twenty unmarried ladies of genteel families; the eldest perhaps about twenty, all agreeable, several handsome, and two or three of exquisite beauty. At each other's houses they assembled almost every day, without the controul, or even the presence of a mother or an aunt; they were trusted to their own prudence, among a crowd of young men of every nation in Europe. They laughed, they sung, they danced, they played at cards, they acted comedies; but in the midst of this careless gaiety, they respected themselves, and were respected by the men; the invisible line between liberty and licentiousness was never transgressed by a gesture, a word or a look, and their virgin chastity was never sullied by the breath of scandal or suspicion."

We readily agree with our author that this singular institution was expressive of the innocent simplicity of Swiss manners; and we only regret that he had not the same respect for the ladies of his own country as for those frolic females of Switzerland. He would not, in that case, have stained some of his most brilliant pages with obscene ribaldry.

We shall not follow him in his ramble through Italy, or repeat his remarks on the towns which he visited. It is sufficient, in such a sketch as this, to inform our readers, that it was at Rome on the 15th of October 1764, as he sat musing amidst the ruins of the Capitol, that the idea of his great work first started into his mind. But his original plan was circumscribed to the decay of the city rather than of the empire.

From carrying even this contracted plan into execution he was for some years diverted. On the 25th of June 1765 he arrived from Italy at his father's house in Hampshire, and found that he had filial duties to perform which interrupted his studies and disturbed his quiet. His father had involved himself in difficulties, from which he could be extricated only by selling or mortgaging part of his estate; and to such sale or mortgage our author cheerfully consented. He regrets on this occasion that he had not "embraced the lucrative pursuits of the law or of trade, the chances of civil office or India adventure, or even the fat slumbers of the church;" and it is to be hoped that, when he thought even of *slumbering* in the church, he had still some faith in revealed religion. He wasted some time in planning a history of the revolutions of Switzerland, and even wrote part of it in the French language, which, by the advice of friends, he however suppressed. We next find him engaged with a friend in a journal entitled *Memoires Literaires de la Grand Bretagne*, of which two volumes for the years 1767 and 1768 were published, and a third almost completed, when his friend, a native of Switzerland, was engaged, through his interest, as travelling governor to Sir Richard Worsley, and the Journal was of course, abandoned. He then entered the lists with Warburton; whose interpretation of the sixth book of the Æneid he attacked with great petulance and with much success. The bishop of Glocester was by this time in a state of great mental decay, which was peculiarly unfortunate for our author; for had his Lordship enjoyed his pristine vigour, he would probably have given Mr Gibbon such a chastisement as might have made him more modest afterwards when writing the history of the Decline and Fall of the Roman Empire.

To that great work he now sat down seriously; and the history which he gives of his preparatory studies sufficiently accounts for the inaccuracy of his quotations. Through the darkness of the middle ages he explored his way in the annals and antiquities of Italy by the learned Muratori and other moderns; and seems to acknowledge that, from the beginning to the end of his work, he frequently contented himself with authorities furnished at second hand.

At last, in 1776, the first volume of his history was published by Cadell the bookseller and Strahan the printer; and the success of it far surpassed his expectation. The encomiums lavished on it by Dr Robertson and Mr Hume in letters to the author, and the fulsome compliments which those three eminent historians paid to each other, are melancholy specimens of lettered littleness and vanity. The second and third volumes appeared in 1781; the fourth, fifth and sixth in 1787; and Mr Gibbon's fame was established as a historian. The work was admired both by natives and by foreigners, and translated into several of the languages of Europe. Dr Zimmerman represents the author as excelling perhaps Hume and Robertson, who were historians of the first rank. "All the dignity (he adds), all the charms of historic style, are united in Gibbon: his periods are melody itself, and all his thoughts have nerve and vigour." This praise, however, must not be admitted without exception. Few writers, indeed, were possessed of such popular talents as our historian. The acuteness of his penetration, and the fertility of his genius, have been seldom equalled, and scarcely ever surpassed. He seizes, with singular felicity, on all the most interesting facts and situations, and these he embellishes with the utmost luxuriance of fancy and elegance of style. His periods are full and harmonious; his language is always well chosen, and is frequently distinguished by a new and peculiarly happy adaptation. His epithets, too, are in general beautiful and happy; but he is rather too fond of them. The uniform stateliness of his diction sometimes imparts to his narrative a degree of obscurity, unless he descends to the miserable expedient of a note, to explain the minuter circumstances. His style, on the whole, is much too artificial; and this gives a degree of monotony to his periods, which

which extends, we had almost said, to the turn of his thoughts.

A more serious objection is his attack upon Christianity; the loose and disrespectful manner in which he mentions many points of morality regarded as important on the principles of natural religion; and the indecent allusions and expressions which too often occur in the work.

An attack upon Christianity is not censurable merely as such; it may proceed from the purest and most virtuous motives: but, in that case, the attack will never be carried on in an insidious manner, and with improper weapons; and Christianity itself, so far from dreading, will invite every mode of fair and candid discussion. Our historian, it must be confessed, often makes, when he cannot readily find, an opportunity to insult the Christian religion. Such, indeed, is his eagerness in the cause, that he stoops to the most despicable pun, or to the most awkward perversion of language, for the pleasure of turning the scripture into ribaldry, or calling Jesus an impostor.

Yet of the Christian religion has Mr Gibbon himself observed, that it "contains a pure, benevolent, and universal system of ethics, adapted to every duty and every condition of life." Such an acknowledgement, and from such a writer, too, ought to have due weight with a certain class of readers, and of authors likewise, and lead them seriously to consider, how far it is consistent with the character of good citizens to endeavour, by sly insinuations, oblique hints, indecent sneer, and profane ridicule, to weaken the influence of so *pure* and *benevolent* a system as that of Christianity, acknowledged to be admirably calculated for promoting the happiness of individuals, and the welfare of society.

Mr Hayley, in his poetical Essay on History, after a splendid panegyric on the arduous labours of his friend, laments the irreligious spirit by which he was actuated.

Think not my verse means blindly to engage
In rash defence of thy profaner page!
Though keen her spirit, her attachment fond,
Base service cannot suit with Friendship's bond;
Too firm from Duty's sacred path to turn,
She breathes an honest sigh of deep concern,
And pities Genius, when his wild career
Gives Faith a wound, or Innocence a tear.
Humility herself divinely mild,
Sublime religion's meek and modest child,
Like the dumb son of Crœsus, in the strife,
Where force assail'd his father's sacred life,
Breaks silence, and with filial duty warm,
Bids thee revere her parent's hallow'd form (B)!

The part of the history which gave such offence to his own friend, as well as to the friends of the Christian religion in general, was the account which our historian has given of the progress and establishment of Christianity in the two last chapters of his first volume; in which he endeavours to prove, that the wonderful triumph of that religion over all the established religions of the earth, was not owing to any miraculous attestations to its truth, but to five secondary causes which he enumerates: and that Christianity, of course, could not be of divine origin. Several answers appeared on this occasion, written, as we may naturally suppose, with different degrees of temper and ability (C).

One of them only, Mr Davis, who had undertaken to point out various instances of misrepresentation, inaccuracy, and even plagiarism, in his account, did our historian condescend particularly to answer, and that in a tone of proud contempt and confident superiority. To this Mr Davis replied; and it is but justice to observe, that his reply bears evident marks of learning, judgment, and critical acumen; and that he has convicted our author of sometimes quoting inaccurately to serve a purpose. At his other answerers Mr Gibbon merely glanced, treating Dr Watson, however, with particular respect; but his posthumous memoirs shew how much he felt the attacks made on him by Lord Hailes, Dr White, of Oxford, and Mr Taylor. To Dr Priestley, who, in his *History of the Corruptions of Christianity*, threw down his gauntlets at once to Bishop Hurd and the historian of the Roman empire, and who presented the latter with a copy of his book, declaring, at the same time, that he sent it not as a gift but as a *challenge;* he wrote in such terms as produced a correspondence, which certainly added not to the honour of the dissenting divine.

At the beginning of the memorable contest between Great Britain and America, our author was returned, by the interest of Mr Eliot (now Lord Eliot), for the borough of Liskeard, and supported with many a sincere and silent vote, the rights, though not, perhaps, the interest, of the mother country. "After a fleeting illusive hope, prudence condemned me (says he) to acquiesce in the humble station of a mute. I was not armed by Nature and education with the intrepid energy of mind and voice.

Vincentem strepitus, et natum rebus agendis.

Timidity was fortified by pride; and even the success of my pen discouraged the trial of my voice."

That pen, however, was useful to the ministry whom he could not support by his eloquence in the house. At the request of the Lord Chancellor and Viscount Weymouth, then secretary of state, he vindicated, in a very able manner, against the French manifesto, the justice of the British arms, and his *Memoire Justificatif*, was delivered as a state paper to the courts of Europe. He was rewarded for this service with the place of one of the lords commissioners of trade and plantations; and kept it, till the board was abolished by Mr Burke's reform bill. For accepting this place he was severely, but most unjustly, blamed by some of the leaders of the opposition,

(B) Herodotus relates, that a Persian soldier, at the storming of Sardis, was preparing to kill Crœsus, whose person he did not know, and who, giving up all as lost, neglected to defend his own life. A son of the unfortunate monarch, who had been dumb from his infancy, and who never spoke afterward, found utterance in that trying moment, and preserved his father by exclaiming, 'O kill not Crœsus!'

(C) Dr Chelsum, Dr Randolph, Dr Watson (bishop of Llandaff) Lord Hailes, Dr White, Mr Apthorp, Mr Davis, and Mr Taylor, the author of 'The Letters of Ben Mordecai.'

oppoſition, as if he had deſerted a party in which he had never enliſted, and to the principles of which he was rendered inimical both by family prepoſſeſſion and by his own judgment.

On the downfal of Lord North's adminiſtration, Mr Gibbon was of courſe in the oppoſition deprived of an office, without the ſalary of which he could not conveniently ſupport the expence of living in London. The coalition was indeed ſoon formed, and his friends were again in power; but having nothing to give him immediately, they could not detain him in parliament or even in England. He was tired of the buſtle of the metropolis, and ſighed once more for the retirement of Lauſanne, at which he arrived before the overthrow of the coalition miniſtry, and where he lived happily till the laſt years of his life. It was in this retreat that he wrote the fourth, fifth, and ſixth volumes of his hiſtory; and he left it only for a year to ſuperintend the publication of theſe volumes in London. This great work being concluded, he returned to the banks of the Leman lake, but found his enjoyments damped by the diſtreſs and ſoon afterwards by the death of his oldeſt and deareſt Swiſs friend. Lauſanne had now loſt much of its attraction; the French revolution had crowded it with unfortunate emigrants, who could not be cheerful themſelves or excite the cheerfulneſs of others; and the demons of democracy had begun to poiſon the minds of the ſober citizens with principles which Mr Gibbon had always held in abhorrence. Speaking of theſe principles and their effects in Switzerland, he adds, "I beg leave to ſubſcribe my aſſent to Mr Burke's creed on the revolution of France. I admire his eloquence, I approve his politics, I adore his chivalry, and I can almoſt excuſe his reverence for church eſtabliſhments. While the ariſtocracy of Berne protects the *happineſs*, it is ſuperfluous to enquire whether it be founded in the *rights* of men: the economy of the ſtate is liberally ſupplied without the aid of taxes: and the magiſtrates *muſt* reign with prudence and equity, ſince they are unarmed in the midſt of an armed nation."

It was againſt the beneficent and mild government of Berne that the emiſſaries of France contrived to excite the diſcontents of the people, by inſtilling into their ſimple and untutored minds their own wild notions of liberty and equality. From the effects of this Gallic phrenzy, which began to be very viſible ſo early as the beginning of the year 1792, Mr Gibbon reſolved to take ſhelter in England, and to abandon, for ſome time at leaſt, what he called his paradiſe at Lauſanne. Difficulties intervened, and forced him to poſtpone his journey from week to week, and from month to month; but on receiving the accounts of Lady Sheffield's death, he haſtened to adminiſter conſolation to his friend, and arrived ſafe in London in the beginning of June 1793.

He continued in good health and ſpirits through the whole of the ſummer; but his conſtitution had ſuffered much from repeated attacks of the gout, and from an incipient dropſy in his ancles. The ſwelling of his ancles, however, ſubſided; but it was only in conſequence of the water flowing to another place; and being repeatedly tapped for a *hydrocele*, he at laſt ſunk under it, and died at his lodgings in St James's ſtreet, London, on the 16th of January, 1794.

To draw a character at once general and juſt of this extraordinary man, would be difficult perhaps to one who had enjoyed the pleaſure of his acquaintance, and muſt be impoſſible to thoſe to whom his perſon was a ſtranger. Of the extent of his erudition there can be but one opinion; but various opinions may be held reſpecting the accuracy of his knowledge. Lord Sheffield, who knew him well, and loved him much, aſſures us, that his converſation was ſtill more captivating than his writings: but this could not reſult from the brilliancy of his wit; for of wit he declares himſelf that he had none. His memory was capacious and retentive, his penetration uncommon, and his colloquial eloquence ready and elegant; ſo that he could illuſtrate almoſt any topic of converſation from the copious ſtores of his own mind. From his private correſpondence, and a journal not written for the public eye, he appears to have been a dutiful ſon, a loyal ſubject, and an affectionate and ſteady friend; but it is dificult to reconcile with ſo much moral and political worth his unfair and unmanly ſneers at the religion of his country.

GIBRALTAR is a fortreſs of immenſe ſtrength, of which a very full account has been given in the *Encyclopædia*. Nothing, however, is in that article ſaid of the natural hiſtory of the mountain on which the fortreſs is built, though, to men of ſcience, that ſubject muſt be as intereſting as a detail of ſieges. This defect we are enabled to ſupply by means of Major Imrie's mineralogical deſcription of Gibraltar, which is publiſhed in the fourth volume of the Tranſactions of the Royal Society of Edinburgh; and, we are perſuaded, the following abſtract of that elegant memoir will afford rational entertainment to many of our readers.

"The form of this mountain is oblong; its ſummit a ſharp craggy ridge; its direction is nearly from north to ſouth; and its greateſt length, in that direction, falls very little ſhort of three miles. Its breadth varies with the indentations of the ſhore, but it no where exceeds three quarters of a mile. The line of its ridge is undulated, and the two extremes are ſomewhat higher than its centre.

"The ſummit of the Sugar Loaf, which is the point of its greateſt elevation towards the ſouth, is 1439 feet; the Rock Mortar, which is the higheſt point to the north, is 1350; and the Signal Houſe, which is nearly the central point between theſe two, is 1276 feet above the level of the ſea. The weſtern ſide of the mountain is a ſeries of rugged ſlopes, interſperſed with abrupt precipices. Its northern extremity is perfectly perpendicular, except towards the north-weſt, where what are called the Lines intervene, and a narrow paſſage of flat ground that leads to the iſthmus, and is entirely covered with fortification. The eaſtern ſide of the mountain moſtly conſiſts of a range of precipices; but a bank of ſand riſing from the Mediterranean in a rapid acclivity, covers a third of its perpendicular height. Its ſouthern extremity falls, in a rapid ſlope from the ſummit of the Sugar Loaf, into a rocky flat of conſiderable extent, called Windmill Hill.

"The principal maſs of the mountain rock conſiſts of a grey, denſe (what is generally called primary) marble; the different beds of which are to be examined in a face of 1350 feet of perpendicular height, which it preſents to Spain in a conical form. Theſe beds, or ſtrata, are of various thickneſs, from 20 to upwards of 40 feet, dipping in a direction from eaſt to weſt, nearly at an angle of 35 degrees. In ſome parts of the ſaid mass of this rock are found testaceous bodies entirely transmuted into the constituent matter of the rock, and their interior hollows filled up with calcareous spar; but these do not occur often in its composition, and its beds are not separated by any intermediate strata.

"The caves of Gibraltar are many, and some of them of great extent. That which most deserves attention and examination is called St Michael's Cave, which is situated upon the southern part of the mountain, almost equally distant from the Signal Tower and the Sugar Loaf. Its entrance is 1000 feet above the level of the sea: This entrance is formed by a rapid slope of earth, which has fallen into it at various periods, and which leads to a spacious hall, incrusted with spar, and apparently supported in the centre by a large massy stalactitical pillar. To this succeeds a long series of caves of difficult access. In these cavernous recesses, the formation and process of stalactites is to be traced, from the flimsy quilt-like cone, suspended from the roof, to the robust trunk of a pillar, three feet in diameter, which rises from the floor, and seems intended by Nature to support the roof from which it originated.

"The only inhabitants of these caves are bats, some of which are of a large size. The soil, in general, upon the mountain of Gibraltar is but thinly sown; and in many parts that thin covering has been washed off by the heavy autumnal rains, which have left the superfices of the rock, for a considerable extent, bare and open to inspection. In those situations, an observing eye may trace the effects of the slow, but constant, decomposition of the rock, caused by its exposure to the air, and the corrosion of sea salts, which, in the heavy gales of easterly winds, are deposited with the spray on every part of the mountain. Those uncovered parts of the mountain rock also expose to the eye a phenomenon worthy of some attention, as it tends clearly to demonstrate, that, however high the surface of this rock may now be elevated above the level of the sea, it has once been the bed of agitated waters. This phenomenon is to be observed in many parts of the rock, and is constantly found in the beds of torrents. It consists of pot-like holes, of various sizes, hollowed out of the solid rock, and formed apparently by the attrition of gravel or pebbles, set in motion by the rapidity of rivers or currents in the sea.

"Upon the west side of the mountain, towards its base, some strata occur, which are heterogenial to the mountain rock: the first, or highest, forms the segment of a circle; its convex side is towards the mountain, and it slopes also in that direction. This stratum consists of a number of thin beds; the outward one, being the thinnest, is in a state of decomposition, and is mouldering down into a blackish brown or ferruginous coloured earth. The beds, inferior to this, progressively increase in breadth to 17 inches, where the stratification rests upon a rock of an argillaceous nature.

"This last bed, which is 17 inches thick, consists of quartz of a blackish blue colour, in the septa or cracks of which are found fine quartz crystals, colourless, and perfectly transparent. These crystals are composed of 18 planes, disposed in hexangular columns, terminated at both extremities by hexangular pyramids. The largest of these that Major Imrie saw did not exceed one-fourth of an inch in length: They, in general, adhere to the rock by the sides of the column, but are detached without difficulty. Their great degree of transparency has obtained them the name of *Gibraltar diamonds*."

Much has been said of the fossil bones found in the rock of Gibraltar; and the general idea which exists concerning them is, that they are found in a petrified state, and inclosed in the solid calcareous rock; but this, says Major Imrie, is a mistake, which could arise only from inaccurate observation and false description.

"In the perpendicular fissures of the rock, and in some of the caverns of the mountain (all of which afford evident proofs of their former communication with the surface), a calcareous concretion is found, of a reddish brown ferruginous colour, with an earthy fracture, and considerable induration, inclosing the bones of various animals, some of which have the appearance of being human. These bones are of various sizes, and lie in all directions, intermixed with shells of snails, fragments of the calcareous rock, and particles of spar; all of which materials are still to be seen in their natural uncombined states, partially scattered over the surface of the mountain. These having been swept, by heavy rains at different periods, from the surface into the situations above described, and having remained for a long series of years in those places of rest, exposed to the permeating action of water, have become inveloped in, and cemented by, the calcareous matter which it deposits.

"The bones, in this composition, have not the smallest appearance of being petrified: and if they have undergone any change, it is more like that of calcination than that of petrifaction, as the most solid parts of them generally admit of being cut and scraped down with the same ease as chalk.

"Bones combined in such concretions are not peculiar to Gibraltar: they are found in such large quantities in the country of Dalmatia, and upon its coasts in the islands of Cherso and Osero, that some naturalists have been induced to go so far as to assert, that there has been a regular stratum of such matter in that country, and that its present broken and interrupted appearance has been caused by earthquakes, or other convulsions, experienced in that part of the globe. But, of late years, a traveller (Abbé Alberto Fortis) has given a minute description of the concretion in which the bones are found in that country: And by his account it appears, that with regard to situation, composition, and colour, it is perfectly similar to that found at Gibraltar. By his description, it also appears that the two mountain rocks of Gibraltar and Dalmatia consist of the same species of calcareous stone; from which it is to be presumed, that the concretions in both have been formed in the same manner and about the same periods.

"Perhaps if the fissures and caves of the rock of Dalmatia were still more minutely examined, their former communications with the surface might yet be traced, as in those described above; and, in that case, there would be at least a strong probability, that the materials of the concretions of that country have been brought together by the same accidental cause which has probably collected those found in the caverns of Gibraltar. Major Imrie traced, in Gibraltar, this concretion, from the lowest part of a deep perpendicular fissure, up to the surface of the mountain. As it approached to the surface, the concretion became less firmly combined, and, when it had no covering of the calcareous rock, a small degree of adhesion only remained, which was evidently

Gibraltar. dently produced by the argillaceous earth, in its composition, having been moistened by rain and baked by the sun.

"The depth at which these materials had been penetrated by that proportion of stalactitical matter, capable of giving to the concretion its greatest adhesion and solidity, he found to vary according to its situation, and to the quantity of matter to be combined. In fissures, narrow and contracted, he found the concretion possessing a great degree of hardness at six feet from the surface; but in other situations more extended, and where a larger quantity of the materials had been accumulated, he found it had not gained its greatest degree of adhesion at double that depth. In one of the caves, where the mass of concretion is of considerable size, he perceived it to be divided into different beds, each bed being covered with a crust of the stalactitical spar, from one inch to an inch and a half in thickness, which seems to indicate, that the materials have been carried in at various periods, and that those periods have been very remote from each other.

"At Rosia Bay, upon the west side of Gibraltar, this concretion is found in what has evidently been a cavern, originally formed by huge unshapely masses of the rock which have tumbled in together. The fissure, or cavern, formed by the disruption and subsidence of those masses, has been entirely filled up with the concretion, and is now exposed to full view by the outward mass having dropped down in consequence of the encroachments of the sea. It is to this spot that strangers are generally led to examine the phenomenon; and the composition, having here attained to its greatest degree of hardness and solidity, the hasty observer seeing the bones inclosed in what has so little the appearance of having been a vacuity, examines no further, but immediately adopts the idea of their being incased in the solid rock. The communication from this former chasm, to the surface from which it has received the materials of the concretion is still to be traced in the face of the rock, but its opening is at present covered by the base of the line wall of the garrison. Here bones are found that are apparently human; and those of them that appear to be of the legs, arms, and vertebræ of the back, are scattered among others of various kinds and sizes, even down to the smallest bones of small birds. Major Imrie found here the complete jaw-bone of a sheep; it contained its full complement of teeth, the enamel of which was perfect, and its whiteness and lustre in no degree impaired. In the hollow parts of some of the large bones was contained a minute crystallization of pure and colourless calcareous spar; but, in most, the interior part consisted of a spary crust of a reddish colour, scarcely in any degree transparent.

"At the northern extremity of the mountain, the concretion is generally found in perpendicular fissures. The miners there, employed upon the fortifications in excavating one of those fissures, found, at a great depth from the surface, two skulls, which were supposed to be human; but, to the Major, one of them, if not both, appeared to be too small for the human species. The bone of each was perfectly firm and solid; from which it is to be presumed, that they were in a state of maturity before they were inclosed in the concretion. Had they appertained to very young children, perhaps the bone would have been more porous and of a less firm texture. The probability is, that they belonged to a species of monkey, which still continues to inhabit, in considerable numbers, those parts of the rock which are to us inaccessible.

"This concretion varies, in its composition, according to the situation in which it is found. At the extremity of Princes Lines, high in the rock which looks towards Spain, it is found to consist only of a reddish calcareous earth, and the bones of small birds cemented thereby. The rock around this spot is inhabited by a number of hawks, that, in the breeding season nestle here and rear their young; the bones in this concretion are probably the remains of the food of those birds. At the base of the rock below King's Lines, the concretion consists of pebbles of the prevailing calcareous rock. In this concretion, at a very considerable depth under the surface, was found the under parts of a glass bottle, uncommonly shaped, and of great thickness; the colour of the glass was of a dark green."

Major Imrie makes an apology for giving so minute a description of these fossil bones; but, in our opinion, the public is indebted to him for bestowing so much attention on a subject which all must admit to be curious, and which, from the strange inferences drawn from similar phenomena by modern philosophers, has become important as well as curious.

We cannot dismiss this article without noticing the subterraneous galleries constructed in the rock not only for the protection of the men during a siege, but also for placing cannon, to annoy the enemy, in situations inaccessible but by such means. The idea of forming these galleries was conceived by the late Lord Heathfield when governor, and by him in some measure, carried into execution; though the plan was not completed till lately by General O'Hara. Of these galleries we have in the *Monthly Magazine* for April 1798 an animated account, which we shall insert in the writer's own words.

"The subterraneous galleries are very extensive, pierce the rock in several places and in various directions, and at various degrees of elevation; all of them have a communication with each other, either by flights of steps cut in the rock, or by wooden stairs where the passages are required to be very perpendicular.

"The centinels may now be relieved during a siege from one post to another in perfect safety; whereas, previously to the constructing of these galleries, a vast number of men were killed by the Spaniards while marching to their several stations. The width of these galleries is about twelve feet, their height about fourteen. The rock is broken through in various places, both for the purpose of giving light and for placing the guns to bear on the enemy. In different parts there are spacious recesses, capable of accommodating a considerable number of men. To these recesses they give names, such as St Patrick's Chamber, St George's Hall, &c. The whole of these singular structures have been formed out of the solid rock by blasting with gunpowder. Through the politeness of an officer on duty, a place called Smart's Reservoir was opened for our inspection, which is a great curiosity, and not generally permitted to be shewn. It is a spring at a considerable depth in the body of the rock, and is above 700 feet above the level of the sea; we descended into the cavern that contains it by a rope ladder, and with the aid of lighted candles

candles proceeded through a narrow paſſage over cryſtallized protuberances of the rock till we came to a hollow, which appears to have been opened by ſome convulſion of Nature. Here, from a bed of gems, ariſes the ſalutary fount, clear as the brilliant of the eaſt, and cold as the iſicle. We hailed the nymph of the grot, and, proſtrating ourſelves, quaffed hygean nectar from her ſparry urn. When reſtored to the light of day, we obtained, through the medium of the ſame gentleman, the key of St George's Hall, at which we arrived by a very intricate and gloomy path to the ſpacious excavation, which is upwards of an hundred feet in length, its height nearly the ſame. It is formed in a ſemicircular part of the rock; ſpacious apertures are broken through, where cannons of a very large calibre command the iſthmus, the Spaniſh lines, and a great part of the bay. The top of the rock is pierced through, ſo as to introduce ſufficient light to enable you to view every part of it. It appears almoſt incredible that ſo large an excavation could be formed by gunpowder, without blowing up the whole of that part of the rock, and ſtill more ſo, that they ſhould be able to direct the operations of ſuch an inſtrument, ſo as to render it ſubſervient to the purpoſe of elegance. We found in the hall a table, placed, I ſuppoſe, for the conveniency of thoſe who are traverſing the rock. The cloth was ſpread, the wine went round, and we made the vaulted roof reſound with the accents of mirth and the ſongs of conviviality."

Theſe excavations are indeed very extraordinary works; but as the whole rock abounds with caverns, we wiſh that our author had inquired more particularly than he ſeems to have done, whether St George's Hall be wholly the work of art. From one of the paſſages which we have extracted from Major Imrie's memoir, we are led to think that it is not, or, at leaſt, that the concretion removed had not acquired the conſiſtence of the more ſolid parts of the rock. If this was the caſe, much of the wonder will vaniſh ſince the pick-axe and chiſel were probably employed to give elegance to the vault, and even, in ſome degree, to direct the operation of the gunpowder.

GIBRALTER, an ancient town in the province of Venezuela, in Terra Firma. It is ſituated on the ſouth-eaſtern ſide of Maracaibo Lake. The country in its vicinity is well watered with rivers, and bears the beſt quality of cacao, and very large cedars. The beſt Spaniſh tobacco is made here, called Tabago de Maracaibo, from which the valuable ſnuff is made, vulgarly called *Mackaba* ſnuff. The air, however, is ſo unhealthy, that very few but labourers live in the town; the wealthier ſort reſorting to Merida or Maracaibo. —*Morſe.*

GILL, a new townſhip in Hampſhire co. Maſſachuſetts, on the weſt bank of Connecticut river, a little below the mouth of Miller's river, on the oppoſite ſide, and named after his Honor, Moſes Gill, Lieutenant-Governor of Maſſachuſetts.—*ib.*

GILLORI, an iſland on the coaſt of Weſt-Florida, is divided from Dauphin Iſland by a narrow channel, through which a boat may paſs with ſome difficulty; and between Gillori and the main land, on the weſt ſide of Mobile Bay, there is a chain of ſmall iſlands, and oyſter ſhells, through which is a paſſage of 4 feet called Paſſe au Heron.—*ib.*

GILMANTOWN, a townſhip in Strafford co. New-Hampſhire, ſouth-weſterly of Lake Winnipiſeogee, and 52 miles N. W. of Portſmouth. It was incorporated in 1727, and contained 775 inhabitants in 1775; and in 1790, 2613.—*ib.*

GIMBOLS, are the braſs rings by which a ſea compaſs is ſuſpended in its box that uſually ſtands in the binacle.

GIRT, in timber-meaſuring, is the circumference of a tree, though ſome uſe this word for the quarter or 4th part of the circumference only, on account of the great uſe that is made of it; for the ſquare of this 4th part is eſteemed and uſed as equal to the area of the ſection of the tree; which ſquare therefore multiplied by the length of the tree, is accounted the ſolid content. This content, however, is always about one-fourth part leſs than the true quantity; being nearly equal to what this will be after the tree is hewed ſquare in the uſual way: ſo that it ſeems intended to make an allowance for the ſquaring of the tree.

Girt-*Line*, is a line on the common or carpenter's ſliding rule, employed in caſting up the contents of trees by means of their girt.

GIRTY'*s Town*, an Indian village in the N. W. Territory, near the head of the navigable water or landing on St Mary's river, where the Indians ceded at the treaty of Greenville, a tract of 2 miles ſquare to the United States.—*Morſe.*

GLADE *Road*, at Bonnets' tavern, 4 miles from Bedford, on the road from Philadelphia to Pittſburg Forks; the ſouthernmoſt is called the Glade Road; the northernmoſt the *Old*, or *Forbes's Road*, and goes by Ligonier. Theſe roads unite 28 miles from Pittſburg. In the *Glades*, a tract of country at the entrance of the Alleghany Mountains, they cannot raiſe corn, as the earth is ſubjected to froſt from Sept. to June. —*ib.*

GLADY *Creek*, a ſmall ſtream which flows through the eaſt bank of Little Miami river in the N. W. Territory.—*ib.*

GLAIZE, *Au*, a S. S. W. branch of the Miami of the Lake, which interlocks with St Mary's river. By the treaty at Greenville, the Indians have ceded to the United States a tract of land 6 miles ſquare, at the head of its navigable waters, and 6 miles ſquare at its confluence with the Miami, where Fort Defiance now ſtands.—*ib.*

GLASGOW, a new county in Newbern diſtrict, N. Carolina, taken from Dobbs' co. It is bounded N. by Edgcomb, S. by Lenoir, E. by Pitt, and W. by Wayne.—*ib.*

GLASS Etching, or *Engraving upon*, is in the article Chemistry *(Encycl.)* ſaid to be a new art; and as that acid which diſſolves ſiliceous earth, and alſo glaſs, was firſt diſcovered in the year 1771 by Scheele, one might naturally imagine that the art of etching with it upon glaſs could not be older. By many others, as well as by us, it has indeed been noticed as a new invention; yet Profeſſor Beckmann, whoſe laborious reſearches have brought many things to light, has proved, that ſo early as the year 1670 the art of etching upon glaſs was diſcovered by Henry Schwanhard, ſon of George Schwanhard, who was a celebrated glaſs-cutter, patronized by the Emperor Ferdinand

Glafs Etching.

nand III. about the middle of the laft century. At the time of his death, 1667, the father practifed his art at Prague and Ratifbon. Whether the fon followed the fame bufinefs at the fame towns, or removed to Nuremberg, is not very evident from the profeffor's hiftory; but in the year above-mentioned, fome *aqua regia* (*nitro-muriatic acid*) having accidentally fallen on his fpectacles, he was furprifed to find the glafs corroded by it, and become quite foft. He thus found himfelf in poffeffion of a liquid by which he could etch writing and figures upon plates of glafs.

Such is our information; but if it be admitted (and it would difplay unreafonable fcepticifm to queftion it), Schwanhard muft either have improved the nitro-muriatic acid by fome means or other unknown to us, or have confined his etchings to fome particular kinds of glafs; for the *fluoric* is the only acid, with which we are acquainted, that corrodes all glafs. (See CHEMISTRY-*Index* in this *Supplement*). M. Beckmann indeed feems to think that he had difcovered the fluoric acid itfelf; for in the year 1725 there appeared in a periodical work the following receipt for making a powerful acid, by which figures of every kind can be etched upon glafs.

"When the *fpiritus nitri per diftillationem* has paffed into the recipient, ply it with a ftrong fire, and when well dephlegmated, pour it, as it corrodes ordinary glafs, into a Weldenburg flafk. Then throw into it a pulverifed green Bohemian emerald, otherwife called *hefphorus* (which, when reduced to powder, and heated, emits in the dark a green light), and place it in warm fand for 24 hours. Take a piece of glafs well cleaned, and freed from all greafe by means of a ley; put a border of wax round it, about an inch in height, and cover it all over with the above acid. The longer you let it ftand fo much the better; and at the end of fome time the glafs will be corroded, and the figures which have been traced out with fulphur and varnifh will appear as if raifed above the pane of glafs."

That the Bohemian emerald or *hefphorus* mentioned in this receipt is green fparry fluor, cannot, fays the profeffor, be doubted; and he feems to have as little doubt of the receipt itfelf having paffed from Schwanhard and his fcholars to the periodical work of 1725, from which it has been lately inferted in the Œkonomifche Encyclopedie of Krunitz. This fuppofition certainly acquires a confiderable degree of probability from the fimilarity of Schwanhard's method of etching to that which is here recommended, and which is fo different from what is now followed. At prefent, the glafs is covered with a varnifh either of ifinglafs diffolved in water, or of turpentine oil mixed with a little white lead, through which the figures to be etched are traced as on copper; but Schwanhard, when he had drawn his figures, covered them with varnifh, and then by his liquid corroded the glafs around them. His figures, therefore, when the varnifh was removed, remained fmooth and clear, appearing raifed from a dim or dark ground; and M. Beckmann, who perfuaded fome ingenious artifts to make trial of this antient method of etching, declares, that fuch figures have a much better effect than thofe which are cut into the glafs.

Before concluding this article, it may be worth while juft to mention a propofal which has been lately made to employ glafs inftead of copper for throwing off prints in the rolling prefs. That it is poffible to ufe glafs plates of great thicknefs for this purpofe, it would be rafh to deny; but the fuperiority of fuch plates to thofe of copper we cannot conceive. If not broken in pieces in the rolling prefs, they would doubtlefs laft longer; but the expence of them at firft would probably be greater, and the engraving on them could not be fo fine.

Glaftonbury || Gloucefter.

GLASTONBURY, a townfhip in Bennington co. Vermont, having only 34 inhabitants. It has good intervale lands, and lies N. E. of Bennington, adjoining.—*Morse.*

GLASTONBURY, a handfome little town in Hartford co. Connecticut, fituated on the eaft fide of Connecticut river, oppofite to Weathersfield, and of which it formed a part until 1690. In the townfhip are 2 meeting houfes; and on Roaring Brook and other fmall ftreams are 17 mills of different kinds and 1 forge.—*ib.*

GLOSSOCOMMON, in mechanics, is a name given by Heron to a machine compofed of divers dented wheels with pinions, ferving to raife huge weights.

GLOUCESTER *Houfe*, belonging to the Hudfon's Bay Company, is fituated in New South Wales, on the N. fide of the waters which form a communication through a chain of fmall lakes, between Winnepeg Lake and Albany river. Henley Houfe lies N. E. of this, nearer the mouth of Albany river, in James' Bay. N. lat. 54. W. long. 87. 30.—*Morse.*

GLOUCESTER, or *Cape-Ann*, a townfhip in Effex co. Maffachufetts, whofe eaft point forms the north fide of the bay of Maffachufetts. It contains 5317 inhabitants, and is divided into 5 parifhes, and has befides a fociety of Univerfalifts. This is a poft-town and port of entry. The harbour is very open and acceffible to large fhips; and is one of the moft confiderable fifhing towns in the Commonwealth. At the harbour, properly fo called, are fitted out annually from 60 to 70 bankers; and from Squam and Sandy Bay, two fmall out ports, the bay fifhery is carried on with great fpirit, and to a large amount. The exports for one year, ending Sept. 30, 1794, amounted in value to 229,613 dollars. Thatcher's Ifland, on which are two lights of equal height, lies clofe to the S. E. fide of the townfhip, which is itfelf joined to the continent by a beach of fand which is very rarely overflowed by the water. There is a very fine white fand here fit for making glafs. The harbour is defended by a battery and citadel erected in 1795. It is 16 miles N. E. by E. of Salem, and 34 N. E. of Bofton.—*ib.*

GLOUCESTER, the north-wefternmoft townfhip, and the largeft, in Providence co. Rhode-Ifland, having Connecticut on the weft, and Maffachufetts on the north; and contains 4025 inhabitants.—*ib.*

GLOUCESTER *County*, in New-Jerfey, is bounded north by Burlington co. fouth by Salem, Cumberland, and Cape May counties, eaft by the Atlantic Ocean, and weft by Delaware river. Its length on the Delaware is about 30 miles, and on the fea the line is about 22 miles. Great and Little Egg Harbour rivers are both navigable for veffels of 200 tons about 20 miles from their mouths. The ftreams which fall into Delaware river are navigable for fmall veffels, a few miles up from their mouths, and afford fome fhad, rock, herrings, and perch. The adjacent iflands are Red Bank, Pett, and Old Man's Creek Iflands. The firft of of which is famous in the history of the American war, for the desperate defence the garrison upon it made, to prevent the British fleet from passing up to Philadelphia. The soil of this county is a mixture of sand and loam, and the tract bordering on the Delaware is in a high state of cultivation. The chief productions are beef, pork, fish, hay, corn, lumber, butter, cheese, &c. It is divided into 10 townships, viz. Woodbury, Waterford, Newtown, Gloucester Township, Gloucester Town, Deptford, Greenwich, Woolwich, Egg Harbour, and Galloway. The first 8 lie along the Delaware, and the other two on the ocean. Mulicus river divides this county from Burlington, and is navigable 20 miles for vessels of 60 tons. Maurice river rises here, runs southerly about 40 miles through Cumberland co. into Delaware Bay, is navigable for vessels of 100 tons 15 miles, and for shallops 10 miles farther. It contains 13,172 free inhabitants, and 191 slaves. There are found in this county quantities of bog iron ore, which is manufactured into pig and bar iron, and hollow ware. Here is also a glass-house. Chief town, Woodbury, 9 miles S. of Philadelphia.—*ib.*

GLOUCESTER, a small town in the above county, on the east side of Delaware river, 3 miles below Philadelphia. It was formerly the county town, but has now scarcely the appearance of a village.—*ib.*

GLOUCESTER, a post-town in Virginia, situated in the county of its own name, on a point of land on the N. side of York river, partly opposite York-Town, 17 miles distant.—*ib.*

GLOUCESTER *County*, in Virginia, is fertile and well cultivated, bounded N. by Piankitank river, which separates it from Middlesex, east by Mathews co. and Chesapeak Bay, N. W. by King and Queen, S. and S. W. by York river, which divides it from York co. It is about 55 miles in length, and 30 in breadth, and contains 13,498 inhabitants, including 7063 slaves. The low lands here produce excellent barley, and Indian corn, the staple produce of the county. Tobacco is little attended to.—*ib.*

GLOUCESTER *House*, in the territory of the Hudson's Bay Company, is on the N. side of Musquacobaston Lake, 120 miles west of Osnaburgh house. N. lat. 51. 24. W. long. 86. 59.—*ib.*

GLUCINA (A), a peculiar earth discovered by Vauquelin in the beryl and the emerald. Its general properties are as follows: 1. It is white: 2. Insipid; 3. Insoluble in water; 4. Adhesive to the tongue; 5. Infusible; 6 Soluble in the fixed alkalis; 7. Insoluble in ammoniac; 8. Soluble in the carbonate of ammoniac; 9. Soluble in almost every one of the acids (except the carbonic and phosphoric acids), and forming salts of a saccharine taste; 10. Fusible with borax into a transparent glass; 11. Absorbs one fourth of its weight of carbonic acid; 12. Decomposes the aluminous salts; 13. Is not precipitable by well saturated hydro sulphurets.

The specific characters of glucina, which are united in none of the other known earths, are; 1. Its salts are saccharine, and slightly astringent; 2. It is very soluble in the sulphuric acid by excess; 3. It decomposes the aluminous salts; 4. It is soluble in the carbonate of ammoniac; 5. Is completely precipitated from its solutions by ammoniac; 6. Its affinity for the acids is intermediate between magnesia and alumine.

One hundred parts of beryl contain 16 of glucina; but for the best method of analyzing the beryl, and of course obtaining the earth, we must refer our readers to the article MINERALOGY in this *Supplement;* and shall conclude this short article with a valuable and judicious remark of Vauquelin's.

"It almost always happens (says this able chemist), in the sciences of observation, and even in the speculative sciences, that a body, a principle, or a property, formerly unknown, though it may often have been used, or even held in the hands, and referred to other simple species, may, when once discovered, be afterwards found in a great variety of situations, and be applied to many useful purposes. Chemistry affords many recent examples of this truth. Klaproth had no sooner discovered the different substances with which he has enriched the science, but they were found in various other bodies; and if I may refer to my own processes, it will be seen, that after I had determined the characters of chrome, first found in the native red lead, I easily recognized it in the emerald and the ruby. The same has happened with regard to the earth of the beryl. I have likewise detected it in the emerald; in which, nevertheless, it was overlooked both by Klaproth and myself in our first analysis: so difficult it is to be aware of the presence of a new substance, particularly when it possesses some properties resembling those already known!"

GLYNN *County*, in the Lower district of Georgia, bounded east by the ocean, north by Alatamaha river, which separates it from Liberty co. and south by Camden co. It contains 413 inhabitants, including 215 slaves. Chief town, Brunswick.—*Morse.*

GNADENHUETTEN, or *Gnadenhutten*, a settlement of the Moravians, or United Brethren, on Muskingum river, opposite to Salem, in the lands which belonged to the Mahikan Indians. In 1746 it was a pleasant town, inhabited by Christian Indians, where were a chapel, missionary's house, and many Indian houses. This together with Schoenbrun and Salem were reserved by Congress, by an ordinance, May 20, 1785, for the Christian Indians formerly settled there; Sept. 3, 1788, it was resolved that the plat of each town should make up 4,000 acres, and the grant was made to the United Brethren for propagating the gospel among the heathen.—Also the name of a Moravian settlement on the south-west bank of Lehigh river, in Pennsylvania, about 29 miles north-west of Bethlehem.—*ib.*

GOAT *Island*, in the State of Rhode-Island, a small islot, opposite to the town of Newport, and on which is Fort Washington. The fort has been lately repaired, and a citadel erected in it. The fort has been ceded to the United States.—*ib.*

GOAVE

(A) This name was given to the earth of beryl by the editors of the *Annales de Chemie*. Its most characteristic property being that it forms salts of a saccharine taste, they gave it a name derived from γλυκαινω, *to render sweet*. According to this etymology, should not the name be *Glycina?*

GOAVE LE PETIT, one of the weſt juriſdictions of the French part of St Domingo. It contains 5 pariſhes, is the unhealthieſt part of the colony, the inhabitants being ſubject to conſtant fevers, occaſioned by the badneſs of the waters. Its dependencies, however, are healthy, and remarkable for the culture of coffee. Exports from Jan. 1, 1789, to Dec. 31, of the ſame year; 27,090 lbs white ſugar—655,187 lbs brown—807,865 lbs coffee—50,053 lbs cotton—and 210 lbs indigo. The town of the ſame name is ſituated on the narroweſt part of the ſouth-weſtern peninſula, on the north ſide of the neck.—*Morse.*

GOELANS, Point Au, a promontory on the north ſide of Lake Ontario, about 33 miles ſouth-weſterly of Fort Frontinac.—*ib.*

GOFFSTOWN, in Hillſborough county, New-Hampſhire, on the weſtern bank of Merrimack river, 3 miles from Amuſkeag Falls, and 60 miles weſt of Portſmouth. It was incorporated in 1761, and contains 1,275 inhabitants. Some pieces of baked earthen ware have been found in this townſhip, from which it is ſuppoſed that the Indians had learned the potters art; but of what antiquity theſe remnants are, is uncertain.—*ib.*

GOLD, the moſt perfect of all the metals. See Chemistry-*Index* in this *Supplement*.

It has been a very common opinion among metallurgiſts, that tin has the property of deſtroying the ductility of gold, on being melted with it even in very ſmall quantities; and Dr Lewis adds, that even the vapours which ariſe from tin in the fire, make gold ſo brittle, that it flies in pieces under the hammer. This opinion was controverted by Staneſby Alchorne, Eſq; of his Majeſty's mint, who made a ſet of experiments, which, in his opinion, authoriſe a very different concluſion, viz. that though tin, like other inferior metals, will contaminate gold in proportion to the quantity mixed with it, yet there does not appear in tin any thing ſpecifically inimical to that precious metal.

As we have elſewhere (See Chemistry, n° 1091, &c. *Encycl.*) enumerated theſe experiments, and admitted the concluſion drawn from them, it becomes our duty, in this place, to ſtate what has been urged againſt that concluſion.

M. Tillet, being in his own mind perſuaded that tin renders gold ſo brittle that it cannot be reduced to thin leaves, and far leſs be made to paſs through the wire plate but by virtue of repeated annealing, and peculiar treatment, which gold of the uſual ductility does not require, determined, from reſpect to M. Alchorne, to repeat his experiments.

His firſt experiment * conſiſted in mixing 24 grains of fine gold with one of tin which contained no arſenic. He wrapped the grain of tin in the 24 grains of gold reduced to a very thin leaf, and placed the whole upon a piece of charcoal, ſo hollowed out as to ſupport the mixed metal during fuſion. He even ſprinkled a ſmall quantity of calcined borax upon the metal, in order that the fuſion might be more ſudden, that the metal might flow together, and the tin unite with the gold, without allowing time for it to become calcined. This alloy was ſpeedily fuſed by the enameller's lamp, and reduced into a ſmall button without any loſs of weight. It was then flattened carefully beneath the hammer; but, notwithſtanding his utmoſt precaution in this reſpect, it cracked, and at laſt broke into three pieces, its thickneſs then being a quarter of a line or thereabouts. He repeated this experiment with a double quantity as well of pure gold as of tin, and the reſult was the ſame.

* Memoirs of the Academy of Sciences at Paris for the year 1790.

He next alloyed 4 ounces of gold, of the fineneſs of 22 carats, with 1 gros 24 grains of tin deprived of arſenic, or, in other words, with 4 pennyweights of tin; and theſe two metals being reduced into ſmall pieces, were mixed together, put into a crucible, and urged by the ſtrong heat of a forge with two pair of bellows. When their fuſion appeared to be complete, he poured the metal into a ſmall ingot mould proportioned to the quantity.

The ingot thus obtained had loſt ſcarcely any thing of the weight of the two metals that compoſed it; which was a proof that the tin had united and incorporated with the four ounces of gold. But on attempting to bend the ingot, which was about ſix inches long, and not more than two or three lines thick, he remarked, contrary to the nature of gold of 22 carats, that it was rigid, and would have required a conſiderable effort to give it any degree of curvature, or bring it to the flexibility it would have poſſeſſed if no tin had entered into its compoſition. Not ſatisfied, however, with the inference naturally flowing from this circumſtance, he proceeded to the proper teſt by hammering, particularly with the edge of the hammer, in order that the bar might be lengthened, and by that means ſubmitted to the moſt deciſive proof. He did not obſerve, during the continuation of this proceſs, till the bar was reduced to about two-thirds of its firſt thickneſs, that its edges were cracked, or exhibited much of the appearance of brittleneſs; but as he was apprehenſive that this accident might happen by too long hammering, he divided the bar by cutting off the part which had been hammered out. This part was placed in the midſt of lighted charcoal, in order that, by a moderate annealing, it might recover the ſtate of malleability it poſſeſſed before it was hammered. But when he went to take it out of the fire, where it had undergone no greater heat than a cherry red, he found it divided into two parts. After having ſuffered theſe to cool, he forged them again. They were extended with conſiderable eaſe, though with ſome cracks at the edges; but they did not yet ſatisfy the whole of his enquiries. He therefore annealed one of the two laſt mentioned pieces a ſecond time, and reſerved the other in its hard-hammered ſtate to be paſſed between the laminating rollers. The annealed part, which might have the thickneſs of about a ſhilling, broke in the fire, though the heat was very gentle, into four or five portions. The longeſt of theſe portions, which beſt reſiſted the action of the fire, bent and twiſted itſelf, and ſhewed, by this ſtate of ſtrong contraction in different directions, that it had tended to break and become divided into ſmall portions, ſimilar to thoſe which had already ſeparated from it.

Satisfied by this experiment that the piece of the mixed ingot which he had kept in its hammer-hardened ſtate would not bear annealing, he determined to extend it ſtill more between the rollers, ſetting them up very gradually, in order that the fracture, if it ſhould take place, might be principally owing to the brittleneſs of the material, and not to the force of compreſfion to which it was fubjected. By this management he fucceeded in extending the metal to double its length notwithftanding its hardnefs, and rendering it as thin as ftrong paper; though the edges were cracked through their whole length like the teeth of a faw. But this accident is not at all furprifing, when it is confidered that gold, though alloyed fimply with copper, whatever may be the caufe, does not poffefs its ufual ductility, particularly when it is laminated very thin, without repeated annealing as the metal becomes hard.

Aware that the fracture of the pieces of gold might be attributed to an incomplete fufion, or unequal mixture of the two metals, he melted the whole ingot over again with the utmoft precaution; but in vain. The metal was as brittle as formerly, and would not bear annealing.

He next fufed 6 ounces of pure gold of 24 carats with 2 gros, or 6 penny-weights of tin, taking every poffible precaution to have the metals completely mixed. When the whole was in perfect fufion, he poured the mixture into an ingot mould, and obtained an ingot rather longer and cleaner than the two former. As foon as it was cold he forged one of its extremities with the edge of the hammer. It was lengthened without any perceptible crack; and when it was reduced to the thicknefs of one line, or thereabouts, he cut it off for feparate treatment. By moderate annealing it maintained its integrity; and, with the exception of a few cracks, it paffed the laminating rollers without breaking. As he was fearful, neverthelefs, that it might break in fome part if he continued to laminate it, he gave it a flight annealing. It had fcarcely acquired a cherry-rednefs between the charcoal, before it broke into five or fix parts, fome of which were fimply bended or twifted, and others flat as they quitted the rollers. Among the annealed pieces of this extremity of the ingot, there was one fufficiently long, though a little curled, which he laminated a fecond time, with the determination of rendering it very thin without the leaft annealing. It acquired at leaft double the length it had at firft without breaking; and, if we except the two fides of this plate which were cracked, the body, or main piece, was entire. It was fpongy, and might be confidered as if formed out of an ingot of common gold containing no tin, but not poffeffing the whole of its natural ductility.

"It follows, fays M. Tillet, from thefe experiments, that gold, whether fine or alloyed, when perfectly fufed with a fmall portion of the fineft tin, acquires rigidity and hardnefs by the mixture; that it lofes fomewhat of its diftinguifhing colour; and that it may, indeed, by careful management, be extended to a certain degree by the hammer, or ftill better by the rollers; but that, as it cannot be annealed without danger of breaking, it is by this defect deprived of the effential advantage of recovering its original foftnefs after it has been ftrongly hammer-hardened. It is not but by careful management in the ufe of the hammer, and by frequent annealing, that artifts employed on works of gold and filver fucceed in obtaining them without cracks, and bringing them to a ftate of perfection, without being obliged to have recourfe to folder to repair the defects which exceffive hardnefs under the hammer would occafion. How much, therefore, ought gold-workers, who continually have this metal in their hands, to be attentive to prevent the introduction of tin in their workfhops, and never to employ fuch compounds of gold as are fubject to break, or even to warp, while annealing? The expence of refining, which they would pay for depurating fuch compounds, would be of lefs confequence to them than the lofs of time required for the careful management of fuch gold contaminated by tin, even if they did fucceed in ufing it, and were not often forced to abandon, after much labour, a work nearly finifhed.

"If it be allowable (continues our author) to form conjectures on the caufe of the fracture of plates of gold containing tin, when fubjected to the annealing heat, it may be prefumed, fince tin very fpeedily melts, while gold requires a ftrong heat for its fufion, that the parts of the tin intermixed in a fort of proportional equality with thofe of the gold, tend to feparate by a fpeedy fufion and at a very gentle degree of heat; that they remain without confiftence between the parts of the gold, while the latter preferve the whole of their folidity, and do not lofe it even by the annealing heat: whence it feems, that the parts of the precious metal, when ignited among the coals, having no longer the folid connection formed by the tin, but, on the contrary, having an infinite number of fmall cavities occupied by particles of that metal in fufion, muft tend to difunion; whereas the fame accident does not take place in the pieces which have refifted the annealing, and have been laminated after cooling, becaufe the particles of tin have become folid by cooling, and have recovered their original ftate of union with the gold.

"This fracture of the compound does not take place with an alloy of gold and copper, for an oppofite reafon to that which has here been explained; namely, becaufe thefe two metals require nearly the fame heat for their fufion. The effect of annealing being therefore equal upon both, the metals, notwithftanding this treatment, preferve their natural confiftence, even tho' the heat be carried near the point of fufion."

Gold-Leaf. See *Gold-Leaf* (Encycl.) where a full account is given from Dr Lewis of the procefs of gold-beating. In that article, we have faid that gold-leaf ought to be prepared from the fineft gold; but Mr Nicholfon, who, in all probability, knows much more of the matter than the author from whom our account was copied, affures us that this is a miftake, and that pure gold is too ductile to be worked between the gold-beater's fkin. The neweft fkins will work the fineft gold, and make the thinneft leaf, becaufe they are the fmootheft. Old fkins, being rough or foul, require coarfer gold. The finer the gold, the more ductile; infomuch that pure gold, when driven out by the hammer, is too foft to force itfelf over the irregularities, but would pafs round them, and by that means become divided into narrow flips. The fineft gold for this purpofe has three grains of alloy in the ounce, and the coarfeft twelve grains. In general, the alloy is fix grains, or one eightieth part. That which is called pale gold contains three pennyweights of filver in the ounce. The alloy of leaf gold is filver, or copper, or both, and the colour is produced of various tints accordingly. Two ounces and two pennyweights of gold is delivered by the mafter to the workman, who, if extraordinarily fkilful, returns two thoufand leaves, or eighty books of gold, together with one ounce and

fix

fix pennyweights of waste cuttings. Hence one book weighs 4.8 grains; and as the leaves measure 3.3 inches in the side, the thickness of the leaf is one two hundred and eighty-two thousandth part of an inch.

The yellow metal called Dutch gold is fine brass. It is said to be made from copperplates, by cementation with calamine, without subsequent fusion. Its thickness, compared with that of leaf gold, proved as 19 to 4, and under equal surfaces it is considerably more than twice as heavy as the gold. *Nicholson's Journal, Vol. 1st.*

GOLD *River*, situated in Terra Firma, on the isthmus of Darien, southward of the river Santa Maria; affording much gold dust, from whence it has its name.—*Morse.*

GOLDEN *Island* lies at the mouth of the river or gulf of Darien, in the province of Terra Firma, in South America, N. lat. 9°. W. long. 77° 10′.—*ib.*

GOLDONI (Charles), was born at Venice in the year 1707. He gave early indications of his humourous character, as well as his invincible propensity to those studies which have rendered his name immortal. His father, perceiving that the darling amusement of his son was dramatic performances, had a small theatre erected in his own house, in which Goldoni, while yet an infant, amused himself with three or four of his companions, by acting comedies. Before he was sent to school, his genius prompted him to become an author. In the seventh and eighth years of his age, ere he had scarcely learned to read correctly, all his time was devoted to the perusing comic writers, among whom was *Cicognini*, a Florentine, little known in the dramatic commonwealth. After having well studied these, he ventured to sketch out the plan of a comedy, which needed more than one eye-witness of the greatest probity to verify its being the production of a child.

After having finished his grammatical studies at Venice, and his rhetorical studies at the Jesuit's college in Perugia, he was sent to a boarding-school at Rimini, to study philosophy. The impulse of nature, however, superseded with him the study of Aristotle's works, so much in vogue in those times. He frequented the theatres with uncommon curiosity; and passing gradually from the pit to the stage, entered into a familiar acquaintance with the actors. When the season of comic performances was over, and the actors were to remove to Chiozza, young Goldoni made his escape in their company. This was the first fault he committed, which, according to his own confession, drew a great many others after it. His father had intended him to be a physician like himself: the young man, however, was wholly averse to the study. He proposed afterwards to make him an advocate, and sent him to be a practitioner in Modena. An horrid ceremony of ecclesiastical jurisdiction, at which he was present, inspired him with a melancholy turn, and he determined to become a capuchin.

His father, perceiving the whimsical, inconstant humour of his son, feigned to second this proposal, and promised to go and present him to the guardian of the capuchins in Venice, in the hope that after some stay in that extensive and merry city, his melancholy fit would cease. The scheme succeeded; for the young man, indulging in all the fashionable dissipation of the place, was cured of his foolish resolution. It was however necessary for him to be settled in some employment; and he was prevailed upon by his mother, after the death of his father, to exercise the profession of a lawyer in Venice. By a sudden reverse of fortune he was compelled to quit at once both the bar and Venice. He then went to Milan, where he was employed by the resident of Venice in the capacity of secretary; where becoming acquainted with the manager of the theatre, he wrote a farce entitled *Il Gondoliere Veneziano*, the Venetian Gondolier, which was the first comic production of his that was performed and printed. Some time after Goldoni broke with the Venetian resident, and removed to Verona.

There was in this place, at that time, the company of comedians of the theatre of St Samuel of Venice, and among them the famous actor *Cosali*, an old acquaintance of Goldoni, who introduced him to the manager. He began therefore to work for the theatre, and became insensibly united to the company, for which he composed several pieces. Having removed along with them to Genoa, he was for the first time seized with an ardent passion for a lady, who soon afterwards became his wife. He returned with the company to Venice, where he displayed for the first time, the powers of his genius, and executed his plan of reforming the Italian stage. He wrote the *Momolo*, *Courtisan*, the *Squanderer*, and other pieces, which obtained universal admiration.

Feeling a strong inclination to reside some time in Tuscany, he repaired to Florence and Pisa, where he wrote *The Footman of Two Masters*, and *The Son of Harlequin lost and found again.* He returned to Venice, and set about executing more and more his favourite scheme of reform. He was now attached to the theatre of St Angelo, and employed himself in writing both for the company and for his own purposes. The constant toils he underwent in these engagements, impaired his health. He wrote, in the course of twelve months, sixteen new comedies, besides forty-two pieces for the theatre; among these many are considered as the best of his productions. The first edition of his works was published in 1753, in 10 vols. 8vo. As he wrote afterwards a great number of new pieces for the theatre at St Luca, a separate edition of these was published under the title of *The New Comic Theatre:* among these was the *Terence*, called by the author his *favourite*, and judged to be the master-piece of his works. He made another journey to Parma on the invitation of Duke Philip, and from thence he passed to Rome. He had composed 59 other pieces so late as the year 1761, five of which were designed for the particular use of Marque Albergati Capacelli, and consequently adapted to the theatre of a private company. Here ends the literary life of Goldoni in Italy.

Through the channel of the French Ambassador in Venice, he had received a letter from Mr Zenuzzi, the first actor in the Italian theatre at Paris, containing a proposal for an engagement of two years in that city. He accordingly repaired to Paris, where he found a select and numerous company of excellent performers in the Italian theatre. They were, however, chargeable with the same faults which he had corrected in Italy; and the French supported, and even applauded in the Italians, what they would have reprobated on their

Goldoni.

own stage. Goldoni wished to extend even to that country his plan of reformation, without considering the extreme difficulty of the undertaking. Scurrilities and jests, which are ever accompanied by actions, gestures and motions, are the same in all countries, and almost perfectly understood, even in a foreign tongue: while the beauties of sentiment and dialogue, and other things which lead to the understanding of characters and intrigues, require a familiar acquaintance with the tongue of the writer.

The first attempt of Goldoni towards his wished-for reform, was the piece called *The Father for Love*; and its bad success was a sufficient warning to him to desist from his undertaking. He continued, during the remainder of his engagement, to produce pieces agreeable to the general taste, and published twenty-four comedies; among which *The Love of Zelinda and Lindor* is reputed the best.

The term of two years being expired, Goldoni was preparing to return to Italy, when a lady, reader to the dauphiness, mother to the late king, introduced him at court, in the capacity of Italian master to the princesses, aunts to the king. He did not live in the court, but resorted there at each summons, in a post-chaise sent to him for the purpose. These journeys were the cause of a disorder in the eyes, which afflicted him the rest of his life; for being accustomed to read while in the chaise, he lost his sight on a sudden, and in spite of the most potent remedies, he could never afterwards recover it entirely. For about six months lodgings were provided him in the chateau of Versailles. The death, however, of the dauphin, changed the face of affairs. Goldoni lost his lodgings, and only, at the end of three years, received a bounty of 100 louis in a gold box, and the grant of a pension of four thousand livres a year. This settlement would not have been sufficient for him, if he had not gained, by other means, farther sums. He wrote now and then comedies for the theatres of Italy and Portugal; and, during these occupations, was desirous to shew to the French that he merited a high rank among their dramatic writers. For this purpose, he neglected nothing which could be of use to render himself master of the French language. He heard, spoke, and conversed so much in it, that, in his 62d year, he ventured to write a comedy in French, and to have it represented in the court theatre, on the occasion of the marriage of the king.

This piece was the *Bourru Bienfaisant*; and it met with so great success, that the author received a bounty of 150 louis from the king, another gratification from the performers, and considerable sums from the booksellers who published it. He published, soon after, another comedy in French, called *L'Avare Fastueux*. After the death of Louis XV. Goldoni was appointed Italian teacher to the Princess Clotilde, the present princess of Piedmont; and after her marriage he attended the late unfortunate Princess Elizabeth in the same capacity.

The approach of old age obliged him to quit Versailles, and to live in Paris, the air of which, less sharp, was better adapted to his constitution. The last work of Goldoni was *The Volponi*, written after his retirement from court; from which time he bade a lasting adieu to writing. Unfortunately for him he lived to see his pensions cut off at the revolution, like others, and he spent his last days in poverty and distress. He died in 1792, at a crisis when, according to the expression of a deputy in the Convention, the French nation was ready to repay him every debt of gratitude.

Goldsborough || Goniometry.

Goldoni is on a par with the greatest comic poets of modern times, with regard to dramatic talents, and is thought superior to them all with regard to the fertility of his genius. His works were printed at Leghorn in 1788—91, in 31 vols. 8vo. He has been generally called the Moliere of Italy; and Voltaire, in one of his letters to Marquis Albergati, styles him *The Painter of Nature*. Goldoni is one of those authors whose writings will be relished in the most remote countries, and by the latest posterity.

GOLDSBOROUGH, a post-town in Hancock county, District of Maine, containing 267 inhabitants. It was incorporated in 1789, is the south-easternmost town in the county. On the waters of its harbour is the town of Washington. It is 47 miles easterly of Penobscot, 188 south-east of Portland, and 330 north-east of Boston. N. lat. 44° 19′.—*Morse*.

GOLPHINGTON, the chief town of Washington county, Georgia, is situated near the head of Ogeeche river, about 26 miles east-south-east of Oconee town, 37 south-west of Augusta, and 50 north-west of Louisville.—*ib.*

GOMASHTEH, in the language of Bengal, one cent.

GONAIVES, a bay in the island of Hispaniola, south-eastward of Cape St Nicholas, in about 19° 33′ N. lat.—*Morse*.

GONAVE, an island in the bay of Leogane, in the western part of the island of St Domingo. It is 14¾ leagues long, and uniformly about 3 broad, except a very small part at each extremity. *Petite Gonave*, an isle about 2 miles each way, is separated from the south-east corner of the former, by a channel 3 miles wide. Gonave is 13½ leagues W. by N. W. of Port-au Prince; and its west point is 33½ leagues E. by N. of Cape Dame Marie.—*ib.*

Gonaives, a sea-port in the same island, at the head of a bay of its own name, on the north side of the bay of Leogane. The town is situated on the great road from Port de Paix to St Mark, 16 leagues south-east of the former and 15 N. by E. of the latter, N. lat. 19° 27′ W. long. from Paris 75° 2′ 30″.—*ib.*

GONIOMETRY, a method of measuring angles, so called by M. de Lagny, who gave several papers on this method in the Memoirs of the Royal Acad. anno 1724, 1725, 1729. M. de Lagny's method of goniometry consists in measuring the angles with a pair of compasses, and that without any scale whatever, except an undivided semicircle. Thus, having any angle drawn upon paper to be measured, produce one of the sides of the angle backwards behind the angular point; then with a pair of fine compasses describe a pretty large semicircle from the angular point as a centre, cutting the sides of the proposed angle, which will intercept a part of the semicircle. Take then this intercepted part very exactly between the points of the compasses, and turn them successively over upon the arc of the semicircle, to find how often it is contained in it, after which there is commonly some remainder: then take this remainder in the compasses, and, in like manner, find how often it is contained in the last of the integral parts of the

the firſt arc, with again ſome remainder: find, in like manner, how often this laſt remainder is contained in the former; and ſo on continually, till the remainder become too ſmall to be taken and applied as a meaſure. By this means he obtains a ſeries of quotients, or fractional parts, one of another, which being properly reduced into one fraction, give the ratio of the firſt arc to the ſemicircle, or of the propoſed angle to two right angles, or 180 degrees, and conſequently that angle itſelf in degrees and minutes.

We have given this account of goniometry from Dr Hutton, and frankly acknowledge that we had never thought of it till we peruſed his excellent Dictionary of Mathematics and Philoſophy. To have omitted the method when pointed out to us would have been wrong; though we miſtake much if mathematicians in general will not look upon it as a method of very little value.

GOOCHLAND, a county in Virginia, ſurrounded by Louiſa, Fluvanna, Henrico, Hanover, and Powhatan counties. It is about 40 miles long and 14 broad, and contains 9,053 inhabitants, including 4,656 ſlaves.—*ib.*

GOOD-HOPE, or CAPE OF GOOD HOPE, was taken by the Britiſh, on 17th Auguſt 1796 with very little difficulty. At this we need not be much ſurpriſed, if to the diſcontent which muſt have prevailed among the planters and townſmen with the new order of things, be added the manners of the people. M. Vaillant, who was at the Cape during the laſt war, when the garriſon expected to be every day attacked by a Britiſh ſquadron, and when the people were not abſolutely diſguſted with their own government, repreſents them, however, as rendered ſo completely frivolous by imitating the manners of their French allies, that though the place was ſtrongly fortified, it could hardly be expected to hold out long againſt a vigorous and well conducted ſiege.

"The females of the Cape (ſays he) when I ſaw them for the firſt time, had really excited my aſtoniſhment by their dreſs and their elegance; but I admired in them, above all, that modeſty and reſerve peculiar to the Dutch manners, which nothing as yet had corrupted.

"In the courſe of ſix months, a great change had taken place. It was no longer the French modes that they copied; it was a caricature of the French. Plumes, feathers, ribbons, and tawdry ornaments, heaped together without taſte on every head, gave to the pretties figures a grotesque air, which often provoked a ſmile when they appeared. This mania had extended to the neighbouring plantations, where the women could ſcarcely be known. A mode of dreſs entirely new was every where introduced; but ſo fantaſtical, that it would have been difficult to determine from what country it had been imported."

At that time a French and a Swiſs regiment were in the garriſon; and though the town was occupied only with warlike preparations, and though an attack from the Britiſh fleet was every moment expected, the French officers had already introduced a taſte for pleaſure. Employed in the morning at their exerciſe, the French ſoldiers in the evening acted plays. A part of the barracks was transformed into a theatre; and as women capable of performing female characters could not be found in the town, they aſſigned theſe parts to ſome of their comrades, whoſe youth, delicate features, and freſhneſs of complexion, ſeemed beſt calculated to favour the deception. Theſe heroines, of a new kind, heightened the curioſity of the ſpectators, and rendered the entertainment ſtill more lively and intereſting.

To add to the general pleaſure, ladies of the firſt rank conſidered it as incumbent on them to lend to the military actors and actreſſes, their laces, jewels, rich dreſſes, and moſt valuable ornaments. But ſome of them had cauſe to repent of their condeſcenſion; for it happened more than once that the Counteſs of Almaviva having left in pledge at the ſuttling houſe her borrowed decorations, the owner, to recover them, was obliged to diſcharge not only the bill due for brandy and tobacco, but all the other debts of the heroine.

During the intoxication and giddineſs occaſioned by theſe amuſements, Love alſo did not fail to act his part; and certain little intrigues were, from time to time, brought to light, which gave employment to the tongue of ſcandal, and introduced unhappineſs into families. Hymen, it is true, amidſt theſe adventures, ſometimes intervened to repair the follies of his brother, and many marriages, which reſtored every thing to order, were the reſult of his negotiations; but the complaints, though ſtifled, did not leſs exiſt. The watchfulneſs of the mother was alert. The huſband, by ſo much the more ſecretly irritated as he ſaw himſelf obliged to conceal his jealouſy, curſed in his heart both actors and theatre; while the matronly part of the community, leſs on the reſerve, declaimed with bitterneſs againſt the licentiouſneſs that prevailed, which they wholly imputed to this mode of theatrical entertainment. At laſt, to the great mortification of the young, but to the high ſatisfaction of the old women and huſbands, the theatre was on a ſudden ſhut up. The cauſe that effected this was altogether foreign to the complaints that were made, and of a nature that it was impoſſible to foreſee. Two of the French actors, who, it muſt be remembered, were officers in the army, thought proper to imitate the paper money of the company, and to put their forged notes in circulation. The forgery was detected, and traced to its authors; the two theatrical heroes were baniſhed from the Cape; and the Company, aſhamed of the adventure, dared neither ſeek others to ſupply the vacant places, nor reſume their ſtage entertainments.

Intoxicating as were theſe pleaſures, government meanwhile had not been inattentive to the danger which threatened the colony. As they daily expected to be attacked by the Britiſh fleet, they had increaſed the means of defence, and ordered different works and new fortifications to be conſtructed.

At firſt, the buſineſs was carried on with activity and ardour; becauſe the inhabitants, inſtigated by their private intereſt, which was then connected and involved with that of the public, had voluntarily offered their ſervices, and mingled with the workmen. Young and old, ſoldiers and magiſtrates, ſailors and planters, all ſolicited the honour of cooperating for the general good and common ſafety. To behold this heterogeneous multitude—ſome loaded with pickaxes, and ſome with ſpades, or other ſimilar implements—marching out in the morning from the town, and proceeding in high ſpirits to the new fortifications, was a ſight truly admirable.

But

But this patriotic fervour was of no long continuance. Under pretence of ſparing their ſtrength, and that they might not weary themſelves to no purpoſe, they ſoon cauſed their ſlaves to follow them with the tools and inſtruments. In a little time they contented themſelves with ſending their ſlaves only; and at laſt theſe ſubſtitutes themſelves, in imitation of their maſters, or perhaps by their ſecret orders, gave over going alſo. Their enthuſiaſm, in ſhort, from the firſt moment of its breaking out till the period when it was thus entirely cooled, had been the affair of ſomething leſs than a fortnight.

This taſte for frivolity which, almoſt twenty years ago, was introduced among the Dutch in Cape-town by their good friends the French, ſpread rapidly thro' the planters, who are thus deſcribed by M. Vaillant, who certainly had the beſt opportunities of knowing them.

The planters of the Cape may be divided into three claſſes; thoſe who reſide in the vicinity of the Cape, within a diſtance of five or ſix leagues; thoſe who live farther off in the interior parts of the colony; and laſtly, thoſe who, more diſtant ſtill, are found at the extremity of the frontiers among the Hottentots.

The firſt, who are opulent proprietors, and have handſome country houſes, may be likened to what was formerly called in France *petits ſeigneurs terriers*, and differ extremely from the other planters in eaſe and luxury, and particularly in their manners, which are haughty and diſdainful. Such is the reſult of wealth. The ſecond, ſimple, kind, hoſpitable, are cultivators, who live upon the fruits of their labour. Here we have an example of the good effects of mediocrity. The laſt, poor enough, yet too indolent to derive ſubſiſtence from the ſoil, have no other reſource than the produce of ſome cattle, which they feed as they can. Like the Beduin Arabs, they think much of the trouble of driving them from canton to canton, and from one paſturage to another. This wandering life prevents them from building any ſettled habitations. When their flocks oblige them to ſojourn for a while in the ſame place, they conſtruct, in haſte, a rude kind of hut, which they cover with matts, after the manner of the Hottentots, whoſe cuſtoms they have adopted, and from whom they in no reſpect differ, but in their complexion and features. And here the evil is, that there is no preciſe ſituation in ſocial life to which theſe miſerable beings belong.

Theſe ſluggiſh tribes are held in horror by their induſtrious neighbours, who dread their approach, and remove as far from them as they can; becauſe, having no property of their own, they ſteal without ſcruple that of others, and, when in want of paſturage for their cattle, conduct them ſecretly to the firſt cultivated piece of ground that comes in their way. They flatter themſelves they ſhall not be diſcovered, and they remain till every thing is devoured. If detected in their thefts, ſquabbles and contentions enſue, and afterwards a ſuit at law, in which recourſe is had to the magiſtrate, and which commonly terminates in making three men enemies, the robber, the perſon robbed, and the judge.

Nothing can be ſo mean and cringing as the conduct of the firſt deſcription of planters, when they have any thing to tranſact with the principal officers of the company, who may have ſome influence over their lot; and nothing ſo abſurdly vain and ſo ſuperlatively inſolent as their behaviour to perſons from whom they have nothing to hope and nothing to fear. Proud of their wealth, ſpoiled by reſiding near a town, from whence they have imbibed only a luxury that has corrupted, and vices that have degraded them, it is particularly towards ſtrangers that they exerciſe their ſurly and pitiful arrogance. Though neighbours to the planters who inhabit the interior of the country, you muſt not ſuppoſe they regard them as brethren; on the contrary, in the true ſpirit of contempt, they have given them the name of Rauw-boer, a word anſwering to the loweſt deſcription of clown. Accordingly, when theſe honeſt cultivators come to the town upon any kind of buſineſs, they never ſtop by the way at the houſes of the gentry of whom we are ſpeaking; they know too well the inſulting manner in which they would be received. One might ſuppoſe them to be two inimical nations, always at war, and of whom ſome individuals only met at diſtant intervals, upon buſineſs that related to their mutual intereſts.

What is the more diſguſting in the inſolence of theſe Africans is, that the majority of them are deſcended from that corrupt race of men, taken from priſons and hoſpitals, whom the Dutch company, deſirous of forming a ſettlement at the Cape, ſent thither to begin, at their riſk and peril, the population of the country. This ſhameful emigration, of which the period is not ſo remote but that many circumſtances of it are remembered, ought to render particularly modeſt thoſe who are in the moſt diſtant manner related to it. On the contrary, it is this very idea that moſt contributes to their arrogance; as if they flattered themſelves that, under the guiſe of ſupercilious manners, they could hide the abjectneſs of their origin. If a ſtranger arrives at the Cape with the deſign of remaining and ſettling there, they conceive him to be driven from his country by the ſame wretched circumſtances which formerly baniſhed their fathers, and they treat him with the moſt ſovereign contempt.

This melancholy failing is the more to be lamented, as the contagion has ſpread through almoſt every reſidence about the Cape, which is in reality a very charming canton. Embelliſhed by cultivation, by its numerous vineyards and pleaſant country houſes, it everywhere exhibits ſo varied and delicious a proſpect, that, were it occupied by other inhabitants, it would excite no ſenſations but thoſe of pleaſure.

As we advance into the country, the planters are a ſort of farmers; and conſtitute, by their manners, cuſtoms, and occupations, a claſs by themſelves, perfectly diſtinct from that we have been deſcribing. Situated farther from the Cape, and, of conſequence, not having the ſame opportunities for diſpoſing of their commodities, they are leſs rich than the firſt. We ſee among them none of thoſe agreeable country houſes, which, placed at different diſtances from the town, embelliſh the country as we paſs, and afford ſuch charming proſpects. Their habitation, which is about the ſize of a large coach-houſe, is covered with thatch, and divided into three rooms by means of two partitions, which reach only to a certain height. The middle apartment, in which is the entrance to the houſe, ſerves at once both as a parlour and eating room. It is there

Good-Hope.

that the family reſide during the day, and that they receive their tea and other viſitors. Of the two other rooms, one forms a chamber for the male children, and the other for the females, with the father and mother. At the back of the middle apartment is a farther room ſerving for a kitchen. The reſt of the building conſiſts of barns and ſtables.

Such is the diſtribution which is generally followed in the interior plantations of the colony; but nearer to the frontiers, where there does not prevail the ſame eaſe of circumſtances, the habitations are much leſs commodious. They are merely a barn, conſiſting of a ſingle room, without any diviſion, in which the whole family live together, without ſeparating, either day or night. They ſleep upon ſheep ſkins, which ſerve them alſo for covering.

The dreſs of theſe planters is ſimple and ruſtic. That of the men conſiſts of a check ſhirt, a waiſtcoat with ſleeves, a large pair of trowſers, and a hat half unlooped. The women have a petticoat, a jacket fitted to their ſhape, and a little round bonnet of muſlin. Unleſs upon extraordinary occaſions, neither ſex wear ſtockings. During a part of the year, the women even walk with their feet quite naked. The occupations of the men require that theirs ſhould have ſome covering; and this covering they make from a piece of the hide of an ox, applied and ſhaped to the foot ſoon after the animal is killed, and while the hide is yet freſh. Theſe ſandals are the only article of their dreſs which they make themſelves; the reſt is the buſineſs of the women, who cut out and prepare their whole wardrobe. Though the equipment we have mentioned conſtitute the every day dreſs of the planter, he has, however, a coat of handſome blue cloth, which he wears upon days of gala and ceremony. He has then alſo ſtockings and ſhoes, and is dreſſed exactly like an European. But this finery never makes its appearance but when he goes to the Cape; and then, indeed, is not put on till he arrives at the entrance of the town.

It is commonly in theſe journeys that they purchaſe ſuch things as they may want to refit their wardrobe. There is, at the Cape, as well as in Paris and London, a ſpecies of old-clothes-men, who deal in commodities of this ſort; and who, from their enormous profits, and the extortion they practiſe, they have obtained the name of *Capſe Smouſe*, or Cape Jews. Theſe traffickers contrive, at all times, to ſell their goods at a dear rate; but they vary their price in proportion as their ſtock is great or ſmall; of courſe they bear no fixed price; and the planter who comes from the deſert, and who can underſtand but little of this fluctuation, is ſure to be duped.

On the other hand, the regular ſhopkeeper, who knows the probity of theſe farmers, and how punctual they are in the payment of their debts, exerts every effort to prevail on them to open an account with him. He tempts them by the pretended cheap price and excellent quality of his ſtuffs, and offers to remit the payment till their next journey in the following year. It is ſeldom that theſe people, ſimple and unexperienced as they are, perceive the craft that is preſented to them under this guiſe of kindneſs and civility. If they ſuffer themſelves to be prevailed upon, they are ſhackled for life. Upon their return, there are new purchaſes to be made upon the ſame conditions; and thus, year after year, always in debt, always buying without prompt payment, they become the prey of an extortioner, who raiſes to himſelf a fortune out of their weakneſs.

It is true, theſe buyers, after being thus duped at the Cape, commonly return home only to make dupes of others. The cunning that has been employed to deceive them, they employ in their turn to tempt the Hottentots who are in their ſervice. The remnants of ſtuff, or the frippery garments which they bring back, are ſold to theſe unfortunate ſervants with ſo great a profit, that commonly the wages of a year are inadequate to the payment, and they find themſelves, like their maſters, in debt for the year that is to come. In the end, therefore, it is the poor Hottentot that pays for the extortion at the Cape.

Cuſtom has rendered the planters inſenſible to the want of fruit and pulſe, though the ſoil is admirably adapted to the cultivation of both. The facility with which they rear their cattle makes up for this privation, as their flocks afford them plenty of proviſion. The chief food is mutton; and their tables are loaded with ſuch profuſion as to diſguſt one at the ſight.

From this mode of living, cattle are in the colonies, as in other places, not only a uſeful object, but an article of the firſt neceſſity. The planter undertakes himſelf the care of watching over his flocks. Every evening, when they return from the field, he ſtands at his door, with a ſtick in his hand, and counts them over one by one, in order to be ſure that none of them are miſſing.

People who have no other employment than a little agriculture, and the ſuperintendance of a flock, muſt have long intervals of idleneſs. It is thus with the planters, particularly thoſe who live in the interior parts of the country, and who being unable, on account of their diſtance from the Cape, to diſpoſe of their corn, never raiſe more than is ſufficient for their own conſumption. From the profound inaction in which they live, one would ſuppoſe their ſupreme felicity to conſiſt in doing nothing. They ſometimes, however, viſit each other; and upon theſe occaſions the day is ſpent in ſmoking, and drinking tea, and in telling, or liſtening to tales of romance, that are equal neither in merit nor morality to the ſtory of Blue-beard.

As every man always carries with him, wherever he goes, both a pipe, and a tobacco pouch made of the ſkin of the ſea-calf, he is ſure in theſe viſits to have one ſource of amuſement. When any one of the company is deſirous of lighting his pipe, he takes out his pouch, and, having filled, paſſes it to the reſt. This is a civility that is never omitted. However numerous may be the party, every body ſmokes: the conſequence of which is a cloud, that, riſing at firſt to the upper part of the room, increaſes, by degrees, till it fills the whole houſe, and becomes at laſt ſo thick, that it is impoſſible for the ſmokers to ſee one another.

When a ſtranger travelling through the country is received by the maſter of a houſe, he inſtantly becomes a member of the family. Accuſtomed to a domeſtic life, the planters delight in the ties of affinity, and conſider in the light of a relative every perſon whom they love. Upon entering a houſe, the form of ſalutation is, to ſhake hands firſt with the maſter, and then with

with every male person in the company arrived at years of maturity. If there happens to be any one whom we do not like, the hand is refused to him; and this refusal, of so common a testimony of friendship, is looked upon as a formal declaration that the visitor considers him as his enemy. It is not the same with the females in the company. They are all embraced one after another, and to make an exception would be a signal affront. Old or young, all must be kissed. It is a benefice with the duties attached to it.

At whatever time of the day you enter the house of a planter, you are sure to find the kettle and tea-things upon the table. This practice is universal. The inhabitants never drink pure water. If a stranger presents himself, it is tea they offer him for refreshment. This is their common liquor in the interval of meals, and in one season of the year, when it often happens that they have neither beer nor wine, is their only beverage.

If a stranger arrives at dinner-time before the cloth is taken away, he shakes hands, embraces, and immediately seats himself at the table. If he wishes to pass the night, he stays without ceremony, smokes, drinks tea, asks the news, gives them all he knows in his turn; and the next day, the kissing and shaking hands being repeated, he goes on his way, to perform elsewhere the same ceremony. To offer money on these occasions would be regarded as an insult.

These particulars of a people, whose condition it is to be hoped that the generosity of the British character, and the mildness of the British government, will gradually meliorate, cannot but be acceptable to many of our readers. We shall, therefore, make no apology for the length of this article.

GOOSE *Creek*, a river which falls into Potowmac river, about a mile south-east of Thorpe, in Fairfax county, Virginia.—*Morse*.

GOOSEBERRY *Mountain*, in New-York State, lies on the west bank of Hudson's river, about 4 miles south of Fort George.—*ib*.

GOOSEBERRY *Islands* and *Rocks*, on the coast of Essex county, Massachusetts, have been the occasion of the loss of many valuable vessels. To prevent such accidents in future, seamen may attend to the following particular information, which is here inserted for their benefit. The north part of Gooseberry great rock with the north of Cat Island, bears S. 54. W. from the beacon on Baker's Island. The western Gooseberry S. 41. W. the distance nearly three fourths of a mile. The northern part of the western Gooseberry is viewed from the beacon over the point of land running out from it. The eastern Gooseberry bears S. 26. W. and it is shoal as far as the western breaker. The eastern breaker lies S. 35. E. and the western breaker S. 29. E. The eastern breaker is about the same distance from the beacon, as the western Gooseberry, but the eastern Gooseberry falls within that distance. Satan appears S. 32. W. and halfway rock S. 3. W. at the distance of $2\frac{1}{2}$ miles. The inner part of Cat Island is above 2 miles from the beacon, and with the beacon to the southward the Gooseberry rock bears only 12 minutes. The western dry breaker extends from 28 to 32; and the eastern from 31 to 32. Half-way rock with the beacon from Cat Island is 65 to the southward.—*ib*.

GORHAM, a township in Cumberland county, Maine, on the north-east side of Saco river, 15 miles from Pepperelborough at the mouth of the river, and 130 miles N. by E. of Boston. It was incorporated in 1764, and contains 2 244 inhabitants.—*ib*.

GOSHEN, a township in Hampshire county, Massachusetts, between Cummington and Conway, 14 miles north of Northampton, and 112 W. by N. of Boston. It was incorporated in 1781, and contains 681 inhabitants.—*ib*.

GOSHEN, a township in Addison county, Vermont, adjoining to Salisbury on the west, and 21 miles N. E. by N. of Mount Independence.—*ib*.

GOSHEN, a township in Chester county, Pennsylvania.—*ib*.

GOSHEN, a town in Litchfield county, Connecticut, famous for the production of excellent cheese. It is 7 miles N. by N. W. of Litchfield, and 50 northward of New-Haven.—*ib*.

GOSHEN, the most considerable town in Orange county, New-York, about 58 miles north of New-York city, 20 W. by S. of New-Windsor, and 30 W. by S. of Fish-Kill. This town is pleasantly situated, containing about 60 or 70 houses, an academy, court-house, gaol, and Presbyterian church. The township contains 2,448 inhabitants; of whom 316 are electors. —*ib*.

GOSHGOSHINK, a Moravian settlement in Pennsylvania, situated on Alleghany river, about 15 miles above Venango, or Fort Franklin.—*ib*.

GOSPORT, formerly called *Appledore*, a fishing town on Star Island, one of the isles of Shoals, belonging to Rockingham county, New-Hampshire, containing 93 inhabitants. It lies about 12 miles E. S. E. of Piscataqua harbour.—*ib*.

GOTHIC ARCHITECTURE, See *Gothic* ARCHITECTURE in this *Supplement*, and ROOF, *Encyclopædia*.

GOUVERNANTE, the Spanish name of a plant which the Indians of California use in decoction as a sudorific drink for the cure of the venereal disease. It is thus described in the third volume (English translation) of Peyrouse's Voyage round the world.

Calyx quadrifid, egg shaped, of the same size with the corolla; placed beneath the fruit, deciduous. Corolla polypetalous; petals four, small, entire, egg shaped, fixed upon the receptacle. Stamina, eight, fixed to the receptacle, of the same length as the corolla: threads channelled, concave on the one side, and convex on the other; wings veiled, antheræ simple. Pistil, germ oblong, covered, with five angles, and five cells; seeds oblong; pericarpium covered with fine hairs.

This plant is a shrub of middle size; the branches are angular and knotty, and covered with an adhesive varnish; the lateral branches are alternate, and placed very near to each other: the leaves are small, petiolated, bilobed, opposite, smooth on the upper side, the under side indistinctly veined; the blossoms are axillary, sometimes terminating, pedunculated, solitary, but sometimes in pairs.

From this description, the gouvernante appears to be a new species of *daphne*.

GRACIAS A DIOS, a town belonging to the province of Honduras, or Comaiagua, and audience of Guatimala. It is situated at the mouth of a river upon a rocky mountain, which has some gold mines in its neighbourhood. It was built the same year as was Vallidolid, the capital, (from which it lies about 27 leagues to the west) for the security of the miners. Also a cape on this coast discovered by Columbus, N. lat. 14° 36′ W. long. 84° 12′.—*Morse.*

GRAFTON *County*, in New-Hampshire, is bounded north by Canada; south by the counties of Strafford, Hillsborough, and Cheshire; west by the State of Vermont, and east by the District of Maine. It comprehends nearly as much territory as all the other four counties, but is by no means so thickly settled. It it divided into 50 townships, and 17 locations, and contains 13,472 inhabitants, of whom 21 are slaves. The increase of population since the enumeration of 1790 has been great.—*ib.*

GRAFTON, a township in the county of its name in New-Hampshire, 13 miles S. E. of Dartmouth college and 19 S. W. of Plymouth. It was incorporated in 1778, and contains 403 inhabitants. *Lapis specularis*, commonly called ising-glass, of the best quality, is found in this town, in a mountain about 20 miles eastward of Dartmouth college. It is found adhering to the rocks of white or yellow quartz, and lying in laminæ, like sheets of paper. It is found in other places in the State in smaller pieces.—*ib.*

GRAFTON, the *Hassanamisco* of the Indians, a township in Worcester county, Massachusetts, containing 900 inhabitants; 40 miles S. W. of Boston, 8 easterly of Worcester, and 34 N. W. of Providence.—*ib.*

GRAINGER, FORT, stands on the N. side of the mouth of Holston river in Tennessee.—*ib.*

GRAINGER, the name given to a new county, in the district of Hamilton, State of Tennessee, formed of parts of the counties of Knox, Jefferson and Hawkins, and called after the maiden name of the Lady of Gov. William Blount.—*ib.*

GRANBY, a township in Essex county, Vermont. —*ib.*

GRANBY, a township in Hampshire county, Massachusetts, E. of South-Hadley, about 90 miles westerly of Boston; was incorporated in 1768, and contains 596 inhabitants.—*ib.*

GRANBY, a township in Hartford county, Connecticut, on the line which separates Connecticut from Massachusetts. It was formerly a part of Symsbury, and is 18 miles north of Hartford.—*ib.*

GRANBY, a small town on the Congaree, in S. Carolina, about 2 miles below the junction of Broad and Saluda rivers. Here a curious bridge has been built, whose arches are supported by wooden pillars, strongly secured in iron work, fixed in the solid rock. Its height is 40 feet above the level of the water. The centre arch is upwards of 100 feet in the clear, to give a passage to large trees which are always brought down by the floods. The ingenious architect has the toll secured to him by the Legislature for 100 years. —*ib.*

GRANDE RIVIERE, a settlement in a hilly tract of the island of St Domingo, 6½ leagues south-west of Fort Dauphin, and 4¾ leagues N. by E. of St Raphael, in the Spanish part of the island, N. lat. 19° 34′, W. long. from Paris 74° 30′.—Also the name of a small river, in the same island, which rises at Limonade, and empties into the sea at Qr Morin, 5 leagues east of Cape François.—*ib.*

GRAND *Fathers*, several large detached mountains in the south-east corner of Tennessee, in which are the head waters of French, Broad and Catabi rivers.—*ib.*

GRAND *Isles*, are two large islands in Lake Champlain; each about 8 or 10 miles long, and each forms a township belonging to Vermont.—*ib.*

GRAND *Island*, at the mouth of Lake Ontario, is within the British territories, having Roebuck and Forest islands on the south-west, and the Thousand Isles on the north-east. It is 20 miles in length, and its greatest breadth is 4 miles.—*ib.*

GRAND *Island*, in Lake Superior, lies on the north side of the lake.—*ib.*

GRAND *Island*, in Niagara river, is about 6 miles long and 3 broad. The south end is 4 miles north of Fort Erie; and its northern extremity 3 miles south of Fort Slusher, and nearly 14 south of Niagara fort.—*ib.*

GRAND *Lake*, in the province of New Brunswick, near the river St John's, is said to be 30 miles in length, 8 or 10 in breadth, and in some places 40 fathoms deep.—*ib.*

GRAND MANAN *Island*, lies 6 miles S. by S. E. of Campo-Bello Island, in the Atlantic Ocean, opposite to Passamaquoddy Bay, on the eastern border of the United States.—*ib.*

GRAND *River* runs a north-west course into Lake Erie, 20 miles below the Forks, 80 miles south-west of Presque Isle.—*ib.*

GRANGE, *Cape La*, or *Cape Monte Christ*, on the north side of the island of St Domingo. It is a high hill, in the form of a tent, and may be seen by the naked eye at Cape François, from which it is 14 leagues E. by N. A strip of land joins it to the territory of Monte Christ; so that at a distance it seems to be an island. The cruisers from Jamaica often lie off here. This cape lies in lat. 19° 54′ 30″ N. and long. 74° 9′ 30″ W. from Paris; and with Point de Dunes forms the mouth of the bay of Monte Christ. —*ib.*

GRANVILLE, a fine township in Annapolis county, Nova-Scotia. It lies on the north side of Annapolis river, on the Bay of Fundy, and is 30 miles in length; first settled from New-England.—*ib.*

GRANVILLE, a township in Hampshire county, Massachusetts, about 14 miles west of Springfield. It was incorporated in 1754, and contains 1979 inhabitants. —*ib.*

GRANVILLE, a township in Washington county, New-York, containing 2240 inhabitants, of whom 422 are electors.—*ib.*

GRANVILLE *County*, in Hillsborough district in North-Carolina, has the State of Virginia north, and contains 10,982 inhabitants, of whom 4163 are slaves. Chief town, Williamsburg.—*ib.*

GRANVILLE, a flourishing town in Kentucky.—*ib.*

GRAVE CREEK, on the Ohio, 12 miles down the river from Wheeling. Here is a mound of earth, plainly the work of art, called an Indian grave. It is of a conical form, in height about 80 feet. It ascends in an angle of about 80°. The diameter at the top is about 60 feet; the margin enclosing a regular concave, sunk about 4 feet in the centre. Near the top stands an oak, about 3 feet in diameter. It is said the Indians have no tradition what nation ever buried their dead in this manner. On examination, these mounds have

have been found to contain a chalky substance, supposed to be bones of the human kind.—*ib.*

GRAVESEND, Port of, is situated on the south-western side of the island of Jamaica, in a large bay. It has two channels; the Leeward and the Main Channel, and affords good anchorage for large vessels.—*ib.*

Gravesend, a small village in King's county, Long-Island, New-York, 7 miles N by E. of the city. The township of its name contains 426 inhabitants.—*ib.*

GRAVIMETER, the name given by citizen Guyton (Morveau) to an instrument of glass, constructed in all respects on the principle of Nicholson's Hydrometer, described in the article Hydrostatics, n° 18 (*Encycl.*) It is therefore needless to give a description of this instrument here; as every artist in glass, who has seen Nicholson's Hydrometer, or understands our description of it, may construct the gravimeter of Morveau; and every man who has made himself master of our article Specific *Gravity*, may apply the gravimeter to every purpose to which it is applicable. It may just be proper to observe, that Morveau, having at first loaded the small scale or bason G (Plate 240, fig. 9. *Encycl.*) with a bulb of glass containing a sufficient quantity of mercury, found it expedient afterwards to substitute in the place of this bulb a small mass of solid glass, brought to the proper form and weight by grinding. For a minute account of this instrument, if any of our readers can be supposed to require a minute account of it, we must refer to the third number of Nicholson's *Journal of Philosophy, Chemistry*, and the *Arts*.

GRAY, a post-town in the District of Maine, in Cumberland county, 15 miles N. by W. of Portland. The township was incorporated in 1778, and contains 577 inhabitants.—*Morse.*

GREAT BARRINGTON, a township in the south-western part of the State of Massachusetts, in Berkshire county, lying south of Stockbridge, 150 miles west of Boston, and 26 E. by S. of Hudson city, New-York.—*ib.*

Great Famine, a river in New-York which rises in the mountains near the source of Oneida river, and flows N. W. by W. to Lake Ontario. Its mouth is 10 miles south-westerly from the mouth of Black river.—*ib.*

Great Kanhaway, a large river which flows through the eastern bank of the Ohio in 39° 5′ N. lat. nearly 500 yards wide at its mouth. The current is gentle for about 10 or 12 miles, when it becomes considerably rapid for upwards of 60 miles farther, where you meet with the first falls, when it becomes impossible to navigate it from the great number of its cataracts.—*ib.*

Great Swamp, between Northampton and Lucern counties, in Pennsylvania. This swamp, on examination and survey, is found to be good farm land; thickly covered with beach and sugar maple.—*ib.*

Great Ridge, one of the ridges of the Alleghany Mountains, which separates the waters of the Savannah and Alatamaha.

At the south-east promontory of the Great Ridge is that extraordinary place called Buffaloe Lick, distant about 80 miles from Augusta. It occupies several acres of ground. A large cane swamp and meadows, forming an immense plain, lie south-east from it; in this swamp Mr Bartram thinks the branches of the Great Ogeeche take their rise. The Lick is nearly level, and lies between the head of the cane swamp, and the ascent of the Ridge. The earth, from the superficies to an unknown depth, is an almost white or cinerous coloured, tenacious, fattish clay, which all kinds of cattle lick into great caves, pursuing the delicious vein. Mr Bartram could not discover any thing saline in its taste, but an insipid sweetness. Horned cattle, horses, and deer, are immoderately fond of it; insomuch that their excrement, which almost totally covers the earth to some distance round this place, appears to be perfect clay; which when dried by the sun and air, is almost as hard as brick.—*ib.*

Great Springs, is an amazing fountain of transparent, cool water, situated near the road, about mid-way between Augusta and Savannah. It breaks suddenly out of the earth at the basis of a moderately elevated hill or bank, forming at once a bason near 20 yards over, ascending through a horizontal bed of soft rocks, chiefly a testaceous concretion of broken, entire, and pulverized sea-shells, sand, &c. constituting a coarse kind of lime-stone. The ebullition is copious, active, and continual, over the ragged apertures in the rocks, which lie seven or eight feet below, swelling the surface considerably, immediately above it; the waters descend swiftly from the fountain, forming at once a large brook, six or eight yards over, and five or six feet deep. There are multitudes of fish in the fountain of various tribes; chiefly the several species of bream, trout, catfish, and garr, which are beheld continually ascending and descending through the rocky apertures. Bartram, from whose travels the above is taken, observes, that he crossed no stream or brook of water within 12 or 15 miles of this fountain, but had in view vast savannahs, swamps, and cane meadows, which he conjectures are the reservoirs which feed this delightful grotto.—*ib.*

GREEN, though one of the seven original or prismatic colours, is among dyers a compound of blue and yellow. Of the European methods of dyeing green, and of the principles on which these methods are founded, a sufficient account will be found in the *Encyclopædia*, under the articles Colour-*making* and Dyeing, and, in this *Supplement*, under *Animal and Vegetable* Substances; but it may be worth while, in this place, to insert the method practised at Astracan, in giving to cotton yarn that beautiful green colour for which the oriental cotton is so justly admired.

The principal dye is the blue, which is employed both for cotton and silk. To prepare it, the indigo or blue dye-stuff is finely pounded, and dissolved in water by a gentle heat in large earthen jars, seven of which stand in brick-work over the fire-place, at the distance of about an ell and a half from each other. About two pounds are put into each vessel. Five pounds of soda finely pounded, together with two pounds of pure lime and one pound of clarified honey, are added to each; when these ingredients have been well mixed, the fire is strengthened; and when the whole begins to boil, the dye is stirred carefully round in all the vessels, that every thing may be completely dissolved and mixed. After the first boiling the fire

Green.

is ſlackened, and the dye is ſuffered to ſtand over a gentle heat, while it is continually ſtirred round: this is continued even after the furnace is cooled, till a thick ſcum ariſes in the neck of each jar, and ſoon after diſappears. The dye is then allowed to ſtand two days, until the whole is incorporated, and the dye thickens.

The dyers aſſert, that with this dye they can produce three ſhades of blue, and that, as the dyeing particles gradually diminiſh, they can die alſo a green colour by the addition of yellow.

When a manufacturer gives cotton yarn to a blue dyer, he firſt boils it at home in a ley of ſoda *(kalakar)*, then dries it, waſhes it, and dries it again. The blue dyer lays this yarn to ſteep in pure water, preſſes out the ſuperfluous water with the hands, and then immediately begins to dip it in the blue jar, often wringing it till it is completely penetrated by the dye. This firſt tint is generally given to yarn in ſuch jars as have had their colouring matter partly exhauſted. It is then dried, rinſed, and again dried: after which, it is put into the freſh blue dye, properly ſaturated; and, after the colour has been ſufficiently heightened, it is dried for the laſt time.

For a yellow dye, the dyers of Aſtracan employ partly ſaw-wort, brought from Ruſſia, and partly the leaves of the *kiſtar belge*, or *ſumach*. The proceſs is as follows: The yarn is firſt boiled for an hour in a ſtrong ley of ſoda; it is then dried, afterwards rinſed and laid wet to ſteep for twelve hours in a ſolution of alum with warm water. When it has been dried in the air, it is laid to ſoak ſeveral times in troughs with the dye which has been boiled thick in kettles from the abovementioned plants, till it has acquired the wiſhed-for colour, care being taken to dry it each time it is ſoaked. It is then rinſed in running water, and dried for the laſt time.

On this yellow colour a green is often dyed. After the yarn has been dyed yellow, it is given out to the blue dyer, who immediately dips it in the blue jars, the dye of which has been already partly exhauſted: and if the green colour is not then ſufficiently high, the operation is repeated, the yarn being dried each time. See *Neue Nordiſche Beytrage*, by Profeſſor Pallas; or *Philoſophical Magazine*, nº 2.

GREEN, a townſhip in Franklin county, Pennſylvania.—Alſo a townſhip in Waſhington county in the ſame State.—*Morse.*

GREEN, a poſt-town in Lincoln county, in the Diſtrict of Maine, ſituated on the eaſt ſide of Androſcoggin river, 31 miles W. by S. of Pittſton, 39 north of Portland, and 164 N. by E. of Boſton, containing 639 inhabitants.—*ib.*

GREEN, a navigable river of Kentucky, which riſes in Mercer county, has a gentle current, and is navigable nearly 150 miles. Its courſe is generally weſt; and at its confluence with the Ohio is upwards of 200 yards wide. Between the mouth of Green river and Salt river, a diſtance of nearly 200 miles, the land upon the banks of the Ohio is generally fertile and rich; but, leaving its banks, you fall into the plain country, which is conſidered as little better than barren land. On this river are a number of Salt ſprings or licks. There are three ſprings or ponds of bitumen near this river, which do not form a ſtream, but empty themſelves into a common reſervoir, and when uſed in lamps, anſwers all the purpoſes of the beſt oil. Vaſt quantities of nitre are found in the caves on its banks; and many of the ſettlers manufacture their own gunpowder.—*ib.*

Green ! Greencaſtle.

GREEN BAY, or *Puan Bay*, a ſouth weſtern branch of Lake Michigan.—*ib.*

GREEN, a ſmall river which riſes in the town of Marlborough in Vermont, and falls into Connecticut river above Deerfield, in Maſſachuſetts.—*ib.*

GREEN BRIAR, a large and fertile county of Virginia, ſurrounded by Bath, Randolph, Harriſon, Kanhaway, Botetourt, and Montgomery counties. It is about 100 miles long and 45 broad; and together with Kanhaway county, which was formerly a part of it, contains 6,015 inhabitants, including 319 ſlaves. There is a large cave on Rich Creek in this county, the earth at the bottom of which is ſtrongly impregnated with ſulphur. Many ſuch are to be found on Green Briar river. The chief town is Lewiſburg. At *Green Briar* court-houſe is a poſt-office, 30 miles W. by S. of Sweet Springs, and 103 weſt of Staunton.—*ib.*

GREEN BRIAR *River* runs a S. W. courſe, and falls into the eaſtern ſide of the Great Kanhaway, at the place where that river breaks through the Laurel Ridge, and oppoſite to the mouth of New river, in N. lat. 38.—*ib.*

GREEN MOUNTAINS, a range of mountains extending N. N. E. to S. S. W. and dividing the waters which flow eaſterly into Connecticut river, from thoſe which fall weſterly into Lake Champlain, Lake George, and Hudſon's river. The aſcent from the eaſt to the top of the Green Mountain in Vermont, is much eaſier than from the weſt, till you get to Onion river, where the mountain terminates. The height of land is generally from 20 to 30 miles from the river, and about the ſame diſtance from the New-York line. The natural growth upon this mountain, is hemlock, pine, ſpruce, and other evergreens; hence it has always a green appearance, and on this account has obtained the deſcriptive name of *Ver Mons*, Green Mountain. On ſome parts of this mountain ſnow lies till May, and ſometimes till June. The chain extends through Maſſachuſetts and Connecticut, and terminates in New-Haven. Kellington Peak, the higheſt of theſe mountains, is about 3,454 feet above the level of the ocean.—*ib.*

GREEN *Woods*, a vaſt foreſt of ſtately pines in Litchfield county, Connecticut, which cover the face of a part of that county. Theſe are cloathed in green bearded moſs, which being pendant from the boughs, ſcreens many of the trees from the eyes, and gives to the whole a gloomy, wild, and whimſical appearance. —*ib.*

GREENBURGH, a townſhip in Weſtcheſter county, New-York, containing 1400 inhabitants, of whom 122 are ſlaves, and 164 are electors.—*ib.*

GREENCASTLE, a town in Franklin county, Pennſylvania, ſituated near the Conegocheague creek. Here are about 80 houſes, 2 German churches, and a Preſbyterian church. It is 11 miles S. by W. of Chamberſburg, and 156 W. by S. of Philadelphia.—*ib.*

Greene, a county in Kentucky, extending from Ohio river on the north, to Tennessee State on the south, and bordering west on the Mississippi river, and east upon Hardin and Jefferson counties.—*ib.*

Greene, a county in Washington district in the State of Tennessee, having 7,741 inhabitants, of whom 454 are slaves. Greenville college has been established by law in this county. It is situated between two small northern branches of Nolachucky river, about 15 miles N. W. by W. of Jonesborough, and 54 east of the mouth of French Broad river.—*ib.*

Greene, a township in Tioga county, New-York, on the east side of Chenengo river.—*ib.*

Greene, a county in the upper district of Georgia, bounded west by the upper part of Oconee river, east by Wilkes county, and south by that of Washington. It contains 5,405 inhabitants, including 1,377 slaves. Chief town, Greensborough.—*ib.*

GREENEVILLE, a post-town, and the chief town of Pitt county, North-Carolina; situated on the south bank of Tar river, distant from Ocreecok Inlet 110 miles. It contains about 50 houses, a court-house and gaol; also a seminary of learning, called the Pitt Academy. It is 23 miles from Washington and 25 miles from Tarborough.—*ib.*

Greeneville, a small post-town in Greene county, in the State of Tennessee, situated on the west side of the north-easternmost branch of Nolachucky river, about six miles N. by E. of Greenville college, 26 miles north-west of Jonesborough, 75 east of Knoxville, and 653 south-west of Philadelphia.—*ib.*

GREENFIELD, a handsome flourishing town in Hampshire county, Massachusetts, about 4 miles north of Deerfield, and 114 W. by N. of Boston. The township lies on the west bank of Connecticut river, was incorporated in 1753, and contains 1,498 inhabitants. A company was incorporated in 1796 to build a bridge over Connecticut river, to connect this town with Montague.—*ib.*

Greenfield, a township in Saratoga county, New-York; 380 of the inhabitants are electors.—*ib.*

GREENLAND, a town in Rockingham county, New-Hampshire, in the vicinity of the ocean, 5 miles southerly from Portsmouth. It was incorporated in 1713, and contains 634 inhabitants.—*ib.*

GREENSBOROUGH, a post-town, and chief town of Greene county, Georgia, 30 miles from Lexington, and 78 W. by S from Augusta.—*ib.*

Greensborough, a thriving village in Caroline county, Maryland; on the west side of Choptank Creek, about seven miles north of Danton, and 22 miles S. E. by S. of Chester.—*ib.*

Greensborough, a new township in Orleans county in Vermont. It adjoins to Minden on the north-west, and Wheelock on the south-east, and contains only 19 inhabitants.—*ib.*

GREENSBURG, a post town, and the capital of Westmoreland county, Pennsylvania. It is a neat pretty town, situated on a branch of Sewickly Creek, which empties into Youghiogany river. Here are 100 dwelling houses, a German Calvinist church, a brick court house, and a stone gaol. It is 31 miles S. E. by E. of Pittsburg, and 270 W. by N. of Philadelphia. —*ib.*

GREENSVILLE, a county of Virginia, encompassed by Brunswick, Southampton, and Sussex counties, on the west, north, and east, and by the State of North-Carolina on the south. It is about 24 miles long, and 20 broad, and contains 6,362 inhabitants, of whom 3,620 are slaves.—*ib.*

GREENVILLE *Court-House*, in Virginia, stands on Kick's Ford, 25 miles from Southampton, and 61 from Norfolk.—*ib.*

Greenville, a county in Washington district, S. Carolina; situated in the N. W. corner of the State; bounded east by Spartanburg county, in Pinckney district; south, by Pendleton; west, by the State of Georgia, and that tract of country which the State of South-Carolina ceded to the United States; and north, by the State of North Carolina. It contains 6,503 inhabitants, of whom 606 are slaves. Taxes £192 : 6 : 8. The lands are mountainous and hilly, and well watered, and the climate healthy and agreeable. —*ib.*

Greenville, a post-town of South-Carolina, and chief town of Cheraws district; situated on the west side of Great Pedee river, in Darlington county. It contains about 30 houses, a court-house, gaol, and academy. It is 55 miles E. N. E. of Camden, 90 N. E. by E. of Columbia, 135 N. by E. of Charleston.—*ib.*

Greenville, a fort and settlement in the N. W. Territory, on the south side of a north-western branch of the Great Miami, six miles north-west of Fort Jefferson on the same branch, and about 23 miles south-east of Fort Recovery. It is a picketed fort, with bastions at each angle, and capacious enough to accommodate 2,000 men. Here the American legion had their head-quarters in the late war with the Indians. It was established by the late Maj. Gen. A. Wayne in 1793, and here he concluded a treaty of peace with the Indian nations, on the 3d of August, 1795.—*ib.*

Greenville Bay, or *La Bay*, a town and port of entry on the east or windward side of the island of Granada. It has about 60 dwelling-houses, a church, and several rich stores of India and European goods, and plantation utensils. The situation is low, and rather unhealthy.—*ib.*

GREENWICH, a township in Hampshire county, Massachusetts, incorporated in 1754, contains 1045 inhabitants. It is 20 miles easterly of Northampton, and 75 westerly of Boston.—*ib.*

Greenwich, a township, the second in rank in Gloucester county, New-Jersey, situated on the east bank of Delaware river, opposite to Fort Mifflin, 3 miles N. by E. of Woodbury, and 6 south-east of Philadelphia.—*ib.*

Greenwich, a township in Sussex county, New-Jersey, on the east side of Delaware river, in a mountainous country, about 5 miles north-easterly of Easton, in Pennsylvania, and 31 south-west of Newton, the shire town. It contains 2,035 inhabitants, of whom 64 are slaves.—*ib.*

Greenwich, a town in Cumberland county, New-Jersey, on the north-west bank of Cohanzy creek, about 3 miles from its mouth in Delaware bay. Here are about 80 houses, and a Friend's meeting-house. It is 15 miles south-easterly of Salem, and 66 S. by W. of Philadelphia.—*ib.*

Greenwich, a maritime township in Fairfield county,

ty,

ty, Connecticut, and the south-westernmost of the State, lies about 50 miles west of New-Haven, and 40 east of New-York city. Its sea-coast on Long Island Sound, and that of the township of Stamford on the eastward, has a number of isles and rocks bordering the inlets of the sea and mouths of the creeks. Byram river passes through this town, the largest of the small streams which water it, and only noticeable as forming part of the line between Connecticut and New-York.

This tract was purchased of the native Indians in 1640, and settled under the government of the New Netherlands (now New-York) and was incorporated by Peter Stuyvesant in 1665, who was then governor of the New Netherlands. This town falling within the bounds of Connecticut, was afterwards granted to eight persons by that colony.—*ib.*

GREENWOOD, a township in Cumberland county, Pennsylvania. Also, a township in Mifflin county in the same State.—*ib.*

GREGORIA, St, a town of New-Mexico, situated on the east side of Rio Bravo, a few leagues north of St Antonio.—*ib.*

GREGORY (David), was a son of the Rev. John Gregory, minister of Drumoak, in the county of Aberdeen, and elder brother to Mr James Gregory, the inventor of the most common reflecting telescope. He was born about the year 1627 or 1628; and though he possessed all the genius of the other branches of his family, he was educated by his father for trade, and served an apprenticeship to a mercantile house in Holland. Having a stronger passion, however, for knowledge than for money, he abandoned trade in 1655; and returning to his own country, he succeeded, upon the death of an elder brother, to the estate of Kinardie, situated about forty miles north from Aberdeen, where he lived many years, and where thirty-two children were born to him by two wives. Of these, three sons made a conspicuous figure in the republic of letters, being all professors of mathematics at the same time in three of the British universities, viz. David at Oxford, James at Edinburgh, and Charles at St Andrews.

Mr Gregory, the subject of this memoir, while he lived at Kinardie, was a jest among the neighbouring gentlemen for his ignorance of what was doing about his own farm, but an oracle in matters of learning and philosophy, and particularly in medicine, which he had studied for his amusement, and began to practise among his poor neighbours. He acquired such a reputation in that science, that he was employed by the nobility and gentlemen of that county, but took no fees. His hours of study were singular. Being much occupied through the day with those who applied to him as a physician, he went early to bed, rose about two or three in the morning, and, after applying to his studies for some hours, went to bed again and slept an hour or two before breakfast.

He was the first man in that country who had a barometer; and having paid great attention to the changes in it, and the corresponding changes in the weather, he was once in danger of being tried by the presbytery for witchcraft or conjuration. A deputation of that body waited upon him to enquire into the ground of certain reports that had come to their ears; but he satisfied them so far as to prevent the prosecution of a man known to be so extensively useful by his knowledge of medicine.

About the beginning of this century he removed with his family to Aberdeen, and in the time of Queen Anne's war employed his thoughts upon an improvement in artillery, in order to make the shot of great guns more destructive to the enemy, and executed a model of the engine he had conceived. Dr Reid informs us, that he conversed with a clock-maker in Aberdeen who had been employed in making this model; but having made many different pieces by direction without knowing their intention, or how they were to be put together, he could give no account of the whole. After making some experiments with this model, which satisfied him, the old gentleman was so sanguine in the hope of being useful to the allies in the war against France, that he set about preparing a field equipage with a view to make a campaign in Flanders, and in the mean time sent his model to his son the Savilian professor, that he might have his and Sir Isaac Newton's opinion of it. His son shewed it to Newton, without letting him know that his own father was the inventor. Sir Isaac was much displeased with it, saying, that if it had tended as much to the preservation of mankind as to their destruction, the inventor would have deserved a great reward; but as it was contrived solely for destruction, and would soon be known by the enemy, he rather deserved to be punished, and urged the professor very strongly to destroy it, and if possible to suppress the invention. It is probable the professor followed this advice. He died soon after, and the model was never found.

If this be a just account of the matter, and Dr Reid's veracity is unquestionable, we cannot help thinking that Newton's usual sagacity had, on that occasion, forsaken him. Were the implements of war much more destructive than they are, it by no means follows that more men would be killed in battle than at present. Muskets and cannons are surely more destructive weapons than javelines and bows and arrows; and yet, it is a well known fact, that since the invention of gunpowder, battles are not half so bloody as they were before that period. The opposite armies now seldom come to close quarters, a few rounds of musketry and artillery commonly decide the fate of the day; and had Mr Gregory's improvement been carried into effect, still fewer rounds would have decided it than at present, and the carnage would consequently have been less.

When the rebellion broke out in 1715, the old gentleman went a second time to Holland, and returned when it was over to Aberdeen, where he died about 1720, aged 93, leaving behind him a history of his own time and country, which was never published.

Gregory (Dr David). In addition to the account given in the *Encyclopædia* of this eminent mathematician, it may be proper to add, that he was a most intimate and confidential friend of Sir Isaac Newton, and was intrusted with a manuscript copy of the *Principia*, for the purpose of making observations on it. Of these Newton availed himself in the second edition, they having come too late for his first publication, which was exceedingly hurried by Dr Halley, from

from fears that Newton's backwardness would not let it appear at all. There is a complete copy of these observations preserved in the library of the university of Edinburgh, presented to it by Dr James Gregory, the present professor of the practice of medicine. These contain many sublime mathematical discussions, many valuable commentaries on the *Principia*, and many interesting anecdotes. There are in it some paragraphs in the hand writing of Huyghens relative to his Theory of Light. It would appear that this work of confidential friendship was the foundation of that system of physical and mathematical astronomy which has raised Dr Gregory to great eminence in the republic of letters.

GREGSTOWN, a village in Somerset county, New-Jersey, on the east side of Millstone river, 6 miles north-easterly of Princeton, and about 9 south-west of New-Brunswick.—*Morse.*

GRES, Cape au, a promontory on the eastern side of the Mississippi in the N. W. Territory, 8 leagues above the Illinois river, and the tract of country so called extends 5 leagues on that river. There is a a gradual descent back to delightful meadows, and to beautiful and fertile uplands, watered by several rivulets, which fall into the Illinois river, between 30 and 40 miles from its entrance into the Mississippi, and into the latter at Cape au Gres. The distance from the Mississippi to the Illinois across the country, is lessened or increased, according to the windings of the former river; the smallest distance is at Cape au Gres, and there it is between 4 and 5 miles. The lands in this intermediate space between the above two rivers are rich, almost beyond parallel, covered with large oaks, walnut, &c. and not a stone to be seen, except upon the sides of the river.

If settlements were begun here, the French inhabitants acknowledge that the Spanish settlements on the other side of the Mississippi would be abandoned; as the former would excite a constant succession of settlers, and intercept all the trade of the upper Mississippi.—*ib.*

GRINDING in Cutlery, a well known operation, by which edge-tools are sharpened. As commonly practised, the grinding of tools is attended with great inconveniency arising from the production or developement of heat by friction. The fact of sparks flying from a dry grindstone when a piece of iron or steel is applied to its surface during the rotation, has been seen by every one. The heat produced during this process is such that the steel very soon becomes ignited, and hard tools are very frequently softened and spoiled, for want of care during the grinding. When a cylindrical stone is partly immersed in a trough of water, the rotation must be moderate and the work slow, otherwise the water would soon be thrown off by the centrifugal force; and when this fluid is applied by a cock from above, the quantity is too small to preserve the requisite low temperature. It is even found, that the point of a hard tool, ground under a considerable mass of water, will be softened, if it be not held so as to meet the stream; sparks being frequently afforded even under the water

To find a remedy for this, Mr Nicholson was led, by some accounts which he received of German cutlery, to make the following experiment. He procured a Newcastle grindstone of a fine grit and ten inches in diameter, and also a block of mahogany to be used with emery on its face. Both the stone and the wooden block were mounted on an axis, to be occasionally applied between the centres of a strong lathe. In this situation both were turned truly cylindrical, and of the same diameter. The face of the wood was grooved obliquely in opposite directions, to afford a lodgement for the emery. The face of the stone was left smooth, and there was a trough of proper size applied beneath the stone to hold water. The grindstone was then used with water, and the wooden cylinder was faced with emery and oil. The instrument ground was a file, out of which it was proposed to grind all the teeth. The rotation was produced by the mechanism of the lathe; the velocity being such as to turn the grinding apparatus about five revolutions in a second. The stone operated but slowly, and the water from the trough was soon exhausted, with inconvenience to the workman, who could scarcely be defended from it but by slackening the velocity. The emery cylinder cut rather faster. But notwithstanding the friction was made to operate successively and by quick changes on the whole surface of the file, it soon became too much heated to be held with any convenience; and when a cloth was used to defend the hand, the work not only became awkward, but the heat increased to such a degree that the oil began to be decomposed, and emitted an empyreumatic smell. The stone was then suffered to dry, and the file tried upon its face. It almost immediately became blue, and soon afterwards red hot. Both the cylinders were then covered with tallow, by applying the end of a candle to each while revolving, and emery was sprinkled upon the cylinder of wood. The same tool was then applied to the grindstone in rapid motion. At the first instant the friction was scarcely perceptible; but very speedily afterwards the zone of tallow pressed by the tool became fused, and the stone cut very fast. The tool was scarcely at all heated for a long time; and when it began to feel warm, its temperature was immediately lowered by removing it to a new zone of the cylinder. The same effect took place when the experiment was repeated with the wooden cylinder.

It is not difficult to explain this by the modern doctrine of heat. When oil was used upon the wooden cylinder, the heat developed by the friction was employed in raising the temperature of the tool and of the fluid oil: but when tallow was substituted instead of the oil, the greatest part of the heat was employed in fusing this consistent body. From the increased capacity of the tallow, when melted, this heat was absorbed, and became latent, instead of being employed to raise the temperature: and whenever, by continuing the process, the tallow already melted began to grow hot, together with the tool, it was easy to reduce the temperature again by employing the heat on another zone of consistent tallow. He used these two cylinders, with much satisfaction, in a considerable quantity of work.

This promises to be a valuable discovery; and the public is obliged to the ingenious author of the Philosophical Journal for being at so much pains on this, as well as on other occasions, to render his science subservient to the useful arts.

Grose.

GROSE (Francis Esq; F.A.S.) was born, we believe, in 1731. He was the son of Mr Francis Grose of Richmond, jeweller, who filled up the coronation crown of George II. and died 1769. By his father he was left an independent fortune, which he was not of a disposition to add to, or even to preserve. He early entered into the Surrey militia, of which he became adjutant and paymaster; but so much had dissipation taken possession of him, that in a situation which above all others required attention, he was so careless as to have for some time (as he used pleasantly to tell) only two books of accounts, viz. his right and left hand pockets. In the one he received, and from the other paid; and this too with a want of circumspection which may be readily supposed from such a mode of book-keeping. His losses on this occasion roused his latent talents. With a good classical education he united a fine taste for drawing; and encouraged by his friends, as well as prompted by his situation, he undertook the work from which he derived both profit and reputation; we mean, his Views of Antiquities in England and Wales, which he first began to publish in numbers in the year 1773, and finished in the year 1776. The next year he added two more volumes to his English Views, in which he included the islands of Guernsey and Jersey, which were completed in 1787. This work answered his most sanguine expectations; and, from the time he began it to the end of his life, he continued without intermission to publish various works (a list of which we subjoin), generally to the advantage of his literary reputation, and almost always to the benefit of his finances. His wit and good humour were the abundant source of satisfaction to himself, and entertainment to his friends. He visited almost every part of the kingdom, and was well received wherever he went. In the summer of 1789 he set out on a tour in Scotland; the result of which he began to communicate to the public in 1790 in numbers. Before he had concluded this work, he proceeded to Ireland, intending to furnish that kingdom with views and descriptions of her antiquities, in the same manner he had executed those of Great Britain; but soon after his arrival in Dublin, being at the house of Mr Home there, he suddenly was seized at table with an apoplectic fit, on the 6th of May, 1791, and died immediately. He was interred in Dublin.

"His literary history (says a friend), respectable as it is, was exceeded by his good humour, conviviality, and friendship. Living much abroad, and in the best company at home, he had the easiest habits of adapting himself to all tempers; and, being a man of general knowledge, perpetually drew out some conversation that was either useful to himself, or agreeable to the party. He could observe upon most things with precision and judgment; but his natural tendency was to humour, in which he excelled both by the selection of anecdotes, and his manner of telling them: it may be said, too, that his figure rather assisted him, which was in fact the very title page to a joke. He had neither the pride nor malignity of authorship; he felt the independency of his own talents, and was satisfied with them without degrading others. His friendships were of the same cast; constant and sincere, overlooking some faults, and seeking out greater virtues. He had a good heart; and, abating those little indiscretions natural to most men, could do no wrong."

Grose | Groton.

He married at Canterbury, and resided there some years, much beloved and respected for his wit and vivacity: "which (another friend observes), though he possessed in an extreme degree, was but little tinctured with the caustic spirit so prevalent among spirits of that class. His humour was of that nature which exhilarates and enlivens, without leaving behind it a sting; and though perhaps none possessed more than himself the faculty of "setting the table in a roar," it was never at the expence of virtue or good manners. Of him, indeed, may be said in the words of Shakespeare,

————— a merrier man,
Within the limits of becoming mirth,
I never spent an hour's talk withal:
His eye begets occasion for his wit;
And every object that the one doth catch,
The other turns to a mirth-moving jest.

"Of the most careless, open, and artless disposition, he was often (particularly in the early part of his life) the prey of the designing; and has more than once (it is believed) embarrassed himself by too implicit confidence in the probity of others. A tale of distress never failed to draw commiseration from his heart; and often has the tear been discovered gliding down that cheek which a moment before was flushed with jocularity."

He was father of Daniel Grose, Esq; captain of the royal regiment of artillery (who, after several campaigns in America, was appointed in 1790 deputy governor of the new settlement at Botany Bay), and some other children.

His works are as follow:

1. The Antiquities of England and Wales, 8 vols. 4to and 8vo. 2. The Antiquities of Scotland, 2 vols. 4to and 8vo. 3. The Antiquities of Ireland, 2 vols. 4to and 8vo. 4. A Treatise on ancient Armour and Weapons, 4to, 1785. 5. A Classical Dictionary of the Vulgar Tongue, 8vo, 1785. 6. Military Antiquities; being a History of the English Army from the Conquest to the present time, 2 vols 4to, 1786, 1788. 7. The History of Dover Castle, by the Rev. William Darell, 4to, 1786. 8. A Provincial Glossary, with a Collection of local Proverbs and popular Superstitions, 8vo, 1788. 9. Rules for drawing Caricatures, 8vo, 1788. 10. Supplement to the Treatise on Ancient Armour and Weapons, 4to, 1789. 11. A Guide to Health, Beauty, Honour, and Riches; being a collection of humourous Advertisements, pointing out the means to obtain those blessings; with a suitable introductory Preface, 8vo. 12. The Olio; being a Collection of Essays in 8vo, 1793.

GROS MORNE stands in the middle of the north peninsula of the island of St Domingo, between the mountain and the head waters of a river which falls into the sea 4 leagues to the north, and a league and a half west of Port de Paix. It is equally distant, 11 leagues north-east of Point Paradis, and north-west of Les Gonaives. N. lat. 19° 46', W. long. from Paris 75° 13'.—*Morse.*

GROTON, a township in Caledonia county, in Vermont, is situated westward of and adjoining to Ryegate

Evenate township on Connecticut river, and 9 miles north-westerly of Stephen's Fort on that river. It contains 45 inhabitants.—*ib.*

GROTON, a township in Middlesex county, Massachusetts, 35 miles N. W. of Boston, and contains 1,840 inhabitants.—*ib.*

GROTON, a township in New London county, Connecticut, having Fisher's Island Sound on the southward, and Thames river on the west; which separates it from New-London, to which it formerly belonged. It was incorporated in 1705, and consists of two parishes, containing 3,946 inhabitants. In 1770 there were 140 Indians here; 44 of whom could read, and 17 were church members. On a height, on the bank of the Thames, opposite New-London city, stood Fort Griswold, memorable for being stormed on the 6th of September, 1781, by Benedict Arnold, a native of Connecticut, after he had become a traitor to his country. Here 70 men, the flower of the town, were put to the sword, after they had surrendered themselves prisoners. The compact part of the town was burnt at the same time, and sustained losses to the amount of £23,217. Fort Griswold defends the harbour of New-London.—*ib.*

GROVE *Point* forms the north side of the mouth of Sassafras river, in Chesapeak Bay, 5 miles south-south-west of Turkey Point.—*ib.*

GROVET's *Creek*, in the State of Tennessee, lies 7 miles from King's Spring, and 2 from the foot of Cumberland Mountain.—*ib.*

GRYALVA, a river in the province of Chiapa, in New Spain, which is said to breed certain amphibious beasts not to be found in any other place. They resemble monkeys, and are spotted like tygers; they hide themselves generally under water, and if they see any man or beast swim by, they twist their tails about a leg or arm to draw them to the bottom; and yet it has never been observed that they eat them.—*ib.*

GRYSON, a new county of Virginia, taken from Montgomery, which bounds it on the north. It has the State of N. Carolina, south, Henry and Wythe counties on the east and west.—*ib.*

GUACANA, a village in New Spain, near the mountain Jeruyo, which was destroyed by a volcano in that mountain, in 1760.—*ib.*

GUADALAJARRA, or *Guadalaxara*, a province in the audience of Galicia, in Old Mexico or New Spain, and its capital, an episcopal city of the same name, both large and beautiful. The city was built anno 1531, by one of the family of the Guzmans; and the bishopric, which was before settled at Compostella, was translated thither in 1570. It is situated on a delightful and fertile plain, watered with several streams and fountains, not far from Baranja river. The air of the country is temperate, and the soil so fertile, that it yields 100 to one; and all the fruits of Europe grow in luxuriance and abundance. N. lat. 20° 50′, W. long. 104° 49′. The province is watered by the Guadalaxara river.—*ib.*

GUADALAXARA, or *Great River*, in Mexico or New Spain, rises in the mountains of the valley of Toloccan, where stands the city of Guadalajarra, or Guadalaxara, the capital of New Galicia. After running a course of more than 600 miles, it empties into the Pacific Ocean, in the 22d degree of N. lat. It has stupendous falls, 15 miles south of the city of its name.—*ib.*

GUAIRA, a Spanish province in the east division of Paraguay, in S. America. Its city is Cividad Real, called also Guaira, and Oliveros.—*ib.*

GUAMALIES, a province in the jurisdiction of the archbishop of Lima, in S. America, and empire of Peru, begins 80 leagues north-east of Lima, and extends along the centre of the Cordillera. The Indian inhabitants apply themselves to weaving, and making a great variety of baizes, serges, and other stuffs, with which they carry on considerable trade with the other provinces.—*ib.*

GUAMAN VILLAS, a jurisdiction under the archbishop of Lima, 7 leagues from Guamanga. It is highly fertile, abounding with corn, fruits, pastures, cattle in great quantities, and all manner of esculent vegetables. The Indians here are equally industrious as those above mentioned, making baizes, corded stuffs, &c. which they send to Cusco and other provinces.—*ib.*

GUAMANGA, or *Guamanca*, or *St Juan de la Vittoria*, a city of Peru, about 60 leagues south-east of Lima, and having Pisco between it and the sea. It was founded by Pizarro, in 1539. The houses are all of stone, covered with slates. There are in it 3 elegant churches, several convents, and a rich hospital; being the seat of a bishop, under the archbishop of Lima, the seat of a governor, and the capital of a small province. The air is wholesome and temperate. The soil produces wheat, and the meadows breed numerous herds of cattle There are in the province mines of gold, silver, iron, lead, copper, and sulphur. The famous quick-silver mines of Guancavelica are 9 or 10 leagues from this city. S. lat. 12° 20′, W. long. 72° 36′.—*ib.*

GUANA PATINA, a volcano near Arequipa, in the valley of Quilca, in S. America, and empire of Peru; whose eruption, assisted by an earthquake, laid Arequipa in ruins in 1600.—*ib.*

GUANCHA BELICA, a jurisdiction subject to the archbishop of Lima, in Peru, 30 leagues north of the city of Guamanga; has very rich quick-silver mines, but otherwise very barren.—*ib.*

GUANCHACO, a port or harbour in Peru, S. America, about 2 leagues north of Truxillo, and the channel of its maritime commerce, situated in 8° 6′ S. lat. in the South Sea.—*ib.*

GUANTA, a jurisdiction north-north-west of Guamanga 4 leagues, in the empire of Peru; under the archbishop of Lima. Its rich silver mines are nearly exhausted.—*ib.*

GUANZAVELICA, or *Guancavelica*, a town of Peru in South-America, and in the audience of Lima. It is rich and abounds in mines of quick-silver; 120 miles north-east of Pisco, and 175 south-east of Lima. S. lat. 13°, W. long. 88° 30′. The famous quick-silver mines called *Guanzavelica*, or *El Assiento de Oropeso*, not far from the above town, near the city of Oropeso, were discovered by the Spaniards in 1566, and produce annually a million pounds of quick-silver, which is transported by land to Lima, afterwards to Arica, and thence to Potosi, where they make use of it to melt and refine the silver; and it yields to the Spanish treasury 40,000 ducats a year, besides other emolu-

emoluments. The quick-ſilver is found in a whitiſh maſs reſembling brick half burned. This ſubſtance is volatilized by fire, and received in ſteam by a combination of glaſs veſſels, where it condenſes by means of a little water at the bottom of each veſſel, and forms a pure heavy liquid.—*ib.*

GUARA, a town in its own juriſdiction on the road from Truxillo to Lima, containing about 200 houſes. It has a pariſh church, and a convent of Franciſcans, ſurrounded by fine plantations, and delightful improvements. At the ſouth end of Guara ſtands a large tower with a gate, and over it a kind of redoubt. This tower is erected before a ſtone bridge, under which runs Guara river. It lies in S. lat. 11° 31′ 36″. Not far from this town are ſtill to be ſeen a great many ruinous remains of the edifices of the Yncas or Incas; ſuch as walls of palaces, large dykes, by the ſides of ſpacious highways, fortreſſes, and caſtles, erected for checking the inroads of the enemy. —*ib.*

GUARCHI, a juriſdiction 6 leagues eaſt of Lima, in Peru, extends itſelf above 40 leagues along the Cordilleras, abounding in grain and fruits. It has ſome ſilver mines, but as the metal is indifferent, few are wrought.—*ib.*

GUARMOY, a ſmall maritime town of Peru, in South-America. It is the reſidence of a corregidore; has a good harbour, and lies 134 miles north-weſt of Lima, S. lat. 18° 3′ 53″.—*ib.*

GUASTACA, or *Panuco*, a province which borders on New Leon and Mexico, in which province are grain, cochineal, and ſome very rich ſilver mines. All the ſhores are low, overflowed, unhealthy, and full of ſalt marſhes.—*ib.*

GUATIMALA, (*Encycl.*). There is a great chain of high mountains, which runs acroſs it from eaſt to weſt, and it is ſubject to earthquakes and ſtorms. It is, however, very fertile, and produces great quantities of chocolate, cochineal, cotton, indigo, honey, ſome balſam and wood. The merchandize of the province is generally conveyed to the port of St Thomas in the bay of Honduras, to be ſent to Europe. The way acroſs this province to the South Sea is about 65 leagues, and is the next to that from Vera Cruz to Acapulco. This province is called by the Indians *Quatuemallac*, which ſignifies a *rotten tree*.

St Jago de Guatimala, the capital city, is ſituated in a valley, through the midſt of which runs a river between two burning mountains. In 1541 this city was ruined by a dreadful tempeſt, and a number of the inhabitants were buried in the ruins. It was rebuilt at a good diſtance from the volcano, and became a large and rich town, with a biſhop's ſee, and an univerſity; but it was ſwallowed up by an earthquake in 1773. It contained about 60,000 inhabitants of all colours, and was immenſely rich, but there are no traces of it left. The loſs was valued at 15 millions ſterling; and it was the third city in rank in Spaniſh America. In this dreadful earthquake 8,000 families inſtantly periſhed. New Guatimala is built at ſome diſtance, is well inhabited, and carries on a great trade. N. lat. 13° 40′, W. long. 90° 30′.—*ib.*

GUAXACA, a province in the audience of Mexico, in New Spain, N. America, and its capital city of the ſame name. It reaches from the bay of Mexico on the north to the South Sea, having the province of Tlaſcala on the north-weſt, and thoſe of Chiapa and Tabaſco on the ſouth-eaſt. It extends nearly 95 leagues along the South Sea, 50 along the bay of Mexico, and near 120, ſay ſome, along the confines of Tlaſcala, but not above 50 on thoſe of Chiapa. The air here is good, and the ſoil fruitful, eſpecially in mulberry trees; ſo that it produces more ſilk than any province in America. Except the valley of Guaxaca (which is famous for giving the title of Marques del Valle to Ferdinand Cortez, the conqueror of Mexico) the greateſt part is mountainous, yet abounding with wheat, cattle, ſugar, cotton, honey, cocoa, plantanes and other fruits. It has rich mines of gold, ſilver, and lead; and all its rivers have gold in their ſands. Caſſia, cochineal, cryſtal, and copperas abound alſo here. Vanilla, a drug, uſed as a perfume to give chocolate a flavor, grows plentifully in this province. There were in this province 120 monaſteries, beſides hoſpitals, ſchools, and other places of public charity, 150 conſiderable towns, beſides upwards of 300 villages. But now the province is ſaid to be thinly inhabited.—*ib.*

GUAXACA, the capital of the laſt mentioned province, is a biſhop's ſee, and the reſidence of a governor. It lies 230 miles ſouth of the city of Mexico, 120 weſt of Spirito Santo, and 132 ſouth of the gulf of Mexico, and of Vera Cruz, in the delightful valley of Guaxaca, which is 40 miles in length and 20 in breadth; and on the road leading through Chiapa to Guatimala. This city contains a very ſtately cathedral, and ſeveral thouſand families, both Spaniards and Indians. It carries on a conſiderable trade with the N. and S. ſeas. The river is not fortified, ſo that it lies open to invaſion. The Creolian clergy here are bitter enemies to the Spaniſh clergy. According to ſome, the proper name of Guaxaca is *Antiquera*; but this laſt, others make a ſeparate town and biſhop's ſee alſo, ſituated about 80 miles to the S. W. It is ſaid to have a ſtately cathedral, adorned with many large and high pillars of marble, each of which is one entire ſtone. It is ſituated in N. lat. 18° 2′, W. long. 101° 10′. Guaxaca is ſituated, according to ſome, in N. lat. 17° 45′. W. long. 100°.—*ib.*

GUAYALAS, a province and juriſdiction in the archbiſhopric of Lima, in Peru, S. America; extends along the centre of the Cordilleras, begins 50 leagues N. N. E. of Lima; produces grain, fruits, and paſture for cattle.—*ib.*

GUAYAQUIL, called by ſome *Guiaquil*, by others *Guagaquil* and *Guayakal*, a city, bay, harbour and river, in Peru, South-America. Guayaquil city is the ſecond of Spaniſh origin, being as ancient as 1534; is ſituated on the weſt ſide of the river Guayaquil, north of the iſland of Puna, at the head of the bay, and about 155 miles S. S. W. of Quito, in 2° 11′ ſouth lat. 79° 17′ weſt long. Cividad Viega, or Old Town, was its firſt ſituation, but it was removed about a quarter of a league in 1693 by Orellana; and the communication over the great ravins or hollows of water, preſerved between the old and new towns by a wooden bridge of half a quarter of a league. The city is about two miles in extent; is defended by three forts, two on the river near the city, and the third behind it, guarding the entrance of a ravin. The churches, convents, and houſes are of wood. It contains about 20,000 inhabitants—Europeans, creoles and other casts; besides a number of strangers drawn hither by commercial interests. The women here are famed for their personal charms, polite manners, and elegant dress. The salt creek here abounds with lobsters and oysters; but the fish in the neighbourhood are not esteemed, being full of bones, and unpalatable. But this place is most noted for a shell-fish called *turbine*, no bigger than a nut, which produces a purple reckoned to exceed all others in the world, and to vie with that of the Tyrians. It is called the purple of Punta, a place in the jurisdiction of Guayaquil. With this valuable and scarce purple, they dye the threads of cotton, ribbands, laces, &c. and the weight and colour are said to exceed according to the hours of the day; so that one of the first preliminaries to a contract is to settle the time when it shall be weighed. The dye is only the blood of the fish, pressed out by a particular process; and the cotton so dyed is called by way of eminence *caracollillo*. The river Guayaquil is the channel of its commerce; and the distance of the navigable part of it, to the custom-house of Babahoio is reckoned about 24 leagues. The commerce of this place is considerable; the productions of the country alone form the most considerable part of it; these are cocoa, timber, salt, horned cattle, mules, and colts; Guinea pepper, drugs, and lana de ceibo, a kind of wool, the product of a very high and tufted tree of that name, being finer than cotton. It is used for matrasses and beds.—*ib.*

GUAYARA, La, a maritime town, and one of the chief of Caraccas, in South-America.—*ib.*

GUERITE, in Fortification, a centry-box; being a small tower of wood, or stone, usually placed on the point of the bastion, or on the angles of the shoulder, to hold a centinel, who is to take care of the ditch, and watch against a surprise.

GUIANDOT, a river of Virginia, which rises in the Cumberland Mountain, and running a N. by W. course about 80 miles, falls into the Ohio river, about 34 miles below the Great Kanhaway. It is said to be 60 yards wide at its mouth, and as many miles navigable for canoes.—*Morse.*

GUILDHALL, a township in Essex county in Vermont, is situated on Connecticut river, and contains 158 inhabitants. It is opposite the mouth of Israel river in New-Hampshire.—*ib.*

GUILFORD, a township in Franklin county, Pennsylvania.—*ib.*

Guilford, a township in Windham county, Vermont, on the west bank of Connecticut river, and opposite to the mouth of Ashuelot river in New-Hampshire. It has Hinsdale on the south-east, and the State of Massachusetts on the south, and contains 2432 inhabitants.—*ib.*

Guilford, a post-town of Connecticut, in New-Haven county, situated on the south side of Long-Island Sound, about 18 miles E. by S. of New-Haven city. The township is large, and is divided into 5 parishes, and was settled in 1639. It was called *Menuncatuck* by the Indians.—*ib.*

Guilford *County*, in Salisbury district, North-Carolina, is bounded east by Orange, west by Rowan, south by Rockingham county, and north by the state of Virginia. It is noted for the extensive and rich tracts called New Garden, Buffaloe and Deep river lands. It contains 7191 inhabitants, inclusive of 576 slaves. Chief town, Martinville.—*ib.*

Guilford *Court-House*. It is on the post-road from Halifax to Salisbury, 48 miles south-west of Hillsborough, and 61 eastward of Salisbury.—*ib.*

GUILLOTINE, a new term introduced into the languages of Europe by the mournful effects of fanaticism in the holy cause of liberty. Our readers are not ignorant that this is the name given by the National Assembly of France to the engine of decapitation, which those usurpers of the legislative authority decreed to be the sole punishment of those condemned to death for their crimes. This decree was issued on March 20th 1792.

We do not imagine that the world will derive much useful instruction from a minute description of this terrible instrument of public justice; and therefore content ourselves with giving two figures of it, sufficiently expressive of its construction. It is only the revival of an instrument used in former times. The earliest accounts that we have of it is, that it was used in the barony of Halyfax in Yorkshire. It was also set up in Scotland; but we have no certain information that it has ever been used; and it is still shewn as a sort of curiosity by the name of the *Mayden*. See Maiden, *Encycl.*

Eratosthenes could not think of a better way of handing down his name to future ages than by burning the temple of Diana at Ephesus; Dr Guillotin, physician at Lyons, and member of the self-named National Assembly of France, thought himself honoured by the decree which associated his name with this instrument of popular vengeance. It was indeed proposed by him as an instrument of mercy, in a studied harangue, filled with that sentimental slang of philanthropy, which costs so little, promises so much, and has now corrupted all the languages of Europe. His invention is indeed one of the most expressive specimens of Gallic philanthropy, whose tender mercies are cruel; and was accordingly received with loud applauses, both from the house, and from the galleries. To proceed, however, with imposing dignity, it was referred to the consideration of a committee, with injunctions to ask the opinion of able surgeons of its efficiency. Mr Louis, a celebrated surgeon of Paris, declared it well fitted for the task, in a long pedantic dissertation; in which he takes occasion to deliver, with academic coldness, a theory of the operation of cutting instruments; and says that he had examined the edge of the guillotine and other such instruments, with a microscope, and had discovered that the finest edges were toothed like a saw. M. Guillotin, he said, had therefore with great judgment made the axe of his engine of death with a sloping edge, by which means *il glissoit d'une façon infinitment plus douce.* This dissertation was so much to the taste of the humane legislature, that they rewarded Mr Louis with 2000 livres, and published it in the Paris Journals. As to the inventor, he reaped all the benefit from it which he so kindly intended for the nation, by the trial of it on his own person, when he fell under the displeasure of Robespierre.

We acknowledge, that in as far as this instrument lessens the duration of the horrid conflict with the king of of terrors, and probably diminishes the corporeal sufferance, it may be called merciful (alas! the day!); but we question much, whether the dreadful agitation of soul is not rather increased by the long train of preparatory operations. The hands of the convict are tied behind his back: he is then stretched along on his face on a strong plank, and his precise position adjusted to the instrument. When fastened to the plank, it is pushed forward into its place, under the fatal edge, his neck adjusted to the block, and a basket placed just before his eyes (for the face of Louis XVI. was not covered) to receive his head. This must employ a good deal of time, and every moment is terrible.

The construction has received many alterations and refinements; and has at last been made so compendious and portable, as to become part of the travelling equipage of a commissioner from the National Assembly, sent on a provincial or special visitation. Thus did the sovereign people become terrible in majesty. So sensible was the Assembly of the advantages of this awful impression, or so intoxicated with the enjoyment of irresistible power, that they have thought their coins ornamented by this attribute of their supremacy: and as Jupiter is distinguished by his thunderbolt, so the majesty of the people is distinguished by the no less fatal axe. We have seen a piece of ten sous, struck at Mentz in 1793, and issued as current money, at the very time that they were planting the tree of liberty in that illuminated city by the hands of Custine and his troops. The device is the fasces and axe of ancient Rome, crowned with the red cap, and surrounded by a laurel wreath. The inscription is, *Republique Françoise*, 1793, *an.* 2d. Fully impressed with the same sentiments, Lequinio, the sentimental novellist of France, whom Mercier compares with the tender, the heart-touching Sterne—Lequinio, now commissioner sent by the National Assembly to regenerate Normandy and Brittany, writes to his masters, that "he is very successful in conversions from superstition to sound reason." He opposes to the bible and the relicts of the saints the constitution and the guillotine. "And you would wonder (says he) at my success—The wise (but they are few) give up their prejudices at once; but the multitude, the stupid worshippers of *Notre Dame*, look at our lady the guillotine; are silent, become serious, and their doubts vanish;—they are converted. This is your *labarum*—*in hoc signo vinces*."

GULA, Gueule, or Gola, in Architecture, a wavy member whose contour resembles the letter S, commonly called an Ogee.

GULF of Florida, or *New Bahama Channel*, is bounded on the west by the peninsula of East-Florida, and on the east by the Bahama Islands. It is generally about 40 miles wide, and extends from the 25th to the 28th degree of N. latitude.—*Morse.*

Gulf Stream. This remarkable phenomenon is a current in the ocean which runs along the coast, at unequal distances from Cape Florida to the Isle of Sables and the banks of Newfoundland, where it turns off and runs down through the Western islands; thence to the coast of Africa, and along that coast in a southern direction, till it arrives at, and supplies the place of those waters carried by the constant trade-winds from the coast of Africa toward the west, thus producing a constant circulating current. This stream is about 75 miles from the shores of the Southern states, and the distance increases as you proceed northward. The width of it is about 40 or 50 miles, widening towards the north. Its common rapidity is three miles an hour. A north-east wind narrows the stream, renders it more rapid, and drives it nearer the coast. North-west and west winds have a contrary effect. The Gulf-Stream is supposed to be occasioned by the trade-winds that are constantly driving the water to the westward, which being compressed in the Gulf of Mexico, finds a passage between Florida and the Bahama Islands, and runs to the north-east along the American coast. This hypothesis is confirmed by another fact: It is said that the water in the Gulf of Mexico is many yards higher than on the western side of the continent in the Pacific Ocean. It is highly probable that the sand carried down by great rivers into bays, and the current out of these bays meeting with the Gulf Stream, by their eddies, have formed Nantucket Shoals, Cape Cod, George's Bank, the Island of Sable, &c.

Skilful navigators, who have acquired a knowledge of the extent to which this stream reaches on the New-England coast, have learnt, in their voyages from Europe to New-England, New-York, or Pennsylvania, to pass the banks of Newfoundland in about 44° or 45° N. lat. to sail thence in a course between the northern edge of the Gulf Stream, and the shoals and banks of Sable Island, George's Bank, and Nantucket, by which they make better and quicker voyages to America. —*ib.*

GUNPOWDER, as we have observed in the *Encyclopædia* under the word Gun, has been known in the east, and particularly in China, from a period of very remote antiquity. No man, however, seems to have suspected that the knowledge of it was conveyed from the east into Europe; but all have agreed to allow the merits of the invention both to friar Bacon and to Bartholomew Schwartz. This generally received opinion has been lately controverted by citizen Langles, who, in a memoir read in the French national institute, contends, that the knowledge of gunpowder was conveyed to us from the Arabs, on the return of the Crusaders to Europe. He assures us that the Arabs made use of it in 690 at the siege of Mecca; and he adds, that they derived it from the Indians, among whom it must have been known in the remotest ages, since their sacred books (the Vedam) forbid the use of it in war.

It is indeed extremely probable, that the composition of gunpowder was known in India at a very early period; for in whatever country nature forms nitre in the greatest plenty, there its deflagrating quality is most likely to be first observed; and a few experiments founded on that observation, will lead to the composition which produces such sudden and violent effects. "Nitre (says Sir George Staunton) is the natural and daily produce of China and India; and there, accordingly, the knowledge of gunpowder seems to be coeval with that of the most distant historic events. Among the Chinese, it has been applied at all times to useful purposes, such as blasting rocks, and removing great obstructions, and to those of amusement in making a vast variety of fire works. It was also used as a defence, by undermining the probable passage of the enemy, and blowing him up. But its force had not been directed through strong metallic tubes as it was by Europeans soon after they had discovered it. And though, in imitation of Europe, it has been introduced into the armies of the East, other modes of warfare are sometimes still preferred to it."

Of gunpowder manufactured by those who have manufactured it so long, it is desirable to know the composition and the qualities. It was therefore natural for the Hon. George Napier, when superintending the royal laboratory at Woolwich, and making experiments upon so necessary an implement of modern war, to procure some Chinese powder from Canton.

This he did; and analyzing two ounces of it, he found, after repeating the operation six times, that the mean result gave the following proportions*. Nitre 1 oz. 10 dwts. charcoal 6 dwts. sulphur 3 dwts. 14 grs. Here is a deficiency in weight of ten grains, which M. Napier supposes the consequence of some defect in his process; but as M. Baumé, a French chemist, made a variety of experiments to obtain a total separation of the sulphur from the charcoal of gunpowder, and was never able to effect it, one fourteenth part remaining united, three grains must be deducted from the charcoal, and added to the sulphur to give the accurate proportion of the ingredients; which by turning to the article Gunpowder, *Encycl.* the reader will perceive differs somewhat from the proportion of the same ingredients in the gunpowder of Europe. This Chinese powder was usually large grained and not strong, but very durable. It had been made many years when our author got it; yet there was no visible symptom of decay, the grain being hard, well coloured, and though angular, it was even-sized, and in perfect preservation.

* *Transactions of the Royal Irish Academy.*

When we consider the operations in which gunpowder is employed, it is obvious that it must be an object of importance to ascertain its explosive force; and yet there is scarcely a subject concerning which the most approved writers have so much differed. Mr Robins, who has done more towards perfecting the art of gunnery than any other individual, states the explosive force of gunpowder to be 1000 times greater than the mean pressure of the atmosphere; while the celebrated Daniel Bernouilli determines it not to be less than 10,000 times this pressure. Such a difference of opinion led Count Rumford to pursue a course of experiments, of which some were published in the Transactions of the Royal Society for the year 1781, and the remainder in the Transactions of the same Society for 1797; with the view principally of determining the initial expansive force of gunpowder. By one of these experiments, it appeared that, calculating even on Mr Robins's own principles, the force of gunpowder, instead of being 1000 times, must at least be 1308 times greater than the mean pressure of the atmosphere. From this experiment, the Count thought himself warranted in concluding, that the principles assumed by Mr Robins were erroneous, and that his mode of ascertaining the force of gunpowder could never satisfactorily determine it. Despairing of success in that way, he resolved to make an attempt for ascertaining this force by actual measurement; and after many unsuccessful experiments, he was at length led to conclude, that this force was at least 50,000 times greater than the mean pressure of the atmosphere.

Mr Robins apprehends that the force of fired gunpowder consists in the action of a permanently elastic fluid, similar, in many respects, to common atmospherical air; and this opinion has been very generally received: but Count Rumford thinks, that though the permanently elastic fluids, generated in the combustion of gunpowder, assist in producing the effects which result from its explosion, its enormous force, allowing it to be 50,000 times greater than the mean pressure of the atmosphere, cannot be explained, without supposing that it arises principally from the elasticity of the aqueous vapour generated from the powder in its combustion.

"The brilliant discoveries of modern chemists (says he) have taught us, that both the constituent parts of which water is composed, and even water itself, exist in the materials which are combined to make gunpowder; and there is much reason to believe that water is actually formed, as well as disengaged, in its combustion. M. Lavoisier, I know, imagined that the force of fired gunpowder depends in a great measure upon the expansive force of uncombined *caloric*, supposed to be let loose in great abundance during the combustion or deflagration of the powder: but it is not only dangerous to admit the action of an agent whose existence is not yet clearly demonstrated; but it appears to me that this supposition is quite unnecessary, the elastic force of the heated aqueous vapour, whose existence can hardly be doubted, being quite sufficient to account for all the phænomena. It is well known that the elasticity of aqueous vapour is incomparably more augmented by any given augmentation of temperature than that of any permanently elastic fluid whatever; and those who are acquainted with the amazing force of steam, when heated only to a few degrees above the boiling point, can easily perceive that its elasticity must be almost infinite when greatly condensed and heated to the temperature of red hot iron; and this heat it must certainly acquire in the explosion of gunpowder. But if the force of fired gunpowder arises *principally* from the elastic force of heated aqueous vapour, a cannon is nothing more than a *steam engine* upon a peculiar construction; and upon determining the ratio of the elasticity of this vapour to its density, and to its temperature, a law will be found to obtain very different from that assumed by Mr Robins in his Treatise on Gunnery."

In order to measure the elastic force of fired gunpowder, Count Rumford adopted a new plan; and, instead of causing the generated elastic fluid to act on a moveable body through a determined space, which he had found to be ineffectual to his purpose, he contrived an apparatus in which this fluid should be made to act, "by a determined surface against a weight, which, by being increased at pleasure, should at last be such as would just be able to confine it, and which in that case would just counterbalance and consequently *measure* the elastic force."

Having succeeded in setting fire to the powder, without any communication to the external air, "by causing the heat employed for that purpose to pass through the solid substance of the barrel, it only remained to apply such a weight to an opening made in the barrel, as the whole force of the generated elastic fluid should not be able to lift or displace." Many precautions were necessary. A solid block of very hard stone,

ſtone, four feet four inches ſquare, was placed upon a bed of ſolid maſonry, which deſcended ſix feet below the ſurface of the earth. Upon this block of ſtone, which ſerved as a baſe to the whole machinery, was placed the ſmall barrel, in which the exploſions were made, with its opening directly upwards. This opening was cloſed by a ſolid hemiſphere of hardened ſteel, on which the weight to be overcome by the exploſion was laid. Having charged the barrel with 10 grains of powder, its whole contents being about 28 grains, and a 24 pounder weighing 8081 lbs avoirdupois, being placed on its caſcabel ſo as by its weight to confine the generated elaſtic fluid, a heated iron ball was applied to the end of the vent tube, (a ſmall ſolid projection from the centre of the bottom of the barrel). In a few moments the powder took fire, though the exploſion made a very feeble report; and when the weight was raiſed, the confined elaſtic vapour ruſhed out of the barrel. The ſlight effect produced by this exploſion induced ſome of the attendants on this occaſion to undervalue the importance of this experiment, and to form a very inadequate idea of the real force of the elaſtic fluid that had been thus almoſt inſenſibly diſcharged. In a ſecond experiment, the barrel was filled with powder, and the ſame weight laid on as before. The barrel was made of the beſt hammered iron, and uncommonly ſtrong. The charge of powder amounted to little more than $\frac{1}{10}$ of a cubic inch, which is not ſo much as would be required to load a ſmall pocket piſtol, and not *one-tenth* part of the quantity frequently uſed for the charge of a common muſket. Yet this inconſiderable quantity of powder, when ſet on fire, exploded with a force that burſt the barrel, and with a loud report that alarmed the whole neighbourhood.

The author proceeds to make an eſtimate from the known ſtrength of iron, and the area of the fracture of the barrel in the preceding experiment, of the real force employed by the elaſtic vapour to burſt it; and he computes that it muſt have been equal to the preſſure of a weight of 412529 lbs.; which, by another computation, he found to be 55004 times greater than the mean preſſure of the atmoſphere. By another proceſs, he inveſtigates the ſtrength of the iron of which the barrel was made; and he thence finds that the force required to burſt it was equal to the preſſure of a weight of 410624½ lbs. This weight, reduced into atmoſpheres, gives 54750 atmoſpheres for the meaſure of the force exerted by the elaſtic fluid in the preſent inſtance. This force muſt be conſiderably leſs than the initial force of the elaſtic fluid generated in the combuſtion of gunpowder, before it has begun to expand; "for it is more than probable (ſays Count Rumford) that the barrel was in fact burſt before the generated elaſtic fluid had exerted all its force, or that this fluid would have been able to have burſt a barrel ſtill ſtronger than that uſed in the experiment."

After having ſhewn the extreme force of fired gunpowder, the Count adverts to an objection which may be made againſt his deductions. How does it happen that fire-arms and artillery of all kinds, which certainly are not calculated to withſtand ſo enormous a force, are not always burſt when they are uſed? Inſtead of anſwering this queſtion, by aſking how it happened that the extremely ſtrong barrel uſed in his experiment could be burſt by the force of gunpowder, if this force be not in fact much greater than it has ever been ſuppoſed to be, he proceeds to ſhew that the combuſtion of gunpowder, inſtead of being inſtantaneous, as Mr Robins's theory ſuppoſes, is much leſs rapid than has hitherto been apprehended; an obſervation which, if eſtabliſhed, is certainly ſufficient to anſwer the objection.

He remarks, that it is a well-known fact, that on the diſcharge of fire-arms of all kinds, there is always a conſiderable quantity of unconſumed grains of gunpowder blown out of them; and what is very remarkable, as it leads directly to a diſcovery of the cauſe of this effect, theſe unconſumed grains are not merely blown out of the muzzles of fire-arms, but come out alſo by their vents or touch-holes, where the fire enters to inflame the charge, as many perſons who have had the misfortune to ſtand with their faces near the touch-hole of a muſket, when it has been diſcharged, have found to their coſt.

It appears extremely improbable to our author, if not abſolutely impoſſible, that a grain of gunpowder actually in the chamber of the piece, and completely ſurrounded by flame, ſhould, by the action of that very flame, be blown out of it without being at the ſame time ſet on fire. And, if this be true, he conſiders it as a moſt deciſive proof, not only that the combuſtion of gunpowder is leſs rapid than it has generally been thought to be, but that a grain of gunpowder actually on fire, and burning with the utmoſt violence over the whole of its ſurface, may be projected with ſuch a velocity into a cold atmoſphere, as to extinguiſh the fire, and ſuffer the remains of the grain to fall to the ground unchanged, and as inflammable as before.

This extraordinary fact was aſcertained beyond all poſſibility of doubt by the Count's experiments. Having procured from a powdermill in the neighbourhood of the city of Munich, a quantity of gunpowder, all of the ſame maſs, but formed into grains of very different ſizes, ſome as ſmall as the grains of the fineſt Battel powder, he placed a number of vertical ſcreens of very thin paper, one behind another, at the diſtance of 12 inches from each other; and loading a common muſket repeatedly with this powder, ſometimes without and ſometimes with a wad, he fired it againſt the foremoſt ſcreen, and obſerved the quantity and effects of the unconſumed grains of powder which impinged againſt it. The ſcreens were ſo contrived by means of double frames united by hinges, that the paper could be changed with very little trouble, and it was actually changed after every experiment.

The diſtance from the muzzle of the gun to the firſt ſcreen was not always the ſame; in ſome of the experiments it was only 8 feet, in others it was 10, and in ſome 12 feet.

The charge of powder was varied in a great number of different ways; but the moſt intereſting experiments were made with one ſingle large grain of powder, propelled by ſmaller and larger charges of very fine grained powder.

Theſe large grains never failed to reach the ſcreen; and though they ſometimes appeared to have been broken into ſeveral pieces by the force of the exploſion, yet they frequently reached the ſcreen entire; and ſometimes paſſed through all the ſcreens (five in number) without being broken.

When they were propelled by large charges, and

cateconsequently with great velocity, they were seldom on fire when they arrived at the first screen; which was evident not only from their not setting fire to the paper (which they sometimes did), but also from their being found sticking in a soft board, against which they struck, after having passed through all the five screens; or leaving visible marks of their having been impinged against it, and being broken to pieces and dispersed by the blow. These pieces were often found lying on the ground; and from their forms and dimensions, as well as from other appearances, it was often quite evident that the little globe of powder had been on fire, and that its diameter had been diminished by the combustion before the fire was put out, on the globe being projected into the cold atmosphere.

That these globes or large grains of powder were always set on fire by the combustion of the charge, can hardly be doubted. This certainly happened in many of the experiments; for they arrived at the screens on fire, and set fire to the paper; and in the experiments in which they were projected with small velocities, they were often seen to pass through the air on fire; and when this was the case, no vestige was to be found. They sometimes passed on fire through several of the foremost screens, without setting them on fire, and set fire to one or more of the hindmost, and then went on and impinged against the board, which was placed at the distance of 12 inches behind the last screen.

The Count then proceeds to mention another experiment, in which the progressive combustion of gunpowder was shewn in a manner still more striking, and not less conclusive.

A small piece of red hot iron being dropped down into the chamber of a common horse-pistol, and the pistol being elevated to an angle of about 45 degrees, upon dropping down into its barrel one of the small globes of powder (of the size of a pea), it took fire, and was projected into the atmosphere by the elastic fluid generated in its own combustion, leaving a very beautiful train of light behind it, and disappearing all at once like a falling star. This amusing experiment was repeated very often, and with globes of different sizes. When very small ones were used singly, they were commonly consumed entirely before they came out of the barrel of the pistol; but when several of them were used together, some, if not all of them, were commonly projected into the atmosphere on fire.

As the slowness of the combustion of gunpowder is undoubtedly the cause which has prevented its enormous and almost incredible force from being discovered, our author deduces, as an evident consequence, that the readiest way to increase its effects, is to contrive matters so as to accelerate its inflammation, and combustion. This may be done in various ways; but, in his opinion, the most simple and most effectual manner of doing it would be to set fire to the charge of powder, by shooting (through a small opening) the flame of a smaller charge into the midst of it.

He contrived an instrument on this principle for firing cannon three or four years ago; and it was found, on repeated trials, to be useful, convenient in practice, and not liable to accidents. It likewise supersedes the necessity of using priming, of vent-tubes, port-fires, and matches, and on that account he imagined it might be of use in the British navy, but it does not appear to have been received into practice.

Another infallible method of increasing very considerably the effect of gunpowder in fire-arms of all sorts and dimensions, would be to cause the bullet to fit the bore exactly, or without windage, in that part of the bore at least where the bullet rests on the charge; for, when the bullet does not completely close the opening of the chamber, not only much of the elastic fluid, generated in the first moment of the combustion of the charge, escapes by the side of the bullet; but what is of still greater importance, a considerable part of the unconsumed powder is blown out of the chamber along with it in a state of actual combustion, and, getting before the bullet, continues to burn on as it passes through the whole length of the bore; by which the motion of the bullet is much impeded.

The loss of force which arises from this cause, is in some cases almost incredible; and it is by no means difficult to contrive matters so as to render it very apparent, and also to prevent it.

If a common horse-pistol be fired with a loose ball, and so small a charge of powder that the ball shall not be able to penetrate a deal board so deep as to stick in it when fired against it from the distance of six feet; the same ball, discharged from the same pistol with the same charge of powder, may be made to pass quite through one deal board, and bury itself in a second placed behind it, merely by preventing the loss of force which arises from what is called windage, as he found more than once by actual experiment.

The Count has in his possession a musket, from which, with a common charge of powder, he fires two bullets at once with the same velocity that a single bullet is discharged from a musket on the common construction with the same quantity of powder. And, what renders the experiment still more striking, the diameter of the bore of his musket is exactly the same as that of a common musket, except only in that part of it where it joins the chamber, in which part it is just so much contracted, that the bullet, which is next to the powder, may stick fast in it. He adds, that though the bullets are of the common size, and are consequently considerably less in diameter than the bore, means are used which effectually prevent the loss of force by windage; and to this last circumstance, he concludes, it is doubtless owing, in a great measure, that the charge appears to exert so great a force in propelling the bullets.

That the conical form of the lower part of the bore where it unites with the chamber has a considerable share in producing this extraordinary effect, is, however, very certain, as he has found by experiment made with a view merely to ascertain that fact.

At the close of the Count's last memoir, we have a computation, designed to shew that the force of the elastic fluid generated in the combustion of gunpowder, enormous as it is, may be satisfactorily explained on the supposition that it depends *solely* on the elasticity of watery vapour, or steam. From experiments made in France in the year 1790, it appears that the elasticity of steam is doubled by every addition of temperature equal to 30° of Fahrenheit's thermometer. As the heat generated in the combustion of gunpowder cannot be less than that of red-hot iron, it may be supposed

Gunpowder ‖ Gut-tie.

pofed equal to 1000° of Fahrenheit's fcale:—but the elaftic force of fteam is juft equal to the mean preffure of the atmofphere, when its temperature is equal to that of boiling water, or to 212° of Fahrenheit's thermometer; confequently $212°+30°=240°$ will reprefent the temperature, when its elafticity will be equal to the preffure of two atmofpheres; and, purfuing the calculation, at 602° or 2° above the heat of boiling linfeed oil, its elafticity will be equal to the preffure of 8192 atmofpheres, or above *eight times* greater than the utmoft force of the fluid generated in the combuftion of gunpowder, according to Mr Robins's computation: but the heat in this cafe is much greater than that of 602° of Fahrenheit; and therefore the elafticity of the fteam generated from the water contained in the powder muft be much greater than the preffure of 8192 atmofpheres. At 722°, the elafticity will be equal to the preffure of 131,072 atmofpheres; and this temperature is lefs than the heat of iron, which is vifibly red-hot in daylight, by 355°:—but the flame of gunpowder has been found to melt brafs, which requires a heat equal to that of 3807° of Fahrenheit; 2730° above the heat of red-hot iron, or 3805° higher than the temperature which gives to fteam an elafticity equal to the preffure of 131,072 atmofpheres. That there is in gunpowder water fufficient for fupplying the neceffary quantity of fteam, the author has very fatisfactorily evinced: but we muft not purfue his curious inveftigations any farther. Thofe who want a fuller account of them, will find it either in the original memoirs themfelves, or in a very accurate abridgement of thefe memoirs in the firft volume of Nicholfon's *Journal of Natural Philofophy*, &c.

We cannot conclude this article without mentioning a new kind of gunpowder, invented fome years ago in France, in which the marine acid is fubftituted, in equal quantity, for nitre. Dr Hutton tried fome of this new powder which was made at Woolwich, and found it of about double the ftrength of the ordinary fort; but it is not likely to come into common and general ufe, for the preparation of the acid is difficult and expenfive, (See Chemistry-*Index* in this *Suppl.*), and the powder which is made of it catches fire and explodes from the fmalleft degree of heat, and without the aid of a fpark. It is to this circumftance, however, that its fuperior ftrength feems to be in a great meafure owing.

Gunpowder, a river of the weftern fhore of Maryland, whofe chief branches unite a little above Joppa, and empty into Chefapeak Bay, about 12 miles above Patapfco river. It is navigable only a few miles, by reafon of falls.—*Morse*.

Gunpowder Neck, near the head of Chefapeak Bay, is a curious peninfula formed by Gunpowder river, and Bufh river.—*ib.*

GUNTER's Chain. See Geometry, *Encyclopædia*, Part II. chap. 1.

GUT-tie, a dangerous difeafe to which oxen and male calves are rendered liable by an improper mode of caftration. In fome places, and particularly in Herefordfhire, the breeders of cattle, when they caftrate their calves, open the *fcrotum*, take hold of the tefticles with their teeth, and tear them out with violence; by which means all the veffels thereto belonging are ruptured. The *vafa deferentia*, entering by the holes of the tranfverfe and oblique mufcles into the abdomen, pafs over the ureters in acute angles; at which turning, by their great length and elaftic force, the peritoneum is ruptured; the *vafa deferentia* are fevered from the tefticles, and fpringing back, form a kind of bow from the urethra, where they are united, over the ureters, to the tranfverfe and oblique mufcles, and there again unite, where they firft entered the abdomen; the part of the gut that is tied is the jejunum, at its turning from the left fide to the right, and again from the right to the left, forming right angles under the kidney, and attached to the duplicature of the peritoneum, to which it was united, where the rupture happened. There the bow of the gut hangs over the bow of the *vafa deferentia*, which, by a fudden motion, or turn of the beaft, form a hitch or tie of the ftring round the bow of the gut (filled with air), fimilar to what a carter makes on his cart line. This caufes a ftoppage in the bowels, and brings on a mortification, which, in two days, or four at moft, proves fatal: And to this accident is the beaft, when caftrated as above, liable from the day that he was caftrated till the time of his being flaughtered.

The fymptoms of the gut-tie are the fame as thofe of an incurable colic, *volvulus*, or mortification of the bowels. The beaft affected with this complaint will kick at its belly, lie down, and groan; it has alfo a total ftoppage in its bowels (except blood and mucus, which it will void in large quantities), and a violent fever, &c. To diftinguifh with certainty the gut-tie from the colic, &c. the hand and arm of the operator muft be oiled, and introduced into the anus, through the rectum, beyond the os pubis, turning the hand down to the tranfverfe and oblique mufcles, where the veffels of the tefticles enter the abdomen. There the ftring will be found united to the mufcles, and is eafily traced to the ftricture by the hand, without pain to the beaft.

From the general view of the agriculture of the county of Hereford, drawn up by Mr Clark of Builth, Breconfhire, we learn that Mr Harris farmer at Wickton, near Leominfter, had been uncommonly fuccefsful in the cure of the gut-tie. That gentleman informs us, that he had cut cattle for this difeafe from the age of three months to that of nine years; and as it is a matter of great importance, we fhall ftate his method of operating in his own words.

"The only method of cure (fays he) that can be fafely ventured upon is, to make a perpendicular incifion, four inches under the third vertebra of the loins, on the left fide, over the paunch or ftomach, and introduce the arm to find the part affected; if poffible, keep the beaft ftanding by the help of proper affiftants. The knife I make ufe of to fever the ftring is in the form of a large fifh hook, with an edge on the concave fide; it is fixed to a ring, which fits the middle finger, which finger crooks round the back of the knife, the end of the thumb being placed on its edge. The inftrument, by being thus held in the hand, is fecured from wounding the furrounding inteftines: with it I divide the ftring or ftrings, and bring out one or both as circumftances require. Here it is to be obferved, that great care muft be taken by the operator not to wound or divide the ureters, which would be certain death. I then few up the divided lips of the peritoneum very clofe, with a furgeon's needle threaded with ftrong thread, eight or ten double, fufficiently waxed;

I alfo

I alſo ſew up the ſkin, leaving a vacancy at the top and bottom of the wound ſufficiently wide to introduce a tent of ſurgeon's tow, ſpread with common digeſtive and traumatic balſam; covering the inciſion with a plaſter made of the whites of eggs and wheat flour. The wound, thus treated and dreſſed every day, will be well in a fortnight. The medicine I give to remove the ſtoppage in the three ſtomachs occaſioned by the tie, and to carry off the fever, is four ounces of Glauber's ſalt, two ounces of cream of tartar, and one ounce of ſenna, infuſed in two pounds of boiling water, adding half a pound of olive-oil, and working it off with plenty of gruel, mixed with a large quantity of infuſion of mallows and elder-bark. I adminiſter the gruel and infuſion for at leaſt two or three days; by which time the beaſt will be well, will eat his provender, and chew the cud, and will for ever be relieved, and remain ſafe from this fatal diſorder.

"The following ſimple and eaſy method of caſtration will effectually prevent the gut tie. Open the ſcrotum, looſen out the teſticles, and tie the ſeveral veſſels with a waxed thread or ſilk; or ſear them with a hot iron, to prevent their bleeding, as in the common way of cutting colts. This method can never diſplace the veſſels of the teſticles, bladder, kidneys, or inteſtines; all of which remain covered or attached to the peritoneum, or lining of the abdomen of the beaſt, which renders it impoſſible that there ſhould ever be a ſtricture or tie on the gut."

GUZ, an Indian meaſure, varying in different places, but which may be reckoned about an Engliſh yard. The guz of Akbar was 41 fingers.

H.

HACHA, Rio de la, or *La Hacha*, a province, its chief town, and a river, in Terra Firma or Caſtile del Oro, in South-America. The province is ſurrounded on two ſides by the ocean, viz. on the N. and N. W. and on the third eaſtward by the gulf of Venezuela. The town is ſituated at the mouth of the river, and on its weſt ſide, on a little hill about a mile from the ſea. The ſoil about it is very rich, and abounds with productions common to the climate, alſo European plants and fruits; well ſupplied with ſalt ſprings, veins of gold, and ſome gems of great value. The harbour is none of the beſt, being expoſed to the north winds. It is about 8 leagues from New-Salamanca, and 18 from Cape Vela, N. by E. and 246 miles eaſt of Carthagena. Here the Spaniſh Galleons touch at their arrival in South-America, from whence expreſſes are ſent to all the ſettlements, to give them notice of it. In 1595 it was ſurpriſed and ſacked by Sir Francis Drake. N. lat. 11° 30′, W. long. 72°.—*Morſe.*

HACKETSTOWN, a ſmall poſt-town in Suſſex county, New-Jerſey, on the north-weſt ſide of Muſconecunk river. It is about three miles above the mineral ſpring near Roxbury, on the oppoſite ſide of the river, 22 miles W. by N. of Morriſtown, 16 S. W. by W. of Suſſex court-houſe, and 120 N. N. E. of Philadelphia.—*ib.*

HACKINSACK, a river of New-Jerſey which riſes in New-York, and runs a ſoutherly courſe four or five miles weſt of Hudſon's river. It unites with Paſſaic river at the head of Newark bay, and is navigable about 15 miles.—*ib.*

Hackinsack, the chief town in Bergen county, New-Jerſey, is ſituated near the weſt bank of the above river, 20 miles North-weſt of New-York city. The inhabitants are moſtly Dutch. The houſes are chiefly built of ſtone, in the old Dutch taſte. Here are four public buildings, a Dutch and Epiſcopal church, a court-houſe, and a flouriſhing academy. The people, who are moſtly farmers, carry their produce to New-York.—*ib.*

HADDAM, a town of Connecticut, the ſecond in rank in Middleſex county, ſituated on the weſt ſide of Connecticut river, 18 or 20 miles from its mouth, and 10 miles ſouth-eaſt of the city of Middletown. This townſhip, including Eaſt-Haddam, on the oppoſite ſide of the river, was purchaſed of the Indians, May 20th, 1662. A ſpot in Eaſt-Haddam was famous for Indian *Pawaws*, and was ſubject for many years to earthquakes and various noiſes, which the firſt ſettlers, agreeable to the ſuperſtitious ideas of that age, attributed to theſe *Pawaws*. An old Indian being aſked what was the reaſon of ſuch noiſes in this place? anſwered, The Indian's God was very angry becauſe the Engliſhmen's God came here." Theſe noiſes are now frequently heard.—*ib.*

HADDONFIELD, a ſmall town in Glouceſter county, New-Jerſey, 9 miles S. E. by E. of Philadelphia, and 17 from Burlington.—*ib.*

HADLEY, a pleaſant town in Hampſhire county, Maſſachuſetts, lying on the eaſt ſide of Connecticut river, nearly oppoſite to Northampton, 20 miles north of Springfield, and 97 weſt of Boſton. The town conſiſts of two long ſpacious ſtreets, which run parallel with each other, and with the river. The townſhip contains 882 inhabitants.—*ib.*

HAGARSTOWN, now called *Elizabeth-Town.* It has a conſiderable trade with the weſtern country, and has between two and 300 houſes. It is ſituated in Waſhington county, Maryland; it is a poſt-town 26 miles north-weſt of Fredericktown, 73 N. W. by W. of Baltimore, and 22 S. by W. of Chamberſburg in Pennſylvania.—*ib.*

HALBUT POINT, the north east point of Cape Anne, in Massachusetts.—*Morse.*

HALF MOON, an extensive township in Albany county, New-York. It contains 3,600 inhabitants; of these, 128 are slaves, and 563 are qualified electors. *Waterford*, a neat, compact, thriving village of about 70 or 80 houses, two miles E. N. E. of the Cohoez, and 12 miles north of Albany, on the north bank of the most northerly branch of Mohawk river and on the west bank of the Hudson, is situated in this township.—*ib.*

HALIFAX, a county in the eastern part of the British province of Nova-Scotia. It contains Halifax, the capital; the townships of Londonderry, Truro, Onslow, Colchester, Lawrence, Southampton, Canso, and Tinmouth. The inhabitants are chiefly Irish, Scotch, and New-Englanders. It has numerous bays, and rivers; the chief of the latter are Shabbennacadie, which is a boatable river, the Petitcodiac, Memramcook, &c.—*ib.*

HALIFAX, the capital of the province of Nova Scotia, in the county of its name, was settled by a number of British subjects in 1749. It is situated on a spacious and commodious bay or harbour, called Chebucto, of a bold and easy entrance, where a thousand of the largest ships might ride with great convenience and safety. The town is built on the west side of the harbour, on the declivity of a commanding hill, whose summit is 236 feet perpendicular from the level of the sea. The town is laid out into oblong squares; the streets parallel and at right angles. The town and suburbs are about two miles in length; and the general width a quarter of a mile. It contained in 1793 about 4000 inhabitants and 700 houses. At the northern extremity of the town, is the king's naval yard, completely built and supplied with stores of every kind for the royal navy. The harbour of Halifax is reckoned inferior to no place in British America for the seat of government, being open and accessible at all seasons of the year, when almost all other harbours in these provinces are locked up with ice; also from its entrance, situation, and its proximity to the bay of Fundy, and principal interior settlements of the province.

This city, lying on the south coast of Nova Scotia, has communication with Pictou, 68 miles to the north-east on the gulf of St. Lawrence, by a good cart-road, finished in 1792. It is twelve miles northerly of Cape Sambro, which forms in part the entrance of the bay; 27 south-easterly of Windsor, 40 N. by E. of Truro, 80 N. E. by E. of Annapolis on the bay of Fundy, and 157 south-east of St. Ann, in New-Brunswick, measuring in a straight line. N. lat. 44° 40′ W. long 63° 15′.—*ib.*

HALIFAX, a fort in the town of Winslow, in Lincoln county, Maine, erected by order of Governor Shirley in 1754. It stands on the point of land formed by the confluence of the Sebasticook with the Kennebeck, 30 miles below Sandy river.—*ib.*

HALIFAX, a township in Windham county, Vermont, 23 miles E. by S. of Bennington, has Marlborough on the north, and the Massachusetts line south. It contains 1309 inhabitants.—*ib.*

HALIFAX, a township in Plymouth county, Massachusetts, situated 35 miles south-east of Boston. It was incorporated in 1734, and contains 664 inhabitants.—*ib.*

HALIFAX, a village or settlement on the east side of Susquehannah river, in Dauphin county, Pennsylvania, 13 miles north of Harrisburg.—*ib.*

HALIFAX, one of the middle districts of North-Carolina, bounded north by the State of Virginia, east by Edenton district, west by Hillsborough, and south by Newbern. It is divided into 7 counties, viz. Northampton, Halifax, Martin, Edgecomb, Warren, Franklin, and Nash, which contain 64,630 inhabitants, including 25,402 slaves. Besides smaller streams, the Roanoke passes through this district in a south-east course, and the Pamplico has its source in it. Chief town, Halifax.—*ib.*

HALIFAX, a county of the above district, bounded north by Northampton, south by Edgcomb, east by Bertie, and west by Warren. It contains 7459 inhabitants, and 6506 slaves. Chief town, Halifax.—*ib.*

HALIFAX, the chief town of the above county, and of the district of its name in North-Carolina, is a post-town, pleasantly situated on the western bank of the Roanoke, about six miles below the falls, regularly laid out, and besides dwelling houses, has a court-house and gaol. It is 36 miles north of Tarborough, 28 miles from Grenville court house, 147 north-east of Fayetteville, 75 S. by W. of Petersburg, Virginia, and 393 S. W. by S. of Philadelphia. N. lat. 36° 13′.—*ib.*

HALIFAX, a county in Virginia, bordering on the State of North-Carolina. It is about 42 miles long and 39 broad, and contains 14,722 inhabitants, including 5565 slaves.—*ib.*

HALLOWELL, a flourishing post-town in the District of Maine, and the shire town of Lincoln county, situated in N. lat. 44° 16′, at the head of the tide waters on the west side of Kennebeck river. An academy is established here with a considerable fund in lands. The court-house here is 12 miles S. by W. of Vassalborough, 30 N. by W. of Wiscasset, 40 north-east of New-Gloucester, and 195 N. by E. of Boston. *Hallowell Hook* lies on the same side of the river, three miles below the town, and five north of Pittston. The whole township contains 1194 inhabitants.—*ib.*

HAMBATO, a principal asiento or jurisdiction in the province of Quito, in Peru. It is situated in 1° 41′ S. lat. and 12 miles west of the city of Quito; and has 6 small villages in its dependence. It contains about 18,000 inhabitants, who are mostly employed in weaving stuffs, and in knitting.—*ib.*

HAMBDEN, or *Hamden*, a township in New-York State, bounded north by land ceded to Massachusetts, south by the north line of Pennsylvania, and east by Sidney. Susquehannah river passes in a west course through both towns. The centre of the town lies 13 miles W. by S. of the mouth of Chenengo river.—*ib.*

HAMBURG, a small post town of New-Jersey, 18 miles from Goshen in New-York, and 20 from Newtown or Sussex court house.—*ib.*

HAMBURG, a handsome town in Burke's county, Pennsylvania, seated on the east side of Schuylkill. Here are about 50 or 60 houses, a German Lutheran and Calvinist church united. It is 18 miles N. by W. of Reading, and 70 north-north-west of Philadelphia. North lat. 40° 34′, west long. 76°.—*ib.*

HAMDEN, a township in New-Haven county, Connecticut, about eight miles north of New-Haven city.—*ib.*

HAMILTON, a cape on the north end of Newfoundland island —*ib.*

HAMILTON. There are three townships of this name in Pennsylvania; one in each of the counties of York, Franklin, and Northampton.—*ib.*

HAMILTON, a settlement in Vermont on the Canada line.—*ib.*

HAMILTON, in Herkemer county, New-York, a township 12 miles square, 20 south of old Fort Schuyler, a level township of good land, fast settling.—Oriskè or Olhiske creek, a water of Mohawk, and Chenung, a water of Susquehannah, rise in this township. In 1796 there were 1202 inhabitants, of whom 196 were electors.—*ib.*

HAMILTON, a town or settlement lately laid out in Albany county, New-York, in the extensive township of Water Vliet, formerly called the *Glass Factory;* and has its present name in honour of that great patron of American manufactures, the late secretary of the treasury of the United States of America. It lies 10 miles west of Albany, two miles from the Schenectady road; and is one of the most decisive efforts of private enterprize in the manufacturing line, as yet exhibited in the United States. The glass manufactury is now so well established, and so happily situated for the supply of the northern and western parts of the State of New-York, as well as Vermont and Canada, that it is to be expected the proprietors will be amply rewarded for their great and expensive exertions. The glass is in good reputation. Here are two glass houses, and various other buildings, curious hydraulic works, to save manual labour, by the help of machinery. A copious stream runs through the heart of the settlement which lies high; and being surrounded by pine plains, the air is highly salubrious. The great Schoharie road traverses the settlement. A spacious schoolhouse, and a church of an octagon form are soon to be erected.

In the neighbourhood of these glass works, a block was cut out of an ancient tree, not many years ago, containing evident marks of an axe or some edge tool, made 185 years ago, determined according to the usual and certain mode of ascertaining the age of trees. The block is preserved in Albany as a curiosity. Henry Hudson ascended the river which bears his name, as high as Albany, in the autumn of 1609, 187 years ago, and these marks were probably made by some of his men.—*ib.*

HAMILTON FORD lies near the mouth of Bullock's Creek in North-Carolina. This was the route pursued by Tarleton, after his defeat at Cowpens, in January, 1781.—*ib.*

HAMILTON, a district in the State of Tennessee, situated on the waters of the Holston and Clinch; bounded south by Tennessee river, and separated from Mero district on the west by an uninhabited country. It contains the counties of Knox, Jefferson, Blount, Sevier and Grainger.—*ib.*

HAMILTON, a county of the N. W. Territory, erected Jan. 2, 1790, "beginning on the bank of the Ohio river, at the confluence of the Little Miami; and down the said Ohio river to the mouth of the big Miami, and up said Miami to the Standing Stone Forks, or branch of said river; and thence with a line to be drawn due E. to the Little Miami, and down said little Miami river, to the place of beginning."—*ib.*

HAMILTON FORT, stands on the east side of the Great Miami, in the N. W. Territory; 25 miles south of Fort St. Clair, and 25 north of Cincinnati. It is a stockaded fort, capable of containing 200 men. The situation is as advantageous for defence as pleasing to the eye. It is built upon a narrow neck of land, commanding the Miami on the north-west, and a praire and sheet of water on the north-east, about a mile wide, and 2¼ miles long. The soil near it is rich and fertile; and forage may be got by repeated mowings of natural grass.—*ib.*

HAMILTON, a port in the Bermuda Islands.—*ib.*

HAMMEL'S TOWN, a town in Dauphine county, Pennsylvania, five miles from Susquehannah river, and 85 from Philadelphia. It contains a German church, and about 35 dwelling houses.—*ib.*

HAMPSHIRE, an extensive, populous, and wealthy county in Massachusetts, made a shire in 1662. It is in many parts mountainous and hilly, and extends across the State from north to south; bounded north by the States of New-Hampshire and Vermont, south by the State of Connecticut, east by Worcester county, and west by Berkshire. It contains 60 townships, 9181 houses, 9617 families, and 59,681 inhabitants. Its principal towns lie on both sides of Connecticut river, which intersects it from north to south. These are Springfield, West Springfield, Northampton, Hadley, Hatfield, Deerfield, and Northfield. It is generally of a fertile soil, and produces the necessaries of life, and some of its luxuries in great plenty.—*ib.*

HAMPSHIRE, a county in Virginia, bounded N. and N. W. by the Patowmack river, which divides it from the State of Maryland. It is about 60 miles long and 50 broad, and contains 7346 inhabitants, including 454 slaves. It is well watered by Patowmack and its south branch. Iron ore and coals have been discovered on the banks of this river. Chief town, Romney.—*ib.*

HAMPSTEAD, a town in Rockingham county, New-Hampshire, about 34 miles westerly of Portsmouth. It was incorporated in 1749, and contained in 1775, 768 inhabitants; in 1790, 724.—*ib.*

HAMPSTEAD, a town on Long Island, New-York, nine miles easterly of Jamaica, and 23 miles eastward of New-York city. In this town is an extensive and remarkable plain called *Hampstead Plain.*—*ib.*

HAMPSTEAD, a village in Georgia, about four miles from Savannah, and about a mile from another village called Highgate. The inhabitants are gardeners, and supply the town with greens, pot herbs, roots, &c.—*ib.*

HAMPTON, a township in Windham county, Connecticut, three miles north-east of Windham, of which it was formerly a parish, but lately incorporated.—*ib.*

HAMPTON, EAST, a township in Hampshire county, Massachusetts, containing 457 inhabitants, and situated 105 miles west of Boston. It was incorporated in 1785.—*ib.*

HAMPTON, EAST, on the east end of Long-Island, (New-York) a half shire town of Suffolk county. It has 3260 inhabitants; and in it is Clinton Academy, which in 1795 had 92 students.—*ib.*

HAMPTON, a township on the sea coast of New-Hampshire,

Hampshire, on the eastern side of Rockingham county, and called *Winicumet* by the Indians. It was settled under Massachusetts, and incorporated in 1638. In 1775 it contained 862 inhabitants, and in 1790, 853. It is 12 or 14 miles S. by W. of Portsmouth, and 8 south-east of Exeter. In 1791, a canal was cut through the marshes in this town, which opens an inland navigation from Hampton through Salisbury into Merrimack river for about eight miles; loaded boats may pass through it with ease and safety.—*ib.*

HAMPTON FALLS, a small town taken from the above town, lying on the road which leads from Exeter to Newbury-Port, six miles south easterly of the former, and eight northerly of the latter. In 1775 it contained 645, and in 1790, 541 inhabitants. It was incorporated in 1712.—*ib.*

HAMPTON, a township in the northern part of Washington county, New-York, having Skeensborough on the west. It has 463 inhabitants, of whom 107 are electors.—*ib.*

HAMPTON, the capital of Elizabeth county, in Virginia, also a port of entry, and post town, situated at the head of a bay which runs up north from the mouth of James river, called *Hampton Road*, five miles northwest of Point Comfort. It contains about 30 houses, an episcopal church, a court-house and gaol. The value of its exports of grain, lumber, staves, &c. amounted to 41,997 dollars in one year, ending September 30, 1794. This town was anciently called *Kecoughton* by the Indians. It is 18 miles north of Norfolk, 22 south-east of Yorktown, 93 east-south east of Richmond, and 205 W. by S. of Philadelphia.—*ib.*

HANCES, HANCHES, HAUNCHES, or *Hanses*, in architecture, are certain small intermediate parts of arches between the key or crown and the spring at the bottom, being perhaps about one-third of the arch, and situated nearer the bottom than the top or crown; and are otherwise called the *spandrels*. See ARCH in this *Supplement*.

HANCOCK's HARBOUR, called by the Indians *Clioquot*, is situated about 20 leagues east-south-east of Nootka, in N. lat. 48° 30′, west long. from Greenwich 125° 26′. The entrance of this harbour is about five miles in length, and has good anchorage; about it are scattered a number of islands, and several sand-banks or spits. It has also a number of fine coves. The land round the harbour is generally uneven, rocky and mountainous; covered however with pine, fir, spruce, cedar, hemlock, cypress and other trees of a remarkable size. The climate here is much milder than in the same latitude on the eastern side of the continent; the frost in winter being seldom so severe as to prevent vegetation. An easterly wind is considered here is a prognostic of a storm, and west winds bring fair weather. Deer, racoons, wolves, bears, squirrels, martins, land otters, beaver, and wild cats are the animals which inhabit the forests. The amphibious animals are the common seal, and the sea-otter. The skin of the latter is very valuable. The inhabitants are said to be cannibals. This and other places of the same name have their appellation in honour of the late Governor Hancock, of Massachusetts.—*Morse.*

HANCOCK, a river of Washington island, on the north-west coast of North-America, called *Masheet* by the Indians, discovered by Captain Crowell in 1791. It empties into the sea from the north end of the largest island. At its mouth it is nearly two and a half nautical miles wide; and a considerable size ten miles up. It has at its mouth five fathoms water, gradually increasing in breadth; and for 7½ miles up, to Goose Island, has not less than ten fathoms. Captain Ingraham examined it about 12 miles; but by the information of the natives, he judged that it communicates with Skitikiss Bay, or near it, on the east side of the islands. It is by far the most eligible for a new settlement of any place the Captain had seen on the coast. The land is low and apparently very fertile: and the river abounds with salmon. Were a good house erected on some of the pleasant spots it would have every appearance of being long settled. Beautiful bushes and grass occupy the skirts of the woods. The mouth of the river is in north lat. 54° 7′, west long. 131° 54′.—*ib.*

HANCOCK, a township in Addison county, Vermont. —*ib.*

HANCOCK, a large maritime county of the District of Maine, bounded north by Lower Canada, south by the ocean, east by Washington county, and west by Lincoln county. It is 190 miles long from north to south, and nearly 60 broad. It contains 24 townships and plantations; of which Penobscot and Castine are the chief. The number of inhabitants is greatly increased since 1790. At that time there were 9549 souls. It is remarkably well watered by Penobscot river, and its branches, Union river, and other smaller streams. The northern part of the county sends its waters in one stream from numerous branches in a N. E. course to St. John's river. On the sea-coast are many harbours and inlets, hid by a multitude of fertile islands; the largest of these in a S. W. direction from Goldsborough, are Mount Desart, Swan Isles, Vinal Haven, Haut Isle, Deer and Islesborough, all situated in Penobscot Bay. Great part of the county is yet unsettled. The towns along the sea coast, and on the banks of Penobscot and Union rivers, are the most fertile and populous. Castine is the shire town.—*ib.*

HANCOCK, a township in Lincoln county, Maine, embosomed by the Kennebeck and Sebasticook rivers, bounded N. W. by Canaan, and 7 miles north of the confluence of the two rivers. It contains 278 inhabitants.—*ib.*

HANCOCK, a township in Hillsborough county, New-Hampshire, situated between two western branches of Contoocook river, 14 miles east of Keene, and between 60 and 70 W. by S. of Portsmouth. It was incorporated in 1779, and contains 634 inhabitants. —*ib.*

HANCOCK, a long, narrow and mountainous township on the New-York line, in Berkshire county, Massachusetts, having the towns of Lanesborough and Partridgefield on the northward, and Pittsfield on the S. It was incorporated in 1776, has 1211 inhabitants, and lies 20 miles N. by W. of Lenox, and 150 W. of Boston.—*ib.*

HANCOCK, a small post town of Maryland, situated in Washington county, on the N. bank of Patowmack river, between Conolowy and Little Conolowy creeks, about 25 miles S. E. of Bedford in Pennsylvania, 34 N. E. of Old Town in Maryland, and 119 N. W. of Baltimore.—*ib.*

HANCOCK, a new county in the upper diſtrict of Georgia.—*ib.*

HANNAH BAY *Houſe*, a factory of the Hudſon's Bay Company, at the ſouth end of James' Bay in North America, and on the eaſtern ſide of Harricanaw river, 45 miles E. by S. of Mooſe Fort, and 18 below a houſe on the ſame river.—*ib.*

HANNAH'S TOWN, in Weſtmoreland county, Pennſylvania, 4 miles N. N. E. of Greenſburg, and on the road from Bedford to Pittſburg; 54 miles N. W. by W. of the former, and 26 eaſt of the latter.—*ib.*

HANNIBAL, a military townſhip in the State of New-York, on Lake Ontario, 10 miles S. by W. of Fort Oſwego.—*ib.*

HANOVER, a bay in the ſea of Honduras, ſituated on the eaſt ſide of the peninſula of Yucatan, from which it receives the waters of the Rio Honde. The tract of land between the river Honde and the Balize was ceded by the Spaniſh king to the king of Great Britain, at the peace of 1783, for the purpoſe of cutting and carrying away logwood.—*ib.*

HANOVER, a townſhip in Luzerne county, Pennſylvania. Alſo a townſhip in Waſhington county. Eaſt and Weſt Hanover, are two townſhips in Dauphine county in the ſame State.—*ib.*

HANOVER, or *M'Alliſter's Town*, a poſt town in York county, Pennſylvania, ſituated between Cadorus creek, and a branch of Little Conewago, which flows into the Suſquehannah. It contains nearly 300 dwelling houſes, and a German and Lutheran church. It is 7 miles north of the Maryland line, 18 miles ſouth-weſt of York, and 106 W. by S. of Philadelphia.—*ib.*

HANOVER, a townſhip in Plymouth county, Maſſachuſetts, 25 miles S. E. from Boſton, was incorporated in 1727, and contains 1,083 inhabitants.—*ib.*

HANOVER, a poſt-town of New-Hampſhire, ſituated on the eaſt ſide of Connecticut river in Grafton county. *Dartmouth College*, in this town, is ſituated on a beautiful plain, about half a mile, from the river, in 43° 43′ N. lat. and in 72° 14′ W. long. from Greenwich. It derives its name from William Earl of Dartmouth, one of its principal benefactors, and was founded in the year 1769 by the late Dr Eleazer Wheelock. The funds of the college conſiſt chiefly of lands, amounting to about 80,000 acres, which are increaſing in value in proportion to the growth of the country; 1,200 acres lie contiguous to the college; and are capable of the beſt improvement; 12,000 lie in Vermont. A tract of 8 miles ſquare was granted by the aſſembly of New-Hampſhire in 1789. The revenue of the college ariſing from the lands, in 1793, amounted annually to £140. By contracts then made, they would amount, in four years after, to £450; and in 12 years, to 650. The income from tuition is about £600 per annum. The number of under-graduates is, on an average, from 150 to 180. A grammar ſchool of about 50 or 60 ſcholars is annexed to the college. The ſtudents are under the immediate government and inſtruction of a preſident, who is alſo profeſſor of hiſtory, a profeſſor of mathematics, and natural philoſophy, a profeſſor of languages, and two tutors. The college is furniſhed with a handſome library and a philoſophical apparatus tolerably complete. A new college edifice of wood, 150 by 50 feet, and three ſtories high, was erected in 1786, containing 36 rooms for ſtudents. Its ſituation is elevated, healthful and pleaſant, commanding an extenſive proſpect to the weſt. There are three other public buildings, belonging to the college, and a handſome congregational meeting houſe has lately been erected, in which the commencement exerciſes are exhibited. It is 32 miles north of Charleſton, 115 N. W. by W. of Portſmouth, 138 N. W. of Boſton, and 378 N. E. by N. of Philadelphia.—*ib.*

HANOVER, a townſhip in Morris county, New-Jerſey. In a ridge of hills in this townſhip are a number of wells, 40 miles from the ſea in a ſtraight line, which regularly ebb and flow about 6 feet twice in every 24 hours. It is about 16 miles N. W. of Elizabeth-Town, and joins upon Morriſtown.—*ib.*

HANOVER, a county of Virginia, lying between Pamunky and Chickahominy rivers. Its length is about 48 miles, and its breadth 22; and contains 14,754 inhabitants, including 8,223 ſlaves. It abounds with lime-ſtone.—*ib.*

HANOVER, a ſmall town of Virginia, of the above county, ſituated on the weſt ſide of the Pamunky, in which is an academy. It is 6 miles from Newcaſtle, 22 N. E. by E. of Richmond, and 110 N. N. W. of Waſhington city.—*ib.*

HANSPIKE, or HANDSPEC, a lever or piece of ſtrong wood, for raiſing by the hand great weights, &c. It is five or ſix feet long, cut thin and crooked at the lower end, that it may get the eaſier between things that are to be ſeparated, or under any thing that is to be raiſed. It is better than a crow of iron, becauſe its length allows a better poiſe.

HANTS, a county of Nova-Scotia, beginning about 30 miles from Halifax, contains the townſhips of Windſor, Falmouth, and Newport; ſeveral valuable tracts remain unſettled. The road from Halifax runs part of the way between Windſor and Newport, and has ſettlements on it at ſmall diſtances. The county is about 20 miles ſquare, and is well watered. The rivers St. Croix, Kenetcoot, and Cocmiguen empty into the Avon, and are all navigable except the laſt. The Cacaguet and Cobeguit are navigable 40 miles for veſſels of 60 tons.—*Morſe.*

HARDIN, a new county in the State of Kentucky, bounded N. E. by Waſhington and Lincoln, N. W. and W. by Nelſon and Greene, and S. E. by Logan counties.—*ib.*

HARDWICK, a townſhip in Caledonia county, in Vermont.—*ib.*

HARDWICK, a townſhip in Worceſter county, Maſſachuſetts, 25 miles N. W. of Worceſter, and 70 S. W. of Boſton. It is ſeparated from New-Braintree and Ware by Ware river. There are within this town 245 houſes, 1,725 inhabitants, 5 corn and 4 ſaw mills, and two clothiers' works.—*ib.*

HARDWICK, a townſhip in Suſſex county, New-Jerſey, nearly 10 miles S. W. of Newton.—*ib.*

HARDWICK, a ſmall town of Georgia, at the mouth of Ogeeche river, and about 18 miles S. by W. of Savannah. It has lately been made a port of entry.—*ib.*

HARDY, a county of Virginia, bounded north by Hampſhire. It is about 60 miles long, and 40 in breadth, and contains 7,336 inhabitants, including 369 ſlaves. Chief town, Moorfield.—*ib.*

HARDYSTON, a townſhip in Suſſex county, New-Jerſey, containing 2,393 inhabitants, including 26 ſlaves.—*ib.*

HARFORD *County*, in Maryland, is bounded north by York county in Pennſylvania; eaſt by Suſquehannah river and Cheſapeak Bay. The chief waters within the county are Buſh river and Deer creek; on which are 16 mills of different kinds. On the former and its branches are the towns of Harford, Abington, Coopſtown, and Belle-Air. The other towns are Havre de Gras at the mouth of Suſquehannah, and Joppa below the forks of Gunpowder.

It contains 14,976 inhabitants, including 3,417 ſlaves. Chief town, Belle-Air.—*ib.*

Harford, or *Buſh-town*, in Harford county, Maryland, lies at the head of the tide waters of Buſh river, between Binam's and James's runs; the former ſeparating it from Abington. It has few houſes, and is falling to decay ſince the courts of juſtice have been removed to Belle-Air. It is 9 miles S. E. of Belle-Air, and 25 N. E. by E. of Baltimore.—*ib.*

HARLEM, a townſhip in Lincoln county, Maine, incorporated in 1796. It was formerly called *Jones's Plantation.*—*ib.*

Harlem, or *Eaſt River*, a river which connects Long-Iſland Sound with North, or Hudſon river, and forms York-Iſland.—*ib.*

Harlem, a diviſion of New-York county in the northern part of York-Iſland, which contains 803 inhabitants, including 189 ſlaves. The village of its name ſtands 9 miles northerly of New-York city, and 4 S. W. of Weſt-Cheſter. It is oppoſite to the weſt end of Hell Gate.—*ib.*

HARMAN's *Station*, in Kentucky, is a fort on the eaſt ſide of the weſt branch of Big Sandy river. On the oppoſite ſide of this branch is the Great Salt ſpring. Harman's Station is about 20 miles ſouth of Vancouver's fort.—*ib.*

HARMAR, a well conſtructed fort in the N. W. Territory, ſituated at the mouth of the Muſkingum. It has 5 baſtions, and 3 cannon mounted, and is garriſoned by 4 companies. It is conveniently ſituated to reinforce any of the poſts up or down the river Ohio. The place is remarkably healthy.—*ib.*

HARMONY, a village in Luzerne county, Pennſylvania, cloſe on the line of New-York, on the north ſide of Starucca creek, a water of the eaſt branch of Suſquehannah river. Between this and Stockport on Delaware river, diſtant 18 miles E. S. E. there is a portage. It is about 140 miles N. by W. of Philadelphia, and 130 N. W. of New-York. N. lat. 41° 58'.—*ib.*

HARPATH, a ſmall boatable river in Tenneſſee, which, after a N. N. W. courſe of about 40 miles, falls into Cumberland river, 19 miles N. W. of Naſhville.—*ib.*

HARPERSFIELD, a townſhip in Otſego county, in New-York, bounded S. W. by Unadilla townſhip, and 32 miles S. E. of Cooperſtown; 155 of its inhabitants are electors. Through this town runs the great poſt-road from Hudſon to Williamſburgh, 62 miles weſt of Hudſon city.—*ib.*

HARPLE, a townſhip in Delaware county, Pennſylvania.—*ib.*

HARPSWELL, a townſhip in Cumberland county, Diſtrict of Maine, incorporated in 1758, and contains 1071 inhabitants. It is bounded eaſterly by Georgetown; from which it is ſeparated by a navigable river. The people here are opening a communication by a canal between the waters of Kennebeck river and thoſe of Caſco Bay, through the arm of the ſea called Stevens's river. The point called Merryconeag, projecting itſelf into the bay together with the iſland Sebaſcodeagan, and ſeveral other ſmall iſlands, are incorporated and form this townſhip. The waters round this iſland extend to within two miles of the waters of the Kennebeck, and thus form what is called ſmall Point.—*ib.*

HARRINGTON, a townſhip in Bergen county, New-Jerſey.—*ib.*

HARRIOT (Thomas) was a very eminent mathematician of the 16th and 17th centuries, of whom ſome account has been given in the *Encyclopædia.* In that article it has been ſhewn, that Des Cartes had ſeen ſome improvements of Harriot's in algebra, and publiſhed them to the world as his own; but this piece of plagiariſm has been more completely proved in the Aſtronomical Ephemeris for the year 1788, by Dr Zach, aſtronomer to the Duke of Saxe-Gotha; who likewiſe ſhews that Harriot was an aſtronomer as well as an algebraiſt.

"I here preſent to the world (ſays the Doctor) a ſhort account of ſome valuable and curious manuſcripts, which I found in the year 1784 at the ſeat of the earl of Egremont, at Petworth in Suſſex.

"A predeceſſor of the family of lord Egremont, viz. that noble earl of Northumberland, named Henry Percy, was not only a generous favourer of all good learning, but alſo a patron and Mæcenas of the learned men of his age. Thomas Harriot, the author of the ſaid manuſcripts, Robert Hues (well known by his Treatiſe upon the Globes), and Walter Warner, all three eminent mathematicians, who were known to the earl, received from him yearly penſions; ſo that when the earl was committed priſoner to the Tower of London in the year 1606, our author, with Hues and Warner, were his conſtant companions: and were uſually called the earl of Northumberland's three Magi.

"Thomas Harriot is a known and celebrated mathematician among the learned of all nations, by his excellent work. *Artis Analyticæ Praxis, ad æquationes algebraicas nova expedita & generali methodo, reſolvendas, Tractatus poſthumus:* Lond. 1631: dedicated to Henry earl of Northumberland; publiſhed after his death by Walter Warner. It is remarkable, that the fame and the honour of this truly great man were conſtantly attacked by the French mathematicians, who could not endure that Harriot ſhould in any way diminiſh the fame of their Vieta and Des Cartes, eſpecially the latter, who was openly accuſed of plagiariſm from our author.

"Des Cartes publiſhed his Geometry ſix years after Harriot's work appeared, viz. in the year 1637. Sir Charles Cavendiſh, then ambaſſador at the French court at Paris, obſerved to the famous geometrician Roberval, that theſe improvements in analyſis had been already made theſe ſix years in England, and ſhewed him afterwards Harriot's *Artis Analyticæ Praxis*; which, Harriot. as Roverval was looking over, at every page he cried out, *Oui! oui! il l'a vu! Yes! yes! he has seen it!* Des Cartes had also been in England before Harriot's death, and had heard of his new improvements and inventions in analysis.

"Now all this relates to Harriot the celebrated analyst; but it has not hitherto been known that Harriot was an eminent astronomer, both theoretical and practical, which first appears by these manuscripts; among which, the most remarkable are 199 observations of the sun's spots, with their drawings, calculations, and determinations of the sun's rotation about his axis. There is the greatest probability that Harriot was the first discoverer of these spots, even before either Galileo or Scheiner. The earliest intelligence we have of the first discovered solar spots is of one Joh. Fabricius Phrysius, who in the year 1611 published at Wittemberg a small treatise, intitled, *De Maculis in Sole observatis & apparente eorum cum Sole conversione narratio.* Galileo, who is commonly accounted the first discoverer of the solar spots, published his book, *Istoria e Dimonstrazioni intorne alle Machie Solare e loro accidenti*, at Rome in the year 1613. His first observation in this work is dated June 2d 1612. Angelo de Filiis, the editor of Galileo's work, who wrote the dedication and preface to it, mentions, page 3. that Galileo had not only discovered these spots in the month of April in the year 1611, at Rome, in the Quirinal Garden, but had shewn them several months before (*molti-mesi inanzi*) to his friends in Florence; and that the observations of the disguised Apelles (the Jesuit Scheiner, a pretender to this first discovery) were not later than the month of October in the same year; by which the epoch of this discovery was fixed to the beginning of the year 1611. But a passage in the first letter of Galileo's works, pa. 11. gives a more precise term to this discovery. Galileo there says in plain terms, that he had observed the spots in the sun 18 months before. The date of this letter is May 24. 1612; which brings the true epoch of this discovery to the month of November 1610. However, Galileo's first produced observations are only from June 2. 1612, and those of father Scheiner of the month of October in the same year. But now it appears from Harriot's manuscripts, that his first observations of these spots are of Dec. 8. 1610. It is not likely that Harriot could have this notice from Galileo, for I do not find this mathematician's name ever quoted in Harriot's papers: But I find him quoting book i. chap. 2. of Joseph a Costa's *Natural and Moral History of the West Indies;* in which he relates, that in Peru there are spots to be seen in the sun which are not seen in Europe: and hence it is probable, that Harriot took the hint of looking for such spots. Besides, it is not unlikely, that living with so munificent a patron, Harriot got from Holland the new invented telescopes much sooner than they could reach Galileo, who at the time lived at Venice. Harriot's very careful and exact observations of these spots, shew also that he was in possession of the best and most improved telescopes of that time; for it appears he had some with magnifying powers of 10, 20, and 30 times. At least there are no earlier observations of the solar spots extant than his; they run from December 8. 1610, till January 18. 1613. I compared the corresponding ones with these observed by Galileo, between which I found an exact agreement. Had Harriot had any notion about Galileo's discoveries, he certainly would have also known something about the phases of Venus and Mercury, and especially about the singular shape of Saturn, first discovered by Galileo; but I find not a word in all his papers concerning the particular figure of that planet.

"I found likewise, (continues Dr Zach) among the papers of Harriot a large set of observations on the satellites of Jupiter, with drawings of them, their positions, and calculations of their revolutions and periods. His first observation of those discovered satellites, I find to be of January 16. 1610; and they go till February 26. 1612. Galileo pretends to have discovered them January 7. 1610; so that it is not improbable that Harriot was likewise the first discoverer of these attendants of Jupiter.

"Among his other observations of the moon, of eclipses, of the planet Mars, of solstices, of refraction, of the declination of the needle, &c. there are remarkable ones of the comet of 1607, and the latter comet (for there were two) of 1618. They were all observed with a cross-staff, by measuring their distances from fixed stars; whence these observations are the more valuable, as comets had before been but grossly observed. Kepler himself observed the comet of 1607 only with the naked eye, pointing out its place by a coarse estimation, without the aid of an instrument; and the elements of their orbits could, in defect of better observations, be only calculated by them. The observations of the comet of the year 1607 are of the more importance, even now for modern astronomy, as this is the same comet that fulfilled Dr Halley's prediction of its return in the year 1759. That prediction was only grounded upon the elements afforded him by these coarse observations; for which reason he only assigned the term of its return to the space of a year. The very intricate calculations of the perturbations of this comet, afterwards made by M. Clairaut, reduced the limits to a month's space. But a greater light may now be thrown upon this matter by the more accurate observations on this comet by Mr Harriot. In the month of October 1785, when I conversed upon the subject of Harriot's papers, and especially on this comet, with the celebrated mathematician M. de la Grange, director of the Royal Academy of Sciences at Berlin, he then suggested to me an idea, which, if brought into execution, will clear up an important point in astronomy. It is well known to astronomers how difficult a matter it is to determine the mass, or quantity of matter, in the planet Saturn; and how little satisfactory the notions of it are that have hitherto been formed. The whole theory of the perturbations of comets depending upon this uncertain datum, several attempts and trials have been made towards a more exact determination of it by the most eminent geometricians of this age, and particularly by la Grange himself; but never having been satisfied with the few and uncertain data heretofore obtained for the resolution of this problem, he thought that Harriot's observations on the comet of 1607, and the modern ones of the same comet in 1759, would suggest a way of resolving the problem *à posteriori;* that of determining by them the elements of its ellipsis. The retardation of the comet compared to its period, may clearly be laid to the account of the attraction and perturbation it has

has suffered in the region of Jupiter and Saturn; and as the part of it belonging to Jupiter is very well known, the remainder must be the share which is due to Saturn; whence the mass of the latter may be inferred. In consequence of this consideration, I have already begun to reduce most of Harriot's observations of this comet, in order to calculate by them the true elements of its orbit on an elliptical hypothesis, to complete M. de la Grange's idea upon this matter.

"I forbear to mention here any more of Harriot's analytical papers, which I found in a very great number. They contain several elegant solutions of quadratic, cubic, and biquadratic equations; with some other solutions and *loca geometrica*, that shew his eminent qualifications, and will serve to vindicate them against the attacks of several French writers, who refuse him the justice due to his skill and accomplishments, merely to save Des Cartes's honour, who yet, by some impartial men of his own nation, was accused of public plagiarism."

HARRISBURG, a post-town, and the capital of Dauphine county, Pennsylvania, is situated on the N. E. bank of Susquehannah river. It is laid out regularly, and contains about 300 houses; of which several are neat and convenient; some of brick and others of stone. In 1789, it contained 130 houses, a stone gaol, and a German church. At that period it had been settled about 3 years. It is 107 miles W. N. W. of Philadelphia, 53 W. S. W. of Reading, and 17 E. N. E. of Carlisle. N. lat. 40° 16′.—*Morse*.

HARRISON, a township in West-Chester county, New-York, containing 1004 inhabitants; of whom 115 are electors, and 54 slaves.—*ib.*

HARRISON, a county in the western part of Virginia, bounded N. by Ohio county, N. E. by Monongalia, S. by Greenbriar, and S. W. by Kenhawa. Its length is about 120 miles, its breadth 80; and the number of inhabitants 2,080, including 67 slaves. Chief town Clarksburg.—*ib.*

HARRISON, a new county in the N. E. part of the State of Kentucky, N. of Bourbon.—*ib.*

HARRODSBURG, or *Harrodstown*; a post-town in Mercer county, Kentucky, at the head of Salt river, which contains about 20 houses, and is 10 miles S. W. of Danville, 30 S. by W. of Frankfort, and 825 S. W. of Philadelphia.—*ib.*

HARTFORD, a township in Windsor county, Vermont, on Connecticut river, opposite the town of Lebanon, in New-Hampshire. It contains 988 inhabitants.—*ib.*

HARTFORD, a township on the east bank of Genessee river, in New-York State, 40 miles W. of Geneva, and 67 S. E. by E. of Fort Niagara.

HARTFORD, a fertile and populous, though hilly county, in Connecticut, bounded N. by the State of Massachusetts; S. by part of Middlesex and New-Haven counties; E. by Tolland, and W. by Litchfield county. It is about 34 miles from N. to S. and its greatest breadth from E. to W. is 30 miles. It is divided into 15 townships, and contains 38,029 inhabitants, including 263 slaves. Chief town, Hartford city.—*ib.*

HARTFORD *City*, the capital of Connecticut, lies on the west bank of Connecticut river, in the county and township of its own name, 50 miles north-westerly from the mouth of the river, at Saybrook Bar, in Long Island Sound; and thus far the tide flows. The township is 6 miles square, bounded N. by Windsor, N. E. by East-Windsor, W. by Farmington, E. by East-Hartford, S. E. by Glastenbury, and S. by Wethersfield. The town is divided by a small stream called Little River, with high romantic banks, over which is a bridge connecting the two divisions of the town. The city is regularly laid out, the streets intersecting each other at right angles. Its buildings are an elegant state-house, lately built, 2 churches for Congregationalists, 1 for Episcopalians, and between 400 and 500 dwelling-houses; a number of which are handsomely built with brick. The inhabitants amount to upwards of 4,000. A bank was incorporated in 1792, with 100,000 dollars capital, number of shares 250. The corporation have the power to extend their capital to 500,000 dollars. A woollen manufactory was established here and encouraged by the State, but has not succeeded. The town is advantageously situated for trade, has a fine back country, enters largely into the manufacturing business, and is a rich, flourishing, commercial town.

This town was first settled in the year 1636, by Mr Haynes and Mr Hooker, who, with their adherents, removed from Massachusetts. The Dutch had then a trading house at the confluence of Mill and Connecticut rivers. They soon relinquished the settlement, and their lands were confiscated by a commission from the Commonwealth of England in 1653. A point of land, which formed part of their possessions, is still called Dutch Point. It is 40 miles N. E. by N. of New-Haven, 55 N. W. of New-London, 124 S. W. of Boston, 128 N. E. of New-York, 223 N. E. of Philadelphia, 502 from Richmond, 376 from Washington city, 1044 from Augusta, and 1018 from Frankfort in Kentucky. N. lat. 41° 44′, W. long. 73° 4′.—*ib.*

HARTLAND, a township of Connecticut, the north-easternmost in Litchfield county.—*ib.*

HARTLAND, a township in Windsor county, Vermont, situated on the west bank of Connecticut river, 11 miles below the 15 mile Falls.—*ib.*

HARVARD, a township in the eastern part of Worcester county, Massachusetts, 23 miles N. E. of Worcester, and 35 north easterly of Boston. It was incorporated in 1732, by this name, in honour of the founder of Harvard University in Cambridge. It has 1400 inhabitants.—*ib.*

HARWICH, a township on Cape Cod, in Barnstable county, Massachusetts, lying between Yarmouth and Chatham, about 88 miles S. E. of Boston, containing 2392 inhabitants. It extends quite across the cape, which is here about 6 miles over. Their marine business lies chiefly in the fishery. The remains of the Indians of this township are only 6 or 7 souls. They live at *Potanumaquut*.—*ib.*

HARWICH, a township in Rutland county, Vermont, containing 165 inhabitants.—*ib.*

HARWINGTON, a post town of Connecticut, in Litchfield county, 8 miles E. of Litchfield, and 24 W. by N. of Hartford.—*ib.*

HASSELQUIST (Frederick) was born in the province of East Gothland in 1722, and studied medicine and botany in the university of Upsal. Linnæus had in his lectures represented the extraordinary merits and

Hasselquist. and great celebrity which a young student might obtain by travelling through Palestine, and by inquiring into and describing the natural history of that country, which was till then unknown, and had become of the greatest importance to interpret the bible, and to understand eastern philology. Hasselquist was fired with ambition to accomplish an object so important in itself, and so warmly recommended by his beloved master. There being no fund arising from the liberality of the crown, private collections were made, which poured in very copiously, especially from the native country of the young traveller. All the faculties of the university of Upsal also granted him a stipend.

Thus protected, he commenced his journey in the summer of 1749. By the interference of Lagerstroem, he had a free passage to Smyrna in one of the Swedish East Indiamen. He arrived there at the conclusion of the year, and was received in the most friendly manner by Mr A. Rydel, the Swedish consul. In the beginning of 1750 he set out for Egypt, and remained nine months at Cairo the capital. Hence he sent to Linnæus, and to the learned societies of his country, some specimens of his researches. They were published in the public papers, and met with the greatest approbation; and upon the proposition of Dean Baeck and Dr Wargentin, secretary of the Royal Academy of Sciences, a collection of upwards of 10,000 dollars in copper money was made for the continuance of the travels of young Hasselquist. Counsellors Lagerstroem and Nordencrantz were the most active in raising subscriptions at Stockholm and Gothenburgh. In the spring of 1751, he repaired to his destination, and passed through Jaffa to Jerusalem, Jericho, &c. He returned afterwards through Rhodus and Scio to Smyrna. Thus he fulfilled all the expectations of his country, but he was not to reap the reward of his toils. The burning heat of the sandy deserts of Arabia had affected his lungs; he reached Smyrna in a state of illness, in which he languished for some time, and died February 9. 1752, in the 30th year of his age.

The fruits of his travels were, however, preserved through the liberality of a great princess. He had been obliged to contract debts. The Turks, therefore, seized upon all his collections, and threatened to expose them to public sale. The Swedish consul prevented it. He sent, with the intelligence of the unhappy exit of his countryman, an account of the distresses under which he died;—and at the representation of Dean Baeck, Queen Louisa Ulrica granted the sum of 14,000 dollars in copper specie to redeem all his collections. They arrived afterwards in good preservation at Stockholm; consisting of a great quantity of antiques, Arabian manuscripts, shells, birds, serpents, insects, &c. and were kept in the cabinets at Ulrichsdale and Drottningholm. The specimens of the natural curiosities of these museums being double or treble in number, Linnæus obtained some of them, and published the voyage of his ill-fated friend, and honoured his memory with a plant, which he called from his name *Hasselquistia*. Hasselquista, *Encycl.*

Hat-making. HAT-MAKING is a mechanical process, which is detailed in the *Encyclopædia* from the best information that could then be obtained. We have lately learned, however, that our detail is sometimes defective, and sometimes erroneous; and it is our duty to supply those defects, and to correct these errors. But, strangers as we are to the business of hat-making, we should not perhaps have suspected, that we had been misled by the persons whom we consulted, had we not been informed by a very intelligent writer in Nicholson's Philosophical Journal, that the account of the manufacturing of hats, which is given in the *Encyclopædia* is far from the truth. This information induced us to look through the Journal itself for a more accurate account of the process; well convinced, that the liberal-minded author of that work would not have pointed out our mistakes without making us welcome to avail ourselves of his aid to correct them. Our readers will therefore be indebted only to Mr Nicholson and his correspondent for whatever instruction they may derive from this article; and as we wish not to deck ourselves in borrowed plumes, we shall communicate that instruction in the words of its author.

Having visited the manufactory of Messrs Collinsons, hatters in Gravel lane, Southwark, Mr Nicholson gives the following account of their procedure:

"The materials for making hats are rabbits fur cut off from the skin, after the hairs have been plucked out, together with wool and beaver. The two former are mixed in various proportions, and of different qualities, according to the value of the article intended to be made; and the latter our author believes to be universally used for facing the finer articles, and never for the body or main stuff. Experience has shewn, that these materials cannot be evenly, and well felted together, unless all the fibres be first separated, or put into the same state with regard to each other. This is the object of the first process, called *bowing*. The material, without any previous preparation (A), is laid upon a platform of wood, or of wire, somewhat more than four feet square, called a *hurdle*, which is fixed against the wall of the work-shop, and is enlightened by a small window, and separated by two side partitions from other hurdles, which occupy the rest of the space along the wall. The hurdle, if of wood, is made of deal planks, not quite three inches wide, disposed parallel to the wall, and at the distance of one fortieth or one fiftieth of an inch from each other, for the purpose of suffering the dust, and other impurities of the stuff, to pass through; a purpose still more effectually answered by the hurdle of wire.

"The workman is provided with a bow, a bow-pin, a basket, and several cloths. The bow is a pole of yellow deal wood, between seven and eight feet long, to which are fixed two bridges, somewhat like that which receives the hair in the bow of the violin (B). Over these

(A) Some writers mention a partial wetting of the fur while on the skin, by lightly smearing it with a solution of nitrate of mercury to give it a curl. Messrs Collinsons do not use it, nor any other preparation.

(B) Mr Nicholson's correspondent, who is himself a hatter, says that a bow is best made of ash; that it is composed of the *stang* or handle; that the bridge at the smaller end, or that which is nearest the window in the act of bowing, is called the *cock*; and that the other bridge, which is nearer to the workman's hand, is called the *breech*.

Hat-making.

these is stretched a catgut, about one-twelfth part of an inch in thickness. The bow-pin is a stick with a knob, and is used for plucking the bow-string. The basket is a square piece of ozier work, consisting of open strait bars with no crossing or interweaving. Its length across the bars may be about two feet, and its breadth eighteen inches. The sides into which the bars are fixed are slightly bended into a circular curve, so that the basket may be set upright on one of these edges near the right hand end of the hurdle, where it usually stands. The cloths are linen. Besides these implements, the workman is also provided with brown paper.

"The *bowing* commences by shovelling the material towards the right hand partition with the basket, upon which, the workman holding the bow horizontally in his left hand, and the bow-pin in his right, lightly places the bow string, and gives it a pluck with the pin. The string, in its return, strikes part of the fur, and causes it to rise, and fly partly across the hurdle in a light open form. By repeated strokes, the whole is thus subjected to the bow; and this beating is repeated till all the original clots or masses of the filaments are perfectly opened and obliterated. The quantity thus treated at once is called a *batt*, and never exceeds half the quantity required to make one hat.

"When the batt is sufficiently bowed, it is ready for *hardening*; which term denotes the first commencement of felting. The prepared material being evenly disposed on the hurdle, is first pressed down by the convex side of the basket, then covered with a cloth, and pressed successively in its various parts by the hands of the workman. The pressure is gentle, and the hands are very slightly moved back and forwards at the same time through a space of perhaps a quarter of an inch, to favour the hardening or entangling of the fibres (See Felting in this *Suppl.*) In a very short time, indeed, the stuff acquires sufficient firmness to bear careful handling. The cloth is then taken off, and a sheet of paper, with its corners doubled in, so as to give it a triangular outline, is laid upon the batt, which last is folded over the paper as it lies, and its edges, meeting one over the other, form a conical cap. The joining is soon made good by pressure with the hands on the cloth. Another batt, ready hardened, is in the next place laid on the hurdle, and the cap here mentioned placed upon it, with the joining downwards. This last batt being also folded up, will consequently have its place of junction diametrically opposite to that of the inner felt, which it must therefore greatly tend to strengthen. The principal part of the hat is thus put together, and now requires to be worked with the hands a considerable time upon the hurdle, the cloth being also occasionally sprinkled with clear water. During the whole of this operation, which is called *basoning* (c), the article becomes firmer and firmer, and contracts in its dimensions. It may easily be understood, that the chief use of the paper, is to prevent the sides from felting together.

"The basoning is followed by a still more effectual continuation of the felting called *working* (d). This is done in another shop, at an apparatus called a *battery*, consisting of a *kettle* (containing water slightly acidulated with sulphuric acid, to which, for beaver hats, a quantity of the grounds of beer is added, or else plain water for rinsing out), and eight *planks* of wood joined together in the form of a frustum of a pyramid, and meeting in the kettle at the middle. The outer or upper edge of each plank is about two feet broad, and rises a little more than two feet and a half above the ground; and the slope towards the kettle is considerably rapid, so that the whole battery is little more than six feet in diameter. The quantity of sulphuric acid added to the liquor is not sufficient to give a sour taste, but only renders it rough to the tongue. In this liquor heated rather higher than unpractised hands could bear, the article is dipped from time to time, and then worked on the planks with a roller, and also by folding or rolling it up, and opening it again; in all which, a certain degree of care is at first necessary, to prevent the sides from felting together; of which, in the more advanced stages of the operation, there is no danger. The imperfections of the work now present themselves to the eye of the workman, who picks out knots and other hard substances with a bodkin, and adds more felt upon all such parts as require strengthening. This added felt is patted down with a wet brush, and soon incorporates with the rest. The beaver is laid on towards the conclusion of this kind of working. Mr Nicholson could not distinctly learn why the beer grounds were used with beaver-hats. Some workmen said, that by rendering the liquor more tenacious, the hat was enabled to hold a greater quantity of it for a longer time; but others said, that the mere acid and water would not adhere to the beaver facing, but would roll off immediately when the article was laid on the plank.

(c) Mr Nicholson's correspondent says, that after bowing, and previous to the basoning, a *hardening skin*, that is, a large piece of skin, about four feet long and three feet broad, of leather alumed or half tanned, is pressed upon the batt, to bring it by an easier gradation to a compact appearance; after which it is basoned, being still kept upon the hurdle. This operation, the basoning, derives its name from the process or *mode of working*, being the same as that practised upon a wool hat after bowing; the last being done upon a piece of cast metal, four feet across, of a circular shape, called *a bason*: the joining of each batt is made good here by thumbling the hand, that is, by rubbing the edges of each batt folded over the other to excite the progressive motion of each of the filaments in felting, and to join the two together. Many journeymen, to hurry this work, use a quantity of vitriol (sulphuric acid), and then, to make the nap rise and flow, they kill the vitriol, and open the body again by throwing in a handful or two of oatmeal; by this means they get a great many made, though, at the same time, they leave them quite grainy from the want of labour. This, in handling the dry grey hat when made may be in part discovered; but in part only.

(d) The intelligent writer, who has been so often quoted, says, that before this operation is begun, the hat is dipped into the boiling kettle, and allowed to lie upon the plank until cold again; this is called *soaking*, that is, being perfectly saturated with the hot liquor: if they are put in too hastily in this state, for they are then only bowed and basoned, they would burst from the edges, each batt not being sufficiently felted into the other.

plank. It is probable, as he observes, that the manufacturers who now follow the established practice, may not have tried what are the inconveniencies this addition is calculated to remove."

Our author's correspondent, however, assigns several reasons for the addition of those dregs, which, he says, ought to be thick, and the sourest that can be got. 1. Vitriol (sulphuric acid) would harden the hat too much, which is kept mellow by the dregs. 2. The dregs are said by the workmen to hold or fill the body, whilst a little vitriol cleanses it of the dirt, &c. that may be on the rabbit or other wools. 3. Another advantage attending the use of dregs, whether of beer, porter, or wine, is, that as the boiling of the dyeing does not draw out much of the mucilage from each hat when it comes to be stiffened, the dregs form a body within the hat, sufficiently strong or retentive to keep the glue from coming through amongst the nap. 4. Vitriol (sulphuric acid) alone purges or weakens the goods too much; consequently half of the quantity does better with the addition of dregs, as it allows the body to be made closer by more work.

Of these four reasons for the use of dregs, the last alone appears to us perspicuous or at all satisfactory. But be this as it may, acid of some kind gives a roughness to the surface of the hair, which facilitates the mechanical action of felting; and Mr Collinson informed Mr Nicholson, that in a process, called *carotting*, they make use of nitrous acid. In this operation, the material is put into a mixture of the nitrous and sulphuric acids in water, and kept in the digesting heat of a stove all night; by which means the hair acquires a ruddy or yellow colour, and loses part of its strength.

"It must be remembered, that our hat still possesses the form of a cone, and that the whole of the several actions it has undergone have only converted it into a soft flexible felt, capable of being extended, though with some difficulty, in every direction. The next thing to be done is to give it the form required by the wearer. For this purpose the workman turns up the edge or rim to the depth of about an inch and a half, and then returns the point back again through the centre or axis of the cap, so far as not to take out this fold, but to produce another inner fold of the same depth. The point being returned back again in the same manner, produces a third fold; and thus the workman proceeds, until the whole has acquired the appearance of a flat circular piece, consisting of a number of concentric undulations or folds, with the point in the centre. This is laid upon the plank, where the workman, keeping the piece wet with the liquor, pulls out the point with his fingers, and presses it down with his hand, at the same time turning it round on its centre in contact with the plank, till he has, by this means, rubbed out a flat portion, equal to the intended crown of the hat. In the next place he takes a block, to the crown of which he applies the flat central portion of the felt, and by forcing a string down the sides of the block, he causes the next part to assume the figure of the crown, which he continues to wet and work, until it has properly disposed itself round the block. The rim now appears like a flounced or puckered appendage round the edge of the crown; but the block being set upright on the plank, the requisite figure is soon given by working, rubbing and extending this part. Water only is used in this operation of fashioning or blocking; at the conclusion of which it is pressed out by the blunt edge of a copper implement for that purpose.

"Previous to the dyeing, the nap of the hat is raised or loosened out with a wire brush, or carding instrument. The fibres are too rotten after the dyeing to bear this operation. The dyeing materials are logwood, and a mixture of the sulphates of iron and of copper, known in the market by the names of green copperas and blue vitriol. As the time of Mr Collinson was limited, and my attention, says Mr Nicholson, was more particularly directed to the mechanical processes, I did not go into the dye-house; but I have no doubt that the hats are boiled with the logwood, and afterwards immersed in the saline solution. I particularly asked whether galls were used, and was answered in the negative.

"The dyed hats are, in the next place, taken to the stiffening shop. One workman, assisted by a boy, does this part of the business. He has two vessels, or boilers, the one containing the grounds of strong beer, which costs seven shillings per barrel, and the other vessel containing melted glue a little thinner than it is used by carpenters. Our author particularly asked, whether this last solution contained any other ingredient besides glue, and was assured that it did not. The beer grounds are applied in the inside of the crown to prevent the glue from coming through to the face, and also, as he supposes, to give the requisite firmness at a less expence than could be produced by glue alone. If the glue were to pass through the hat in different places, it might, he imagines, be more difficult to produce an even gloss upon the face in the subsequent finishing. The glue stiffening is applied after the beer-grounds are dried, and then only upon the lower face of the flap, and the inside of the crown. For this purpose, the hat is put into another hat, called a stiffening hat, the crown of which is notched, or slit open in various directions. These are then placed in a hole in a deal board, which supports the flap, and the glue is applied with a brush.

"The dry hat, after this operation, is very rigid, and its figure irregular. The last dressing is given by the application of moisture and heat, and the use of the brush, and a hot iron, somewhat in the shape of that used by tailors, but shorter and broader on the face. The hat being softened by exposure to steam, is drawn upon a block, to which it is securely applied by the former method of forcing a string down from the crown to the commencement of the rim. The judgment of the workman is employed in moistening, brushing, and ironing the hat, in order to give and preserve the proper figure. When the rim of the hat is not intended to be of an equal width throughout, it is cut by means of a wooden, or perhaps metallic pattern; but as no such hats are now in fashion, Mr Nicholson saw only the tool for cutting them round. The contrivance is very ingenious and simple. A number of notches are made in one edge of a flat piece of wood for the purpose of inserting the point of a knife, and from one side or edge of this piece of wood there proceeds a strait handle, which lies parallel to the notched side, forming an angle somewhat like that of a carpenter's square. When the legs of this angle are applied to the outside of the crown, and the board lies flat on the rim of the hat, the notched edge will lie nearly in the direction of the

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the radius, or line pointing to the centre of the hat. A knife being therefore inserted in one of the notches, it is easy to draw it round by leaning the tool against the crown, and it will cut the border very regular and true. This cut is made before the hat is quite finished, and is not carried entirely through; so that one of the last operations consists in tearing off the redundant part, which by that means leaves an edging of beaver round the external face of the flap. When the hat is completely finished, the crown is tied up in gauze paper, which is neatly ironed down. It is then ready for the subsequent operations of lining," &c.

Our author concludes his valuable memoir on the fabrication of hats, with some observations on the probable gain or loss of employing machinery in the manufacture. These observations, as they are stated in the original paper, we recommend to the serious attention of every judicious hat-maker, who carries on his business on a large scale; for he will find them not the reveries of a rash speculatist, but the cool reflections of a real philosopher, who is at the same time no stranger to the arts of life. They suggest the following subjects of enquiry; Whether carding, which is rapidly and mechanically done, be inferior to bowing, which does not promise much facility for mechanical operation? Whether a succession of bats or cardings might be thrown round a fluted cone, which rapidly revolving, in contact with three or more cylinders, might perform the hardening, and even the working, with much more precision and speed than they are now done by hand? Whether blocking or shaping be not an operation extremely well calculated for the operation of one or more machines? Whether loose weaving and subsequent felting might not produce a lighter, cheaper, and stronger article? And how far the mechanical felting, which is not confined merely to the hairs of animals, might be applied to this art?

Before we dismiss this subject, it may be worth while to state Mr Dunnage's method of making *water-proof hats*, in imitation of beaver, for which, in November 1794, he obtained a patent. It is as follows: Let a shag be woven, of such count in the reed, and cut over such sized wire, as will give the hats to be manufactured from it that degree of richness, or appearance of fur, which may be thought necessary. The materials of which this shag may be composed are various, and should be accommodated to different kinds of hats, according to the degree of beauty and durability to be given them, and the price at which they are designed to be sold; that is to say, silk, mohair, or any other hair that is capable of being spun into an end fine enough for the purpose, cotton, inkle, wool, or a mixture of any, or all the above materials, as may suit the different purposes of the manufacturer. Those answer best, (says our author), which are made with two poles, either of Bergam, Piedmont, or Organzine silk, rising alternately, in a reed of about nine hundred count to eighteen inches wide, with three shoots over each wire. This method of weaving distributes the silk (as it may be put single into the harness), and prevents any ribby appearance which it might have if the silk were passed double, and the whole of the pole cut over each wire. This may be made either on a two or four thread ground of hard silk, shot with fine cotton, which he thinks preferable for shoot, to silk, inkle, or any other material, as it forms both a close and fine texture. An inferior kind of hats may be made from any of the before mentioned materials, and with cheaper silk. This shag should be stretched on a frame, such as dyers use to rack cloth; then (having previously set the pile upright with a comb, to prevent its being injured or stuck together), go over the ground with thin size, laid on with a soft brush. For black, or dark colours, common size will do; with white, or any light colour, use isinglass, or a size made from white kid leather. These, or gum, or any other mucilaginous matter, which, without altering the colour, will prevent oil from getting through the ground so as to injure the pile, will answer the purpose. Take care not to apply more of any material, as a preparation, than may be fully saturated with oil or varnish, so that water will not discharge it from the ground. The size, or other glutinous matter, being dry, the pile must be teaseled, or carded with a fine card, till the silk is completely taken out of the twist or throwing, when it will lose its coarse shaggy look, and assume the appearance of a very fine fur. It must now be once more set upright with a comb, and you may proceed to lay on your water-proof material; this too may be varied according to circumstances. For black, or any dark colour, linseed oil well boiled with the usual driers, and thickened with a small quantity of any good drying colour, will do; for white, or very fine colours, poppy or nut oil, or copal or other varnishes, may be used. In this particular the manufacturer must judge what will best answer his purpose, taking care never to use any thing that will dry hard, or be subject to crack. Mr Dunnage has found good drying linseed oil preferable to any other thing which he has used, and, with the precaution of laying on very little the first time, it will not injure the finest colours. When the first coat of oil is dry, go over it a second and a third time, if necessary, till you are convinced the pores of the ground are fully closed up, and the stuff rendered impervious to water. It should now stand several days, till the smell is sufficiently gone off; and before it is taken from the frame, should be gone over with some ox gall or lime-water, to take off the greasiness, which would otherwise prevent the stiffening from adhering to the oil. The material being now ready to be formed into hats, should be cut into proper shapes for that purpose. The crown should be made up over a block, with needle and silk, the oiled side outwards. The seams should then be rubbed with a piece of hard wood, bone, or ivory, to make them lie flat, and the edges of the stuff pared off very near the stitches, that no joint may appear on the right side. The seams should then be carefully gone over with the prepared oil, till every crevice or hole made by the needle is completely filled up, and the crown rendered perfectly water-proof. The crown may then be turned and stiffened, by sticking linen, leather, paper, or any other material that may be found to answer the purpose, to the inner or painted side, till it acquires about the same degree of stiffness, or resistance to the touch, as a good beaver. The mucilaginous matter which he used to attach the stiffening to the crown, and the upper and under parts of the brim to each other, was composed of one pound of gum arabic or senega, one pound of starch, and a half a pound of glue, boiled up with as much water as reduced the whole to the consistence of a thick paste. A greater or less proportion of any of these ingredients may be used, and other glutinous and adhesive substances may answer the same purposes; or drying-oils may be made use of, instead of this or other mucilage; or any of the resinous gums dissolved in oil or spirits; only it should be observed, in this case, the hats will require more time in the preparation, as the oily matter, unless exposed to the air, will not readily dry; but he found by experience that the above mentioned composition does not dry hard or brittle, but retains that pleasant flexibility which is agreeable to the touch, while it communicates to the other materials a sufficient degree of elasticity. Before the brim is perfectly dry, care should be taken to form a neck or rising round the hole where it is to be attached to the crown, by notching it round with a pair of scissars, and then forcing it over a block something larger than you have made the hole, so that the uncut stuff may turn up, under the lower edge of the crown, about a quarter of an inch. Before you join the crown and brim together, go over the outside of the neck of the brim, and the inside of the crown, as high as the neck will come (which should be about half an inch), with the prepared oil; and when they are nearly dry, so as to adhere to the finger on touching them, put the crown over the neck of the brim, and let them be sewed strongly together, taking care to sew down as little of the pile as possible, and using the same precaution of oiling, where the needle has been through, as was observed in making up the crown. The hat is now ready for dressing; which operation may be performed over a block, with a hot iron, brush, &c. in the same manner as those commonly called felts. When putting in the lining, be very careful to let the needle only take hold of the under surface of the brim; for should it perforate the upper one, the water will find its way through, and the hat be of no value. Though we have already declared how little we are acquainted with the operation of hat-making, we cannot help suggesting the enquiry, whether these water-proof hats might not be improved both in strength and beauty, by a slight felting before the application of the size by the brush. Such of them as are composed of wool or hair, or contain a mixture of these materials, are unquestionably susceptible of felting.

HATBOROUGH, a small town in Montgomery county, Pennsylvania, situated on the N. E. side of Pennepeck Creek, which runs into Delaware river about 5 miles above Frankfort. It contains about 20 houses.—*Morse.*

HATCHY, a navigable river in the State of Tennessee, runs westerly into the Mississippi, about 19 miles N. of Wolf river, and is about 80 yards wide 7 miles from its month.—*ib.*

HATFIELD, a very pleasant town in Hampshire county, Massachusetts, situated on the west bank of a bend of Connecticut river where it is 80 rods wide, 5 miles north of Northampton, and 100 west of Boston. It lies chiefly on one street, and contains 103 houses, and 703 inhabitants. Here are two ferries on Connecticut river; the one to Hadley, the other to Amherst. North of the ferry to Amherst, the river meets with a bed of rocks, which lessens its breadth 20 or 30 rods—no fall, but a large eddy at high water.—*ib.*

HATTERAS is the most remarkable and dangerous cape on the coast of N. America. This point extends far into the ocean, from the coast of N. Carolina, in 35° 15′ N. lat. The water is very shoal at a great distance from the cape, which is remarkable for sudden squalls of wind, and for the most severe storms of thunder, lightning and rain, which happen almost every day, during one half the year. At the time of Sir Walter Raleigh's approaching this coast, the shoals in the vicinity of Hatteras were found so dangerous, so extensive, and so shallow, many of them covered with not more than 5 or 6 feet water, that no vessels, in that latitude, ventured within 7 leagues of the land.

At present the out-shoals, which lie about 14 miles S. W. of the cape, are but of 5 or 6 acres extent, and where they are really dangerous to vessels of moderate draught, not above half that extent. On the shoalest part of these is about 10 feet at low water; and here, at times, the ocean breaks in a tremendous manner, spouting, as it were, to the clouds, from the violent agitation of the Gulf Stream, which touches the eastern edge of the banks, from which the declivity is sudden, that is to say, from 10 fathoms to no soundings. On the spot above mentioned, which is firm sand, it has been the lot of many a good vessel to strike, in a gale of wind, and go to pieces. In moderate weather, however, these shoals may be passed over, if necessary, at full tide, without much danger, by vessels not drawing more than 8, 9, or 10 feet water. From this bank, formerly of vast extent, and called the *Full Moon Shoal*, a ridge runs the whole distance to the cape about a N. W. course, is about half a mile wide, and at low water has generally, 10, 11 and 12 feet water. There are gaps at equal intervals, affording channels of about 15 or 16 feet water. The most noted of these is about a mile and a half from the land, and is at least two miles and a half wide, and might at full sea be safely passed by the largest ships; but is rarely used except by coasting vessels. It may be easily known by a range of breakers always seen on the west side, and a breaker head or two on the eastern side; which, however, are not so constant, only appearing when the sea is considerably agitated. A little north of the cape is good anchoring in 4 or 5 fathoms; and with the wind to the westward, a boat may land in safety, and even bring off casks of fresh water, plenty of which is to be found every where on the beach, by digging a foot or two, and putting a barrel into the sand.—*ib.*

HATTON'S FORD, on Tugelo river, a village 16 miles from Pendleton court-house, in S. Carolina, and 17 from Franklin court-house, in Georgia.—*ib.*

HAVERFORD, a township in Delaware county, Pennsylvania.—*ib.*

HAVERHILL, a post-town of New-Hampshire, and the capital of Grafton county, situated on the east side of Connecticut river, in Lower Coos. It has between 40 and 50 compact houses, a well constructed court-house, and a congregational church. This township was incorporated in 1763, and contains 552 inhabitants. In it is a bed of iron ore, which has yielded some profit to the proprietor, also a quarry of freestone, fit for hearths and chimney pieces. It has also a fulling-mill, an oil-mill, and many other excellent mill seats. It is opposite to Newbury in Vermont, 35 miles

miles above Dartmouth college, 119 miles N. W. of Portsmouth.—*ib.*

HAVERHILL, a handsome post-town of Massachusetts, in Essex county, situated on the N. side of Merrimack river, across which is an elegant bridge, connecting this town with Bradford, 650 feet long and 34 wide. It has 3 arches, of 180 feet each, supported by 3 handsome stone piers, 40 feet square; also a draw of 30 feet, over the channel of the river. Haverhill has a considerable inland trade, lying about 32 miles N. by W. of Boston, and 12 miles from Newburyport, at the mouth of the river, and about 28 S. W. of Portsmouth in New-Hampshire. It lies chiefly upon two streets; the principal of which runs parallel with the river. Vessels of 100 tons burden can go up to it. Travellers are struck with the pleasantness of the situation; and a number of neat and well finished houses give it an air of elegance. Here are two churches, one for Congregationalists and one for Baptists; 3 distilleries, one of which has lately undergone a laudable transmutation into a brewery. Some vessels are annually built here, and several are employed in the West India trade. A manufactory of sail-cloth was begun here in 1789, and is said to be in a promising way. The trade of the place, however, is considerably less than before the revolution. The whole township contains 330 houses, and 2,408 inhabitants. —*ib.*

HAVERSTRAW BAY, called by some *Haversham*, in Hudson's river, 38 miles above New-York city, spreads S. of Stony Point, and before the town of its own name, is 10 miles long and about 3 wide. —*ib.*

HAVERSTRAW, a township in Orange county, New-York, situated on the W. side of the above bay, 35 miles N. of New-York city. It contains 4,826 inhabitants, of whom 98 are qualified electors, and 238 slaves.—*ib.*

HAVRE DE GRACE, or GRAS, a post-town and port of entry in Harford county, Maryland, on the W. side of Susquehannah river, at its mouth in Chesapeak Bay. It contains about 40 houses, 250 inhabitants, and is the port of entry for all the shores of Chesapeak Bay above Turkey Point. It is 6 miles W. by S. of Charleston in Cecil county, 37 N. E. of Baltimore, and 65 W. S. W. of Philadelphia. N. lat. 39° 39′.—*ib.*

HAW, a water of Cape Fear which unites with Deep river. It may be rendered navigable for 50 miles.—*ib.*

HAWKE, a township in Rockingham county, New-Hampshire, was incorporated in 1760, and contained in 1775, 504, and in 1790, 420 inhabitants.—*ib.*

HAWKINS (Sir John), was the youngest son of a man who, though descended from Sir John Hawkins the memorable admiral and treasurer of the navy in the reign of Queen Elizabeth, followed at first the occupation of a house-carpenter, which he afterwards exchanged for the profession of a surveyor and builder. He was born in the city of London on the 30th day of March 1719; and after having been sent first to one school, and afterwards to a second, where he acquired a tolerable knowledge of Latin, he went through a regular course of architecture and perspective, in order to fit him for his father's profession of a surveyor. He was, however, persuaded, by a near relation, to abandon the profession of his first choice, and to embrace that of the law; and was accordingly articled to Mr John Scott an attorney and solicitor in great practice. In this situation his time was too fully employed in the actual dispatch of business to permit him, without some extraordinary means, to acquire the necessary knowledge of his profession by reading and study; besides that, his master is said to have been more anxious to render him a good copying clerk, by scrupulous attention to his hand-writing, than to qualify him by instruction to conduct business. To remedy this inconvenience, therefore, he abridged himself of his rest, and rising at four in the morning, found opportunity of reading all the necessary and most eminent law writers, and the works of our most celebrated authors on the subjects of verse and prose. By these means, before the expiration of his clerkship, he had rendered himself a very able lawyer, and had acquired a love for literature in general, but particularly for poetry and the polite arts; and the better to facilitate his improvement, he occasionally furnished to the Universal Spectator, the Westminster Journal, the Gentleman's Magazine, and other periodical publications of the time, essays and disquisitions on several subjects. The first of these is believed to have been an Essay on *Swearing*; but the exact time of its appearance, and the paper in which it was inserted, are both unknown. It was, however, re-published some years before his death (without his knowledge till he saw it in print) in one of the newspapers. His next production was an Essay on *Honesty*, inserted in the Gentleman's Magazine for March 1739; and which occasioned a controversy, continued through the Magazines for several succeeding months, between him and a Mr Calamy, a descendant of the celebrated Dr Edmund Calamy, then a fellow-clerk with him.

About the year 1741, a club having been instituted by several amateurs of music, under the name of the Madrigal Society, to meet every Wednesday evening, and his clerkship being now out, he became a member of it, and continued so many years. Pursuing his inclination for music still farther, he became also a member of the Academy of Ancient Music, which used to meet every Thursday evening at the Crown and Anchor in the Strand, but since removed to Freemasons Hall; and of this he continued a member till a few years before its removal.

Impelled by his own taste for poetry, and excited to it by his friend Foster Webb's example, who had contributed to the Gentleman's Magazine many very elegant poetical compositions, he had, before this time, himself become an occasional contributor in the same kind, as well to that as to some other publications. The earliest of his productions of this species, now known, is supposed to be a copy of verses "To Mr George Stanley, occasioned by looking over some Compositions of his lately published," which bears date 19th February 1740, and was inserted in the Daily Advertiser for February 21. 1741; but, about the year 1742, he proposed to Mr Stanley, the project of publishing, in conjunction with him, six cantatas for a voice and instruments, the words to be furnished by himself, and the music by Mr Stanley. The proposal was accepted, the publication was to be at their joint expence, and for their mutual benefit; and accordingly, in 1742, six cantatas were thus published, the five first written by Mr Hawkins, the sixth and last by Foster Webb; and these having succeeded

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ceeded beyond the most sanguine expectations of their authors, a second set of six more, written wholly by himself, was in like manner published a few months after, and succeeded equally well.

As these compositions, by being frequently performed at Vauxhall, Ranelagh, and other public places, and at many private concerts, had become favourite entertainments, many persons, finding the author also a modest well-informed young man of unexceptionable morals, were become desirous of his acquaintance. Among these was Mr Hare of Limehouse, a brewer, who being himself a musical man, and having met him at Mr Stanley's at musical parties, gave him an invitation to his house: and, to forward him in his profession, introduced him to a friend of his, Peter Storer of Highgate, Esq; which proved the means of making his fortune.

In the winter of the year 1749, Dr then Mr Johnson, was induced to institute a club to meet every Tuesday evening at the King's Head, in Ivy-lane, near St Paul's. It consisted only of nine persons; and Mr Hawkins was one of the first members. About this time, as it is supposed, finding his father's house, where he had hitherto resided, too small for the dispatch of his business, now very much increasing, he, in conjunction with Dr Munckley, a physician, with whom he had contracted an intimacy, took a house in Clements-lane, Lombard-street. The ground floor was occupied by him as an office, and the first floor by the Doctor as his apartment. Here he continued till the beginning of 1753, when, on occasion of his marriage with Sidney, the youngest of Mr Storer's daughters, who brought him a considerable fortune, he took a house in Austin Friars, near Broad-street, still continuing to follow his profession of an attorney.

Having received, on the death of Peter Storer, Esq; his wife's brother, in 1759, a very large addition to her fortune, he quitted business to Mr Clark, afterwards Alderman Clark, who had a short time before completed his clerkship under him, disposed of his house in Austin Friars, and purchased a house at Twickenham. Soon afterwards he bought the lease of one in Hatton-street London, for a town residence.

From a very early period of his life he had entertained a strong love for the amusement of angling; and his affection for it, together with the vicinity of the river Thames, was undoubtedly his motive to a residence at this village. He had been long acquainted with Walton's Complete Angler; and had, by observation and experience, become himself a very able proficient in the art. Hearing, about this time, that Mr Moses Browne proposed to publish a new edition of that work, and being himself in possession of some material particulars respecting Walton, he, by letter, made Mr Browne an offer of writing, for his intended edition, Walton's Life. To this proposal no answer was returned, at least for some time; from which circumstance Mr Hawkins concluded, as any one reasonably would, that his offer was not accepted; and, therefore, having also learnt that Mr Browne meant not to publish the text as the author left it, but to modernize it, in order to file off the rust, as he called it, he wrote again to tell Mr Browne that he understood his intention was to sophisticate the text, and that therefore he, Mr Hawkins, would himself publish a correct edition. Such an edition, in 1760, he accordingly published in octavo with notes, adding to it a Life of Walton by himself, a Life of Cotton, the author of the second part by the well-known Mr Oldys; and a set of cuts designed by Wale, and engraved by Ryland.

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His propensity to music, manifested by his becoming a member and frequenter of the several musical societies before mentioned, and also by a regular concert at his house in Austin Friars, had led him, at the time that he was endeavouring to get together a good library of books, to be particularly solicitous for collecting the works of some of the best musical composers; and, among other acquisitions, it was his singular good fortune to become possessed by purchase of several of the most scarce and valuable theoretical treatises on the science any where extant, which had formerly been collected by Dr Pepusch. With this stock of erudition, therefore, he, about this time, at the instance of some friends, set about procuring materials for a work then very much wanted, a History of the Science and Practice of Music, which he afterwards published.

At the recommendation of the well known Paul Whitehead, to the Duke of Newcastle, then Lord Lieutenant for Middlesex, his name was, in 1761, inserted in the Commission of the Peace for that county; and having by the proper studies, and a sedulous attendance at the sessions, qualified himself for the office, he became an active and useful magistrate in the county (A). Observing, as he had frequent occasion to do in the course of his duty, the bad state of highways, and the great defect in the laws for amending and keeping them in repair, he set himself to revise the former statutes, and drew an act of parliament consolidating all the former ones, and adding such other regulations as were necessary. His sentiments on this subject he published in octavo, in 1763, under the title of "Observations on the State of Highways, and on the Laws for amending and keeping them in repair;" subjoining to them the draught of the act before mentioned; which bill being afterwards introduced into parliament, passed into a law, and is that under which all the highways in England are at this time kept repaired. Of this bill it is but justice to add, that, in the experience of more than thirty years, it has never required a single amendment.

Johnson and Sir Joshua, then Mr Reynolds, had, in the winter of this year 1763, projected the establishment of a club to meet every Monday evening at the Turk's Head in Gerard street; and, at Johnson's solicitation, Mr Hawkins became one of the first members.

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(A) When he first began to act, he formed a resolution of taking no fees, not even the legal and authorised ones, and pursued this method for some time, till he found that it was a temptation to litigation, and that every trifling ale-house quarrel produced an application for a warrant. To check this, therefore, he altered his mode, and received his due fees, but kept them separately in a purse; and at the end of every summer, before he left the country for the winter, delivered the whole amount to the clergyman of the parish, to be by him distributed among such of the poor as he judged fit.

An event of confiderable importance engaged him, in the year 1764, to ftand forth as the champion of the county of Middlefex, againft a claim then for the firft time fet up, and fo enormous in its amount as juftly to excite refiftance. The city of London finding it neceffary to re-build the gaol of Newgate, the expence of which, according to their own eftimates, would amount to L.40,000, had this year applied to parliament, by a bill brought into the Houfe of Commons, in which, on a fuggeftion that the county prifoners removed to Newgate for a few days previous to their trials at the Old Bailey, were as two to one of the London prifoners, conftantly confined there, they endeavoured to throw the burthen of two-thirds of the expence on the county, while they themfelves propofed to contribute one-third only. This attempt the magiftrates for Middlefex thought it their duty to oppofe; and accordingly a vigorous oppofition to it was commenced and fupported under the conduct of Mr Hawkins, who drew a petition againft the bill, and a cafe of the county, which was printed and diftributed amongft the members of both houfes of parliament. It was the fubject of a day's converfation in the Houfe of Lords; and it produced fuch an effect in the Houfe of Commons, that the city, by its own members, moved for leave to withdraw the bill. The fuccefs of this oppofition, and the abilities and fpirit with which it was conducted, naturally attracted towards Mr Hawkins the attention of his fellow-magiftrates; and the chairman of the quarter feffions dying not long after, he was, on the 19th day of September 1765, elected his fucceffor.

In the year 1771, he quitted Twickenham, and fold his houfe there to Mr Vaillant; and, in the fummer of the next year, for the purpofe of obtaining, by fearches in the Bodleian and other libraries, farther materials for his hiftory of mufic, he made a journey to Oxford, carrying with him an engraver from London, to make drawings from the portraits in the mufic fchool.

On occafion of actual tumults or expected difturbances, he had more than once been called into fervice of great perfonal danger. When the riots at Brentford had arifen, during the time of the Middlefex election in the year 1768, he and fome of his brethren attended to fupprefs them; and, in confequence of an expected riotous affembly of the journeymen Spital-fields weavers in Moorfields in 1769, the magiftrates of Middlefex, and he at their head, with a party of guards, attended to oppofe them; but the mob, on feeing them prepared, thought it prudent to difperfe. In thefe and other inftances, and particularly in his conduct as chairman, having given fufficient proof of his activity, refolution, abilities, integrity and loyalty, he, on the 23d of October 1772, received from his majefty the honour of knighthood.

In 1773 Dr Johnfon and Mr Stevens publifhed, in ten volumes octavo, their firft joint edition of Shakefpeare, to which Sir John Hawkins contributed fuch notes as are diftinguifhed by his name, as he afterwards did a few more on the republication of it in 1778. An addrefs to the king from the county of Middlefex, on occafion of the American war, having, in 1774, been judged expedient, and at his inftance voted, he drew up fuch an addrefs, and, together with two of his brethren, had, in the month of October in that year, the honour of prefenting it.

After fixteen years labour, he, in 1776, publifhed, in five volumes quarto, his General Hiftory of the Science and Practice of Mufic; which in confequence of permiffion obtained in 1773, he dedicated to the king, and prefented it to him at Buckingham-houfe on the 14th of November, 1776, when he was honoured with an audience of confiderable length both from the king and queen.

Not long after this publication, that is to fay in November 1777, he was induced, by an attempt to rob his houfe, which, though unfuccefsful, was made three different nights with the interval of one or two only between each attempt, to quit his houfe in Hatton-ftreet; and, after a temporary refidence for a fhort time in St James's Place, he took a leafe of one, formerly inhabited by the famous admiral Vernon, in the ftreet leading up to Queen Square, Weftminfter, and removed thither.

By this removal he became a conftant attendant on Divine worfhip at the parifh-church of St Margaret, Weftminfter; and having learnt, in December 1778, that the furveyor to the board of ordnance was, in defiance of a provifo in the leafe under which they claimed, carrying up a building at the eaft end of the church, which was likely to obfcure the beautiful painted glafs window over the altar there, Sir John Hawkins, with the concurrence of fome of the principal inhabitants, wrote to the furveyor, and compelled him to take down two feet of the wall, which he had already carried up above the fill of the window, and to flope off the roof of his building in fuch a manner as that it is not only no injury, but, on the contrary, a defence to the window.

In the month of December 1783, Dr Johnfon having difcovered in himfelf fymptoms of a dropfy, fent for Sir John Hawkins, and telling him the precarious ftate of his health, declared his defire of making a will, and requefted him to be one of his executors. Sir John accepted the office; inftructed the Doctor how to make his will: and on his death undertook to be his biographer, and the guardian of his fame, by publifhing a complete edition of his works.

Not three months after the commencement of this undertaking, he met with the feverett lofs of almoft any that a literary man can fuftain, fhort of that of his friends or relations, in the deftruction, by fire, of his library; confifting of a numerous and well chofen collection of books, ancient and modern, in many languages, and on moft fubjects, which it had been the bufinefs of above 30 years at intervals to get together. Of this lofs, great as it was in pecuniary value, and comprifing in books, prints, and drawings, many articles that could never be replaced, he was never heard in the fmalleft degree to complain; but having found a temporary reception in a large houfe in Orchard-ftreet, Weftminfter, he continued there a fhort time, and then took a houfe in the Broad Sanctuary, Weftminfter.

This event, for a fhort time, put a ftop to the progrefs of his literary purfuits. As foon, however, as he could fufficiently collect his thoughts, he recommenced his office of biographer of Johnfon; and completed his intention by publifhing, in 1787, the life and works, in eleven volumes octavo, which he dedicated to the king.

With this production he terminated his literary labours; and having for many years been more particularly fedulous in his attention to the duties of religion, and accuſtomed to ſpend all his leiſure from other neceſſary concerns in theological and devotional ſtudies, he now more cloſely addicted himſelf to them, and ſet himſelf to prepare for that event, which he ſaw could be at no great diſtance; and the better to accompliſh this end, in the month of May 1788, he, by a will and other proper inſtruments, made ſuch an arrangement of his affairs as he meant ſhould take place after his deceaſe.

In this manner he ſpent his time till about the beginning of May 1789, when, finding his appetite fail him in a greater degree than uſual, he had recourſe, as he had ſometimes had before on the ſame occaſion, to the waters of the Iſlington Spa. Theſe he drank for a few mornings; but on the 14th of that month, while he was there, he was, it is ſuppoſed, ſeized with a paralytic affection, as, on his returning to the carriage which waited for him, his ſervants perceived a viſible alteration in his face. On his arrival at home, he went to bed, but got up a few hours after, intending to receive an old friend, from whom he expected a viſit in the evening. At dinner, however, his diſorder returning, he was led up to bed, from which he never roſe, on the 21ſt of the ſame month, about two in the morning, dying of an apoplexy. He was interred on the 28th in the cloiſters of Weſtminſter Abbey, in the north walk near the eaſtern door into the church, under a ſtone, containing, by his expreſs injunctions, no more than the initials of his name, the date of his death, and his age; leaving behind him a high reputation for abilities and integrity, united with the well-earnt character of an active and reſolute magiſtrate, an affectionate huſband and father, a firm and zealous friend, a loyal ſubject, and a ſincere Chriſtian.

Such is the character of him in the Biographical Dictionary, which we have neither right nor inclination to controvert. With none of his works are we acquainted but his edition of *Walton's Complete Angler*, and his *Life of Johnſon*. The former is a very pleaſing book; and in the latter are collected many intereſting anecdotes of literature and literary men; but they are not well arranged, and the ſtyle of the compoſition is coarſe and ſlovenly. Sir John, we doubt not, was a man of worth, and his reflections on the ſentimental ſlang of Sterne and others, ſhew that he had ſucceſsfully ſtudied human nature; but he certainly was not a man of general taſte.

HAWKINS, a county in Waſhington diſtrict, in Tenneſſee, having 6,970 inhabitants, incluſive of 807 ſlaves. Chief town, Rogerſville.—*Morſe.*

HAWKINS *Court-Houſe*, in Tenneſſee, is 25 miles from Free-ſtone Gap, 72 from Abington, and 178 from Danville in Kentucky.—*ib.*

HAWK'S BAY, on the coaſt of Weſt-Florida, weſtward of the mouth of Mobile Bay, is between Pelican and Dauphin iſlands. There is a broad channel of 11 and 12 feet water, afterwards ſafe anchorage in 4 fathoms, good holding ground, and ſheltered from moſt winds; on which account it is very convenient for ſmall veſſels.—*ib.*

HAWK'S HARBOUR is an arm of Igornachoix Bay, Newfoundland Iſland.—*ib.*

HAWLEY, a townſhip in Hampſhire county, Maſſachuſetts, 120 miles weſterly of Boſton. Previous to its incorporation in 1792, it was called *Plantation No.* 7, and had 539 inhabitants. It is compoſed of parts of ſeveral adjoining towns, and is about 20 miles N. W. of Northampton.—*ib.*

HAYCOCKS, a ſmall iſle in Delaware river, about 7 miles below Eaſton, in Northampton county, Pennſylvania.—*ib.*

HAYNE'S FORT, COLONEL, is ſituated in Nelſon county, Kentucky, on the north ſide of Green river, 25 miles weſt of Craig's Fort, and 53 from the Ohio.—*ib.*

HEAT. See in this Supplement, CHEMISTRY, Part I. chap. v. where we have endeavoured to eſtabliſh the modern doctrine reſpecting *Caloric* or latent heat. In nº 309, &c. of that article, we have given an account of Count Rumford's ingenious experiments, inſtituted with a view to determine whether or not caloric be a ſubſtance, and have ſtated our reaſons for diſſenting from his opinion. It has been ſuggeſted to us, however, by a friend, to whoſe judgment we are inclined to pay great deference, that it would be proper, in this place, to give the Count's arguments at full length, and in his own words: and the propriety of this is the more apparent, that in the ſupplementary article ELECTRICITY, we have hinted our own ſuſpicions of the non-exiſtence of an *electrical fluid*. The Count then reaſons from his experiments in the following words:

"By meditating on the reſults of all theſe experiments, we are naturally brought to that great queſtion which has ſo often been the ſubject of ſpeculation among philoſophers, namely, What is heat?—Is there any ſuch thing as an *igneous fluid?*—Is there any thing that can with propriety be called caloric?

"We have ſeen that a very conſiderable quantity of heat may be excited in the friction of two metallic ſurfaces, and given off in a conſtant ſtream or flux *in all directions*, without interruption or intermiſſion, and without any ſigns of diminution or exhauſtion.

"From whence came the heat which was continually given off in this manner in the foregoing experiments? Was it furniſhed by the ſmall particles of metal detached from the larger ſolid maſſes on their being rubbed together? This, as we have already ſeen, could not poſſibly have been the caſe.

"Was it furniſhed by the air? This could not have been the caſe; for in three of theſe experiments, the machinery being kept immerſed in water, the acceſs of the air of the atmoſphere was completely prevented.

"Was it furniſhed by the water which ſurrounded the machinery? That this could not have been the caſe is evident; *firſt*, becauſe this water was continually *receiving heat* from the machinery, and could not at the ſame time be *giving to* and *receiving heat from* the ſame body; and, *ſecondly*, becauſe there was no chemical decompoſition of any part of this water. Had any ſuch decompoſition taken place (which indeed could not reaſonably have been expected), one of its compound elaſtic fluids (moſt probably inflammable air) muſt at the ſame time have been ſet at liberty, and, in making its eſcape into the atmoſphere, would have been detected; but though I frequently examined the water to ſee if any air bubbles roſe up through it, and had even made preparations for catching them in order to examine them if any ſhould appear, I could perceive none;

nor

nor was there any ſign of decompoſition of any kind whatever, or other chemical proceſs going on in the water.

"Is it poſſible the heat could have been ſupplied by means of the iron bar to the end of which the blunt ſteel borer was fixed? or by the ſmall neck of gun-metal by which the hollow cylinder was united to the cannon? Theſe ſuppoſitions appear more improbable even than either of thoſe before mentioned; for heat was continually going off or *out of the machinery*, by both theſe laſt paſſages, during the whole time the experiment laſted.

"And, in reaſoning on this ſubject, we muſt not forget to conſider that moſt remarkable circumſtance, that the ſource of the heat generated by friction in theſe experiments appeared evidently to be inexhauſtible.

"It is hardly neceſſary to add, that any thing which any *inſulated* body or ſyſtem of bodies can continue to furniſh *without limitation*, cannot poſſibly be a *material ſubſtance*; and it appears to me to be extremely difficult, if not quite impoſſible, to form any diſtinct idea of any thing capable of being excited and communicated in the manner the heat was excited and communicated in theſe experiments, except it be motion.

"But although the mechaniſm of heat ſhould in fact be one of theſe myſteries of nature which are beyond the reach of human intelligence, this ought by no means to diſcourage us, or even leſſen our ardour, in our attempts to inveſtigate the laws of its operations. How far can we advance in any of the paths which ſcience has opened to us, before we find ourſelves enveloped in thoſe thick miſts which on every ſide bound the horizon of the human intellect? But how ample and intereſting is the field that is given us to explore?

"Nobody, ſurely, in his ſober ſenſes has ever pretended to underſtand the mechaniſm of gravitation; and yet what ſublime diſcoveries was our immortal Newton enabled to make, merely by the inveſtigation of the laws of its action! The effects produced in the world by the agency of heat are probably *juſt as extenſive* and quite as important, as thoſe which are owing to the tendency of the particles of matter towards each other; and there is no doubt but its operations are in all caſes determined by laws equally immutable."

HEATH, a townſhip in Hampſhire county, Maſſachuſetts, containing 379 inhabitants. It was incorporated in 1785, and is 125 miles N. W. of Boſton, and about 18 miles N. N. W. of Northampton.—*Morse.*

HEBRON, a town in Cumberland county, Maine, ſituated on the N. E. ſide of Little Androſcoggin, was incorporated in 1792. It is 35 miles N. by W. of Portland.—*ib.*

Hebron, a townſhip in Waſhington county, New-York, containing 1703 inhabitants, of whom 414 are electors.—*ib.*

Hebron, a townſhip in Tolland county, Connecticut, ſettled in 1704 from Northampton. Moſt of the lands were given by Joſhua, ſachem of the Mohegan tribe, in his laſt will and teſtament. It lies between Lebanon and Glaſtenbury, about 18 miles S. E. of Hartford, and 16 ſouth of Tolland.—*ib.*

Hebron, a Moravian ſettlement in Pennſylvania, 16 miles from Litiz, which is 70 miles northerly of Philadelphia. This ſettlement began in 1757.—*ib.*

HECTOR, a military townſhip in the State of New York, on the eaſt ſide of Seneca Lake toward the ſouth end, having Ovid on the north and Newtown townſhip on the ſouth, and 29 miles S. by W. of the ferry on Cayuga Lake.—*ib.*

HEIDELBERG, a Moravian ſettlement in Pennſylvania, begun in 1743; ſituated 24 miles from Litiz, which is in Warwick townſhip, Lancaſter county.—*ib.*

Heidelberg, a handſome town in Dauphine county, Pennſylvania, containing about 100 houſes and two German churches for Lutherans and Calviniſts; one of the churches is a handſome ſtone building. It is 33 miles E. by N. of Harriſburg, and 74 N. W. by W. of Philadelphia. There are two other townſhips of this name in the State, the one in York county, the other in that of Northampton.—*ib.*

HEIGHT OF LAND, a range of mountains which extend from S. W. to the N. E. and ſeparates the Diſtrict of Maine from Lower Canada, giving riſe to many rivers which fall into St Lawrence river, and others which fall into the Atlantic Ocean. The principal growth between the Height of Land and St Francis river is beech, maple, birch, hemlock and fir, very few white pines, and no oak of any ſort. Some of the rivers have fine intervales.—*ib.*

HELENA, or St Helena. In addition to the account of this iſland in the *Encyclopædia*, the following particulars from Sir George Staunton deſerve a place in this *Supplement*, becauſe ſome of them are important in themſelves, while others correct one or two miſtakes into which we had fallen, by adopting, implicitly, the narrative of Forſter.

The circumference of St Helena meaſures ſomewhat leſs than twenty-eight miles. Along the whole coaſt to leeward, or to the northward, ſhips may anchor in perfect ſecurity in all ſeaſons of the year, but the bank ſhelves ſo abruptly afterwards, that the anchorage, being in deep water, is inſecure. The tide ſeldom riſes above three feet and a half; but the ſurge of the ſea is ſometimes tremendous; and ſeveral accidents happened in approaching or quitting the ſhore, until a wharf was erected, lately, which renders the arrival there, and departure from it, perfectly ſafe. In the immediate neighbourhood of the iſland, ſtorms are little known, thunder is rarely heard, and lightning is ſeldom perceived.

The ſteep eminences which intervene between the valleys, that are the chief ſeats of population, render the communication from one part of this little ſpot to another ſlow and difficult. Planters on the windward ſide of the iſland conſider a journey to the leeward, or ſeat of government, as a ſerious undertaking. Several of them take that opportunity of paying their reſpects to the governor, which is called there ſometimes "going to court." There are St Helena planters who have not travelled ſo far. At preſent, by order of the governor, there are ſignals ſo placed all round the iſland, as to give inſtant notice of the approach of veſſels to any part of it.

In the *Encyclopædia*, it is ſaid that peaches are the only European fruits which thrive in St Helena; but this appears to be a miſtake. Several ſorts of fruit trees imported into the iſland had been deſtroyed by a particular inſect; but encouragement has been given for the cultivation of thoſe which that miſchievous animal is known to ſpare, ſuch as the apple, for example,

 with

with all the varieties of which it is susceptible. The plantain and banana, or the two species of the *musa*, thrive also remarkably well. The ground is fertile, and in favourable seasons produces, in some instances, double crops within the year. Plantations, however, of cotton, indigo, or canes, were not found to answer: though some good coffee has been produced in it. A botanic garden has been established near the governor's country house. An intelligent gardener has been sent to take care of it by the company; and a vast variety of trees, plants, and flowers of different, and sometimes opposite climates, are already collected in it. The surrounding sea abounds in esculent fish; and seventy different species, including turtle, have been caught upon the coasts. Whales are seen in great numbers playing round the island, where it is supposed the southern whale fishery might be carried on to great national advantage.

The country is chiefly cultivated by blacks. Persons of that colour were brought in a state of slavery to it by its first European settlers; and it seldom happens that white men will submit to common work where there are black slaves to whom it may be transferred. These were for a long time under the unlimited dominion of their owners, until a representation of the abuses made of that power induced the India Company to place them under the immediate protection of the magistracy, and to enact various regulations in their favour; which have contributed to render them, in a great degree, comfortable and secure. These regulations may have hurt, at first, the feelings of the owners of slaves, but not their real interest; for it appears, that before their introduction there was a loss, upon an average, of about ten in a hundred slaves every year, to be supplied at a very heavy expence; whereas, under the present system, they naturally increase. All future importation of slaves into the island is prohibited.

Besides the blacks in a state of slavery, there are some who are free. The labour of these tending to diminish the value of that of slaves, the free blacks became once obnoxious to some slave owners; who had sufficient influence, in a grand jury, to present them as without visible means of gaining a livelihood, and liable to become burdensome to the community; but upon examination, it appeared that all free blacks of age to work were actually employed; that not one of them had been tried for a crime for several years, nor had any of them been upon the parish. They are now by the humane interposition of the company placed under the immediate protection of the government, and put nearly upon a footing with the other free inhabitants, who, when accused of crimes, have the privilege of a jury, as well as in civil causes.

The principal settlement of St Helena has the peculiar advantage of uniting the shelter of a leeward situation with the coolness of windward gales. The south-east wind blows constantly down the valley, rendering a residence in it pleasant as well as healthy. The country is so fertile, and the climate so congenial to the human feelings, that perhaps it would be difficult to find out a spot where persons, not having acquired a relish for the enjoyments of the world, or already advanced in life, and surfeited with them, could have a better chance of protracting their days in ease, health and comfort.

HELENA ISLAND, St, on the coast of S. Carolina, with the continent on the north, forms St Helena Sound or Entrance, and gives name to a parish in Beaufort district.—*Morse.*

Helena Parish, St, in Beaufort district, S. Carolina, consists of a cluster of islands, on the S. W. side of St Helena Island, one of the largest of which is Port Royal. Adjacent to Port Royal are St Helena, Ladies, Paris, and Hunting Islands. The Hunting Islands are 5 or 6 in number, bordering on the ocean, so called from the number of deer and other game found upon them. All these islands, and some others of less note belong to this parish. The produce of the islands is rice, indigo, cotton, corn, and sweet potatoes; the cultivation of which, as well as in other parts of the State, is entirely carried on by slaves. Taxes paid by St Helena parish £1,144 : 13 : 2. Chief town, Beaufort, on Port Royal island.—*ib.*

Helena, St, a town on the coast of Florida, built by the Spaniards, and burnt by Sir Francis Drake in 1585.—*ib.*

HELICOID Parabola, or the *Parabolic Spiral* is a curve arising from the supposition that the common or Apollonian parabola is bent or twisted, till the axis come into the periphery of a circle, the ordinates still retaining their places and perpendicular positions with respect to the circle, all these lines still remaining in the same plane.

HELISPHERICAL Line, is the Rhumb line in Navigation; being so called, because on the globe it winds round the pole helically or spirally, coming still nearer and nearer to it.

HELL GATE, this celebrated strait is near the west end of Long Island Sound, opposite to Harlem in York Island, and about 8 miles north-east of New-York city, and is remarkable for its whirlpools, which make a tremendous roaring at certain times of the tide. These whirlpools are occasioned by the narrowness and crookedness of the passage, and a bed of rocks which extend quite across it; and not by the meeting of the tides from east to west, as has been conjectured, because they meet at Frog's Point, several miles above. A skilful pilot may conduct a ship of any burden, with safety, through this strait, at high water with the tide, or at low water with a fair wind. There is a tradition among the Indians, that in some distant period, in former times, their ancestors could step from rock to rock, and cross this arm of the sea on foot at Hell Gate.—*Morse.*

HEMLOCK, a lake in New-York State, 12 miles long, and 1 broad, in the Gennessee country.—*ib.*

HEMPFIELD, the name of two townships in Pennsylvania, the one in Lancaster county, the other in that of Westmoreland.—*ib.*

HENDERSON'S GRANT, a tract 12 miles square, on the peninsula formed by the junction of Green river with the Ohio, in the State of Kentucky.—*ib.*

HENIOCHAS, or Heniochus, a northern constellation, the same as Auriga, which see *Encycl.*

HENLEY HOUSE, a station of the Hudson's Bay Company, on the north bank of Albany river, in New S. Wales, 150 miles S. W. of Albany Fort, and 110 N. W. by W. of Brunswick House. N. lat. 51° 14′ 27″. W. long. 85° 5′ 54″.—*Morse.*

HENNIKER, a township in Hillsborough county, New-

New-Hampshire, about 12 miles west of Concord. In 1775, it contained 367, and in 1790, 1127 inhabitants.—*ib.*

HENLOPEN, CAPE, forms the S. W. side of the entrance of Delaware Bay, and Cape May the N. E. side, 28 miles apart. Cape Henlopen lies in N. lat. 38° 50′, and in W. long. 75° 26′. There is a light-house here, a few miles below the town of Lewis, of an octagon form, handsomely built of stone 115 feet high, and its foundation is nearly as much above the level of the sea. The lantern is between 7 and 8 feet square, lighted with 8 lamps, and may be seen in the night 10 leagues off at sea. Its annual expense is about £650. There is a strong iron net-work, in order to prevent birds from breaking the glass at night. Yet so attractive is the light to the winged tribe, that shortly after its erection, 110 birds of different kinds were found dead one morning, and a duck, in particular flew against it with such force, as to penetrate through both the wire and glass, and was found dead in the lantern. Since the above accident, few similar ones have occurred, and the birds have become more wary.

Vessels off the Delaware, upon displaying a jack at the foretopmast-head, will be immediately furnished with a pilot. None, however, are to be depended upon, unless they are furnished with branches, and with a certificate from the board of wardens of Philadelphia.—*ib.*

HENRICO, a county of Virginia, about 30 miles long, and 7 broad, contains 12,000 inhabitants, including 5819 slaves. It is surrounded by Hanover, Charles City, and Goochland counties, and James river. A number of coal mines are in the county, and pits have been opened by many of the proprietors, and worked to considerable profit. The coals in several of the pits are found nearly 200 feet above the level of the river, and 3 or 4 feet below the surface of the ground. It is supposed that 500,000 bushels might be raised from one of these in a year. Chief town, Richmond.—*ib.*

HENRIQUELLE, a remarkable salt-pond in the Spanish part of the island of St. Domingo, about 22 leagues in circuit. It is inhabited by lizards and alligators, and land tortoises, all of a large size. The water is deep, clear, bitter and salt, and has a disagreeable smell. Near the middle of this pond is an island about 2 leagues long, and a league wide, in which is a spring of fresh water, well stocked with *cabritoes*, and thence called *Cabrito island*. This pond is about 11 leagues E. of Port-au-Prince.—*ib.*

HENRY, a cape, the north-eastern extremity of Princess Ann county, in Virginia, 12 miles S. by W. of Cape Charles in Northampton county. These capes form the entrance of Chesapeak Bay. Cape Henry lies in N. lat. 37°, W. long. 76° 16′.—*ib.*

HENRY, a fort in Pennsylvania, 8 miles N. by W. of Myer's Town, at the head of Tulpehocken creek, 32 N. of Lancaster, and nearly 37 S. E. of Sunbury.—*ib.*

HENRY, a mountainous and hilly county of Virginia, bounded N. by Franklin, S. and S. E. by Patrick, S. W. by Grifon, and N. W. and W. by Montgomery. It is about 40 miles long, 15 broad, and contains 6928 inhabitants, including 1551 slaves.—*ib.*

HERKEMER, a new county of New-York, divided into 20 townships, viz. German Flats, Warren, Frankfort, and Litchfield, formed out of *German Flats* in Feb. 1796. Herkemer, Fairfield and N[illegible], formed out of *Fairfield*, Feb. 1796.—Schuyler. The following were comprehended originally in *H[illegible]*, viz. Paris, Sangerfield, Hamilton, Sherburn, Brookfield, Cazenovia, Westmoreland, Mexico, Rome, Steuben and Floyd. By the State census of 1796 the county contains 25,573 inhabitants, of whom 4161 are electors. It is bounded N. by part of Lower Canada and the river St Lawrence, N. W. by the E. end of Lake Ontario, and the river St Lawrence; S. by Otsego county; E. by Clinton and part of Washington county.—*ib.*

HERKEMER TOWN, in the above county, is situated on the north side of Mohawk river. The township includes the village called Little German Flats, and the celebrated plain called German Flats. The village contains a court-house, gaol, a Dutch church, and about 40 dwelling houses, which last are very indifferent buildings. It is 80 miles N. W. by W. of Albany, 16 S. E. of old Fort Schuyler, and 20 in a like direction from Whitestown. In the midst of the flats is a shrub oak plain of 80 or 100 acres, barren and [illegible], of no use but for building lots. The township is named in honour of general Herkemer, who was mortally wounded in the late war. It contained in 1796, by the State census, 2073 inhabitants; of whom [illegible] were electors.—*ib.*

HERO, NORTH, an island in Lake Champlain, is a township annexed to Chittenden county in Vermont, and contains 125 inhabitants. It is 13 miles in length, and 2 in breadth.—*ib.*

HERO, SOUTH, an island in the same lake, belonging to Chittenden county, Vermont, is a township and port of entry, and contains 537 inhabitants. It is 14 miles long, and 3½ broad. Numerous small isles surround the Heros. This island produces good crops of wheat and other grain. In it is a quarry of [illegible] grey marble, which has the appearance of being a petrifaction of scallops, a species of shell common in the vicinity of the lake, together with the common earth of the shore, which is [illegible].—*ib.*

HERON, PASS AU, at the bay of Mobile, in W. Florida, is 18 miles E. of [illegible] river, and has 4 feet water; and from thence to the [illegible] the E. side of the bay of Mobile, in N. lat. [illegible] is nearly 6 miles.—*ib.*

HERRING BAY, lies on the W. side of Chesapeak Bay, Maryland, 26 miles [illegible] and derives its name from the [illegible] quent it.—*ib.*

HERSCHEL, the name [illegible] and most other European nations, call [illegible] discovered by Dr Herschel in the year [illegible]. [illegible] or character is H. The [illegible] call it Uranus, or Urania; but the English, the Georgium [illegible], or Georgium Sidus.

HERTFORD, a county of Edenton district, N. Carolina; bounded N. by the State of Virginia, S. by Bertie county, E. by Chowan, and W. by Northampton, and contains [illegible] inhabitants, of whom [illegible] are slaves. Chief town, Wynton.—*M[illegible]*

HETERODROMUS VECTIS, or LEVER, in Mechanics, a lever in which the fulcrum or point of suspension is between the weight and the power; being the same as what is otherwise called a lever of the first kind.

HIATSTOWN, a village in Middlesex county, New-Jersey; 13 miles northeasterly of Trenton, and 17 S. by W. of New-Brunswick.—*Morse.*

HICKMAN'S, a settlement in Fayette county, Kentucky, on the N. side of Kentucky river, 10 miles N. of Danville, and 22 S. of Lexington.—*ib.*

HID ISLAND is situated in the N. W. Territory; in Plein river, the northern head water of the Illinois. —*ib.*

HIGHGATE, a village in Georgia, about 4 miles from Savannah.—*ib.*

HIGHGATE, the north-westernmost township except Alburgh, in Vermont, in Franklin county, contains 103 inhabitants.—*ib.*

HIGHLANDS, a mountainous tract of country on the banks of Hudson's river, in the State of New-York, between 40 and 60 miles N. of New-York city. The passage on the river through these Highlands, for the distance of about 18 miles, is grand and romantic in a high degree. The opening seems to have been formed on purpose for the passage of this noble river. In these highlands are situated the important and famous fortresses of West Point, Fort Montgomery, and Stoney Point. The most noted peaks are, as you ascend the river, Thunder Hill, St Anthony's Nose, Sugar Loaf, Butter Hill, and Break Neck Hill. After passing the two last, the country opens delightfully, and presents to the eye the pleasant villages of New-Windsor and Newburgh. These mountains abound with iron ore.—*ib.*

HIGUEY, or *Alta Gracia*, a city in the S. E. part of the Spanish division of St Domingo, the easternmost of all the settlements in the island, celebrated formerly for its fertility, and the quantity of sugar it produced. It was formerly the seat of *Cayacoa*, the most powerful cacique of the island. It has now only about 500 inhabitants, and is distant about 40 leagues to the eastward of St Domingo, between which and Higuey are three roads, the circuitous and northernmost of which leads by Bayaguana. N. lat. 18° 30'.—*ib.*

HILLSBOROUGH, an island on the Labrador coast, on a bay at the head of which is Nain.—*ib.*

HILLSBOROUGH, a county of New-Hampshire, bounded N. by Grafton county, S. by the State of Massachusetts, W. by Cheshire, and E. by Rockingham county.

It is divided into 37 townships and 4 gores of land, which contain 32,871 inhabitants, all free people, who chiefly follow agriculture. The academy at Amherst, has £800 funds, and another at New-Ipswich of £1000. Chief towns, Amherst and Hopkinton.—*ib.*

HILLSBOROUGH, a township in the above county, situated on the northern head branches of Contocook river, about 18 or 20 miles W. of Concord, was incorporated in 1772, and contains 798 inhabitants.—*ib.*

HILLSBOROUH, a township in Somerset county, New-Jersey, containing 2,201 inhabitants, including 386 slaves. It is about 15 miles W. of Brunswick, and 18 northerly of Trenton.—*ib.*

HILLSBOROUGH, a village on the eastern side of Chesapeak Bay, in Caroline county, Maryland; seated on the E. side of Tuckahoe Creek, one of the chief branches of Choptank river, 7 miles S. E. by E. of Denton, 9 N. W. of Greensborough, and 27 S. S. W. of Chester.—*ib.*

HILLSBOROUGH, one of the middle districts of North-Carolina, bounded N. by the State of Virginia, S. by Fayetteville district, E. by Halifax, and W. by Salisbury. It comprehends the counties of Granville, Person, Caswell, Orange, Wake, Chatham, and Randolph; and contains 59,983 inhabitants, of whom 13,506 are slaves. Chief town, Hillsborough.—*ib.*

HILLSBOROUGH, a post-town of North-Carolina, and capital of the district of its name, is situated in Orange county, on the N. side of Eno river, in a high, healthy and fertile country. It contains about 80 houses, a court-house and gaol; and had in 1788 an academy of 60 or 80 students, patronized by the principal gentlemen of the State. The Eno unites with Little and Flat rivers, and forms the Neus, about 17 miles below the town. It is 180 miles W. N. W. of Newbern, 26 S. by W. of Person court-house, 101 W. by S. of Halifax, 110 E. N. E. of Salisbury, and 452 S. W. by S. of Philadelphia.—*ib.*

HILLSDALE, a township in Columbia county, New-York, 18 miles from Hudson city, containing 4556 inhabitants, including 31 slaves. By the State census of 1796, 622 of the inhabitants are electors.—*ib.*

HILLTOWN, a small town near the centre of Chester county, Pennsylvania; 28 miles W. of Philadelphia, and 21 N. W. of Chester. Also the name of a township in Bucks county in the same State.—*ib.*

HILTON HEAD is the most southern sea land in S. Carolina. W. and S. W. of Hilton Head lie Pinckney's Bulls, Dawfuskies and some smaller islands, between which and Hilton Head, are Calibogie river and sound, which form the outlet of May and New rivers.—*ib.*

HILTON'S POINT, in Pascataqua river, in New-Hampshire, is the spot where the united stream of Newichawannock and Cochecho rivers, which comes from Dover, meets the western branch and forms the Piscataqua: From thence to the sea is 7 miles, the course generally S. to S. E. and the river is so rapid that it never freezes.—*ib.*

HINCHE, a territory and town in the Spanish part of St Domingo. The canton of Hinche is bounded W. by the French parishes of Gonaives, Petit Riviere and Mirebalais—and contains with some appendages about 12,000 souls. The town contains about 500 houses, and, together with its dependencies, 4,500 souls, 500 of whom are capable of bearing arms. It is situated on the E. side of the mouth of the river Guayamuco, 64 miles N. W. of St Domingo, N. lat. 19° 3'.—*ib.*

HINESBURGH, a township in Chittenden county, in Vermont, lies E. of and joins Charlotte on Lake Champlain. It contains 454 inhabitants.—*ib.*

HINGHAM, a post-town in Suffolk county, Massachusetts, situated on a small bay which sets up south from Boston Bay. It contains a number of houses compactly built, two Congregational churches, and a well endowed school, called, in honour of its principal donor

donor and founder, Derby School. It is 19 miles S. E. of Bofton, and 22 in a like direction from Plymouth. The townfhip is about 4 miles fquare, confifts of two parifhes, was incorporated in 1635, and contains 2,085 inhabitants. Here are 6 grift-mills, 3 faw-mills, and a fulling-mill; four of which are tide mills. Two hills in this town, one of which is called Baker's Hill, prefent extenfive and delightful profpects of Bofton Bay, its iflands, and the adjacent country.—*ib.*

HINSDALE, the S. eafternmoft townfhip in Vermont, and in Windham county. It contains 482 inhabitants.—*ib.*

HINSDALE, a townfhip in Chefhire county, New-Hampfhire, on the eaft bank of Connecticut river, where the fouth line of the State ftrikes the river in 42° 43′ 59″ N. lat. and is oppofite to Hinfdale in Vermont. It was incorporated in 1753, and contains 522 inhabitants. It is about 38 miles above Northampton.—*ib.*

HINZUAN, the proper name of one of the Comora iflands, which by different writers of different nations has been called *Anzuame, Anjuan, Juanny*, and *Johanna*, and which is defcribed in the *Encyclopædia* under the name of St Joanna. In that article, it is obferved, that an anonymous writer has cenfured the defcriptions of this ifland given by the Abbé Reynal and Major Rooke, as being not only exaggerated, but erroneous; neither the country being fo picturefque as the former reprefents it, nor the inhabitants meriting the refpectable character given of them by the latter.

There was not perhaps much propriety in admitting into fuch a work as the *Encyclopædia* the anonymous cenfure of defcriptions, authenticated by the names of refpectable authors; but the beft reparation which we can make to thofe authors, is, to inform our readers, that their defcriptions of Hinzuan are confirmed by Sir William Jones, whofe teftimony, we believe, no man will controvert. That accomplifhed fcholar, who vifited the ifland on his voyage to India, thus defcribes its appearance from the bay in which the fhip rode at anchor.

"Before us was a vaft amphitheatre, of which you may form a general notion by picturing in your minds a multitude of hills infinitely varied in fize and figure, and then fuppofing them to be thrown together, with a kind of artlefs fymmetry, in all imaginable pofitions. The back ground was a feries of mountains, one of which is pointed, near half a mile perpendicularly high from the level of the fea, and little more than three miles from the fhore, all of them richly clothed with wood, chiefly fruit trees, of an exquifite verdure. I had feen many a mountain of ftupendous height in Wales and Swifferland, but never faw one before, round the bofom of which the clouds were almoft continually rolling, while its green fummit rofe flourifhing above them, and received from them an additional brightnefs. Next to this diftant range of hills was another tier, part of which appeared charmingly verdant, and part rather barren; but the contraft of colours changed even this nakednefs into a beauty: nearer ftill were innumerable mountains, or rather cliffs, which brought down their verdure and fertility quite to the beach; fo that every fhade of green, the fweeteft of colours, was difplayed at one view by land and by water. But nothing conduced more to the variety of this enchanting profpect, than the many rows of palm-trees, efpecially the tall and graceful *Arecas*, on the fhores, in the valleys, and on the ridges of hills, where one might almoft fuppofe them to have been planted regularly by defign. A more beautiful appearance can fcarce be conceived, than fuch a number of elegant palms in fuch a fituation, with luxuriant tops, like verdant plumes, placed at juft intervals, and fhowing between them part of the remoter landfcape, while they left the reft to be fupplied by the beholder's imagination. The town of *Matfamúdò* lay on our left, remarkable at a diftance for the tower of the principal mofque, which was built by Halímah, a queen of the ifland from whom the prefent king is defcended: a little on our right was a fmall town called *Bantàni*. Neither the territory of *Nice*, with its olives, date trees and cypreffes, nor the ifles of *Hieres*, with their delightful orange groves, appeared fo charming to me, as the view from the road of *Hinzúàn*."

Sir William Jones, fpeaking of the inhabitants, takes notice of the *Lords, Dukes* and *Princes*, of whom we have made mention after major Rooke. "The frigate, (fays he) was prefently furrounded with canoes, and the deck foon crowded with natives of all ranks, from the high born chief, who wafhed linen, to the half-naked flave who only paddled. Moft of them had letters of recommendation from Englifhmen, which none of them were able to read, though they fpoke Englifh intelligibly; and fome appeared vain of titles, which our countrymen gave them in play, according to their fuppofed ftations: we had *Lords, Dukes*, and *Princes* on board, foliciting our cuftom, and importuning us for prefents. In fact, they were too fenfible to be proud of empty founds, but juftly imagined, that thofe ridiculous titles would ferve as marks of diftinction, and, by attracting notice, procure for them fomething fubftantial." He fpeaks with great refpect of the king, whofe name was *Ahmed*, as well as of feveral chiefs whom he faw, and feems to have met with no man of rank on the ifland whofe character was contemptible, but Selim the king's eldeft fon. For the behaviour of that prince, the old fovereign made the beft apology that he could, while he privately affured the interpreter, that he was much difpleafed with it, and would not fail to exprefs his difpleafure. He concluded his converfation with a long harangue on the advantage which the Englifh might derive from fending a fhip every year from Bombay to trade with his fubjects, and on the wonderful cheapnefs of their commodities, efpecially of their cowries. Ridiculous as this idea might feem, it fhowed (fays Sir William) an enlargement of mind, a defire of promoting the intereft of his people, and a fenfe of the benefits arifing from trade, which could hardly have been expected from a petty African chief, and which, if he had been fovereign of Yemen, might have been expanded into national projects proportioned to the extent of his dominions.

The mafter of the frigate learned from one of the chiefs a few curious circumftances concerning the government of *Hinzuan*: which he found to be a monarchy limited by an ariftocracy. The king, he was told, had no power of making war by his own authority; but, if the affembly of nobles, who were from time to time convened by him, refolved on a war with any of the neighbouring iflands, they defrayed the charges

of

of it by voluntary contributions; in return for which, they claimed as their own all the booty and captives that might be taken. The hope of gain or the want of slaves, is usually the real motive for such enterprises, and ostensible pretexts are easily found: at that very time, he understood they meditated a war, because they wanted hands for the following harvest. Their fleet consisted of sixteen or seventeen small vessels, which they manned with about two thousand five hundred islanders, armed with muskets and cutlasses, or with bows and arrows. Near two years before they had possessed themselves of two towns in *Mayóta*, which they still kept and garrisoned. The ordinary expences of the government were defrayed by a tax from two hundred villages; but the three principal towns were exempt from all taxes, except that they paid annually to the chief *Mufti* a fortieth part of the value of all their moveable property, and from that payment neither the king nor the nobles claimed an exemption. The kingly authority, by the principles of their constitution, was considered as elective, though the line of succession had not in fact been altered since the first election of a sultan.

Sir William Jones concludes his remarks on this island with some reflections; of which, though they may be considered as digressive, we are persuaded our readers will approve of our extending the circulation.

"We have lately heard of civil commotions in *Hinzuan*, which, we may venture to pronounce, were not excited by any cruelty or violence of Ahmed, but were probably occasioned by the insolence of an oligarchy naturally hostile to king and people. That the mountains in the *Comara* islands contain diamonds, and the precious metals, which are studiously concealed by the policy of the several governments, may be true, though I have no reason to believe it, and have only heard it asserted without evidence; but I hope, that neither an expectation of such treasures, nor of any other advantage, will ever induce an European power to violate the first principles of justice by assuming the sovereignty of *Hinzuan*, which cannot answer a better purpose than that of supplying our fleets with seasonable refreshment; and, although the natives have an interest in receiving us with apparent cordiality, yet, if we wish their attachment to be unfeigned and their dealings just, we must set them an example of strict honesty in the performance of our engagements. In truth, our nation is not cordially loved by the inhabitants of *Hinzuan*, who, as it commonly happens, form a general opinion from a few instances of violence or breach of faith. Not many years ago an European, who had been hospitably received and liberally supported at *Matsamudo*, behaved rudely to a young married woman, who, being of low degree, was walking veiled through a street in the evening: her husband ran to protect her, and resented the rudeness, probably with menaces, possibly with actual force; and the European is said to have given him a mortal wound with a knife or bayonet, which he brought, after the scuffle, from his lodging. This foul murder, which the law of nature would have justified the magistrate in punishing with death, was reported to the king, who told the governor (I use the very words of Alwi a cousin of the king's), that "it would be wiser to hush it up." Alwi mentioned a civil case of his own, which ought not to be concealed. When he was on the coast of Africa in the dominions of a very savage prince, a small European vessel was wrecked; and the prince not only seized all that could be saved from the wreck, but claimed the captain and the crew as his slaves, and treated them with ferocious insolence. Alwi assured me, that, when he heard of the accident, he hastened to the prince, fell prostrate before him, and by tears and importunity prevailed on him to give the Europeans their liberty; that he supported them at his own expence, enabled them to build another vessel, in which they sailed to *Hinzuan*, and departed thence for Europe or India: he shewed me the captain's promissory notes for sums, which to an African trader must be a considerable object, but which were no price for liberty, safety, and, perhaps, life, which his good, though disinterested offices had procured. I lamented that, in my situation, it was wholly out of my power to assist Alwi in obtaining justice; but he urged me to deliver an *Arabic* letter from him, enclosing the notes, to the governor-general, who, as he said, knew him well; and I complied with his request. Since it is possible, that a substantial defence may be made by the person thus accused of injustice, I will not name either him or the vessel, which he had commanded; but, if he be living, and if this paper should fall into his hands, he may be induced to reflect how highly it imports our national honour, that a people, whom we call savage, but who administer to our convenience, may have no just cause to reproach us with a violation of our contracts."

HIPS, in architecture, are those pieces of timber placed at the corners of a roof. These are much longer than the rafters, because of their oblique position. Hip means also the angle formed by two parts of the roof, when it rises outwards.

Hip-Roof, called also Italian roof, is one in which two parts of the roof meet in an angle, rising outwards: the same angle being called a valley, when it sinks inwards.

HIRCUS, in astronomy, a fixed star of the first magnitude, the same with capella.

Hircus is also used by some writers for a comet, encompassed as it were with a mane, seemingly rough and hairy.

HIRUDO. See *Encycl.* A new species of this insect was discovered in the South Sea by Le Martiniere, naturalist in Perouse's voyage of discovery. He found it buried about half an inch in a shark's liver, but could not conceive how it had got thither. It was something more than an inch long, of a whitish colour, and composed of several rings similar to those of the tænia. The superior part of its head was furnished with four small ciliated mamillæ, by which it took its food; under each mamilla on both sides was a small oblong pouch, in the form of a cup; and in the form of its *instrumenta cibaria*, it very nearly resembles the animal which has been supposed to be the cause of measles in swine. Both these species are referable to the genus *hirudo*, the characters of which, as given by Linnæus, stand (says Martiniere) in need of reformation.

HIRUNDO Esculenta (see Hirundo, *Encycl.* n° 3.), is thus described in the *Transactions of the Batavian Society in the Island of Java*, vol. iii.; and the description confirms the sagacious conjecture of Mr Latham

Hirundo || Hispaniola.

Latham respecting the size of the bird, which the reader will find in our article referred to.

"The hirundo esculenta is of a blackish grey colour, inclining a little to green; but on the back to the tail, as well as on the belly, this blackish colour gradually changes into a mouse colour. The whole length of the bird from the bill to the tail is about four inches and a half, and its height from the bill to the extremity of the middle toe three inches and a quarter. The distance from the tip of the one wing to that of the other, when extended, is ten inches and a quarter. The largest feathers of the wings are about four inches in length. The head is flat; but, on account of the thickness of the feathers, appears round, and to be of a large size in proportion to the rest of the body. The bill is broad, and ends in a sharp extremity, bent downwards in the form of an awl. The width of it is increased by a naked piece of skin somewhat like parchment, which, when the bill is shut, lies folded together; but which, when the bill opens, is considerably extended, and enables the bird to catch with greater ease, while on wing, the insects that serve it for food. The eyes are black, and of a considerable size. The tongue, which is not forked, is shaped like an arrow. The ears are flat, round, naked spots, with small oblong openings, and are entirely concealed under the feathers of the head. The neck is very short, as well as the legs and the bones of the wings. The thighs are wholly covered with feathers; and the very tender lower parts of the legs, and the feet themselves, are covered with a skin like black parchment. Each foot has four toes, three of which are before and one turned backwards. They are all detached from each other to the roots; and the middle one, together with the claw, is fully as long as the lower part of the leg. Each toe is furnished with a black, sharp, crooked claw of a considerable length, by which the animal can with great facility attach itself to crags and rocks. The tail is fully as long as the body together with the neck and the head. When expanded it has the form of a wedge, and consists of ten large feathers. The four first on each side are long; and, when the tail is closed, extend almost an inch beyond the rest. The other feathers decrease towards the middle of the tail, and are equal to about the length of the body."

There is a variety of this species of hirundo, with a speckled breast, and white spots on the tail feathers; and this, though less numerous than the other, and indeed not found at all in Java, appears to have been the only hirundo esculenta known to Linnæus. For an account of the eatable nests of these birds, and the manner of collecting them, see CAP and BUTTON in this *Supplement*.

HISPANIOLA, or ST DOMINGO, the largest of the Antilles or Caribbee islands, has been described, as it existed prior to the French revolution, in the *Encyclopædia*. Previous to the year 1789 the government of the French part of the island was administered by an officer called the Intendant, and a Governor-General, both nominated by the crown, and invested with authority for three years. Their powers were in some cases distinct, and in others united; but though these powers were extensive and almost absolute, the attention which the old government of France paid to the character and rank of those persons whom it had placed over its foreign settlements, secured to the inhabitants of Hispaniola a very considerable share of happiness. In spite of what our restless innovators call political evils, signs of prosperity were everywhere visible; their towns were opulent, their markets plentiful, their commerce extensive, and their cultivation increasing.

Hispaniola.

Such was, in 1788, the state of the French colony in the island of St Domingo; but in that eventful year, the flame, which had burst forth in Europe, spread itself to the West-Indies. An association had been formed in France upon principles somewhat similar to those of our society for the abolition of the slave trade; but that association, which called itself *Amis des Noirs*, had much more dangerous designs than ours. Avowing its detestation of every kind of slavery, as well as of the African trade, and condemning those abettors of liberty who dared to declare themselves poss[illegible], its members kept up an intimate and clandestine connection with those rich mulattoes who resided in France for their education, and laboured to convince them that neither their colour nor their *spurious birth* [illegible] make any civil or political distinction between them and the whites who were born in [illegible]. [illegible], as it were, with these factions and [illegible], the National Assembly issued its [illegible] declaration, in which it was maintained that all men [illegible] and continue free, and equal in their rights. The consequence of this was such as might have been expected. The mulattoes of Hispaniola instructed in the French philosophy of the rights of man, broke out into rebellion; but not acting in concert, they were quickly overpowered.

The spirit, however, which had been excited among them, still continued to ferment; and the National Assembly of France, taking the state of the island into solemn consideration, decreed, by a great [illegible], that its intention had never been to interfere with the internal affairs of the colony; that their internal legislation was entirely their own; and that the legislature of the mother country would make no innovation, directly or indirectly, in the system of commerce in which the colonies were already concerned. [illegible] grateful this declaration might be to the whites of St Domingo, and in the then state of things however wise in itself, it occasioned discontent and [illegible] on the part of the factious friends of the negroes. They regarded it as an unwarrantable [illegible] of the African traffic, and a confession, that the planters of Hispaniola were not colonists, but an independent people.

The colonists themselves, indeed, [illegible] representatives, seem to have [illegible] they were rendered independent; [illegible] assembly they passed an act [illegible] gate, the governor general, [illegible] their future acts. This [illegible] giving universal [illegible] called their delegates, [illegible] nounced their obedience to [illegible], and petitioned the governor [illegible].

During these [illegible] the line, which lay in [illegible] gave a sumptuous entertainment [illegible] governor; on which [illegible] themselves in the [illegible] to mutiny; and [illegible], in [illegible] thanks to the mutineers. [illegible] ing at the ſame time a powder magazine, the governor declared them adherents to traitors, and called on all officers, civil and military, to bring them to puniſhment. This was the ſignal for civil inſurrection; armed troops took the field on both ſides; and war ſeemed inevitable, when the aſſembly reſolved to repair in a body to France and juſtify their paſt conduct.

In the mean time the *Amis des Noirs* contrived to excite the people of colour to rebellion. They initiated in the doctrine of equality and the rights of man one James Oge, then reſiding in Paris in ſome degree of affluence. They perſuaded him to go to St Domingo, put himſelf at the head of his people, and deliver them from the oppreſſion of the whites; and in order to evade the notice of government, they undertook to procure for him arms and ammunition in America. He embarked accordingly, July 1790, for New England with money and letters of credit; but notwithſtanding the caution of the *Amis des Noirs*, his deſigns were diſcovered by the French government, and his portrait was ſent out before him to St Domingo. He landed on the iſland in October, and ſix weeks afterwards publiſhed a manifeſto, declaring his intention of taking up arms, if the privileges of whites were not granted to *all perſons without diſtinction*. He was joined by about 200 men of colour; and this little army of ruffians not only maſſacred the whites wherever they fell in with them in ſmall numbers, but, by a ſtill more unjuſtifiable mode of conduct, took vengeance on thoſe of their own colour who refuſed to join their rebellious ſtandard. They were, however, ſoon overpowered by the regular troops; and their leader, after diſcloſing, it is ſaid, ſome important ſecrets, ſuffered the puniſhment due to his treaſon.

While theſe things were going on in the iſland, the members of the Colonial Aſſembly arrived at Paris, where they were received by the repreſentatives of the French people with marked ſymptoms of averſion. The reſolutions compoſing their famous decree were pronounced improper; their vote of thanks to the mutineers was declared criminal; they were themſelves perſonally arreſted; orders were given for a new aſſembly to be called; and the king was requeſted to augment the naval and military force then at St Domingo.

The National Aſſembly of France having decreed that every perſon twenty-five years old and upwards, poſſeſſing property, or having reſided two years in the colony and paid taxes, ſhould be permitted to vote in the formation of the colonial aſſembly, the people of colour very naturally concluded that this privilege was conferred upon them. Such, however, we believe, was not the meaning of the National Aſſembly; but Gregoire, with the other friends of the negroes, at laſt prevailed, and mulattoes born of free parents were pronounced to be not only worthy of chooſing their repreſentatives, but alſo eligible themſelves to ſeats in the colonial aſſemblies. This decree ſacrificed at once all the whites in the iſland to the people of colour; and the indignation which filled the minds of both the royal and the republican parties ſeemed to have united them in one common cauſe. They reſolved to reject the civic oath; to confiſcate the French property in the harbour, on which they actually laid an embargo; to pull down the national colours, and to hoiſt the Britiſh ſtandard in their ſtead. The mulattoes in the mean time collected in armed bodies, and waited with anxious expectation to ſee what meaſures the colonial aſſembly would adopt.

During theſe diſſenſions, the negro ſlaves, into whoſe minds had been ſeduloufly inſtilled an opinion that their rights were equal to thoſe of their maſters, reſolved to recover their freedom. On the morning of the 23d of Auguſt 1791, the town of the Cape was alarmed by a confuſed report that the ſlaves in the adjoining pariſhes had revolted; and the tidings were ſoon confirmed by the arrival of thoſe who had narrowly eſcaped the maſſacre. The rebellion had broken out in the pariſh of Acul, nine miles from the city, where the whites had been butchered without diſtinction; and now the rebels proceeded from pariſh to pariſh, murdering the men, and raviſhing the unfortunate women who fell into their hands. In a ſhort time the ſword was accompanied with fire, and the cane-fields blazed in every direction. The citizens now flew to arms, and the command of the national troops was given to the governor, whilſt the women and children were put aboard the ſhips in the harbour for ſafety. In the firſt action the rebels were repulſed; but their numbers rapidly increaſing, the governor judged it expedient to act ſolely on the defenſive. In the ſpace of two months it was computed that upwards of 2000 white perſons periſhed; and of the inſurgents, who conſiſted as well of mulattoes as of negroes, not fewer than 10,000 died by famine and the ſword, and hundreds by the hands of the executioner.

When intelligence of theſe dreadful proceedings reached Paris, the Aſſembly began to be convinced that its equalizing principles had been carried too far; and the famous decree, which put the people of colour on the ſame footing with the whites, was repealed. Three commiſſioners were likewiſe ſent to the colony to reſtore peace between the whites and the mulattoes; but two of them being men of bad character, and none of them poſſeſſing abilities for the arduous taſk of extinguiſhing the flames of a civil war, they returned to France without accompliſhing in any degree the object of their miſſion.

In the mean time the *Amis des Noirs* in the mother country had once more gained the aſcendant in the National Aſſembly; and three new commiſſioners, Santhonax, Polverel, and Ailhaud, with 6000 choſen men from the national guards, were embarked for St Domingo. It was ſtrongly ſuſpected that the object of theſe commiſſioners was to procure unqualified freedom for all the blacks in the iſland; but they ſolemnly ſwore that their ſole purpoſe was to eſtabliſh the rights of the mulattoes, as decreed by the law which had been lately repealed. The whites therefore expected that a colonial aſſembly would be convoked; but inſtead of this the commiſſioners nominated twelve perſons, of whom ſix had been members of the laſt aſſembly, and ſix were mulattoes, *Une Commiſſion Intermediare*, with authority to raiſe contributions on the inhabitants, the application of which, however, they reſerved to themſelves. The governor finding that the commiſſioners uſurped all authority, complained that he was but a cypher in public affairs; his complaint was anſwered by an arreſt upon his perſon, and he was ſent a ſtate priſoner to France.

The tyranny of the commiſſioners did not ſtop here. They overawed the members of the commiſſion *intermediare*, by arreſting four of their number; and diſagreeing among themſelves, Santhonax and Polverel diſmiſſed

Hispaniola, || Hiwassee.

Hoboken || Holland.

missed Ailhaud from their councils. War was by this time declared between the mother country and Great Britain, and prudence compelled the government of France to take some care of the injured colony. Galbaud, therefore, a man of fair character, was appointed governor, and ordered to put the island in a state of defence against foreign invasion; but possessing West India property, which it seems was a legal disqualification for the office of governor, the commissioners disregarded his authority, and took up arms against him. Finding themselves likely to be worsted, they offered to purchase the aid of the rebel negroes, by the offer of a pardon for their past conduct, freedom in future, and the plunder of the capital. Two of the negro chiefs, more honourable than the French commissioners, spurned at the base proposal; but a third, after the governor had fled to the ships, entered the town with 3000 revolted negroes, and began an indiscriminate massacre. The miserable inhabitants fled to the shore, but their retreat was stopped by a party of mulattoes; and for two days the slaughter was incessant. The town was half consumed by fire; and the commissioners, terrified at the work of their own hands, fled for protection to a ship of the line, and thence issued a manifesto, which, while it tried to extenuate, evinced a consciousness of their guilt.

Thus was lost perhaps to Europe, and lost by the frantic conduct of French philanthropists, the finest island in the West Indies; an island which produced alone as much sugar as all the British West India possessions united; not to mention the coffee and indigo, which were in immense quantities cultivated in Hispaniola. Had it not been for the restless machinations of the *Amis des Noirs*, it does not appear that so general a revolt would have taken place among the slaves; for though the spirit of republicanism had found its way into the island, the republicans joined with the royalists to keep the negroes in proper subjection. The unsuccessful attempt which, at the request of the more respectable part of the inhabitants, the British government made to subdue the execrable commissioners and their adherents, is fresh in the memory of all our readers, and need not here be detailed at length. Suffice it to say, that after prodigies of valour, our troops were compelled, rather by disease than by the swords of the enemy, to abandon the island, which is now under the controul of a negro or mulatto-chief. What will ultimately become of it, future events must decide; but let its protracted and bloody disputes be a warning to all, and among others to our association for the abolition of the slave trade, that it is impossible to promote a good end by wicked means, and that slaves must be civilized before they be made free.

HITCHELAGA, or *Hochelaga*, an Indian village in Lower Canada, situated in the island of Montreal, and at the foot of the mountain so called. It is fortified after the Indian manner, and the inhabitants speak the Huron language.—*Morse.*

HITTON, a small village in Anne Arundel county, Maryland, 13 miles W. by S. of Baltimore.—*ib.*

HIWASSEE is the only river of any consequence which empties into the Tennessee from the south. It is a bold river, passing through the Cherokee towns and empties into the Tennessee about 40 miles below the mouth of the Clinch, and 46 above the Whirl or Suck, by land, but 60 by water. It is navigable till it penetrates the mountains on its S. side. Ore was found in these mountains, when in possession of the British, from which gold was extracted. The Indians know the spot; but are very anxious to keep it a secret. A branch of the Hiwassee, called Amoia, almost interlocks a branch of the Mobile. The portage between them is short, and the road firm and level.—*ib.*

HOBOKEN, a tract of land in Bergen county, New-Jersey, situated on the W. bank of the Hudson, in the mountainous country between the town of Bergen and Fort Lee, about 7 miles above New-York city.—*ib.*

HOCKHOCKING, a river in the N. W. Territory, about 28 miles below the Muskingum, which it resembles, but is inferior to it in size. It rises near a branch of the Sciota, and taking a S. W. course enters the Ohio at Bellpre, in N. lat. 38° 57′. It is navigable for large flat bottomed boats, between 70 and 80 miles; has fine meadows with high banks, which are seldom overflowed, and rich uplands on its borders. On the banks of this fine river are inexhaustible quarries of free-stone, large beds of iron ore, rich mines of lead, and coal pits. There are also productive salt springs, beds of white and blue clay of an excellent quality. Red bole, and many other useful fossils have been found on the banks of this river.—*ib.*

HOLDEN, a township in Worcester county, Massachusetts, was formerly the north-western part of Worcester, from which it is distant 7 miles, and 51 miles W. of Boston. It contains 1080 inhabitants. It was incorporated in 1740. In the earthquake in 1755, there were several acres of land, in an obscure place in the N. E. corner of the township, quite surrounded by a visible fracture in the earth, of a circular form, and of various width and depth. The small river there had its bed raised so as to occasion a considerable fall of water, where there was little or none before. The stump of a tree, that stood directly over the chasm, on the E. was divided into two equal parts, one standing on the outside of the chasm, the other upon the inside; but not opposite to each other: the half within the chasm, being carried 5 feet forward, towards the river.—*ib.*

HOLDERNESS, a township in Grafton county, New-Hampshire, situated on the eastern side of Pemigewasset river, was incorporated in 1761, and contains 329 inhabitants. A corner of Squam Lake is in this township; and Rattlesnake Mountain lies partly in this and Sandwich the adjoining township on the N. E. It is 64 miles N. N. W. of Portsmouth.—*ib.*

HOLE-IN-THE-WALL, a village in Talbot county, Maryland, on the E. side of Chesapeak bay; 7 miles easterly of Oxford, and a like distance S. of Easton.—*ib.*

HOLLAND, a township in Hampshire county, Massachusetts, which, until incorporated in 1785, was the E. parish of South Brimfield, and is bounded S. by Tolland county, in Connecticut, E. by Worcester county, and northward by Brimfield. It contains 428 inhabitants, and is 75 miles S. W. by W. of Boston.—*ib.*

Holland *Company Lands*, are situated in Pennsylvania, on the navigable waters of Alleghany river and French Creek.—*ib.*

HOLLAND'S *Islands* are near to, and south of Hooper's Island and Straits in Chesapeak Bay.—*ib.*

HOLLAND'S *Point*, on the west side of Chesapeak Bay, together with Parker's Island, form the mouth of Herring Bay.—*ib.*

HOLLIS, the *Nisitissit* of the Indians, a township in Hillsborough county, New-Hampshire, situated on the Massachusetts line, incorporated in 1746, and contains 1441 inhabitants. It is about 70 miles S. W. of Portsmouth, and 45 N. W. of Boston.—*ib.*

HOLLIDAYS *Island* lies 15 miles up Chowan river in North Carolina: Thus far the river is three miles wide.—*ib.*

HOLLISTON, the most southern township in Middlesex county, Massachusetts, has Hopkinton on the north, Wrentham on the east, and is 24 miles S. by W. of Boston. The first settlements were made here in 1710, and in 1724 the town was incorporated by its present name in honour of Thomas Hollis of London, one of the patrons of Cambridge University; and it now contains 875 inhabitants.—*ib.*

HOLLOW, in architecture, a concave moulding, about a quarter of a circle, by some called a casement, by others an abacus.

Hollow-Tower, in fortification, is a rounding made of the remainder of two brisures, to join the curtain to the crillon, where the small shot are played, that they may not be so much exposed to the view of the enemy.

HOLSTON, the largest branch of Tennessee river, rises in Virginia, and joins that river 22 miles below Knoxville. It is a large, bold river, upwards of 300 yards wide at that town, is about 200 miles in length, and receives in its course several considerable rivers, viz. from its head downwards, Watauga, French Broad, (which includes Limestone Creek, Nolachucky, Swanano, Big Laurel, and Big and Little Pigeon) and Little rivers. The streams on the northern side are creeks of no great size or length of course. Holston is navigable for boats of 25 tons upwards of 100 miles, as high as the mouth of the North Fork; at which place Mr David Ross has erected iron-works upon a large scale. At the mouth of this river, on the north side, stands Fort Grainger. The river is 150 yards wide, 16 miles above the North Fork at Ross's iron-works, and nearly 5 above Long-Island, and in N. lat. 36° 27′, W. long. 83° 8′.—*Morse.*

HOLSTON, a settlement on the river above mentioned, in the State of Tennessee, containing 28,649 inhabitants, though in the year 1775 it had hardly 2,200; yet its importance during the revolution may be conceived, when it is known that a great part of those volunteer troops who attacked and defeated the British and tories on King's Mountain, who were commanded by Colonel Ferguson, came from this country.

The land is generally fertile, but the face of the country is much broken. Placed between two large mountains, it seldom suffers for want of rain. It abounds with iron ore. A capital furnace and forge have lately been erected in Holston near the Virginia line, a bloomery below the mouth of Watawga, and another 25 miles above the mouth of the French Broad. There are sundry lead mines in the settlement, one in particular on the French Broad, that produces 75 per cent. pure lead. Long-Island on Holston river is 340 miles S. W. by W. of Richmond in Virginia.—*ib.*

HOLWELL (John Zephaniah, Esq;), was a gentleman of letters, whose history is well intitled to a place in such a collection as ours; but, unfortunately, we know not either the time or the place of his birth, or the school at which he was educated. At an early period of life he was sent to Bengal as a writer in the East-India Company's service, and in the year 1756, was second in council at Fort William, when an offence was given to the nabob of Bengal by the governor's protecting a fugitive native. In revenge for this, the nabob marched against the fort with a powerful army. Drake, the chief who had given the offence, deserted his station, and the command devolved on Mr Holwell, who, with the few men he had, defended the place to the last extremity. This opposition incensed the nabob against Mr Holwell; and although on the surrender he had given his word that no harm should come to him, Mr Holwell and his unfortunate fellows in arms were thrust into a close prison, called the Black Hole*, not eighteen feet square, to the number of 146 persons, and into which no supply of air could come but by two small windows in one end. Here for one whole night they were confined; the numbers crowded together caused a most profuse perspiration, which was succeeded by a raging thirst. They called for water, but the little supply which the humanity of the black soldiers could grant them, was nearly all lost in the struggle to obtain it. Every few minutes some one or other expired, through thirst, or pressure, or were trampled to death. Mr Holwell, after struggling for many hours, threw himself down on a platform, and in a short space of time happily became insensible. In this dismal dungeon they were kept till six o'clock in the morning, when twenty-three only were found alive. Mr Holwell himself was in a high fever, but was loaded with fetters and otherwise ill treated, yet the excellency of his constitution overcame all his hardships, and he was soon after released and embarked for England. In 1758 he published a well written and affecting narrative of the sufferings of himself and his companions. Since this time Mr Holwell has resided in England, and has written several tracts on Indian affairs, particularly a work in three parts, intitled "Events relative to Bengal and Hindostan."—"The manner of inoculating for the small-pox in the East Indies."—"A new experiment for the prevention of crimes," published in 1786. He has also published a tract which contains some very singular sentiments on religious subjects, intitled "Dissertations on the origin, nature, and pursuits of intelligent beings, and on Divine Providence, religion, and religious worship." Mr Holwell was elected many years ago, F. R. S. and lived to a good old age, respected by his acquaintance, and although much afflicted by bodily complaints, possessed a wonderful fund of spirits.

* See CALCUTTA, *Encycl.*

HOMER, a military township in Onondaga county, New York, on the head waters of the N. W. branch of Chenengo river; 56 of its inhabitants are electors.—*ib.*

HOMODROMUS VECTIS, or *Lever*, in mechanics, is a lever in which the weight and power are both on the same side of the fulcrum as in the lever of the 2d and 3d kind; being so called, because here the weight and power move both in the same direction, whereas in the heterodromus they move in opposite directions.

HONA CHITTO, a river which rises in Georgia, in in N. lat. 32°, between Pearl and Loofa Chitto rivers, runs foutherly 125 miles, and at the town of Manca in Weft-Florida, a few miles from its mouth, runs W. to Miffiffippi river. N. lat. 30° 25'.—*ib.*

HONDO, RIO, a river of Yucatan, which empties into the bay of Honduras. This river, by the peace of 1783, was the northern boundary of the tract fouthward of Balleffe river, granted by the Spaniards to the Britifh, to cut and carry away logwood.—*ib.*

HONDURAS, a province of New Spain, having the bay of its name and the North Sea on the north; Yucatan on the north-weft; and the Mofquito Shore on the north-eaft; Nicaragua and Guatimala on the fouth, and Vera Paz on the weft. It is about 100 leagues long and 80 broad. It abounds with honey, cotton, fine wool, dye woods in particular, and has fome gold and filver mines. The rivers overflow like the Nile, and enrich the land. The air is good, except near the lagoons and low grounds. The foil in many parts bears Indian corn thrice a year; and the vineyards bear twice a year; for immediately after the vintage they cut them again; and the fecond grapes are ripe before Chriftmas. Valladolid is the chief town, where the governor and bifhop refide. Truxillo is alfo a fine town, and very ftrong by nature; and Omoah is ftrongly fortified. The Spaniards claim this country; but the Englifh have been long in poffeffion of the logwood tract in the Bay of Honduras, cutting large quantities of it every year. And the Mofquito Indians to the eaft of this province have entered into treaties with the Englifh, received them into their country, and done them feveral fervices. Befides, the Spaniards have no forts in this bay, or in the country of the Mofquitos, only two fmall towns.—*ib.*

HONEYYOE, a lake in the Geneffee country in New-York State, weftward of Canandargua Lake, 5 miles long and 3 broad.—*ib.*

HONOMINIES, a river in the N. W. Territory which runs S. S. eafterly into Puan Bay. Between the head of this river and Lake Superior is a fhort portage.—*ib.*

HOOKE (Dr Robert) is faid, in the account of him which is publifhed in the *Encyclopædia*, to have laid claim to the inventions of others, and to have boafted of many of his own, which he never communicated. We will not prefume to fay that this charge is entirely groundlefs; but we know that it has been greatly exaggerated, and that many difcoveries undoubtedly made by him have been claimed by others. Of this the reader will find one confpicuous proof under the article Watch *(Encycl.)*; and perhaps the following hiftory of the inventions to which he laid claim may furnifh another. It would be harfh to charge him with falfity in any of them; that is to fay, to imagine that he either ftole them from others, or did not *think*, at leaft, that he was *an* inventor. And, with refpect to many of them, the priority of his claim is beyond difpute.

1656, Barometer, a weather glafs.

1657, A fcapement, for maintaining the vibration of a pendulum.—And not long after, the regulating or balance-fpring for watches.

1658, The double barrelled air pump.—The conical pendulum.—His firft employment of the conical pendulum was no lefs ingenious and fcientific than it was original. He employed it to reprefent the mutual gravitation of the planets; a fact which he had moft fyftematically announced. He had fhewn, that a force, perfectly analogous to gravity on this earth, operated on the furface of the moon and of Jupiter. Confidering the numerous round pits on the furface of the moon, furrounded with a fort of wall, and having a little eminence in the middle, as the production of volcanoes, he inferred, that the ejected matter fell back again to the moon, as fuch matter falls back again to the earth. He faw Jupiter furrounded with an atmofphere, which accompanied him; and therefore preffed on him, as our air preffes on the earth:—He inferred, that it was the fame kind of power that maintained the fun and other planets in a round form. He inferred a force to the fun from the circulation round him, and he called it a *gravitation;* and faid that it was not the earth which defcribed the ellipfe, but the centre of gravity of the earth and moon. He therefore made a conical pendulum, whofe tendency to a vertical pofition reprefented the gravitation to the fun, and which was projected at right angles to the vertical plane; and fhewed experimentally, how the different proportions of the projectile and centripetal tendencies produced various degrees of eccentricity in the orbit. He then added another pendulum, defcribing a cone round the firft, while this defcribed a cone round the vertical line, in order to fee what point between them defcribed the ellipfe. The refults of the experiment were intricate and unfatisfactory; but the thought was ingenious. He candidly acknowledged, that he had not difcovered the true law of gravitation which would produce the defcription of an ellipfe *round the focus*, owing to his want of due mathematical knowledge; and therefore left this inveftigation to his fuperiors. Sir Ifaac Newton was the happy man who made the difcovery, after having entertained the fame notions of the forces which connected the bodies of the folar fyftem, before he had any acquaintance with Dr Hooke, or knew of his fpeculations.

1660, The engine for cutting clock and watch wheels.—The chief phenomena of capillary attraction.—The freezing of water a fixed temperature.

1663, The method of fupplying air to a diving bell.—The number of vibrations made by a mufical chord.

1664, His Micrographia was, by the council of the Royal Society, ordered to be printed; but in that work are many juft notions refpecting refpiration, the compofition of the atmofphere, and the nature of light, which were afterwards attributed as difcoveries to Mayow and others, who, though we are far from fuppofing that they ftole their difcoveries from Dr Hooke, were certainly anticipated by him.

1666, A quadrant by reflection.

1667, The marine barometer.—The gage for founding unfathomable depths.

1668, The meafurement of a degree of the meridian, with a view to determine the figure of the earth, by means of a zenith fector.

1669, The fact of the *confervatio virium vivarum*, and that in all the productions and extinctions of motion, the accumulated forces were as the fquares of the final or initial velocities. This doctrine he announces in all its generality and importance, deducing from it all the confequences which John Bernoulli values himfelf fo highly upon, and which are the chief facts adduced by Leibnitz in support of his doctrine of the forces of bodies in motion. But Hooke was perfectly aware of their entire correspondence with the Cartesian, or common doctrine, and was one of the first in applying the celebrated 39th proposition of Newton's Principia to his former positions on this subject, as a mathematical demonstration of them.

1673, That the catenarea was the best form of an arch.

1674, Steam engine on Newcomen's principle.

1679, That the air was the sole source of heat in burning: That combustion is the solution of the inflammable vapour in air; and that in this solution the air gives out its heat and light. That nitre explodes and causes bodies to burn without air, because it consists of this air, accompanied by its heat and light in a condensed or solid state; and air supports flame, because it contains the same ingredients that gunpowder doth, that is, a nitrous spirit: That this air dissolves something in the blood while it is exposed to it in the lungs in a very expanded surface, and when saturated with it, can no longer support life nor flame; but in the act of solution, it produces animal heat: That the arterial and venal blood differ on account of this something being wanting in one of them. In short, the fundamental doctrines of modern chemistry are systematically delivered by Dr Hooke in his Micrographia, published in 1664, and his Lampas, published in 1677.

1680, He first observed the secondary vibrations of elastic bodies, and their connection with harmonic sounds. A glass containing water, and excited by a fiddlestick, threw the water into undulations, which were square, hexagonal, octagonal, &c. shewing that it made vibrations subordinate to the total vibration; and that the fundamental sound was accompanied by its octave, its twelfth, &c.

1681, He exhibited musical tones by means of toothed wheels, whirled round and rubbed with a quill, which dropped from tooth to tooth, and produced tones proportioned to the frequency of the cracks or snaps.

1684, He read a paper before the Royal Society, in which he affirms, that some years before that period he had proposed a method of discoursing at a distance, not by sound, but by sight. He then proceeds to describe a very accurate and complete telegraph, equal, perhaps, in all respects to those now in use. But some years previous to 1684, M. Amontans had not invented his telegraph; so that, though the Marquis of Worcester unquestionably gave the first hint of this instrument, Dr Hooke appears to have first brought it to perfection. See TELEGRAPH, *Encycl.*; and a book, published 1726, entitled *Philosophical Experiments and Observations* of the late eminent Dr Robert Hooke.

We are indebted to him for many other discoveries of lesser note; such as the wheel barometer, the universal joint, the manometer, screw divided quadrant, telescopic sights for astronomical instruments, representation of a muscular fibre by a chain of bladders, experiments shewing the inflection of light, and its attraction for solid bodies, the curvilineal path of light through the atmosphere.

HOOKSET FALLS, or *Hookset Isle Falls* in Merrimack river, just below the mouth of Suncook, 7 miles above Amuskeag Falls, and 8 miles below Concord, in New-Hampshire.—*Morse*.

HOOKSTOWN, a village on the west side of Chesapeak Bay in Maryland, in Baltimore county, 6 miles N. W. of the town of Baltimore.—*ib.*

HOOKTOWN, a village on the east side of Chesapeak Bay, in Talbot county, Maryland, lies north of Easton, and S. W. of Williamsburg, nearly 3 miles from each.—*ib.*

HOOPER'S ISLAND AND STRAITS lie on the east side of Chesapeak Bay, and on the S. W. coast of Dorchester county, Maryland. The island is 7 miles long, and 2½ broad.—*ib.*

HOOSACK, a river of New-York which falls into the Hudson from the east, about 8 miles above the city of Lansinburgh. It rises in Berkshire county, Massachusetts, runs north-westerly through Pownal in Vermont, thence into New-York State. Its length is about 40 miles. The curious mill-stream called Hudson's Brook, which falls into a north branch of Hoosack, is described in the article *Adams*, in this *Supplement*.—*ib.*

HOPE, a village in Sussex county, New-Jersey, on the post-road from Newtown to Easton in Pennsylvania, 16 miles S. W. of the former, and 20 N. E. of the latter. It is inhabited by about 100 of the Moravian United Brethren.—*ib.*

HOPE, a bay on the N. W. coast of N. America, so named by Capt. Cook. The entrance of Nootka, or St George's Sound, is situated in the east corner of Hope Bay, in N. lat. 49° 33′, E. long. 233° 12′.—*ib.*

HOPE, a Moravian settlement in Wachovia, in N. Carolina, in Surry county, where is a meeting-house of the United Brethren.—*ib.*

HOPE, a small island in Narraganset Bay, State of Rhode-Island.—*ib.*

HOPEWELL, a township in Cumberland county, in the province of New-Brunswick, situated on Chepodie river, which runs easterly into a northern arm of the Bay of Fundy, and is navigable 4 or 5 miles.—*ib.*

HOPEWELL, the name of 3 townships in Pennsylvania, viz. in York, Huntingdon, and Washington counties.—*ib.*

HOPEWELL, a township in Hunterdon county, New-Jersey, situated on Delaware river, 14 miles W. of Princeton, 11 above Trenton and 30 south-westerly of New-Brunswick. It contains 2320 inhabitants, including 233 slaves. Another township of this name lies in Cumberland county, in New-Jersey.—*ib.*

HOPKINS, or *Hopkinsville*, a township in Caledonia county, in Vermont, was granted to Dr Hopkins; 11 miles northwest of the upper bar of the Fifteen Mile Falls in Connecticut river.—*ib.*

HOPKINSON (Francis, Esq.) Judge of the Court of Admiralty in Pennsylvania, possessed an uncommon share of genius of a peculiar kind. He excelled in music and poetry, (A) and had some knowledge

(A) He invented an improved tongue for the harpsichord; a description of which accompanied with an engraving, may be seen in the Columbian Magazine for May 1787. He also published a small collection of songs, composed and set to musick by himself, which have been universally admired.

ledge in painting. But these arts did not monopolise all the powers of his mind. He was well skilled in many practical and useful sciences, particularly mathematics and natural philosophy, and he had a general acquaintance with the principles of anatomy, chemistry, and natural history.—But his *forte* was *humour* and *satire*, in both of which he was not surpassed by Lucian, Swift, or Rabelais. These extraordinary powers were consecrated to the advancement of the interests of patriotism, virtue, and science. It would fill many pages to mention his numerous publications during the late revolution, all of which were directed to those important objects.——He began in the year 1775, with a small tract which he entitled "A pretty story" in which he exposed the tyranny of Great Britain in America, by a most beautiful allegory, and he concluded his contributions to his country, in this way, with the history of "a new roof." A performance, which for wit, humour, and good sense, must last as long as the citizens of America continue to admire, and to be happy under, the present national government of the United States.

Newspaper scandal, frequently for months together, disappeared or languished, after the publication of several of his irresistible satires upon that disgraceful species of writing. He gave a currency to a *thought* or *phrase* in these effusions from his pen, which never failed to bear down the spirit of the times, and frequently to turn the divided tides of party-rage, into one general channel of ridicule or contempt.

Sometimes he employed his formidable powers of humour and satire in exposing the formalities of technical science.—He thought much, and thought justly, upon the subject of education. He often ridiculed in conversation, the practice of teaching children the English language by means of grammar. He considered most of the years which are spent in learning the Latin and Greek languages as lost, and he held several of the arts and sciences which are still taught in our colleges, in great contempt. His specimen of modern learning, in a tedious examination, the only object of which was to describe the properties of a "salt-box," published in the American Museum for February 1787, will always be relished as a morsel of exquisite humour, while the present absurd modes of education continue to be practised in the United States.

Mr Hopkinson possessed uncommon talents for pleasing in company. His wit was not of that coarse kind which was calculated to "set the table in a roar." It was mild and elegant, and infused cheerfulness, and a species of delicate joy, rather than mirth, into the hearts of all who heard it. His empire over the attention and passions of his company was not purchased at the expense of innocence. A person who has passed many delightful hours in his society, declares with pleasure, that he never once heard him use a profane expression, nor utter a word that would have made a lady blush, or have clouded her countenance for a moment with a look of disapprobation. It is this species of wit alone that indicates a rich and powerful imagination, while that which is tinctured with profanity, or indelicacy, argues poverty of genius, inasmuch as they have both been considered very properly, as the cheapest products of the mind.

Mr Hopkinson's character for abilities and patriotism procured him the confidence of his countrymen in the most trying exigencies of their affairs. He represented the state of New-Jersey, in Congress, in the year 1776, and subscribed the ever-memorable declaration of independence. He held an appointment in the loan-office for several years, and afterwards succeeded George Ross, Esq. as judge of the admiralty for the state of Pennsylvania. In this station he continued till the year 1790, when he was appointed judge of the district court in Pennsylvania, by the President of the United States. In each of these judicial offices, he conducted himself with integrity. His education qualified him for their duties, for he had been regularly bred to the law, under Benjamin Chew, Esq. when attorney general of Pennsylvania.

He was an active and useful member of three great parties which at different times divided his native state —he was a *whig*, a *republican*, and a *federalist*, and he lived to see the principles and wishes of each of those parties finally and universally successful. Although his labours had been rewarded with many plentiful harvests of well-earned fame, yet his death, to his country and his friends, was premature. He had been subject to frequent attacks of the gout in his head, but for some time before his death, he had enjoyed a considerable respite from them. On Sunday evening, May the 8th, 1791 he was somewhat indisposed, and passed a restless night after he went to bed. He rose on Monday morning at his usual hour, and breakfasted with his family.—At seven o'clock he was seized with an apoplectic fit, which in two hours put a period to his existence, in the 53d year of his age.

His person was a little below the common size. His features were small, but extremely animated. His speech was quick, and all his motions seemed to partake of the unceasing activity and versatility of the powers of his mind.

It only remains to add to this account of Mr Hopkinson, that the various causes which contributed to the establishment of the independence and federal government of the United States, will not be *fully traced*, unless much is ascribed to the irresistible influence of the *ridicule* which he poured forth, from time to time, upon the enemies of those great political events.

HOPKINTON, a township in Hillsborough county, New-Hampshire, on Contoocook river, 9 miles S. W. from its confluence with the Merrimack, and divided from Concord on the east, by the Rockingham county line. It was first granted by Massachusetts, was incorporated in 1765, and contains 1,715 inhabitants, who are chiefly farmers. It is 42 miles E. by S. of Charlestown on Connecticut river, and about 58 W. by N. of Portsmouth.—*Morse.*

HOPKINTON, a township in Middlesex county, Massachusetts. It was incorporated in 1715, and contains 1317 inhabitants. The rivers Concord, Providence and Charles receive each of them a branch from this town: These streams furnish seats for 7 or 8 grist-mills, a number of saw-mills, iron-works, &c.—*ib.*

HOPKINTON, a township in Washington county, Rhode-Island, situated on the west line of the State, on several branches of Pawcatuck river. It contains 2462 inhabitants, including 7 slaves.—*ib.*

HORNE (George, D. D.), late Lord Bishop of Norwich, was a man of such amiable dispositions, primitive

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mitive piety, and exemplary morals, that we wish it were in our power to do justice to his character. His life, it is true, has been already written, at considerable length, by two authors, possessed of erudition and of unquestionable integrity; but mere erudition is by no means sufficient to fit a man for discharging the duties of a biographer. It was not the learning of Johnson, but his sagacity, and intimate acquaintance with human nature, that placed him so far above his contemporaries in this department of literature.

Of Bishop Horne's biographers, one possessed, indeed, the great advantage of having lived in habits of intimacy with him from his boyish years. In the authenticity of his narrative, therefore, the fullest confidence may be placed: and that narrative we shall faithfully follow; reserving, however, to ourselves the liberty of sometimes making reflections on the various incidents recorded, widely different from those of the author.

George Horne was, in 1730, born at Otham in Kent, a village near Maidstone, giving the name to a parish, of which his father was the rector. He was the second of four sons; of whom the eldest died in very early life, and the youngest, who is still alive, succeeded his father both in the rectory of Otham and in that of Breda in the county of Sussex. He had likewise three sisters, of whose fortunes we know nothing.

Mr Horne, the father of the family, was of a temper so remarkably averse from giving pain or trouble upon any occasion, that he used to awake his son George, when an infant, by playing upon a flute, that the change from sleeping to awaking might be gradual and pleasant. Having been for some years a tutor at Oxford, he took upon himself the early part of the classical education of his favourite son; an office of which he was well qualified to discharge the duties. Under such an instructor, the subject of this memoir led a very pleasant life, and made a rapid progress in the Greek and Latin languages. By the persuasion of a friend, however, he was, at the age of thirteen, placed in the school of Maidstone, then under the care of a Mr Bye, eminent for his knowledge of ancient literature. And remaining with this gentleman two years, he added much to his stock of learning; and, among other things, a little elementary knowledge of the Hebrew tongue, which Mr Bye taught on the plan of Buxtorf. Though Dr Horne afterwards rejected that plan, he readily admitted, that the knowledge of it was of great advantage to him.

At the age of fifteen, he was removed from Maidstone school to University college Oxford, where his father had happily obtained for him a scholarship. At college his studies were, in general, the same with those of other virtuous and ingenious youths; while the vivacity of his conversation, and the propriety of his conduct, endeared him to all whose regard was creditable. About the time of his taking his batchelor's degree, he was chosen a fellow of Magdalen College; and soon afterwards, if not before, commenced author.

The history of his authorship is curious, and we shall give it at some length. While he was deeply engaged in the study of oratory, poetry, and every branch of polite literature, he was initiated by his faithful friend Mr Jones in the mysteries of Hutchinsonianism; but Mr Jones was not his preceptor. Indeed that gentleman informs us, that when he first communicated to Mr Horne the novelties with which his own mind was filled, he found his friend very little inclined to consider them; and had the mortification to see, that he was himself losing ground in Mr Horne's esteem, even for making the attempt to convert him. At this we are not to be much surprised. Mr Horne, though, by his biographer's account, no deep Newtonian, saw, or thought he saw, the necessity of a *vacuum* to the possibility of *motion;* and as we believe that every man, who knows the meaning of the words *motion* and *vacuum*, and whose mind is not biassed in favour of a system, sees the same thing, it was not to be supposed, that a youth of sound judgment would hastily relinquish so natural a notion. By Mr Horne, however, it was at length relinquished. Mr Jones introduced him to Mr George Watson, a fellow of University college, whom he represents as a man of very superior accomplishments; and by Mr Watson Mr Horne was made a Hutchinsonian of such zeal, that at the age of nineteen he implicitly adopted the wild opinion of the author of that system, that Newton and Clarke had formed the design of bringing the Heathen *Jupiter*, or Stoical *anima mundi*, into the place of the God of the universe. With such a conviction impressed upon his mind, it is not wonderful that he should endeavour to discredit the system of Newton. This he attempted, by publishing a parallel between that system and the Heathen doctrines in the *Somnium Scipionis* of Cicero. That publication which was anonymous, we have never seen; but Mr Jones himself admits it to have been exceptionable; and the amiable author seems to have been of the same opinion, for he never republished it, nor, we believe, replied to the answers which it provoked.

He did not, however, desert the cause, but published, soon afterwards, a mild and serious pamphlet, which he called *A Fair, Candid, and Impartial State of the Case between Sir Isaac Newton and Mr Hutchinson*. Even of this pamphlet we have not been able to procure a sight; but Mr Jones assures us, that the author allows to Sir Isaac the great merit of having settled laws and rules in natural philosophy, and of having measured *forces* as a mathematician with sovereign skill; whilst he claims for Mr Hutchinson the discovery of the true physiological causes, by which, under the power of the Creator, the natural world is moved and directed.

If this be a fair view of *the state of the case*, it allows to Newton more than ever Newton claimed, or has been claimed for him by his fondest admirers; for the laws and rules, which he so faithfully followed in the study of philosophy, were not settled by him, but by the illustrious Bacon. With respect to the *true* causes here mentioned, we have repeatedly had occasion, during the course of this Work, to declare our opinion, that all men are equally ignorant of them, if they be considered as any thing distinct from the general *laws* by which the operations of nature are carried on. To the discovery of other physiological causes, Newton, in his greatest work, made indeed no pretension; but it may be worth while, and can hardly be considered as a digression, to consider what are the pretensions of Hutchinson, to which Messrs Horne and Jones gave so decided a preference.

Mr Hutchinson himself writes so obscurely, that we dare

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dare not venture to translate his language into common English, lest we should undesignedly misrepresent his meaning; but according to Mr Jones, who has studied his works with care, his distinguishing doctrine in philosophy is, that "The forces, of which the Newtonians treat, are not the forces of nature; but that the world is carried on by the action of the elements on one another, and all under God." What is here meant by the elements, we are taught by another eminent disciple of that school. "The great agents in nature, which carry on all its operations, are certainly (says Mr Parkhurst) the *fluid* of the heavens; or, in other words, the fire at the orb of the sun, the light issuing from it, and the spirit or gross air constantly supporting, and concurring to the actions of the other two." (See CHERUBIM in this *Supplement*). Mr Horne adopted this system in preference to the Newtonian; because, says his biographer, "It appeared to him nothing better than raving, to give active powers to matter, supposing it capable of acting where it is not; and to affirm, at the same time, that all matter is inert, that is, inactive; and that the *Deity* cannot act but where he is *present*, because his *power* cannot be but where his *substance* is."

That much impious arrogance has been betrayed, not by Newtonians only, but by philosophers of every school, when treating of the *modus operandi* of the Deity, we feel not ourselves inclined to controvert; but we never knew a well-informed Newtonian, who spoke of the active powers of matter but in a metaphorical sense; and such language is used, and must be used, by the followers of Hutchinson. Mr Jones speaks of the *action* of the elements; and Mr Parkhurst calls the fluid of the heavens, which, according to him, consists of fire, light, and air, *agents;* but it would surely be uncandid to accuse these two pious men of *animating* the elements, though we know that *action* and *activity*, in the literal sense of the words, can be predicated only of living beings. With respect to giving active powers to matter, therefore, the followers of Hutchinson rave just as much as those of Newton; and we see not the raving of either in any other light than as the necessary consequence of the poverty of language.

But the Newtonian makes matter act upon matter at a distance! No; the genuine Newtonian does not make matter *act* (in the proper sense of the word) at all; but he believes, that God has so constituted matter, that the motions of different masses of it are affected by each other at a distance: and the Hutchinsonian holds the very same thing. As this celestial fluid of Mr Parkhurst's consists partly of air, we know, by the test of experiment, that it is elastic. The particles of which it is composed are therefore distant from each other; and yet they resist compression. How does the Hutchinsonian account for this fact? Perhaps he will say, that as matter is in itself equally indifferent to motion and rest, God has so constituted the particles of this fluid, that though they possess no innate power or activity of their own, they are affected by each other at a distance, in consequence of his fiat at the creation. This we believe to be the only solution of the difficulty which can be given by man; but it is the very answer given by the Newtonians to those who object to them the absurdity of supposing matter to be affected by matter at a distance. That the motions of the heavenly bodies are affected by the presence of each other is a fact, say they, which appears incontrovertible. "We have ascertained with precision the laws by which these motions are regulated: and without troubling ourselves with the true physiological causes, have demonstrated the agreement of the phenomena with the laws. The interposition of this celestial fluid removes not a single difficulty with which our doctrine is supposed to be clogged. To have recourse to it can therefore serve no purpose, even were the phenomena consistent with the nature of an elastic fluid considered as a physical cause; but this is not the case. It is demonstrable (see ASTRONOMY and DYNAMICS in this *Suppl.*), that the motions of the heavenly bodies are not consistent with the mechanism of an elastic fluid, considered as the cause of these motions; and therefore, whether there be such a fluid or not diffused through the solar system, we cannot allow that it is the great agent in nature by which all its operations are carried on."

Such might be the reasoning of a well-informed Newtonian in this controversy; and it appears so conclusive against the objections of Hutchinson to the Newtonian forces, as well as against the agents which he has substituted in their stead, that some of our readers may be disposed to call in question the soundness of that man's understanding who could become a Hutchinsonian so zealous as Mr Horne. But to these gentlemen we beg leave to reply, that the soundest and most upright mind is not proof against the influence of a system, especially if that system has novelty to recommend it, and at the same time consists of parts, of which, when taken separately, many are valuable. Such was the system of Hutchinson when adopted by Mr Horne. It was then but very little known; it could be studied only through the medium of Hebrew literature, not generally cultivated; and that literature, to the cultivation of which Mr Hutchinson had given a new and a better turn, is in itself of the utmost importance. Let it be observed, too, that the Hutchinsonians have, for the most part, been men of devout minds, zealous in the cause of Christianity, and untainted by a variety of extravagant heresies which have so often divided the church of Christ:—and when all these circumstances are taken into consideration, it will not be deemed a proof of any defect in Mr Horne's understanding, that in early life he adopted the *whole* of a system, of which some of the parts contain so much that is good; especially when it is remembered, that at *first view* the agency of the celestial fluid appears so plausible, that for a time it seems to have imposed upon the mind of Newton himself.

But the truth is, that Mr Horne was at no period of his life a thorough paced Hutchinsonian. It is confessed by Mr Jones, that "Mr Hutchinson and his admirers laid too great a stress on the evidence of Hebrew etymology; and that some of them carried the matter so far as to adopt a mode of speaking, which had a nearer resemblance to cant and jargon than to sound sense and sober learning. Of this (continues he) Mr Horne was very soon aware; and he was in so little danger of following the example, that he used to display the foibles of such persons with that mirth and good humour," which he possessed in a more exquisite degree than most men. This seems to be complete evidence that he was never a friend to the etymological

cal part of the system; and the present writer can attest, that, in the year 1786, he seemed by his conversation to have lost much of his conviction of the agency of the celestial fluid. He continued, indeed, to study the Hebrew Scriptures on the plan of Mr Hutchinson, unincumbered with the Masoretic points, or with rabbinical interpretations; and the fruits of his studies are in the hands of the religious public, in works which, by *that* public, will be esteemed as long as their language is understood.

Hitherto Mr Horne was a layman, but he interested himself in every thing connected with religion, as much as the most zealous dignitary of the church; and considering the *naturalization* of the Jews as a measure at least indecent in a Christian country, he published, in an evening paper, a series of letters on that subject, both when the Jew-bill was depending, and after it had passed the house. The letters were anonymous; but they attracted much notice, and many groundless conjectures were made respecting their author. To the real author, the measure which they opposed was so very obnoxious, that he refused to dine at the table of a friend, only because the son-in-law of Mr Pelham was to be there. And he was not much more friendly to the marriage-act than to the Jew-bill. If he considered the one as disgraceful to religion, he probably thought that the other, with its numerous clauses, might be made a snare for virtue.

The time now approached when he was to take holy orders, which to him was a very serious affair; and when he gave an account of his ordination to an intimate friend, he concluded the letter with the following reflections, which, even in an abstract like this, it would be unpardonable to omit:

"May he, who ordered Peter three times to *feed his lambs*, give me grace, knowledge, and skill, to watch and attend to the flock which he purchased upon the cross, and to give rest to those who are under the burden of sin and sorrow. It hath pleased God to call me to the ministry in very troublesome times indeed, when a lion and a bear have broken into the fold, and are making havoc among the sheep. With a firm, though humble confidence, do I purpose to go forth; not in my own strength, but in the strength of the Lord God; and may he prosper the work of my hands!" This was in the year 1753, when the pious author was hardly 23 years of age; and he had not been many months in orders, when one of the most celebrated preachers in the metropolis pronounced, that "George Horne was, without exception, the best preacher in England."

In the year 1756, he was again involved in controversy. A pamphlet had been published at Oxford, supposed by Mr Kennicott, who afterwards gained such fame as a collator of Hebrew manuscripts, entitled *A Word to the Hutchinsonians*, in which Mr Horne was personally struck at. To this work our author replied in a small tract, called *An Apology for certain Gentlemen in the University of Oxford, Aspersed in a late Anonymous Pamphlet*; and whatever may be thought of the question at issue, all men must admire the temper with which the apologist conducted himself under very great provocation.

But it was not about Hutchinsonianism alone that these two illustrious men were doomed to differ. Mr Horne took a decided part against Mr Kennicott's proposal for collating the text of the Hebrew bible, with such manuscripts as could be found, for the purpose of *reforming the text*, and preparing it for a new translation into the English language; and in the year 1760, he published *A View of Mr Kennicott's Method of Correcting the Hebrew Text, with three Queries formed thereon, and humbly submitted to the Christian world.* That his alarm was on this occasion too great, experience has shewn; but that it was not groundless, is evident from the *View*, in which the reader will find above 20 instances from Mr Kennicott's dissertations (see KENNICOTT, *Encycl.*), to shew what an inundation of licentious criticism was breaking in upon the sacred text. Indeed there is reason to believe, that this tract, together with another on the same side of the question by Dr Rutherforth of Cambridge, contributed to repress the collator's rashness, and to make the Bible of Dr Kennicott the valuable work which we find it. Be this as it may, such was the moderation of the Drs Kennicott and Horne, that though their acquaintance commenced in hostility, they at length contracted for each other a friendship, which lasted to the end of their lives, and still subsists between their families.

In what year Mr Horne was admitted to the degree of D. D. and when he was chosen president of his college, Mr Jones has not informed us; but, if our memory does not deceive us, he had obtained both these preferments when, in the year 1772, he gave to the public a small work, 8vo, intitled *Considerations on the Life and Death of St John the Baptist.* This tract was the substance of a course of sermons, which he had many years before, in conformity to an established custom at Magdalen College, preached before the university of Oxford. Mr Jones, speaking of it, says, that "he is persuaded, there was no other man of his time, whose fancy as a writer was bright enough, whose skill as an interpreter was deep enough, and whose heart as a moralist was *pure* enough, to have made him the author of that little work." By most readers this strain of panegyric will be thought extravagant, and of course it will defeat its own purpose; but the work is certainly a work of merit.

In the year 1776, when the author was vice-chancellor, was published, in two volumes 4to, Dr Horne's Commentary on the Psalms. It is a work of which very different opinions have been formed, though it was the result of the labour of twenty years. That it will always be a favourite companion of the devout Christian, we are as much inclined to believe as Mr Jones; but we cannot, without belying our own judgment, say that it appears to us calculated to produce much general good in an age like the present. Granting it to be true, which we believe will not be granted without some exceptions, that Clarke, and Hoadley, and Hare, and Middleton, and Warburton, and SHERLOCK, and SOUTH, and WILLIAM LAW, and Edmund Law, had turned the public attention, of which they had got the entire command, too much to the *letter* of the bible to the neglect of the *spirit* of it; should not Dr Horne, after the example of St Paul, have let in the light gradually upon such weak organs as those of the public thus diseased, rather than pour it upon them at once in a flood of splendor. The apostle "fed his Corinthian converts with milk and not with

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with meat," when he found them unable to bear the latter food; and there is reason to suspect that the carnal followers of Warburton, and Sherlock, and South, were unable to bear, at once, such strong meat, as that which makes the fifteenth psalm a portrait of our Saviour. Indeed, we think it not improbable that the mind of Sherlock would have recoiled with horror from the very conception of the *possibility* of Jesus Christ "swearing to his neighbour and disappointing him," though that conception must have passed through a mind which was certainly as pure as his. The commentary, however, though truth thus compels us to say that, in our opinion, it is far from perfect, is certainly a work of great learning, great genius, and fervent piety, and such as the devout Christian will peruse again and again with much advantage.

Dr Horne's next work was of a different kind, and, we think, of a superior order. In the year 1776 was published a letter of Dr Adam Smith's, giving an account of the death of Mr David Hume. The object of the author was to shew that Mr Hume, notwithstanding his sceptical principles, had died with the utmost composure, and that in his life as well as at his death he had conducted himself as became one of the wisest and best men that ever existed. The letter is very much laboured, and yet does no honour either to the author or his friend. It could not represent Mr Hume as supporting himself under the gradual decay of Nature with the hopes of a happy immortality; but it might have represented him as taking refuge, with other infidels, in the eternal sleep of death. This, though but a gloomy prospect, would not have been childish; but the hero of the tale is exhibited as talking like a school boy of his conferences with Charon, and his reluctance to go into the Stygian ferry-boat, and consoling himself with the thought of leaving all his friends, and his brother's family in particular, in great prosperity!!! The absurdities of this letter did not escape the watchful and penetrating eye of Dr Horne; and as he could not mistake its object, he held it up to the contempt and scorn of the religious world in *A Letter to Adam Smith, L. L. D. on the Life, Death and Philosophy of his Friend David Hume, Esq; by one of the People called Christians.* The reasoning of this little tract is clear and conclusive, while its keen, though good humoured wit is inimitable; and it was, some years afterwards, followed by a series of *Letters on Infidelity*, composed on the same plan, and with much of the same spirit. This small volume, to the second edition of which the letter to Dr Smith was prefixed, is better calculated, than almost any other with which we are acquainted, to guard the minds of youth against the insidious strokes of infidel ridicule, the only dangerous weapon which infidelity has to wield.

When the letters on infidelity were published, their author had for some time been Dean of Canterbury, where he was beloved by the chapter and almost adored by the citizens. He was a very frequent preacher in the cathedral and metropolitical church, where the writer of this short sketch has listened to him with delight, and seen thousands of people of very various descriptions hang with rapture on his lips. As a preacher indeed he excelled; and notwithstanding the shortness of his sight, which deprived him of some of the graces of a pulpit orator, such were the excellence of his matter, the simple elegance of his style, and the sweetness of his voice, that, when at the primary visitation of the present archbishop, he preached his admirable sermon *on the Duty of Contending for the Faith*, the attention of more than 2000 people was so completely fixed, that the smallest noise was not to be heard through the whole crowded choir. Of the importance of preaching, and of the proper mode of performing that duty, he had very just notions; and though he never had himself a parochial cure of souls, it was the desire and pleasure of his life to make himself useful in the pulpit wherever he was, whether in town or in the most obscure corner of the country. Four or five volumes of his sermons have been published since his death.

In the year 1787 he published, under the name of an undergraduate of the university of Oxford, *a letter to Dr Priestley*, in which he made that oracle of Socinianism almost as ridiculous as, in the letter to Dr Smith, he had formerly made the hero of modern scepticism.

The merits of Dr Horne, which had made him president of Magdalen College, a king's chaplain, and dean of Canterbury, raised him, we think in the year 1790, to the see of Norwich; and he had soon an opportunity of shewing that he had not lost sight of his spiritual character in the splendor of the peer of parliament. The Scotch Episcopalians had for some time been soliciting the legislature to repeal certain penal laws of uncommon severity, under which they had groaned for upwards of forty years; but they found it a work of no little difficulty to make the equity of their claim generally understood*. In removing this difficulty no man was more assisting to them than the Dean of Canterbury, to whom their religious and political principles were well known; and he continued his assistance after he was bishop of Norwich. Indeed the whole bench shewed, on this occasion, a zeal for the interests of true religion every way becoming their character of Christian bishops; and after Dr Horne was removed to a better world, the Scotch Episcopalians found among his surviving brethren friends as zealous and active as he.

* See Scotch Episcopalians in this *Supplement*.

Dr Horne, though a very handsome man, was not naturally of a strong constitution; and from the disadvantage of being uncommonly near sighted, he had not been able to increase its strength by the practice of any athletic exercise. The only amusement in which he took delight was agreeable conversation; and his life was therefore what is called sedentary. The consequence of this was, that the infirmities of age came fast upon him; and when the design was formed of making him a bishop, he felt himself little inclined to undertake the charge of so weighty an office. He was, however, prevailed upon to accept of the see of Norwich; but he enjoyed his new dignity for a very short period, if he can with truth be said to have *enjoyed* it at all. His health declined rapidly; and, in the autumn of 1791, he suffered, while on the road from Norwich to Bath, a paralytic stroke, the effects of which he never recovered. He lingered a month or two, with such apparent changes in the state of his health as sometimes gave delusive hopes to his family, till the 17th of January 1792, when he died in the 62d year of his age, with those hopes which can be excited only by the consciousness of a well spent life, and by a firm trust in the promises of the gospel.

In this short sketch of the life of bishop Horne we have taken the liberty to express our dissent from some of his opinions, and to state the reasons on which that dissent rests. By himself we know that this part of our conduct would have been applauded; but it is possible that by some of his friends it may be deemed disrespectful to his memory. To these gentlemen we beg leave to observe, that if Johnson made the praise of *Kyrl*, Pope's man of Ross, really more solid by making it more credible, it will be difficult to persuade us that we have done any injury to Dr Horne's fame by avoiding the extravagant panegyric of those who seem to have considered him as a man exempted from error. He was first induced to favour the Hutchinsonians because he thought he perceived danger to religion in the Newtonian doctrines of attraction and repulsion; and we very readily admit that many Newtonians, not understanding the doctrines of their master, have expressed themselves in such a manner as could not render a religious man partial to their system. But from the dangers of mistake no system, whether religious or philosophical, was ever free; and the atheistical purposes which the agency of ethers and celestial fluids has lately been made to serve, must induce every man of piety to pause before he admit such agency. Dr Horne lived to witness some of its pernicious effects; and we have reason to believe that they made a due impression on his mind; but he spent his latter years, as indeed he had spent the greater part of his life, in nobler pursuits than the study of human science; he spent them in the proper employments of a Christian, a clergyman, and a bishop. His faith was founded on a rock; and it was that genuine faith which worketh by love; for though his preferments were rich, his charity kept pace with them; and it has been proved that, notwithstanding his proper economy, he hoarded not one shilling of his annual income. This was an elevation of character above all literary, above all philosophic fame. The author of this article had the honour to be known to Dr Horne, to enjoy, if he mistook not, a share in his friendship, and to correspond with him regularly for many years; and there is not one of his rational admirers who more fully admits the truth of the character given of him by Dr Thurlow late bishop of Durham when succeeding him in the office of proctor in the University. "As to the last proctor (said he) I shall speak of him but in few words, for the truth of which I can appeal to all that are here present. If ever virtue itself was visible and dwelt upon earth, it was in the person who this day lays down his office."

Soon after he was advanced to the presidentship of Magdalen college, this great and good man married the only daughter of Philip Burton, Esq; a gentleman of considerable fortune. By this lady he had three daughters, of whom the eldest was married to a clergyman a short time before the death of her father, and the two younger were, in 1796, residing with Mrs Horne in Hertfordshire.

HORN-TOWN, a village in Maryland, 31 miles from Snowhill, 26 from Drummond, or Accomack court-house, in Virginia, and 168 from Philadelphia. —*Morse*.

HOROGRAPHY, the art of making or constructing dials; called also dialling, horologiography, gnomonica, sciatherica, photosciatherica, &c.

HOROPTER, in optics, is a right line drawn through the point where the two optic axes meet, parallel to that which joins the centres of the two eyes, or the two pupils.

HORSENECK-FIELD-POINT, a round bluff on the coast of Greenwich township in Connecticut, 2 miles E. of the New-York line at Byram river.—*Morse*.

Horseneck, a point of land, on the north side of Long-Island, between Hog's Neck and Easton's Neck. —*ib*.

Horseneck, a town in Fairfield county, Connecticut, called by the Indians *Pai hom sing*, was settled in 1680. It lies six miles N. E. of Rye, in West-Chester county, New-York State. A bloody battle was fought here between the Dutch and the Indians, in 1646. The Dutch with great difficulty gained the victory. Great numbers were slain on both sides; and their graves appear to this day. It is 53 miles S. W. of New-Haven, and 37 N. E. of New-York city.—*ib*.

Horseneck, a village in Essex county, New-Jersey, on the southern bank of Passaic river above the Little Falls, four miles S. W. by S. of the town of Patterson.—*ib*

HORSE-Shoe, in fortification, is a work sometimes of a round, sometimes of an oval figure, inclosed with a parapet, raised in the ditch of a marshy place, or in low grounds; sometimes also to cover a gate; or to serve as a lodgment for soldiers, to prevent surprises, or relieve an over tedious defence.

HORSHAM, a township in Montgomery county, Pennsylvania.—*Morse*.

HOSACK, or *Hoosack*, a township in Renssalaer county, New-York, situated on the eastern boundary of the State, contains 3035 inhabitants, 419 of whom are electors.—*ib*.

HOVEN is a word of the same import with *raised, swelled, tumefied*. It is particularly applied to black cattle and sheep, when from eating too voraciously of clover, or any other succulent food, they become swollen. Such cattle are, in the language of the farmer, called, *Hoven-Cattle*; and the beast, whether bullock or sheep, which is hoven, when left without relief, dies in half an hour. The cause of the disease is the extra-quantity of air taken down with that kind of food, which, in its passage from the paunch upwards, forces the broad leaves of the clover before it, till they close up the passage at the entrance of the paunch, and prevent the wind from going upwards in its regular course. The usual method of relief is to stab the animal in the paunch; an operation which is always dangerous, and has often proved fatal. It was therefore with good reason that the Society for the Encouragement of Arts, Manufactures, and Commerce, voted a bounty of fifty guineas to Mr Richard Eager of Graffham farm, near Guildford, for making public a very simple method practised by him for the cure of hoven cattle. It is this; "let the grazier or farmer have always ready smooth knobs of wood, of different sizes, fixed to the end of a flexible cane, which for oxen should be at least six feet long, and for sheep three feet. When a beast is hoven, let one person take hold of him by the nostril and one horn; let another hold his tongue fast in one hand, putting the cane down his throat with the other. Be careful not to let the animal get the knob of the cane between his grinders: observe also to put the cane far enough

enough down; the whole length will not injure. You will find the obſtacle at the entrance of the paunch: puſh the cane hard, and when you perceive a ſmell to come from the paunch, and the animal's body to ſink, the cure is performed, and Nature will act for itſelf."

This method, we doubt not, will prove ſucceſsful; but might not the purpoſe be as well, if not better, effected, by uſing, inſtead of the cane and knob, a piece of thick ſtiff rope, which, in many places of Scotland, is employed to force down turnips or potatoes when they ſtick in the throat of a bullock?

HOUGHTON (——) is a man to whom the ſcience of geography is ſo much indebted, that we are almoſt aſhamed to confeſs that we know not his Chriſtian name, the place where he was born, or the age at which he died. He had been a captain in the 69th regiment, and in the year 1779 had acted under General Rooke as fort major in the iſland of Goree. Hearing, ſome time in the year 1789, or perhaps earlier, that the African aſſociation wiſhed to penetrate to the Niger by the way of Gambia, he expreſſed his willingneſs to undertake the execution of their plan. For this taſk he was peculiarly fitted. A natural intrepidity of character, which ſeemed inacceſſible to fear, and an eaſy flow of conſtitutional good humour, which even the roughest accidents of life were not able to ſubdue, formed him for exploring the country of relentleſs ſavages; whilſt the darkneſs of his complexion was ſuch, that he ſcarcely differed in appearance from the Moors of Barbary, whoſe dreſs in travelling he intended to aſſume.

His inſtructions from the aſſociation were, to aſcertain the courſe, and, if poſſible, the riſe and termination of the Niger; and after viſiting the cities of TOMBUCTOO and HOUSSA (ſee theſe articles in this *Supplement*), to return by the way of the deſart, or by any other route which the circumſtances of his ſituation at the time might recommend to his choice.

Having left England on the 16th of October 1790, he arrived at the entrance of the Gambia on the 10th of November, and was kindly received by the king of Barra, who remembered the viſit which the Major had formerly paid him from the iſland of Goree; and who now, in return for a ſmall preſent of the value of 20s. cheerfully tendered protection and aſſiſtance as far as his dominion or influence extended.

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An offer from the maſter of an Engliſh veſſel employed in the trade of the river, enabled the Major, and the interpreter he had engaged on the coaſt, to proceed to Junkiconda; where he purchaſed from the natives a horſe and five aſſes, and prepared to paſs with the merchandiſe which conſtituted his travelling fund, to Medina, the capital of the ſmall kingdom of Woolli.

Fortunately for him, a few words, accidentally dropped by a negro woman in the Mandingo language, of which he had haſtily acquired a ſuperficial knowledge, excited ſuſpicions of danger; and gave him intimation of a conſpiracy which the negro miſtreſſes of the traders, who feared that the Major's expedition portended the ruin of their commerce, had formed againſt his life. Afraid, therefore, of travelling by the cuſtomary route, he availed himſelf of the opportunity which the dry ſeaſon and the tide of ebb afforded of ſwimming his horſe and his aſſes acroſs the ſtream; and having by thoſe means avoided the parties who were ſent for his deſtruction, he proceeded with much difficulty on the ſouthern ſide of the river, to that diſtrict of Cantor which is oppoſite to the kingdom of Woolli. There he repaſſed the Gambia, and ſent a meſſenger to inform the king of his arrival, and to requeſt a guard for his protection.

An eſcort, commanded by the king's ſon, was immediately diſpatched; and the Major, whoſe intended preſent had been announced, was kindly received, and hoſpitably entertained at Medina.

The town is ſituated at the diſtance of about 900 miles by water from the entrance of the Gambia; and the country adjacent abounds in corn and cattle, and, generally ſpeaking, in all things that are requiſite for the ſupport, or eſſential to the comfort of life. Two different ſects of religion diſtinguiſh rather than divide the people; the one is compoſed of the profeſſors of the Mahomedan faith, who are called Buſhreens; the other, and, it is ſaid, the more numerous, conſiſts of thoſe who, denying the miſſion of the prophet, avow themſelves deiſts, and from their cuſtom of drinking with freedom the liquors of which he prohibited the uſe, are denominated Sonikees or drinking men.

In a letter from Major Houghton to his wife, which a ſeaman preſerved from the wreck of a veſſel in which the diſpatches to the ſociety were loſt, the Major indulged the reflections that naturally aroſe from his paſt and preſent ſituations. A bilious fever had attacked him ſoon after his arrival in the Gambia; but his health was now unimpaired—a conſpiracy had aſſailed his life; but the danger was paſſed—the journey from Junkiconda had expoſed him to innumerable hardſhips; but he was now in poſſeſſion of every gratification which the kindneſs of the king or the hoſpitality of the people could enable him to enjoy. Delighted with the healthineſs of the country, the abundance of the game, the ſecurity with which he made his excurſions on horſeback, and above all, with the advantages that would attend the erection of a fort on the ſalubrious and beautiful hill of Fatetenda, where the Engliſh once had a factory, he expreſſes his earneſt hope that his wife will hereafter accompany him to a place in which an income of ten pounds a year will ſupport them in affluence; and that ſhe will participate with him in the pleaſure of rapidly acquiring that vaſt wealth which he imagines its commerce will afford.

While, in this manner, he indulged the dream of future proſperity, and with ſtill more ample ſatisfaction contemplated the eclat of the diſcoveries for which he was preparing, but in the purſuit of which he was retarded by the abſence of the native merchant, for whoſe company he had engaged, he found himſelf ſuddenly involved in unexpected and irreſiſtible misfortune. A fire, the progreſs of which was accelerated by the bambou roofs of the buildings, conſumed with ſuch rapidity the houſe in which he lived, and with it the greateſt part of Medina, that ſeveral of the articles of merchandize, to which he truſted for the expences of his journey, were deſtroyed; and to add to his affliction, his faithleſs interpreter, who had made an ineffectual attempt on his goods, diſappeared with his horſe and three of his aſſes; a trade gun which he had purchaſed on the river ſoon afterwards burſt in his hands, and wounded him in the face and arm: and though the hoſpitable kindneſs of the people of the neighbouring town of Barraconda, who cheerfully opened their houſes to more than a thouſand families, whoſe tene-

ments

Houghton. ments the flames had consumed, was anxiously exerted for his relief; yet the loss of his goods, and the consequent diminution of his travelling fund, were evils which no kindness could remove.

It was in this situation that, wearied with the fruitless hope of the return of the native trader, with whom he had contracted for his journey, he resolved to avail himself of the company of another slave merchant, who was lately arrived from the south, and was now on his way to his farm on the frontier of the kingdom of Bambouk. Accordingly, on the evening of the 8th of May, he proceeded by moon light and on foot, with his two asses, which the servants of the slave merchant offered to drive with their own, and which carried the wreck of his fortune; and journeying by a north-east course, arrived on the fifth day at the uninhabited frontier which separates the kingdoms of Woolli and Bondou.

He had now passed the former limit of European discovery; and while he remarked with pleasure the numerous and extensive population of this unvisited country, he observed, that the long black hair and copper complexion of the inhabitants announced their Arab original. They are a branch of that numerous tribe which, under the appellation of Foolies, have overspread a considerable part of Senegambia; and their religious distinctions are similar to those which prevail in the kingdom of Woolli.

A journey of 150 miles, which was often interrupted by the engagements of his companion, who traded in every town, conducted him to the banks of the Falemé, the south-western boundary of the kingdom of Bambouk. Its stream was exhausted by the advanced state of the dry season, and its bed exhibited an appearance of slate intermixed with gravel.

Bambouk is inhabited by a nation, whose woolly hair and sable complexions bespeak them of the negro race, but whose character seems to be varied in proportion as the country rises from the plains of its western division to the highlands of the east. Distinguished into sects, like the people of Woolli and Bondou, by the different tenets of Mahomedans and Deists, they are equally at peace with each other, and mutually tolerate the respective opinions they condemn.

Agriculture and pasturage, as in the negro states on the coast of the Atlantic, are their chief occupations; but the progress which they have made in the manufacturing arts, is such as enables them to smelt their iron ore, and to furnish the several instruments of husbandry and war. Cloth of cotton, on the other hand, which in this part of Africa seems to be the universal wear, they appear to weave by a difficult and laborious process; and to these two circumstances it is probably owing, that with them the measure of value is not, as on the coast, a bar of iron, but a piece of cloth.

The common vegetable food of the inhabitants appears to consist of rice; their animal, of beef or mutton. A liquor, prepared from fermented honey, supplies the want of wine, and furnishes the means of those festive entertainments that constitute the luxury of the court of Bambouk.

On the Major's arrival at the banks of the river Falemé, he found that the war which had lately subsisted between the kings of Bondou and Bambouk was terminated by the cession to the former of the conquests he had made in the low land part of the dominions of the latter; and that the king of Bondou had taken up his residence in the territory which he had thus obtained. Houghton.

The Major hastened to pay his respects to the victorious prince, and to offer a similar present to that which the kings of Barra and Woolli had cheerfully accepted; but to his great disappointment an ungracious reception, a sullen permission to leave the present, and a stern command to repair to the frontier town from which he came, were followed by an intimation that he should hear again from the king. Accordingly, on the next day, the king's son, accompanied by an armed attendance, entered the house in which the Major had taken up his temporary dwelling, and demanded a sight of all the articles he had brought. From these the prince selected whatever commodities were best calculated to gratify his avarice, or please his eye; and to the Major's great disappointment, took from him the blue coat in which he hoped to make his appearance on the day of his introduction to the Sultan of Tombuctoo. Happily, however, a variety of articles were successfully concealed, and others of inferior value were not considered as sufficiently attractive.

The Major now waited with impatience for the performance of the promise which the slave merchant, with whom he had travelled from the Gambia, had made of proceeding with him to Tombuctoo; but as the merchant was obliged to spend a few days at his rice farm on the banks of the Falemé, the Major accepted an invitation to the hospitality of his roof. There he observed, with extreme regret, that the apprehension of a scarcity of grain had alarmed his friend; and that, dreading the consequences of leaving his family in so perilous a season to the chances of the market, he had determined on collecting, before his departure, a sufficient supply for their support. This argument for delay was too forcible to be opposed; and therefore the Major resolved to employ the interval in visiting the king of Bambouk, who resided in the town of Ferbanna, on the eastern side of the Serra Coles, or river of Gold. Unfortunately, however, by a mistake of his guide, he lost his way in one of the vast woods of the country; and as the rainy season, which commenced with the new moon on the 4th of July, and was introduced with a westerly wind, was now set in, the ground on which he passed the night was deluged with rain, while all the sky exhibited that continual blaze of lightning, which in those latitudes often accompanies the tornado. Distressed by the fever, which began to assail him, the Major continued his route at the break of day, and waded with difficulty through the river Serra Coles, which was swelled by the floods, and on the banks of which the alligators were basking in the temporary sun-shine.

Scarcely had he reached Ferbanna when his fever rose to a height that rendered him delirious; but the strength of his constitution, and the kindness of the negro family to which his guide had conducted him, surmounted the dangerous disease; and in the friendly reception which was given him by the king of Bambouk, he soon forgot the hardships of his journey. The king informed him, that the losses he had lately sustained in the contest with the armies of Bondou, arose from his having exhausted his ammunition; for, as the French traders

Houghton. traders, who formerly supplied his troops, had abandoned the fort of St Joseph, and, either from the dryness of the last season, or from other causes, had deserted the navigation of the upper part of the Senegal, he had no means of replenishing his stores; whereas his enemy, the king of Bondou, continued to receive from the British, through the channel of his agents on the Gambia, a constant and adequate supply.

Major Houghton availed himself of the opportunity which this conversation afforded, to suggest to the king the advantage of encouraging the British to open a trade by the way of his dominions to the populous cities on the banks of the Niger.

Such was the state of the negociation, when all business was suspended by the arrival of the annual presents of Mead, which the people of Bambouk, at that season of the year, are accustomed to send to their king; and which are always followed by an intemperate festival of several successive days.

In the interim, the Major received, and gladly accepted, the proposal of an old and respectable merchant of Bambouk; who offered to conduct him on horseback to Tombuctoo, and to attend him back to the Gambia. A premium of L. 125, to be paid on the Major's return to the British factory at Junkiconda, was fixed by agreement as the merchant's future reward. It was further determined, that the Major should be furnished with a horse in exchange for his two asses; and should convert into gold dust, as the most portable fund, the scanty remains of the goods he had brought from Great Britain.

This plan was much approved by the king, to whom the merchant was personally known; and who gave to the Major at parting, as a mark of his esteem, and a pledge of his future friendship, a present of a purse of gold. With an account of these preparations the Major closed his last dispatch, of the 24th July 1791; and the African association entertained for some time sanguine hopes of his reaching Tombuctoo. Alas! these hopes were blasted. Mr Park, who succeeded him in the arduous task of exploring that savage country, learned, that having reached Jarra (See that article in this *Supplement*), he there met with some Moors who were travelling to Tisheet (a place by the salt pits in the Great Desart, ten days journey to the northward) to purchase salt; and that the Major, at the expence of some tobacco and a musket, engaged them to convey him thither. It is impossible (says Mr Park) to form any other opinion on this determination, than that the Moors intentionally deceived him with a view to rob, and leave him in the Desart. At the end of two days he suspected their treachery, and insisted on returning to Jarra. Finding him persist in this determination, the Moors robbed him of every thing which he possessed, and went off with their camels. Being thus deserted, he returned to a watering place, in possession of the Moors, called Farra; and being by these unfeeling wretches refused food, which he had not tasted for some days, he sunk at last under his misfortunes. Whether he actually died of hunger, or was murdered outright by the savage Mahometans, Mr Park could not learn; but he was shewn at a distance the spot in the woods to which his body was dragged, and where it was left a prey to corruption.

Thus perished, in the prime of life, Major Houghton, a man whose travels enlarged the limits of European discovery, and whose accounts of the places which he visited were strongly confirmed by the intelligence which the British consul at Tunis collected from the Barbary merchants.

Houssa. HOUSSA, the capital of an African empire, on the banks of the Niger, is a city which has excited much curiosity among men of science, since it was first mentioned to a committee of the African Association about the year 1790. The person from whom they received their information was an Arab, of the name of Shabeni; who said that the population of Houssa, where he had resided two years, was equalled only (so far as his knowledge extended) by that of London and Cairo: and, in his rude unlettered way, he described the government as monarchical, yet not unlimited; its justice as severe, but directed by written laws; and the rights of landed property as guarded by the institutions of certain hereditary officers, whose functions appear to be similar to those of the Canongoes of Hindostan (See Canongoes, in this *Suppl.*); and whose important and complicated duties imply an unusual degree of civilization and refinement. For the probity of the merchants of Houssa, the Arab expressed the highest respect; but remarked, with indignation, that the women were admitted to society, and that the honour of the husband was often insecure. Of their written alphabet he knew no more, than that it is perfectly different from the Arabic and the Hebrew characters; but he represented the art of writing as common in Houssa. And when he described the manner in which their pottery is made, he gave, unknowingly to himself, a representation of the ancient Grecian wheel. In passing to Houssa from Tombuctoo, in which last city he had resided seven years, he found the banks of the Niger more numerously peopled than those of the Nile, from Alexandria to Cairo; and his mind was obviously impressed with higher ideas of the wealth and grandeur of the empire of Houssa, than of those of any kingdom which he had seen, England alone excepted.

The existence of the city of Houssa, and of the empire thus described by Shabeni, was strongly confirmed by letters which the committee received from his Majesty's consuls at Tunis and Morocco; and it has been put beyond all possibility of doubt by Mr Park, who received from various persons such concurring accounts of it, as could not be the offspring of deliberate falsehood. From a well informed shereeff, who had visited Houssa, and lived some years at Tombuctoo, he learned, that the former of these cities was the largest that the shereeff had ever seen; and by comparing this man's account of its population with that of various other cities, of which Mr Park had seen one or two, we can hardly estimate the inhabitants of Houssa at a less number than 100,000. Many merchants, with whom our traveller conversed, represented Houssa as larger, and more populous than Tombuctoo, and the trade, police, and government as nearly the same in both. In that case, the king of Houssa and chief officers of state must be Moors, and zealots for the Mahometan religion; but they cannot be so intolerant as the sovereign of Tombuctoo and his ministers; for in Houssa, Mr Park was told that the negroes are in greater proportion to the Moors than in Tombuctoo, and that they have likewise some share in the government. According to accounts

counts derived from Barbary merchants, the people of Houssa have the art of tempering their iron with more than European skill; and their files in particular are much superior to those of Great Britain and France. The consuls at Tunis and Morocco assured the committee of the African Association, that at both these courts the eunuchs of the seraglio are brought from Houssa.

To those who may still entertain doubts of so much refinement being to be found in the interior parts of a country, considered as peculiarly savage, we shall only observe, in the words of the committee of association, that it is by no means "impossible that the Carthaginians, who do not appear to have perished with their cities, may have retired to the southern parts of Africa; and though lost to the Desart, may have carried with them to the new regions which they occupy, some portion of those arts and sciences, and of that commercial knowledge, for which the inhabitants of Carthage were once so eminently famed. In Major Rennel's last map of North Africa, Houssa is placed in 16° and about 20′ N. L. and 4° 30′ E. Long.

HOUSATONICK, a river of Connecticut, in the Indian language signifying *over the mountain*, rises by two sources; the one in Lanesborough, the other in Windsor, both in Berkshire county, Massachusetts. These branches form a junction near Salisbury, and the river after passing through a number of towns, empties itself into Long-Island Sound, between Stratford and Milford in Connecticut. It is navigable about 12 miles, to Derby. A bar of shells, however, at its mouth, obstructs the navigation of large vessels. In this river, between Salisbury and Canaan, is a cataract, where the water of the whole river, which is 150 yards wide, falls perpendicularly 60 feet.—*Morse.*

HOUZOUANAS are a wandering people, who inhabit that part of Africa, which, in a direction from east to west, extends from Caffraria to the country of the Greater Nimiquas (see NIMIQUAS, in this *Suppl.*) According to the map prefixed to Vaillant's new travels, the district occupied by the Houzouanas lies between 16° and 29° east longitude. Of its breadth from south to north we are ignorant; but it begins at the 23d parallel, and stretches northward probably a great way.

M. Vaillant is inclined to believe, that the Houzouanas are the original stem of the various nations, inhabiting at present the southern part of Africa, and that from them all the tribes of the eastern and western Hottentots are descended. The people themselves know nothing of their origin; but to the questions that are put to them on the subject, they always reply, that they inhabit the country which was inhabited by their ancestors. At the Cape, M. Vaillant received the following account of them, which, though he does not warrant its authenticity, has much the appearance of being authentic.

When the Europeans first established themselves at the Cape, the Houzouanas inhabited the country of Camdebo, the snowy mountains, and the district that separates these mountains from Caffraria. Become neighbours to the colony, in consequence of its extending itself towards them, they at first lived on peaceable terms with the planters; and, as they displayed more intelligence and greater activity than the Hottentots, they were even employed in preference to assist in cultivating the land and in forming the settlement. This good understanding and harmony were, however, soon interrupted by that multitude of lawless banditti sent from Holland to people the country.

These worthless profligates wished to enjoy the fruits of the land without the trouble of tilling it. Educated, besides, with all the prejudices of the whites, they imagined that men of a different colour were born only to be their slaves. They accordingly subjected them to bondage, condemned them to the most laborious services, and repaid those services with harsh and severe treatment. The Houzouanas, incensed at such arbitrary and tyrannical conduct, refused any longer to work for them, and retired to the defiles of their mountains. The planters took up arms and pursued them; they massacred them without pity, and seized on their cattle and their country. Those who escaped their atrocities betook themselves to flight, and removed to the land which they now occupy; but, on quitting their former possessions, they swore, in their own name and that of their posterity, to exterminate these European monsters, to be revenged against whom they had so many incitements. And thus, if tradition be true, was a peaceful and industrious nation rendered warlike, vindictive, and ferocious.

This hatred has been perpetuated from generation to generation, though the Houzouanas of the present day are ignorant of the original cause of it. Bred up with an invincible aversion to the planters, they know only that they are animated to plunder and destroy them; but it is only by a vague sentiment of detestation, with the source of which they are unacquainted; and which, though it renders them cruel towards the planters, does not prevent them from being good, kind, and humane, towards each other.

The Houzouanas, being known only by their incursions and plundering, are in the colonies often confounded with the Boshmen, and distinguished by the same appellation. Sometimes, however, from their tawny colour, they are called Chinese Hottentots; and, by means of this double denomination, ill-informed travellers may easily be led into an error, of which the consequence must be, that their narratives will be replete with absurdity and falsehoods.

Their real name, and the only one which they give themselves, is that of Houzouana; and they have nothing in common with the Boshmen, who are not a distinct people, but a mere collection of fugitives and free-booters. The Houzouanas form no alliances but among themselves. Being almost always at war with the surrounding nations, they never mix with them; and, if they consent at any time to admit a stranger into their hordes, it is only after a long acquaintance, a sort of apprenticeship, during which he has given proofs of his fidelity, and established his courage. Such indeed are their courage and predatory habits, that they are the dread of all the surrounding tribes; and the Hottentots who accompanied M. Vaillant trembled at the very thought of entering the Houzouana territories. Nay, after they had lived many days among them, and had experienced their fidelity, they continued under the daily apprehension of being massacred by them. Yet one of their own countrymen, who had lived long among the Houzouanas, gave such a character of that people as should have banished those idle fears.

"The Houzouanas (said he) are by no means what you suppose them to be, murderers by profession. If they sometimes shed blood, it is not from a thirst of carnage, but to make just reprisals that they take up arms. Attacked and persecuted by surrounding nations, they have found themselves reduced to the necessity of flying to inaccessible places among the barren mountains, where no other people could exist.

"If they find antelopes and damans to kill; if the nymphs of ants are abundant; or if their good fortune brings them plenty of locusts—they remain within the precincts of their rocks; but if the provisions necessary to subsistence fail, the nations in their neighbourhood must suffer. From the summits of their mountains, they survey at a distance the countries around; and, if they observe cattle, they make an incursion to carry them off, or slaughter them upon the spot, according to circumstances; but though they rob, they never kill, except to defend their lives, or by way of retaliation to revenge an ancient injury.

"It happens sometimes, however, that after very fatiguing expeditions they return without booty; either because the objects of their attack have disappeared, or because they have been repulsed and beaten. In such cases, the women, exasperated by hunger and the lamentation of their children crying for food, become almost furious with passion. Reproaches, insult, and threats, are employed; they wish to separate from such dastardly men, to quit husbands destitute of courage, and to seek others who will be more anxious to procure provision for them and their children. In short, having exhausted whatever rage and despair could suggest, they pull off their small apron of modesty, and beat their husbands about the head with it till their arms are weary of the exercise.

"Of all the affronts which they can offer, this is the most insulting. Unable to withstand it, the men in their turn become furious. They put on their war-cap, a sort of helmet made with the skin that covers the neck of the hyæna, the long hair of which forms a crest that floats over the head, and, setting out like madmen, never return till they have succeeded in carrying off some cattle.

"When they come back, their wives go to meet them, and extol their courage amidst the fondest caresses. In a word, nothing is then thought of but mirth and jollity; and, till similar scenes are recalled by similar wants, past evils are forgotten."

Such was the character given of this formidable people to M. Vaillant at his first interview with them; and during the long excursions which he made in their company they did not belie it in a single instance. In many respects they appeared to resemble the Arabs, who, being also wanderers, and like them brave and addicted to rapine, adhere with unalterable fidelity to their engagements, and defend, even to the last drop of their blood, the traveller who civilly purchases their services, and puts himself under their protection. In our author's opinion, if it be at all practicable to traverse from south to north the whole of Africa, it could only be under the conduct of the Houzouanas; and he really thinks that fifty men of their temperate, brave, and indefatigable nation, would be sufficient to protect an enterprizing European through that long and hazardous journey.

Yet these people, so superior both in body and mind to the other natives of South Africa, are but of low stature; and a person five feet four inches in height is accounted among them very tall; but in their little bodies, perfectly well proportioned, are united, with surprising strength and agility, a certain air of assurance, boldness, and haughtiness, which awes the beholder, and with which our author was greatly pleased. Of all the savage races, he saw none that appeared to be endowed with so active a mind, and so hardy a constitution.

Their head, though it exhibits the principle characteristics of that of the Hottentot, is, however, rounder towards the chin. They are also not so black in complexion; but have the lead colour of the Malays, distinguished at the Cape by the name of *louguinée*. Their hair, more woolly, is so short that he imagined at first their heads to have been shaved. The nose too is still flatter than that of the Hottentots; or, rather, they seem altogether destitute of a nose; what they have consisting only of two broad nostrils which project at most but five or six lines. From this conformation of the nose, a Houzouana, when seen in profile, is the reverse of handsome, and considerably resembles an ape. When beheld in front, he presents, on the first view, an extraordinary appearance, as half the face seems to be forehead. The features, however, are so expressive, and the eyes so large and lively, that, notwithstanding this singularity of look, the countenance is tolerably agreeable.

As the heat of the climate in which he lives renders clothing unnecessary, he continues during the whole year almost entirely naked, having no other covering than a very small jackal skin fastened round his loins by two thongs, the extremities of which hang down to his knees. Hardened by this constant habit of nakedness, he becomes so insensible to the variations of the atmosphere, that when he removes from the burning sands of the level country to the snow and hoar-frost of his mountains, he seems indifferent to, and not even to feel the cold.

His hut in no wise resembles that of the Hottentot. It appears as if cut vertically through the middle; so that the hut of a Hottentot would make two of those of the Houzouanas. During their emigrations, they leave them standing, in order that, if any other horde of the same nation pass that way, they may make use of them. When on a journey, they have nothing to repose on but a mat suspended from two sticks, and placed in an inclined position. They often even sleep on the bare ground. A projecting rock is then sufficient to shelter them; for every thing is suited to a people whose constitutions are proof against the severest fatigue. If however they stop anywhere to sojourn for a while, and find materials proper for constructing huts, they then form a kraal; but they abandon it on their departure, as is the case with all the huts which they erect.

This custom of labouring for others of their tribe announces a social character and a benevolent disposition. They are indeed not only affectionate husbands and good fathers, but excellent companions. When they inhabit a kraal, there is no such thing among them as private property; whatever they possess is in common.

mon. If two hordes of the same nation meet, the reception is on both sides friendly; they afford each other mutual protection, and confer reciprocal obligations. In short, they treat one another as brethren, though perhaps they are perfect strangers, and have never seen each other before.

Active and nimble by nature, the Houzouanas consider it as amusement to climb mountains, and the most elevated peaks; and they conducted M. Vaillant, his servants and cattle, over precipices, and through defiles, which he and his Hottentots would have deemed absolutely impassable. The only arms of this people are bows and arrows, in the use of which they are very expert. The arrows, which are uncommonly short, are carried on the shoulder in a quiver, about eighteen inches in length, and four in diameter, made of the bark of the aloe, and covered with the skin of a large species of lizard, which these wanderers find in all their rivers, particularly on the banks of Orange and Fish River.

Nocturnal fires are a peculiar language understood and employed by almost all savage nations. None, however, have carried this art so far as the Houzouanas, because none have so much need of understanding and bringing it to perfection. If it be necessary to announce a defeat or a victory, an arrival or departure, a successful plundering expedition, or the want of assistance, in a word, any intelligence whatever, they are able, either by the number of their fires or the manner in which they arrange them, to make it known in an instant. They are even so sagacious as to vary their fires from time to time, lest their enemies should become acquainted with their signals, and treacherously employ them in their turn to surprise them.

Our author says that he is unacquainted with the principles of these signals, invented with so much ingenuity. He did not request information; because he very rationally inferred that his request would not have been granted; but he observed, that three fires kindled at the distance of twenty paces from each other, so as to form an equilateral triangle, were the signal for rallying.

Among the physical qualities, which, in M. Vaillant's opinion, prove that the Houzouanas are a distinct nation, he mentions the enormous natural rump of the women, as a deformity which distinguishes them from every other people, savage or polished, which he had ever known. "I have several times (says he) had occasion to remark, that, among the female Hottentots in general, as they advance in age, the inferior part of the back swells out, and acquires a size which greatly exceeds the proportion it bore in infancy with the other parts of the body. The Houzouana women, having in their figure some resemblance to the Hottentots, and appearing, therefore, to be of the same race, one might be induced to believe that their projection behind is only the Hottentot rump more swelled and extended. I observed, however, that among the former this singularity was an excrescence of slow growth, and in some measure an infirmity of old age; whereas among the latter it is a natural deformity, an original characteristic of their race. The Houzouana mothers wear on their reins, like our miners, a skin which covers this protuberance of the posteriors; but which, being thin and pliable, yields to the quivering of the flesh, and becomes agitated in the same manner. When on a journey, or when they have children too young to follow them, they place them upon their rump. I saw one of these women run in this manner with a child, about three years of age, that stood erect on its feet at her back, like a foot boy behind a carriage."

If one half of what our traveller says of the activity and enterprising spirit of this singular people be true, might not the African Association, now that the Cape is a British province, send a second Houghton, or second Park, to make discoveries in that unexplored country, under the protection of the Houzouanas? We do not indeed think that it would be possible to traverse the whole extent of Africa from south to north, but Vaillant penetrated farther in that direction than any one had done before him; and it appears, that with his intrepid Houzouanas he might have penetrated much farther.

HOWLAND'S *Ferry*, is the narrow part of the waters that separate Rhode-Island from the main land. It is about a quarter of a mile wide. The bridge built across this strait cost 30,000 dollars, and was carried away by a storm in January, 1796. It is rebuilt.—*Morse.*

HUBBARDSTON, a township in Worcester county, Massachusetts, and formed the N. E. quarter of Rutland, until incorporated in 1767. It borders on the western part of Wachuset Hill, and contains 933 inhabitants. It is 20 miles N. W. of Worcester, and 60 W. of Boston.—*ib.*

HUDSON'S BAY took its name from Henry Hudson, who discovered it in 1610. It lies between 55 and 65 degrees of north latitude. The eastern boundary of the bay is Terra de Labrador; the northern part has a straight coast, facing the bay, guarded with a line of isles innumerable. A vast bay, called the Archiwinnipy Sea, lies within it, and opens into Hudson's Bay, by means of Gulf Hazard, through which the Beluga whales pass in great numbers. The entrance of the bay, from the Atlantic Ocean, after leaving, to the north, Cape Farewell and Davis's Straits, is between Resolution Isles on the north, and Button's Isles, on the Labrador coast, to the south, forming the eastern extremity of Hudson's Straits. The coasts are very high, rocky and rugged at top; in some places precipitous, but sometimes exhibit extensive beaches. The islands of Salisbury, Nottingham, and Digges are very lofty and naked. The depth of water in the middle of the bay is 140 fathoms. From Cape Churchill to the south end of the bay, are regular soundings; near the shore, shallow, with muddy or sandy bottom. To the northward of Churchill, the soundings are irregular, the bottom rocky, and in some parts the rocks appear above the surface at low water. Hudson's Bay is reckoned about 300 leagues wide, from north to south. Its breadth is unequal, being about 130 leagues where broadest: but it grows narrower at both extremities, being not much above 35 leagues in some places. The commerce in the countries adjacent to this inland sea is in the hands of an exclusive British Company of its name, who employ only 4 ships, and 130 seamen. The forts, Prince of Wales, Churchill river, Nelson, New Severn, and Albany, are garrisoned by 186 men. The French, in 1782, took and destroyed these settlements, &c. said to amount to the value of £500,000 sterling. The

Hudson's. Company's exports are to the amount of £16,000, mostly the drugs of the market, which produce returns, chiefly in beaver skins and rich furs, to the value of £29,000; yielding government a clear revenue of £3,734. This includes the fishery in Hudson's Bay. The skins and furs procured by this trade, when manufactured, afford articles for trading with many nations of Europe, to great advantage.—*ib.*

HUDSON'S STRAIT, or *Frobisher's Mistaken Strait*, which leads into Hudson's Bay, in a westerly course is 76 miles wide, between Cape Chidley and the S. point of Resolution Island.—*ib.*

HUDSON'S HOUSE, one of the Hudson's Bay Company's factories in N. America, lies on the S. W. side of Suskashawan river, 100 miles east of Manchester House, and 167 S. E. by E. of Buckingham House. N. lat. 53° 0' 32", W. long. 106° 27' 20".—*ib.*

HUDSON'S RIVER passes its whole course in the State of New-York, and is one of the largest and finest rivers in the United States. It rises in a mountainous country, between the lakes Ontario and Champlain. In its course southeasterly it approaches within 6 or 8 miles of lake George; then, after a short course E. turns southerly, and receives the Sacondaga from the S W. which heads in the neighbourhood of Mohawk river. The course of the river thence to New-York, where it empties into York Bay, is very uniformly S. 12° or 15° W. Its whole length is about 250 miles. From Albany to lake George is 65 miles. This distance, the river is navigable only for batteaux, and has two portages, occasioned by falls, of half a mile each. The banks of Hudson's river, especially on the western side, as far as the highlands extend, are chiefly rocky cliffs. The passage through the highlands, which is 16 or 18 miles, affords a wild romantic scene. In this narrow pass, on each side of which the mountains tower to a great height, the wind, if there be any, is collected and compressed, and blows continually as through a bellows; vessels, in passing through it are often obliged to lower their sails. The bed of this river, which is deep and smooth to an astonishing distance, through a hilly, rocky country, and even through ridges of some of the highest mountains in the United States, must undoubtedly have been produced by some mighty convulsion in nature. The tide flows a few miles above Albany, which is 160 miles from New-York. It is navigable for sloops of 80 tons to Albany, and for ships to Hudson. Ship navigation to Albany is interrupted by a number of islands, and shoals 6 or 8 miles below the city, called the *Overslaugh*. It has been in contemplation to confine the river to one channel, by which means it will be deepened, and the difficulty of approaching Albany with vessels of a larger size, be removed. About 60 miles above New-York the water becomes fresh. The river is stored with a variety of fish, which renders a summer passage to Albany, delightful and amusing to those who are fond of angling. The advantages of this river for carrying on the fur trade with Canada, by means of the lakes, are very great. Its conveniencies for internal commerce are singularly happy. The produce of the remotest farms is easily and speedily conveyed to a certain and profitable market, and at the lowest expense. In this respect, New-York has greatly the advantage of Philadelphia. A great proportion of the produce of Pennsylvania, is carried to market in waggons, over a great extent of country, some of which is rough; hence it is that Philadelphia is crowded with waggons, carts, horses and their drivers, to do the same business that is done in New-York, where all the produce of the country is brought to market by water, with much less shew and parade. But Philadelphia has other advantages, to compensate for this natural defect. The increasing population of the fertile lands upon the northern branches of the Hudson, must annually increase the amazing wealth that is conveyed by its waters to New-York. The northern and western canals, when completed, will be of incalculable advantage to the trade of this State.—*ib.*

HUDSON'S RIVER, a broad but short river emptying into Chesapeak Bay, in Dorchester county, Maryland. Hill's Point, N. E. of it, shapes the broad mouth of the river.—*ib.*

HUDSON CITY, a port of entry and post town situated in Columbia county, New-York, on the east side of Hudson's river, 30 miles S. by E. of Albany, and 132 north of New-York city. The limits of the corporation include a square mile, and its privileges as a port of entry extend no farther. In the autumn of 1783, Messrs. Seth and Thomas Jenkins, from Providence, in the State of Rhode-Island, fixed on the unsettled spot, whereon this city stands, for a town, to which the city is navigable for vessels of any size. The city is laid out into large squares, bordering on the river, and divided into 30 lots. Other adventurers were admitted to proportions, and the town was laid out in squares, formed by spacious streets, crossing each other at right angles. Each square contains 30 lots, two deep, divided by a 20 feet alley. Each lot is 50 feet in front and 120 feet in depth. In the spring of 1784, several houses and stores were erected. The increase of the town from this period to the spring of 1786, two years only, was astonishingly rapid, and reflects great honour upon the enterprising and persevering spirit of the original founders. In the space of time just mentioned no less than 150 dwelling houses, besides shops, barns, and other buildings, four ware-houses, several wharves, spermaceti works, a covered rope-walk, and one of the best distilleries in America, were erected, and 1,500 souls collected on a spot, which three years before, was improved as a farm, and but two years before began to be built. Its increase since has been very rapid; a printing-office has been established, and several public buildings have been erected, besides dwelling houses, stores, &c. The inhabitants are plentifully and conveniently supplied with water, brought to their cellars in wooden pipes, from a spring two miles from the town. It has a large bay to the southward, and stands on an eminence from which are extensive and delightful views to the N. W. N. and round that way to the S. E. consisting of hills and vallies, variegated with woods and orchards, corn-fields and meadows, with the river, which is in most places a mile over, and may be seen a considerable distance to the northward, forming a number of bays and creeks. From the S. E. to the S. W. the city is screened with hills, at different distances, and west afar off over the river and a large valley, the prospect is bounded by a chain of stupendous mountains, called the Katts Kill, running to the W. N. W. which add

Hugheſburg, || Hummel's town.

magnificence and ſublimity to the whole ſcene. Upwards of 1200 ſleighs entered the city daily, for ſeveral days together, in February, 1786, loaded with grain of various kinds, boards, ſhingles, ſtaves, hoops, iron ware, ſtone for building, fire-wood, and ſundry articles of proviſion for the market, from which ſome idea may be formed of the advantage of its ſituation, with reſpect to the country adjacent, which is every way extenſive and fertile, particularly weſtward. The original proprietors of Hudſon, offered to purchaſe a tract of land adjoining the ſouth part of the city of Albany, and were conſtrained, by a refuſal of the propoſition, to become competitors for the commerce of the northern country, when otherwiſe they would have added great wealth and conſequence to Albany. There is a bank here, called Bank of Columbia, whoſe capital may not exceed 160,000 dollars. It is compoſed of 400 ſhares, at 400 dollars each. Hudſon city is governed by a mayor, recorder, 4 aldermen, 4 aſſiſtants, and a number of other officers. The number of inhabitants in *Hudſon Townſhip*, by the cenſus of 1790, amounted to 2,584, including 193 ſlaves; and it appears by the State cenſus of 1796 that 338 of the inhabitants are electors. Hudſon city is 4 miles S. W. of Claverack; 47 north of Poughkeepſie; and 43 ſouth of Lanſinburg.—*ib.*

HUGHESBURG, a town in Northumberland county, Pennſylvania, called alſo *Cataweſſy*, being ſituated at the mouth of Catawеſſy creek, 25 miles N. E. of Sunbury. It contains about 60 handſome houſes, and a meeting houſe for Friends. It is 144 miles N. W. of Philadelphia. N. lat. 40° 54'.—*ib.*

HULL, an inconſiderable town in Suffolk county, on the ſouth ſide of Boſton harbour, Maſſachuſetts, containing 120 inhabitants. On the fort on the eaſt hill there is a well ſunk 90 feet, which commonly has 80 odd feet of water.—*ib.*

HUMAS, an Indian village on the eaſt ſide of Miſſiſſippi river in Louiſiana, 60 miles above New Orleans. The Humas were formerly a conſiderable nation, but about 1770 were reduced to about 25 warriors. The Alabamas, whoſe villages are near thoſe of the Humas, had, at the above period, about 30 warriors, and followed the French here when they abandoned the poſt on Alabama river in 1762. The Chetimachas have about 27 warriors.—*ib.*

HUMMEL'S TOWN, a thriving town in Dauphine county, Pennſylvania, containing a German Lutheran church and about 90 houſes; ſituated on the ſouth ſide of Swetara creek, 6 miles north of Middletown, 10 E. by N. of Harriſburg, and 100 weſt-north-weſt of Philadelphia.—*ib.*

Hungary.

HUNGARY-WATER, is ſpirit of wine diſtilled upon roſemary, and which therefore contains its oily and ſtrong ſcented eſſence (ſee PHARMACY, n° 365, *Encycl.)*. To be really good, ſays Profeſſor Beckmann, the ſpirit of wine ought to be very ſtrong, and the roſemary freſh; and if that be the caſe, the leaves are as proper as the flowers, which, according to the preſcription of ſome, ſhould only be taken. It is likewiſe neceſſary that the ſpirit of wine be diſtilled ſeveral times upon the roſemary; but that proceſs is too troubleſome and expenſive to admit of this water being diſpoſed of at the low price it is uſually ſold for; and it is certain, that the greater part of it is nothing elſe than common brandy, united with the eſſence of roſemary in the ſimpleſt manner. In general, it is only mixed with a few drops of the oil. For a long time paſt, this article has been brought to us principally from France, where it is prepared, particularly at Beaucaire, Montpellier, and other places in Languedoc, in which that plant grows in great abundance.

Hiſt. of Inventions.

The name Hungary water ſeems to ſignify, that this water, ſo celebrated for its medicinal virtues is an Hungarian invention; and we read in many books, that the receipt for preparing it was given to a queen of Hungary by a hermit; or, as others ſay, by an angel, who appeared to her in a garden, all entrance to which was ſhut, in the form of a hermit or a youth. Some call the queen St Iſabella; but thoſe who pretend to be beſt acquainted with the circumſtance affirm, that Elizabeth, wife of Charles Robert king of Hungary, and daughter of Uladiſlaus II. king of Poland, who died in 1380 or 1381, was the inventreſs. By often waſhing with this ſpirit of roſemary, when in the 70th year of her age, ſhe was cured, as we are told, of the gout and an univerſal lameneſs; ſo that ſhe not only lived to paſs 80, but became ſo lively and beautiful, that ſhe was courted by the king of Poland, who was then a widower, and who wiſhed to make her his ſecond wife.

The Profeſſor juſtly conſiders this ſtory as a ridiculous fable (A). "It appears to me (ſays he) moſt probable, that the French name *l'eau de la reine d' Hongrie*, was choſen by thoſe who, in latter times, prepared ſpirit of roſemary for ſale, in order to give greater conſequence and credit to their commodity; as various medicines

(A) It was firſt publiſhed to the world in 1659 in a poſthumous work of John Prevot, who ſays that in the beginning of a very old breviary, he ſaw a remedy for the gout, written by the queen's own hand, in the following words:

"I Elizabeth, queen of Hungary, being very infirm and much troubled with the gout in the 72d year of my age, uſed for a year this receipt, given to me by an ancient hermit, whom I never ſaw before nor ſince; and was not only cured, but recovered my ſtrength, and appeared to all ſo remarkably beautiful, that the king of Poland aſked me in marriage, he being a widower and I a widow. I, however, refuſed him for the love of my Lord Jeſus Chriſt, from one of whoſe angels, I believe, I received the remedy. The receipt is as follows:

"R. Take of aqua vitæ, four times diſtilled, three parts, and of the tops and flowers of roſemary two parts: put theſe together in a cloſe veſſel, let them ſtand in a gentle heat 50 hours, and then diſtil them. Take one dram of this in the morning once every week, either in your food or drink, and let your face and the diſeaſed limb be waſhed with it every morning.

"It renovates the ſtrength, brightens the ſpirits, purifies the marrow and nerves, reſtores and preſerves the ſight, and prolongs life." Thus far from the Breviary. Then follows a confirmation which Prevot gives from his own experience.

Hunger-ford, Hunter.

dicines, ſome years ago, were extolled in the gazettes under the title of Pompadour, though the celebrated lady, from whoſe name they derived their importance, certainly neither ever ſaw them nor uſed them."

HUNGERFORD, a townſhip in Franklin county, Vermont, containing 40 inhabitants, 7 miles ſouth of the Canada line and 14 eaſt of Lake Champlain.—*Morse.*

HUNGER CREEK, a ſtream which carries the various water machinery, in the new and thriving manufacturing town of Hamilton, between Albany and Schenectady, New-York.—*ib.*

HUNTER (John), the celebrated ſurgeon, was the youngeſt child of John Hunter of Kilbride, in the county of Lanark. He was born on the 14th of July 1728, at Long Calderwood, a ſmall eſtate belonging to the family; and loſing his father when he was about ten years of age, he was, perhaps, too much indulged by his mother. One conſequence of this was, that at the grammar-ſchool he made no progreſs in learning; and he may be ſaid to have been almoſt totally illiterate when, in September 1748, he arrived in London. His brother, Dr William Hunter, of whom an account is given in the *Encyclopædia*, was then the moſt celebrated teacher of anatomy, and John had expreſſed a deſire to aſſiſt him in his reſearches. The Doctor, who was very deſirous to ſerve him, and anxious to form ſome opinion of his talents for anatomy, gave him an arm to diſſect for the muſcles, with the neceſſary directions how it was to be done; and he found the performance ſuch as greatly exceeded his expectation.

His firſt eſſay in anatomy having thus gained him ſome credit, Mr Hunter was now employed in a diſſection of a more difficult nature; this was an arm in which all the arteries were injected, and theſe, as well as the muſcles, were to be expoſed and preſerved. The manner in which this was performed, gave Dr Hunter ſo much ſatisfaction, that he did not ſcruple to ſay, that his brother would become a good anatomiſt, and that he ſhould not want for employment. From this period we may conſider Mr Hunter as having ſeriouſly engaged in anatomy; and under the inſtructions of Dr Hunter, and his aſſiſtant Mr Symonds, he had every opportunity of improvement, as all the diſſections at this time carried on in London were confined to that ſchool.

In the ſummer 1749, Mr Cheſelden, at the requeſt of Dr Hunter, permitted him to attend at Chelſea Hoſpital; and he there learned the firſt rudiments of ſurgery.

The following winter he was ſo far advanced in the knowledge of human anatomy, as to inſtruct the pupils in diſſection, to whom Dr Hunter had very little time to pay attention. This office, therefore, fell almoſt entirely upon him, and was his conſtant employment during the winter ſeaſon.

In the ſummer months of 1750, Mr Hunter attended the hoſpital at Chelſea; in 1751, he became a pupil at St Bartholomew's, and in the winter was preſent at operations occaſionally, whenever any thing extraordinary occurred. The following ſummer he went to Scotland; and in 1753 entered, it is difficult to conceive for what reaſon, as a gentleman commoner at St Mary hall, Oxford. In 1754 he became a ſurgeon's pupil at St George's hoſpital, where he continued during the ſummer months; and in 1756 was appointed houſe-ſurgeon.

In the winter 1755, Dr Hunter admitted him to a partnerſhip in his lectures, and a certain portion of the courſe was allotted to him; beſides which, he gave lectures when the Doctor was called away to attend his patients. Making anatomical preparations was at this time a new art, and very little known; every preparation, therefore, that was ſkilfully made, became an object of admiration; many were wanting for the uſe of the lectures; and the Doctor being himſelf an enthuſiaſt for the art, left no means untried to infuſe into his brother a love for his favourite purſuits. How well he ſucceeded, the collection afterwards made by Mr Hunter will ſufficiently evince. Hunter.

Anatomy ſeems to have been a purſuit for which Mr Hunter's mind was peculiarly fitted, and he applied to it with an ardour and perſeverance of which there is hardly any example. His labours were ſo uſeful to his brother's collection, and ſo gratifying to his diſpoſition, that although in many other reſpects they did not agree, this ſimple tie kept them together for many years.

Mr Hunter worked for ten years on human anatomy, during which period he made himſelf maſter of what was already known, as well as made ſome addition to that knowledge. He traced the ramifications of the olfactory nerves upon the membranes of the noſe, and diſcovered the courſe of ſome of the branches of the fifth pair of nerves. In the gravid uterus, he traced the arteries of the uterus to their termination in the placenta. He was alſo the firſt who diſcovered the exiſtence of the lymphatic veſſels in birds.

Many parts of the human body being ſo complex, that their ſtructure could not be underſtood, nor their uſes aſcertained, Mr Hunter was led to examine ſimilar parts in other animals, in which the ſtructure was more ſimple, and more within the reach of inveſtigation; this carried him into a wide field, and laid the foundation of his collection in comparative anatomy.

In this new line of purſuit, this active inquirer began with the more common animals, and preſerved ſuch parts as appeared by their analogy, or in ſome other way, to elucidate the human economy. It was not his intention to make diſſections of particular animals, but to inſtitute an inquiry into the various organizations by which the functions of life are performed, that he might thereby acquire ſome knowledge of general principles.

So eagerly did Mr Hunter attach himſelf to comparative anatomy, that he ſought by every means in his power the opportunities of proſecuting it with advantage. He applied to the keeper of wild beaſts in the Tower for the bodies of thoſe which died there; and he made ſimilar applications to the men who ſhowed wild beaſts. He purchaſed all rare animals which came in his way; and theſe, with ſuch others as were preſented to him by his friends, he entruſted to the ſhowmen to keep till they died, the better to encourage them to aſſiſt him in his labours.

His health was ſo much impaired by exceſſive attention to his purſuits, that in the year 1760 he was adviſed to go abroad, having complaints in his breaſt, which threatened to be conſumptive. In October of that year, Mr Adair, inſpector-general of hoſpitals, appointed him a ſurgeon on the ſtaff; and in the following ſpring he went with the army to Belliſle, leaving Mr Hewſon to aſſiſt his brother during his abſence.

Mr Hunter ferved, while the war continued, as fenior furgeon on the ftaff, both in Bellifle and Portugal, till the year 1763; and in that period acquired his knowledge of gun-fhot wounds. On his return to England he fettled in London; where, not finding the emoluments from his half-pay and private practice fufficient to fupport him, he taught practical anatomy and operative furgery for feveral winters. He returned alfo, with unabated ardour, to comparative anatomy; and as his experiments could not be carried on in a large town, he purchafed for that purpofe, about two miles from London, a piece of ground near Brompton, at a place called Earl's Court, on which he built a houfe. In the courfe of his inquiries, this excellent anatomift afcertained the changes which animal and vegetable fubftances undergo in the ftomach when acted on by the gaftric juice; he difcovered, by means of feeding young animals with madder (which tinges growing bones red), the mode in which a bone retains its fhape during its growth; and explained the procefs of exfoliation, by which a dead piece of bone is feparated from the living.

His fondnefs for animals made him keep feveral of different kinds in his houfe, which by attention he rendered familiar with him, and amufed himfelf by obferving their peculiar habits and inftincts; but this familiarity was attended with confiderable rifk, and fometimes led him into fituations of danger, of which the following is a remarkable inftance:

Two leopards, which were kept chained in an outhoufe, had broken from their confinement, and got into the yard among fome dogs, which they immediately attacked; the howling this produced alarmed the whole neighbourhood; Mr Hunter ran into the yard to fee what was the matter, and found one of them getting up the wall to make his efcape, the other furrounded by the dogs; he immediately laid hold of them both, and carried them back to their den; but as foon as they were fecured, and he had time to reflect upon the rifk of his own fituation, he was fo much agitated, that he was in danger of fainting.

On the fifth of February 1767, he was chofen a fellow of the Royal Society. His defire for improvement in thofe branches of knowledge which might affift in his refearches, led him at this time to propofe to Dr George Fordyce and Mr Cumming, an eminent mechanic, that they fhould adjourn from the meetings of the Royal Society to fome coffee-houfe, and difcufs fuch fubjects as were connected with fcience. This plan was no fooner eftablifhed, than they found their numbers increafed; they were joined by Sir Jofeph Banks, Dr Solander, Dr Mafkelyne, Sir George Shuckburgh, Sir Harry Englefield, Sir Charles Blagden, Dr Noothe, Mr Ramfden, Mr Watt of Birmingham, and many others. At thefe meetings difcoveries and improvements in different branches of philofophy were the objects of their confideration; and the works of the members were read over and criticifed before they were given to the public. It was in this year that, by an exertion in dancing, after the mufcles of the leg were fatigued, he broke his tendo achillis. This accident, and the confinement in confequence of it, led him to pay attention to the fubject of broken tendons, and to make a feries of experiments to afcertain the mode of their union.

In the year 1768, Mr Hunter became a member of the corporation of furgeons; and in the year following, through his brother's intereft, he was elected one of the furgeons of St George's hofpital. In May 1771, his treatife on the Natural Hiftory of the Teeth was publifhed; and in July of the fame year he married Mifs Home, the eldeft daughter of Mr Home, furgeon to Burgoyne's regiment of light horfe. The expence of his purfuits had been fo great, that it was not till feveral years after his firft engagement with this lady that his affairs could be fufficiently arranged to admit of his marrying.

Though after his marriage his private practice and profeffional character advanced rapidly, and though his family began to increafe, he ftill devoted much of his time to the forming of his collection, which, as it daily became larger, was alfo attended with greater expence. The whole fuit of the beft rooms in his houfe were occupied by his preparations; and he dedicated his mornings, from funrife to eight o'clock (the hour for breakfaft), entirely to his purfuits. To thefe he added fuch parts of the day as were not engaged in attending his patients.

The knowledge he derived from his favourite ftudies he conftantly applied to the improvement of the art of furgery, and omitted no opportunity of examining morbid bodies; from which he made a collection of facts which are invaluable, as they tend to explain the real caufes of fymptoms, which during life could not be exactly afcertained, the judgment of the practitioner being too frequently mifled by theoretical opinions, and delufive fenfations of the patients.

In the practice of furgery, where cafes occurred in which the operations proved inadequate to their intention, he always inveftigated, with uncommon care, the caufes of that want of fuccefs; and in this way detected many fallacies, as well as made fome important difcoveries, in the healing art. He detected the caufe of failure, common to all the operations in ufe for the radical cure of the hydrocele, and was enabled to propofe a mode of operating, in which that event can with certainty be avoided. He afcertained, by experiments and obfervations, that expofure to atmofpherical air fimply, can neither produce nor increafe inflammation. He difcovered in the blood fo many phenomena connected with life, and not to be referred to any other caufe, that he confidered it as alive in its fluid ftate. He improved the operation for the fiftula lachrymalis, by removing a circular portion of the os unguis inftead of breaking it down with the point of a trochar. He alfo difcovered that the gaftric juice had a power when the ftomach was dead of diffolving it; and gave to the Royal Society a paper on this fubject, which is publifhed in the Philofophical Tranfactions.

In the winter 1773, he formed a plan of giving a courfe of lectures on the theory and principles of furgery, with a view of laying before the public his own opinions upon that fubject. For two winters he read his lectures *gratis* to the pupils of St George's Hofpital; and in 1775, gave a courfe for money upon the fame terms as the other teachers in the different branches of medicine and furgery. But giving lectures was always particularly unpleafant to him; fo that the defire of fubmitting his opinions to the world, and learning their general eftimation, were fcarcely fufficient to

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overcome his natural dislike to speaking in public. He never gave the first lecture of his course without taking 30 drops of laudanum to take off the effects of his uneasiness.

Comparative anatomy may be considered as the pursuit in which Mr Hunter was constantly employed. No opportunity escaped him. In the year 1773, at the request of his friend Mr Walsh, he dissected the torpedo, and laid before the Royal Society an account of its electrical organs. A young elephant, which had been presented to the Queen by Sir Robert Barker, died, and the body was given to Dr Hunter, which afforded Mr Hunter an opportunity of examining the structure of that animal by assisting his brother in the dissection; since that time two other elephants died in the Queen's menagerie, both of which came under Mr Hunter's examination. In 1774, he published in the Philosophical Transactions an account of certain receptacles of air in birds, which communicate with the lungs, and are lodged both among the fleshy parts and hollow bones of these animals; and a paper on the Gillaroo trout, commonly called in Ireland the *Gizzardtrout*.

In 1775, several animals of that species, called the *gymnotus electricus of Surinam*, were brought alive to this country, and by their electrical properties excited very much the public attention. Mr Walsh, desirous of pursuing his investigations of animal electricity, made a number of experiments on the living animals; and to give his friend Mr Hunter an opportunity of examining them, purchased those that died. An anatomical account of their electrical organs was drawn up by Mr Hunter, and published in the Philosophical Transactions. In the same volume there is a paper of his, containing experiments on animals and vegetables respecting their power of producing heat.

In the course of his pursuits, Mr Hunter met with many parts of animals where natural appearances could not be preserved, and others, in which the minuter vessels could not be distinctly seen when kept in spirits; it was therefore necessary to have them drawn, either at the moment, or before they were put into bottles. The expence of employing professed draughtsmen, the difficulty of procuring them, and the disadvantage which they laboured under in being ignorant of the subject they were to represent, made him desirous of having an able person in his house entirely for that purpose.

With this view he engaged an ingenious young artist to live with him for ten years; his time to be wholly employed as a draughtsman, and in making anatomical preparations. This gentleman, whose name was Bell, soon became a very good practical anatomist, and from that knowledge was enabled to give a spirited and accurate resemblance of the subjects he drew, such as is rarely to be met with in representations of anatomical subjects. By his labours Mr Hunter's collection is enriched with a considerable number of very valuable drawings, and a great variety of curious and delicate anatomical preparations.

In January 1776, Mr Hunter was appointed surgeon extraordinary to his Majesty; and in the spring he gave to the Royal Society a paper on the best mode of recovering drowned persons.

In the autumn he was taken extremely ill, and the nature of his complaints made his friends, as well as himself, consider his life to be in danger. When he reflected upon his own situation, that all his fortune had been expended in his pursuits, and that his family had no provision but what should arise from the sale of his collection, he became very solicitous to give it its full value, by leaving it in a state of arrangement. This he accomplished with the assistance of Mr Bell and his brother-in-law Mr Home.

In 1778, he published the second part of his Treatise on the Teeth, in which their diseases, and the mode of treatment are considered. This rendered his work upon that subject complete. He published also in the Philosophical Transactions a paper on the Heat of Animals and Vegetables. In 1779, he published his account of the Free Martin in the Philosophical Transactions; and in 1780, he laid before the Royal Society an account of a woman who had the small-pox during pregnancy, where the disease seemed to have been communicated to the fœtus.

In 1781, he was elected a fellow of the Royal Society of Sciences and Belles Lettres at Gottenburg. And in 1782, he gave the Royal Society a paper on the Organ of Hearing in Fish. Besides the papers which he presented to that learned body, he read six Croonion lectures upon the subject of Muscular Action, for the years 1776, 1778, 1779, 1780, 1781, and 1782. In these lectures he collected all his observations upon muscles, respecting their powers and effects, and the stimuli by which they are affected; and to these he added Comparative Observations upon the moving Powers of Plants.

These lectures were not published in the Philosophical Transactions, for they were withdrawn as soon as read, not being considered by the author as complete dissertations, but rather as materials for some future publication.

It is much to be regretted (says Mr Home) that Mr Hunter was so tardy in giving his observations to the public; but such was his turn for investigation, and so extensive the scale upon which he instituted his inquiries, that he always found something more to be accomplished, and was unwilling to publish any thing which appeared to himself unfinished. His observations on the Muscular Action of the Blood-vessels were laid before the Royal Society in 1780, and yet he delayed publishing them till his Observations on the Blood and Inflammation were arranged: and they make part of the volume which was published after his death.

In 1783, he was chosen into the Royal Society of Medicine and the Royal Academy of Surgery in Paris; and the same year the lease of the house which he occupied in Jermyn street having expired, he purchased the lease of a large house on the east side of Leicester-square, and the whole lot of ground adjoining to Castle-street, on which there was another house. In the middle space between the two houses, he erected, at the expence of L.3000, a building for his collection; though, unfortunately for his family, the lease did not extend beyond 24 years.

In the building formed for the collection there was a room fifty-two feet long, by twenty-eight feet wide, lighted from the top, and having a gallery all round, for containing his preparations. Under this were two apartments; one for his lectures, and the other, with

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no particular deſtination at firſt, but afterwards made uſe of for weekly meetings of medical friends during the winter. To this building the houſe in Caſtle-ſtreet was entirely ſubſervient; and the rooms in it were uſed for the different branches of human and comparative anatomy.

About this period Mr Hunter may be conſidered as at the height of his chirurgical career; his mind and body were both in their full vigour. His hands were capable of performing whatever was ſuggeſted by his mind; and his judgment was matured by former experience. Some inſtances of his extraordinary ſkill may very properly be mentioned.

He removed a tumor from the ſide of the head and neck of a patient at St George's Hoſpital, as large as the head to which it was attached; and by bringing the cut edges of the ſkin together, the whole was nearly healed by the firſt intention.

He diſſected out a tumor on the neck, which one of the beſt operating ſurgeons in this country had declared, rather too ſtrongly, that no one but a fool or a madman would attempt; and the patient got perfectly well.

He diſcovered a new mode of performing the operation for the popliteal aneuriſm, by taking up the femoral artery on the anterior part of the thigh without doing any thing to the tumor in the ham. The ſafety and efficacy of this mode have been confirmed by many ſubſequent trials; and it muſt be allowed to ſtand very high among the modern improvements in ſurgery.

If we conſider Mr Hunter at this period of his life, it will afford us a ſtrong picture of the turn of his mind, of his deſire to acquire knowledge, and his unremitting aſſiduity in proſecuting whatever was the object of his attention.

He was engaged in a very extenſive private practice; he was ſurgeon to St George's Hoſpital; he was giving a very long courſe of lectures in the winter; he was carrying on his inquiries in comparative anatomy; had a ſchool of practical human anatomy in his houſe; and was always employed in ſome experiments reſpecting the animal economy.

He was always ſolicitous for ſome improvement in medical education; and, with the aſſiſtance of Dr Fordyce, inſtituted a medical ſociety, which he allowed to meet in his lecture-rooms, and of which he was choſen one of the patrons. The ſociety, called the *Lyceum Medicum Londinenſe*, under his auſpices and thoſe of Dr Fordyce, has acquired conſiderable reputation, both from the numbers and merits of its members.

In the year 1786, in conſequence of the death of Mr Middleton, Mr Hunter was appointed deputy ſurgeon-general to the army. He now publiſhed his work upon the Venereal Diſeaſe, which had been long expected by the public; and, if we may judge from the rapid ſale of the firſt edition, theſe expectations have not been diſappointed. He alſo publiſhed a work entitled, Obſervations on certain Parts of the Animal Economy. In this work he has collected ſeveral of his papers inſerted in the Philoſophical Tranſactions, which related to that ſubject, having permiſſion from the preſident and council of the Royal Society to reprint them; there are alſo Obſervations upon ſome other Parts of the Animal Economy, which had not before been publiſhed. This work met with a very ready ſale.

In the year 1787, he gave a paper to the Royal Society, containing an Experiment to determine the effect of extirpating one Ovarium on the Number of Young; a paper in which the wolf, jackall, and dog, are proved to be of the ſame ſpecies; and a third upon the Anatomy of the Whale Tribe. Theſe papers procured him the honor of receiving Sir John Copley's annual gold medal, given as a mark of diſtinguiſhed abilities.

His collection, which had been the great object of his life, both as a purſuit and an amuſement, was now brought into a ſtate of arrangement; and gave him at length the ſatisfaction of ſhewing to the public a ſeries of anatomical facts formed into a ſyſtem by which the economy of animal life was illuſtrated. He ſhewed it to his friends and acquaintances twice a-year, in October to medical gentlemen, and in May to noblemen and gentlemen, who were only in town during the ſpring. This cuſtom he continued to his death.

Upon the death of Mr Adair, which happened in the year 1792, Mr Hunter was appointed inſpector general of hoſpitals, and ſurgeon general to the army. He was alſo elected a member of the Royal College of Surgeons in Ireland. In the year 1791, he was ſo much engaged in the duties of his office, as ſurgeon-general to the army, and his private practice, that he had little time to beſtow upon his ſcientifical objects; but his leiſure time, ſmall as it was, he wholly devoted to them.

In 1792, he was elected an honorary member of the Chirurgo-Phyſical Society of Edinburgh, and was choſen one of the vice-preſidents of the Veterinary College, then firſt eſtabliſhed in London. He publiſhed in the Tranſactions of the Society for the Improvement of medical and chirurgical Knowledge, of which ſociety he was one of the original members and a zealous promoter, three papers on the following ſubjects: Upon the Treatment of Inflamed Veins, on Introſuſception, and on a Mode of conveying Food into the Stomach in Caſes of Paralyſis of the Œſophagus.

He finiſhed his Obſervations on the Economy of Bees, and preſented them to the Royal Society. Theſe obſervations were made at Earl's Court, and had engaged his attention for many years; every inquiry into the economy of theſe inſects had been attended by almoſt unſurmountable difficulties; but theſe proved to him only an incitement, and the contrivances he made uſe of to bring the different operations of theſe indefatigable animals to view were almoſt without end.

Earl's Court to Mr Hunter was a retirement from the fatigues of his profeſſion; but in no reſpect a retreat from his labours; there, on the contrary, they were carried on with leſs interruption, and with an unwearied perſeverance. From the year 1772 till his death, he made it his cuſtom to ſleep there during the autumn months, coming to town only during the hours of buſineſs in the forenoon, and returning to dinner.

It was there he carried on his experiments on digeſtion, on exfoliation, on the tranſplanting of teeth into the combs of cocks, and all his other inveſtigations on the animal economy, as well in health as in diſeaſe. The common bee was not alone the ſubject of his obſervation, but the waſp, hornet, and the leſs known kinds of bees, were alſo objects of his attention. It was there he made the ſeries of preparations of the external and internal changes of the ſilk worm; alſo a ſeries of the incubation of the egg, with a very valuable ſet of drawings

Hunter.

drawings of the whole series. The growth of vegetables was also a favourite subject of inquiry, and one on which he was always engaged in making experiments.

The collection of comparative anatomy which Mr Hunter has left, and which may be considered as the great object of his life, must be allowed to be a proof of talents, assiduity, and labour, which cannot be contemplated without surprise and admiration. It remains an unequivocal test of his perseverance and abilities, and an honor to the country in whose schools he was educated, and by the patronage of which he was enabled on so extensive a scale to carry on his pursuits. In this collection we find an attempt to expose to view the gradations of Nature, from the most simple state in which life is found to exist, up to the most perfect and most complex of the animal creation—man himself.

By the powers of his art, this collector has been enabled so to expose, and preserve in spirits or in a dried state, the different parts of animal bodies intended for similar uses, that the various links of the chain of perfection are readily followed and may be clearly understood.

This collection of anatomical facts is arranged according to the subjects they are intended to illustrate, which are placed in the following order: *First*, Parts constructed for motion. *Secondly*, Parts essential to animals respecting their own internal economy. *Thirdly*, Parts superadded for purposes connected with external objects. *Fourthly*, Parts for the propagation of the species and maintainance or support of the young.

Mr Hunter was a very healthy man for the first forty years of his life; and, if we except an inflammation of his lungs in the year 1759, occasioned most probably by his attention to anatomical pursuits, he had no complaint of any consequence during that period. In the spring of 1769, in his forty-first year, he had a regular fit of the gout, which returned the three following springs, but not the fourth; and in the spring of 1773, having met with something which very forcibly affected his mind, he was attacked at ten o'clock in the forenoon with a pain in the stomach, attended with all the symptoms of *angina pectoris*. In the life of him prefixed to his *Treatise on the Blood, Inflammation, and Gun-Shot Wounds*, the reader will find one of the most complete histories of that disease upon record. Suffice it, in this place, to say, that for twenty years he was subject to frequent and severe attacks of it, which however did not, till a short time before his death, either impair his judgment or render him incapable of performing operations in surgery. "In autumn 1790 (says Mr Home), and in the spring and autumn 1791, he had more severe attacks than during the other periods of the year, but of not more than a few hours duration: in the beginning of October 1792, one, at which I was present, was so violent that I thought he would have died. On October the 16th, 1793, when in his usual state of health, he went to St George's Hospital, and meeting with some things which irritated his mind, and not being perfectly master of the circumstances, he withheld his sentiments; in which state of restraint he went into the next room, and turning round to Dr Robertson, one of the physicians of the hospital, he gave a deep groan and dropt down dead; being then in his 65th year, the same age at which his brother Dr Hunter had died."

Hunter, || Hunter fort.

It is a curious circumstance, that the first attack of these complaints was produced by an affection of the mind, and every future return of any consequence arose from the same cause; and although bodily exercise, or distention of the stomach, brought on slighter affections, it still required the mind to be affected to render them severe; and as his mind was irritated by trifles, these produced the most violent effects on the disease. His coachman being beyond his time, or a servant not attending to his directions, brought on the spasms, while a real misfortune produced no effect.

Mr Hunter was of a short stature, uncommonly strong and active, very compactly made, and capable of great bodily exertion. His countenance was animated, open, and in the latter part of his life deeply impressed with thoughtfulness. When his print was shewn to Lavater, he said, "That man thinks for himself." In his youth he was cheerful in his disposition, and entered into youthful follies like others of the same age; but wine never agreed with his stomach; so that after some time he left it off altogether, and for the last twenty years drank nothing but water.

His temper was very warm and impatient, readily provoked, and, when irritated, not easily soothed. His disposition was candid, and free from reserve, even to a fault. He hated deceit; and as he was above every kind of artifice, he detested it in others, and too openly avowed his sentiments. His mind was uncommonly active; it was naturally formed for investigation, and that turn displayed itself on the most trivial occasions, and always with mathematical exactness. What is curious, it fatigued him to be long in a mixed company which did not admit of connected conversation; more particularly during the last ten years of his life.

He required less relaxation than most other men; seldom sleeping more than four hours in the night, but almost always nearly an hour after dinner; this, probably, arose from the natural turn of his mind being so much adapted to his own occupations, that they were in reality his amusement, and therefore did not fatigue.

In private practice he was liberal, scrupulously honest in saying what was really his opinion of the case, and ready upon all occasions to acknowledge his ignorance, whenever there was any thing which he did not understand.

In conversation, he spoke too freely, and sometimes harshly, of his contemporaries; but if he did not do justice to their undoubted merits, it arose not from envy, but from his thorough conviction that surgery was as yet in its infancy, and he himself a novice in his own art; and his anxiety to have it carried to perfection, made him think meanly and ill of every one whose exertions in that respect did not equal his own.

HUNTER FORT, 21 miles west of Schenectady, on the south side of Mohawk river, at the mouth of Schohary Creek, over which a bridge is about to be built. Here is an old church built in the reign of queen Ann, and 3 or 4 houses. At this place was the Old Mohawk town, which was abandoned by that nation as late as the spring of 1780. These Indians had made considerable advances in civilization—could generally speak the English language, and numbers of them made profession of their faith in the Christian religion. In the church which is now standing, they used to attend public worship in the Episcopal form. These Indians are

are now settled, a part of them on Grand river, a northern water of Lake Erie, and a part of them in another part of Upper Canada. None of this nation now remain in the United States. The father of the only remaining family was drowned in 1788.—*Morse.*

HUNTERDON *County*, in New-Jersey, is bounded N. by that of Morris, E. by Somerset, S. E. by Burlington, S. W. and W. by Delaware river, which separates it from the State of Pennsylvania, and N. W. by Sussex county. It is about 40 miles long, and 32 broad, is divided into 10 townships, and contains 20,253 inhabitants, including 1,301 slaves. On the top of Musconetcong mountain in this county, is a noted medicinal spring, much resorted to. It issues from the side of a mountain into an artificial reservoir, for the accommodation of those who wish to bathe in, as well as to drink, the waters. It is a strong chalybeate. Trenton is the chief town.—*ib.*

HUNTERSTOWN, a village of Pennsylvania, situated in York county, 25 miles W. by S. of York-Town. —*ib.*

HUNTING-CREEK, in Virginia, runs east into Patowmak river, at the south corner of the territory of Columbia.—*ib.*

HUNTING-CREEK-TOWN, a village in the northern part of Dorchester county, Maryland; 14 miles N. N. W. of Vienna, 16 S. by W. of Denton, and 18 N. E. of Cambridge.—*ib.*

HUNTINGDON, an extensive and mountainous county in Pennsylvania, bounded N. and N. W. by Lycoming county, E. and N. E. by Mifflin, S. E. by Franklin, S. and S. W. by Bedford and Somerset, and west by Westmoreland. It is about 75 miles long and 39 broad; contains 1,432,960 acres of land, divided into 7 townships, which contain 7,565 inhabitants. Limestone, iron ore and lead are found here. A furnace and two forges manufacture considerable quantities of pig and bar iron, and hollow ware; large works have also been established for manufacturing of lead. Chief town, Huntingdon.—*ib.*

HUNTINGDON, the capital of the above county, situated on the N. E. side of Juniatta river, and at the mouth of Standing Stone creek, 50 miles from the mouth of Juniatta, contains about 90 houses, a court-house, and gaol. It is about 23 miles W. S. W. of Lewis Town, and 184 W. N. W. of Philadelphia.—*ib.*

HUNTINGDON, a post-town on the north side of Long Island, New-York, situated at the head of a bay in Suffolk county, which sets up south from the sound, contains about 70 houses, a Presbyterian and Episcopal church. It is 38 miles E. by N. of New-York city. It is opposite to Norwalk in Connecticut, and contains 3,260 inhabitants; of these, 552 are electors, 213 slaves.—*ib.*

HUNTINGDON, a township in York county, Pennsylvania.—*ib.*

HUNTINGTON, a township in Fairfield county, Connecticut, separated from Derby on the north-east by Stratford river.—*ib.*

HUNTING-TOWN, a village on the west side of Chesapeak bay in Maryland, situated on the S. E. side of Hunting Creek, in Calvert county, 3 miles N. by W. of Prince Frederick, and 22 E. N. E. of Port Tobacco.—*ib.*

HUNTSBURG, a township in Franklin county, in Vermont. It is situated on the Canada line, having 46 inhabitants.—*ib.*

HUNTSVILLE, a post-town in North-Carolina, 10 miles from Bethania, and 16 from Rockford.—*ib.*

HURLEY, a township in Ulster county, New-York, containing 847 inhabitants; of whom 116 are electors, and 245 slaves. The compact part contains about 30 houses, situated on Esopus Kill, about 5 miles from the west bank of Hudson's river, and 100 north of New-York. The lands around it are low and fertile, but infested with wild onions.—*ib.*

HURON, one of the five principal northern lakes. It lies between 43° 30′, and 47° 30′ N. lat. and between 80° 45′, and 84° 45′ W. long. and is reckoned to be upwards of 1000 miles in circumference. The fish are of the same kind as in Lake Superior, and it communicates with that lake through the straits of St. Marie on the N. W. with Michigan on the W. and with Erie on the S. It is of a triangular shape, and on the S. W. part is *Saguinum* or Sagana bay, 80 miles in length, and about 18 or 20 in breadth; the other most remarkable bay is *Thunder Bay*. On the banks of the lake are found amazing quantities of sand cherries. The land bordering on the western shore of the lake is greatly inferior in quality to that on Lake Erie. It is mixed with sand and small stones, and is principally covered with pines, birch, and some oaks; but a little distance from the lake the soil is very luxuriant. Twenty years ago, part of the Indian nations, called Chepaways and Ottawas, who inhabited round Saguinum bay and on the banks of the lake could furnish 200 warriors; and those of the latter nation, who lived on the E. side of Lake Michigan, 21 miles from Michillimakkinack could furnish 200 warriors.—*ib.*

HURON, a small river of the N. W. territory, which, after a course of 38 miles, falls into Lake St Clair from the N. W. Gnadenhuetten lies on this river. Also the name of another small river in the same territory, which runs N. eastward into Lake Erie, 40 miles westward of Cayahoga, and 15 S. E. of the mouth of Sandusky Lake.—*ib.*

HURTERS, in fortification, denote pieces of timber, about six inches square, placed at the lower end of the platform, next to the parapet, to prevent the wheels of the gun-carriages from damaging the parapet.

HYDE, a maritime county in Newbern district, North-Carolina; bounded E. by the ocean, W. by Beaufort county, N. by Tyrrel, and S. by Carteret. It contains 4120 inhabitants, of whom 1048 are slaves.—*Morse.*

HYCO-OTEE, or *Hycoo*, a small river which empties into the Dan, about 4 miles above the mouth of Staunton river.—*ib.*

HYDESPARK, a township in Orleans county, in Vermont, containing 43 inhabitants. It is 25 miles S. of the Canada line, and 126 north by east of Bennington.—*ib.*

HYDROGRAPHICAL CHARTS or MAPS, more usually called sea-charts, are projections of some part of the sea, or coast, for the use of navigation. In these are laid down all the rhumbs or points of the compass, the meridians, parallels, &c. with the coasts, capes, islands, rocks, shoals, shallows, &c. in their proper places, and proportions.

Hydrometer, || Hydrus.

HYDROMETER, is an inſtrument, of which ſo much has been ſaid in the *Encycl.* under that title, and in the article Specific *Gravity*, that we certainly ſhould not again introduce it in this place, but to guard our readers againſt error, when ſtudying the works of the French chemiſts. Theſe gentlemen, who are ſo ſtrongly attached to every thing which is new, as to believe that their anceſtors have for ages been wandering in the mazes of ignorance, refer very frequently to the *peſe-liqueur* of Baumé; and as that inſtrument has never been generally uſed in this country, it becomes our duty to deſcribe its conſtruction.

Inſtead of adopting the ſimple method of immediate numerical reference to the denſity of water expreſſed by unity, as is done in all modern tables of ſpecific gravity, he had recourſe to a proceſs ſimilar to that of graduating the ſtems of thermometers from two fixed points. The firſt of theſe points was obtained by immerſing his inſtrument, which is the common areometer, conſiſting of a ball, ſtem, and counterpoiſe, in pure water. At that point of the ſtem which was interſected by the ſurface of the fluid, he marked *zero*, or the commencement of his graduations. In the next place, he provided a number of ſolutions of pure dry common ſalt in water: theſe ſolutions contained reſpectively one, two, three, four, &c. pounds of the ſalt; and in each ſolution the quantity of water was ſuch, as to make up the weight equal to one hundred pounds in the whole; ſo that in the ſolution containing one pound of ſalt, there were ninety-nine pounds of water; in the ſolution containing two pounds of ſalt, there were ninety-eight pounds of water, and ſo of the reſt. The inſtrument was then plunged in the firſt ſolution, in which of courſe it floated with a larger portion of the ſtem above the fluid, than when pure water was uſed. The fluid, by the interſection of its ſurface upon the ſtem, indicated the place for marking his firſt degree; the ſame operation repeated, with the fluid containing two pounds of ſalt, indicated the mark for the ſecond degree; the ſolution of three pounds afforded the third degree; and in this manner his enumeration was carried as far as fifteen degrees. The firſt fifteen degrees afterwards, applied with the compaſſes repeatedly along the ſtem, ſerved to extend the graduation as far as eighty degrees, if required.

This inſtrument, which is applicable to the admeaſurement of denſities exceeding that of pure water, is commonly diſtinguiſhed by the name of the *Hydrometer for ſalts*.

The hydrometer for ſpirits is conſtructed upon the ſame principle; but in this the counterpoiſe is ſo adjuſted, that moſt part of the ſtem riſes above the fluid when immerſed in pure water, and the graduations to expreſs inferior denſities are continued upwards. A ſolution of ten parts by weight of ſalt in ninety parts of pure water, affords the firſt point, or zero, upon the ſtem; and the mark indicated by pure water is called the tenth degree; whence, by equal diviſions, the remaining degrees are continued upwards upon the ſtem as far as the fiftieth degree.

Theſe experiments, in both caſes, are made at the tenth degree of Reaumur, which anſwers very nearly to fifty-five of Fahrenheit.

HYDRUS, or Water Serpent, one of the new ſouthern conſtellations, including only ten ſtars.

Hygrometer.

HYGROMETER, is an inſtrument of ſo much importance to the meteorologiſt, that it becomes us to give ſome account of every improvement of it which has fallen under our notice. In the *Encyclopædia*, the principles upon which hygrometers are conſtructed have been clearly ſtated, and the defects of each kind of hygrometer pointed out.

Inſtead of hairs or cat-gut, of which hygrometers of the firſt kind are commonly made, Caſſebois, a benedictine monk at Mentz, propoſed to make ſuch hygrometers of the gut of a ſilk worm. When that inſect is ready to ſpin, there are found in it two veſſels proceeding from the head to the ſtomach, to which they adhere, and then bend towards the back, where they form a great many folds. The part of theſe veſſels next the ſtomach is of a cylindric form, and about a line in diameter. Theſe veſſels contain a gummy ſort of matter from which the worm ſpins its ſilk; and, though they are exceedingly tender, means have been deviſed to extract them from the inſect, and to prepare them for the above purpoſe. When the worm is about to ſpin, it is thrown into vinegar, and ſuffered to remain there twenty-four hours; during which time the vinegar is abſorbed into the body of the inſect, and coagulates its juices. The worm being then opened, both the veſſels, which have now acquired ſtrength, are extracted; and, on account of their pliability, are capable of conſiderable extenſion. That they may not, however, become too weak, they are ſtretched only to the length of about fifteen or twenty inches. It is obvious that they muſt be kept ſufficiently extended till they are completely dry. Before they attain to that ſtate, they muſt be freed, by means of the nail of the finger, from a ſlimy ſubſtance which adheres to them. Such a thread will ſuſtain a weight of ſix pounds without breaking, and may be uſed for an hygrometer in the ſame manner as cat-gut; but we confeſs that we do not clearly perceive its ſuperiority.

To an improvement of the hygrometer conſtructed on the third principle, ſtated in the *Encyclopædia*, M. Hochheimer was led in the following manner:

Mr Lowitz found at Dmitriewſk in Aſtracan, on the banks of the Wolga, a thin bluiſh kind of ſlate which attracted moiſture remarkably ſoon, but again ſuffered it as ſoon to eſcape. A plate of this ſlate weighed, when brought to a red heat, 175 grains, and, when ſaturated with water, 247: it had therefore imbibed, between complete dryneſs and the point of complete moiſture, 72 grains of water. Lowitz ſuſpended a round thin plate of this ſlate at the end of a very delicate balance, faſtened within a wooden frame, and ſuſpended at the other arm a chain of ſilver wire, the end of which was made faſt to a ſliding nut that moved up and down in a ſmall groove on the edge of one ſide of the frame. He determined, by trial, the poſition of the nut when the balance was in equilibrio and when it had ten degrees of over-weight, and divided the ſpace between theſe two points into ten equal parts, adding ſuch a number more of theſe parts as might be neceſſary. When the ſtone was ſuſpended from the one arm of the balance, and at the other a weight equal to 175 grains, or the weight of the ſtone when perfectly dry, the nut in the groove ſhewed the exceſs of weight in grains when it and the chain were ſo adjuſted that the balance ſtood in equilibrio. A particular apparatus on the

Hygrometer.

the same principles as a vernier, applied to the nut, shewed the excess of weight to ten parts of a grain. Lowitz remarked that this hygrometer in continued wet weather gave a moisture of more than 55 grains, and in a continued heat of 113 degrees of Fahrenheit only 1½ degree of moisture.

The hygrometer thus invented by Lowitz was, however, attended with this fault, that it never threw off the moisture in the same degree as the atmosphere became drier. It was also sometimes very deceitful, and announced moisture when it ought to have indicated that dryness had again begun to take place in the atmosphere. To avoid these inconveniencies, M. Hochheimer proposes the following method:

7. Take a square bar of steel about two lines in thickness, and from ten to twelve inches in length, and form it into a kind of balance, one arm of which ends in a screw. On this screw let there be screwed a leaden bullet of a proper weight, instead of the common weights that are suspended. 2. Take a glass plate about ten inches long, and seven inches in breadth, destroy its polish on both sides, free it from all moisture by rubbing it over with warm ashes, suspend it at the other end of the balance, and bring the balance into equilibrium by screwing up or down the leaden bullet. 3. Mark now the place to which the leaden bullet is brought by the screw, as accurately as possible, for the point of the greatest dryness. 4. Then take away the glass plate from the balance, dip it completely in water, give it a shake that the drops may run off from it, and wipe them carefully from the edge. 5. Apply the glass plate thus moistened again to the balance, and bring the latter into equilibrium by screwing the leaden bullet. Mark then the place at which the bullet stands as the highest degree of moisture. 6. This apparatus is to be suspended in a small box of well dried wood, sufficiently large to suffer the glass-plate to move up and down. An opening must be made in the lid, exactly of such a size as to allow the tongue of the balance to move freely. Parallel to the tongue apply a graduated circle, divided into a number of degrees at pleasure from the highest point of dryness to the highest degree of moisture. The box must be pierced with small holes on all the four sides, to give a free passage to the air; and to prevent moisture from penetrating into the wood by rain, when it may be requisite to expose it at a window, it must either be lackered or painted. To save it at all times from rain, it may be covered, however, with a sort of roof fitted to it in the most convenient manner. But all these external appendages may be improved or altered as may be found necessary.

Hyperbola, || Hypotrachelion.

HYPEBOLA Deficient, is a curve having only one asymptote, though two hyperbolic legs running out infinitely by the side of the asymptote, but contrary ways.

HYPOTRACHELION, in Architecture, is used for a little frize in the Tuscan and Doric capital, between the astragal and annulets; called also the colerin and gorgerin. The word is applied by some authors in a more general sense, to the neck of any column, or that part of its capital below the astragal.

I.

Jacobins.

JACOBINS, in the language of the present day, is the name assumed, at the beginning of the French revolution, by a party in Paris, which was outrageously democratical, and fanatically impious. This party, which consisted of members of the National Assembly, and of others maintaining the same opinions and pursuing the same objects, formed itself into a club, and held its meetings in the hall belonging to the Jacobin friars, where measures were secretly concerted for exciting insurrections, and over-awing at once the legislature and the king. The name of *Jacobin*, though it was derived from the hall where the club first met, has since been extended to all who are enemies to monarchy, aristocracy, and the Christian religion; and who would have every man to be his own priest and his own lawgiver. Hence it is, that we have Jacobins in other countries as well as in France.

Of the proceedings of the French Jacobins, some account has been given, in the *Encyclopædia*, under the title Revolution, and the subject will be resumed in this *Supplement* under the same title. The purpose of the present article is to trace the principles of the sect from their source; for these principles are not of yesterday.

"At its very first appearance, (says the Abbé Barruel), this sect counted 300,000 adepts; and it was supported by two millions of men, scattered through France, armed with torches and pikes, and all the firebrands of the revolution." Such a wide spread conspiracy could not be formed in an instant; and indeed this able writer has completely proved, that this sect, with all its conspiracies, is in itself no other than "the coalition of a triple sect, of a triple conspiracy, in which, long before the revolution, the overthrow of the altar, the ruin of the throne, and the dissolution of all civil society, had been debated and determined."

It is known to every scholar that there have been in all ages and countries men of letters and pretenders to letters who have endeavoured to signalize themselves individually by writing against the religion of their country; but it was reserved for the philosophists (A) of France to enter into a combination for the express purpose

(A) This term was invented by Abbé Barruel, and we have adopted it, as denoting something very different from the meaning of the word *philosopher*.

Jacobins. purpose of eradicating from the human heart every religious sentiment. The man to whom this idea first occurred was Voltaire; who, daring to be jealous of his God, and being weary, as he said himself, of hearing people repeat that twelve men were sufficient to establish Christianity, resolved to prove that one might be sufficient to overthrow it. Full of this project, he swore, before the year 1730, to dedicate his life to its accomplishment; and for some time he flattered himself that he should enjoy alone the glory of destroying the Christian religion. He found, however, that associates would be necessary; and from the numerous tribe of his admirers and disciples, he chose D'Alembert and Diderot as the most proper persons to cooperate with him in his designs. How admirably they were qualified to act the part assigned them, may be conceived from the life of DIDEROT in this *Supplement*. But Voltaire was not satisfied with their aid alone.

He contrived to embark in the same cause Frederic II. of Prussia, who wished to be thought a philosopher, and who of course deemed it expedient to talk and write against a religion which he had never studied, and into the evidence of which he had probably never deigned to enquire. This royal adept was one of the most zealous of Voltaire's coadjutors, till he discovered that the philosophists were waging war with the throne as well as with the altar. This indeed was not originally Voltaire's intention. He was vain; he loved to be caressed by the great; and, in one word, he was, from natural disposition, an aristocrate and admirer of royalty: But when he found that almost every sovereign but Frederick disapproved of his impious projects as soon *as he perceived their issue*, he determined to oppose all the governments on earth, rather than forfeit the glory with which he had flattered himself, of vanquishing Christ and his apostles in the field of controversy.

He now set himself, with D'Alembert and Diderot, to excite universal discontent with the established order of things. This was an employment entirely suited to their disposition; for not being in any sense *great* themselves (B), they wished to pull all men down to their own level. How effectually they contrived to convert the *Encyclopædie* into an engine to serve their purposes, has been shown already; but it was not their only nor their most powerful engine; they formed secret societies, assumed new names, and employed an enigmatical language. Thus, Frederic is called *Luc*; D'Alembert, *Protagoras*, and sometimes *Bertrand*; Voltaire, *Raton*; and Diderot, *Platon*, or its anagram *Tonpla*; while the general term for the conspirators is *Cacouac*. In their secret meetings they professed to celebrate the mysteries of *Mythra*; and their great object, as they professed to one another, was to confound the *wretch*, meaning J— C—. Voltaire proposed to establish a colony of philosophists at Cleves, who, protected by the king of Prussia, might publish their opinions without dread or danger; and Frederic was disposed to take them under his protection, till he discovered that their opinions were anarchical as well as impious, when he threw them off, and even wrote against them. Jacobins.

They contrived, however, to engage the ministers of the court of France in their favour, by pretending to have nothing in view but the enlargement of science, in works which spoke indeed respectfully of revelation, while every discovery which they brought forward was meant to undermine its very foundation. When the throne was to be attacked, and even when barefaced atheism was to be promulgated, a number of impious and licentious pamphlets were dispersed, for some time none knew how, from a secret society formed at the Hotel d'Holbach at Paris. These were sold for trifles, or distributed *gratis* to schoolmasters, and others who were likely to circulate their contents. D'Alembert, Diderot, and Condorcet, who was now associated with the other conspirators, flattered the ambition of every man among the great, and especially of the Duke d'Orleans, the richest subject in Europe, and a prince of the blood of France. The first and the last of these three adepts, had, by their mathematical knowledge, got such an ascendency in the Royal Academy of Sciences, that they could admit or exclude candidates as they knew them to be friendly or inimical to the projects of the conspirators; and they had contrived, by matchless address and unwearied perseverance, to fill almost all the seminaries of education with men of their own principles.

Thus was the public mind in France completely corrupted, when the mason lodges, over which the infamous Orleans presided, were visited by a delegation from the German illuminati; and nothing more was necessary to produce the sect of *Jacobins*, by whose intrigues and influence, France, as M. Barruel expresses himself, has become a prey to every crime. It was by the machinations of this sect that its soil was stained with the blood of its pontiffs and priests, its rich men and nobles; with the blood of every class of its citizens, with no regard to rank, age or sex. These disciples of Voltaire were the men who, after having made the unfortunate Louis, his queen and sister, drink to the very dregs, the cup of outrage and ignominy during a long confinement, solemnly murdered them on a scaffold, proudly menacing all the sovereigns of the earth with a similar fate. Yet think not, indignant reader, that the ways of Providence are unequal. The nations of Europe were ripe for chastisement, and that chastisement these villains were employed to inflict: but their own punishment did not linger. Voltaire died in agonies of desponding remorse, which can be exceeded only by the torments of the damned. There is reason to believe that the end of D'Alembert and Diderot very much resembled that of their leader; while the more hardened adept, Condorcet, became his own executioner; and the other chiefs of the rebellion have reciprocally inflicted vengeance on each other, every alteration of the French constitution (and these alterations have been many) being followed by the execution of those by whom the government was previously administered.

(B) We do not by this mean to insinuate that D'Alembert was not a man of science. He was perhaps the only man of science in that gang; but he was a master of no science but mathematics; and his birth being obscure, if not spurious, and abstract mathematics not furnishing ready access to the great, his ideas, when compared with Voltaire's, were groveling, and (as M. Barruel says) he was afraid to be seen.

JAGHIRE, assignment made in Bengal by an Imperial grant upon the revenue of any district, to defray civil or military charges, pensions, gratuities, &c.

JAGHIREDER, the holder of a Jaghire.

St. JAGO, the largest and most populous of the Cape de Verde islands, of which some account has been given in the *Encyclopædia*, is represented by Sir George Staunton as liable to long and excessive droughts, for which no philosophical cause can be assigned. When the embassy to China touched at it in the latter end of 1792, it was in a state of absolute famine. Little or no rain had fallen for about three years before. The rivers were almost all entirely dry. The surface of the earth was, in general, naked of any herbage. The greatest part of the cattle had perished, not less through drought than want of food. Of the inhabitants, many had migrated, and many were famished to death. Nor was this calamity peculiar to St Jago. All the islands of Cape de Verde were said to have experienced the same long drought, and to be consequently in a state of similar desolation. Yet the frequent showers which were observed by the first navigators who touched at St Jago, induced them to give to the island the name of *Pluvialis*; and no change had been observed in the steady current of wind, blowing from the east, which is common to tropical climates.

"What were the uncommon circumstances (says Sir George) that took place in the atmosphere of that part of Africa to which the Cape de Verde Islands lie contiguous, or in the vast expanse of continent extending to the east behind it, and from which this direful effect must have proceeded (as they happened where no man of science existed to observe or to record them), will therefore remain unknown. Nor is theory bold enough to supply the place of observation. Whatever was the cause which thus arrested the bountiful hand of Nature, by drawing away the sources of fertility, it was observable, that some few trees and plants persevered to flourish with a luxuriance, indicating that they still could extract from the arid earth whatever portion of humidity it was necessary to derive from thence for the purpose of vegetable life, though it was denied to others."

Beside the trees of the palm kind, which are often found verdant amidst burning sands, nothing, for example, could be more rich in flavour, or abound more with milky, though corrosive juice, than the asclepias gigantea (see Asclepias, *Encycl.*), growing plentifully, about several feet high, without culture, indeed, but undisturbed, it being of no avail to cut it down in favour of plants that would be useful, but required the aid of more moisture from the atmosphere. The jatropha curcas, or physic nut tree, which the French West Indians, with some propriety, call *bois immortel*, and plant, on that account, in the boundaries of their estates, appeared as if its perpetuity was not to be affected by any drought. Some indigo plants were still cultivated with success in shaded vales, together with a few cotton shrubs. Throughout the country some of those species of the mimosa, or sensitive plant, which grow into the size of trees, were most common, and did not appear to languish. In particular spots the annona, or sugar apple tree was in perfect verdure. The borassus, or great fan palm, lifted, in a few places, its lofty head and spreading leaves, with undiminished beauty. In a bottom, about a mile and a half behind the town of Praya, was still growing, in a healthy state, what may be called for size a phenomenon in vegetation, a tree known to botanists by the name of adansonia, and in English called *monkey bread tree*. The natives of St Jago call it *kabisera*; others baobab. Its trunk measured at the base no less than 56 feet in girth; but it soon divided into two great branches, one rising perpendicularly, and measuring 42 feet in circumference. That of the other was about 26. By it stood another of the same species, whose single trunk of 38 feet girth, attracted little notice from the vicinity of its huge companion.

But the annual produce of agriculture was scarcely to be found. The plains and fields, formerly productive of corn, sugar-canes, or plantains, nourished by regular falls of rain, now bore little semblance of vegetation. Yet in the small number of plants which survived the drought, were some which, from the specimens sent to Europe, were found to have been hitherto unknown. Vegetation quickly, indeed, revived wherever, through the soil, any moisture could be conveyed.

Sir George represents Praya, the residence of the Portuguese Viceroy, as a hamlet rather than a town. It consists of about 100 very small dwellings, one story high, scattered on each side of the plain, which extended near a mile in length, and about the third of a mile in breadth; and fell off, all around, to the neighbouring valleys and to the sea. Not being commanded by any neighbouring eminence, it was a situation capable of defence; the fort, however, or battery, was almost in ruins; and the few guns mounted on it were mostly honey-combed, and placed on carriages which scarcely held together.

A party belonging to the embassy crossed the country to the ruins of St Jago, the former capital of the island, situated in the bottom of a vale, through which ran a stream then both small and sluggish. On each side of that stream are the remains of dwellings of considerable solidity and size; and the fragments of glass lustres, still hanging from the ceilings of some of the principal apartments, denote the elegance or riches that were once displayed in this now deserted place. Not above half a dozen families remain in it at present; the rest abandoned it, or perished. Here was still, however, an attempt at a slight manufactory of striped cotton slips, the same as are made in the other parts of the island, for the use of the Africans on the main, who pay for them in slaves, elephants teeth, and that gum which is generally called arabic.

Amidst the ruins of St Jago the party found a Portuguese, to whom one of them was recommended, and who received them with the most cordial hospitality in his house, and treated them with every species of tropical fruits from his garden, lying on each side the river.

He had been a navigator; and informed them that the isle of Brava, one of the Cape de Verde's, was a fitter and safer place for ships to call at for water and provisions than the island of St Jago; that it had three harbours; one called Puerto Furno on the east side of the island, from which vessels must warp, or be towed out by boats; the Puerto Fajendago to the west; and the Puerto Ferreo to the south, which was the best for large ships, and into which runs a small river. In another of the Cape de Verde islands, called San Vicenté, he observed that there was also a large harbour on the north

north end, but that fresh water was at some distance from it: and there was likewise a good port at Bonavista. This information of the harbours in the isle of Brava was confirmed by accounts given by others to Sir Erasmus Gower, who recommends to make a trial of them.

JALOFFS, or Yaloffs, are an active, powerful, and warlike people, inhabiting great part of that tract of Africa which lies between the Senegal and the Mandingo states on the Gambia (See Mandingoes in this *Supplement*). Their noses, says Mr Park, are not so much depressed, nor their lips so protuberant, as those of the generality of Africans; and though their skin is of the deepest black, they are considered by the white traders as the most sightly Negroes in that part of the continent where they live. They are divided into several independent states or kingdoms, which are frequently at war with their neighbours or with each other. In their manners, superstitions, and government, they have a greater resemblance to the Mandingoes than to any other nation; but excel them in the manufacture of cotton cloth, spinning the wool to a finer thread, weaving it in a broader loom, and dyeing it of a better colour. They make very good soap, by boiling ground nuts in water, and then adding a ley of wood ashes. They likewise manufacture excellent iron, which they carry to Bondou to barter for salt. Their language is said to be copious and significant, and is often learned by Europeans trading to Senegal. From the names of their numerals, as given by Mr Park, it would appear that their numeration proceeds by *fives*, as ours does by *tens*.

Our author relates the event of a religious war, which, as it displays a generosity of character very uncommon among savages, will afford pleasure to the minds of many of our readers. Almami Abdulkader, sovereign of a Mahomedan kingdom called Foota Torra, sent to Damel, a king of the Jaloffs, an imperious message, commanding him and his subjects to embrace instantly the faith of the prophet. The ambassador having got admission to the presence of Damel, ordered some Bushreens (*i. e.* Mahomedan Negroes) who accompanied him, to present the emblems of his mission. Two knives were accordingly laid before the Jaloff prince, and the ambassador explained himself as follows: "With this knife (said he) Abdulkader will condescend to shave the head of Damel, if Damel will embrace the Mahomedan faith; and with this other knife Abdulkader will cut the throat of Damel, if Damel refuses to embrace it: Take your choice."—Damel coolly told the ambassador that he had no choice to make: he neither chose to have his head shaved, nor his throat cut. And with this answer the ambassador was civilly dismissed.

Abdulkader took his measures accordingly; and with a powerful army invaded Damel's country. The inhabitants of the towns and villages filled up their wells, destroyed their provisions, carried off their effects, and abandoned their dwellings, as he approached. By this means he was led on from place to place, until he had advanced three days journey into the country of the Jaloffs. He had, indeed, met with no opposition; but his army had suffered so much from the scarcity of water, that several of his men died by the way. This induced him to direct his march towards a watering place in the woods, where his men, having quenched their thirst, and being overcome with fatigue, lay down carelessly to sleep among the bushes. In this situation they were attacked by Damel before day-break, and completely routed. Many of them were trampled to death as they lay asleep by the Jaloffs horses; others were killed in attempting to make their escape; and a still greater number were taken prisoners. Among the latter was Abdulkader himself. This ambitious or rather frantic prince, who, but a month before, had sent the threatening message to Damel, was now himself led into his presence as a miserable captive. The behaviour of Damel, on this occasion, is never mentioned by the singing men* but in terms of the highest approbation; and it was, indeed, so extraordinary in an African prince, that the reader may find it difficult to give credit to the recital. When his royal prisoner was brought before him in irons, and thrown upon the ground, the magnanimous Damel, instead of setting his foot upon his neck, and stabbing him with his spear, according to the custom in such cases, addressed him as follows: "Abdulkader, answer me this question. If the chance of war had placed me in your situation, and you in mine, how would you have treated me?" "I would have thrust my spear into your heart (returned Abdulkader with great firmness); and I know that a similar fate awaits me." "Not so (said Damel); my spear is indeed red with the blood of your subjects killed in battle, and I could now give it a deeper stain, by dipping it in your own; but this would not build up my towns, nor bring to life the thousands who fell in the woods. I will not therefore kill you in cold blood, but I will retain you as my slave, until I perceive that your presence in your own kingdom will be no longer dangerous to your neighbours; and then I will consider of the proper way of disposing of you." Abdulkader was accordingly retained, and worked as a slave for three months; at the end of which period, Damel listened to the solicitations of the inhabitants of Foota Torra, and restored to them their king. Strange as this story may appear, Mr Park has no doubt of the truth of it. It was told to him at Malacotta by the Negroes; it was afterwards related to him by the Europeans on the Gambia; by some of the French at Goree; and confirmed by nine slaves, who were taken prisoners along with Abdulkader by the watering place in the woods, and carried in the same ship with him to the West Indies.—Such generosity as this reflects honour on human nature.

* *The historians of the country.*

JARRA, is a town of considerable extent in the Moorish kingdom of Ludamar in Africa. The houses are built of clay and stone intermixed, a kind of wall very common in many parts of Scotland, where clay is made to supply the place of mortar. The greater part of the inhabitants of Jarra are Negroes from the borders of the southern states, who prefer, says Mr Park, a precarious protection under the Moors, which they purchase by a tribute, to the being continually exposed to their predatory hostilities. The tribute which they pay is considerable; and they manifest the most unlimited obedience and submission to their Moorish superiors; by whom they are, in return, treated with the utmost indignity and contempt. The Moors in this, and the other states adjoining the country of the Negroes, resemble in their persons the Mulattoes of the West

West Indies, and seem to be a mixed race between the Moors, properly so called, of the north, and the Negroes of the south; possessing many of the worst qualities of both nations. Jarra is situated in 15° 5′ N. Lat. and 6° 48′ E. Long.

IATA, a bay on the coast of Chili.—*Morse.*

IBBERVILLE, a river or rather a sort of natural canal, of W. Florida, which, when the Mississippi overflows, and is high enough to run into it, (which is generally in the months of May, June, and July) forms a communication for vessels drawing three or four feet, from the Mississippi to the gulf of Mexico, eastward, through the lakes Mauripas and Pontchartrain. This canal, which has been dignified with the name of river, is dry all the rest of the year. It is a mile below a village of Alabama Indians, 35 miles from the settlements of Point Coupeé, 99 W. by N. of New-Orleans, 204 N. W. of the Balize, and 270 W. of Pensacola, by the above lakes. It receives the river Amit or Amite, from the northward, which is navigable for batteaux to a considerable distance.—*ib.*

IBIS. Under the generic name TANTALUS (*Encycl.*), we have described, after Mr Bruce, a bird which he found in Abyssinia, and concluded to be the sacred ibis of ancient Egypt. M. Vaillant, during his last travels in Africa, found, in some lakes near the elephants river, a bird very different from Mr Bruce's, which he considered as belonging to the same species; and which he describes thus: It is three feet in height. Its head and throat, which are extremely bare, are covered with a skin of the brightest red, terminated by a band of a beautiful orange, which separates the naked part from that covered with feathers. The upper part of the wings, having broad stripes of a fine violet colour, agreeably shaded, is bordered by a white band of feathers, the thick and silky beards of which, separated from each other, have a perfect resemblance to a rich fringe. The quills of the wings and tail are of a greenish black, which, as it receives the light in a more or less oblique direction, assumes the appearance of violet or purple. The rest of the plumage is of a beautiful white. The bill, which is long and somewhat crooked, is yellow; as are the feet. This bird belongs to the genus of the ibis, of which we are already acquainted with several species.

ICAQUE POINT, on the E. end of the island of St Domingo, lat. 19° 2′.—*Morse.*

ICE HOUSE. See that article, *Encyclopædia*. Professor Beckmann, in the third volume of his History of Inventions, has proved clearly that the ancients were well acquainted with what served the purpose of ice-houses.

"The art (says he) of preserving snow for cooling liquors during the summer, in warm countries, was known in the earliest ages. This practice is mentioned by Solomon,* and proofs of it are so numerous in the works of the Greeks and the Romans, that it is unnecessary for me to quote them, especially as they have been collected by others. How the repositories for keeping it were constructed, we are not expressly told; but it is probable that the snow was preserved in pits or trenches.

*Proverbs. xxv. 15.

"When Alexander the Great besieged the city of Petra, he caused 30 trenches to be dug, and filled with snow, which was covered with oak branches; and which kept in that manner for a long time. Plutarch says, that a covering of chaff and coarse cloth is sufficient; and at present a like method is pursued in Portugal. Where the snow has been collected in a deep gulph, some grass or green sods, covered with dung from the sheep-pens, is thrown over it; and under these it is so well preserved, that the whole summer through it is sent the distance of 60 Spanish miles to Lisbon.

"When the ancients, therefore, wished to have cooling liquors, they either drank the melted snow, or put some of it in their wine, or they placed jars filled with wine in the snow, and suffered it to cool there as long as they thought proper. That ice was also preserved for the like purpose, is probable from the testimony of various authors; but it appears not to have been used so much in warm countries as in the northern. Even at present snow is employed in Italy, Spain, and Portugal; but in Persia ice. I have never any where found an account of Grecian or Roman ice-houses. By the writers on agriculture they are not mentioned."

ICHNOGRAPHY, in architecture, is a transverse or horizontal section of a building, exhibiting the plot of the whole edifice, and of the several rooms and apartments in any story; together with the thickness of the walls and partitions; the dimensions of the doors, windows, and chimneys; the projectures of the columns and piers, with every thing visible in such a section.

ICHUA-TOWN, in the Genessee country in the State of New-York, is an Indian village at the mouth of Ichua Creek, a north-eastern head water of Alleghany river. It is 60 miles easterly of Fort Erie, 70 E. by S. of La Boeuf, and 67 S. W. by S. of Hartford on Genessee river.—*Morse.*

ICUNADA DE BARRUGAN, a town on the river La Plata, in S. America.—*ib.*

ICY CAPE is the north-westernmost head land of N. America, situated in the Northern ocean. Between this cape and Cape North, in Asia, is the opening into Behring's Straits, which lead from the Northern into the Pacific ocean.—*ib.*

JEBB (John), was born in Southampton-street, Covent Garden, London on the 16th of February, 1736. He was the eldest son of the Rev. John Jebb, dean of Cashel, in the kingdom of Ireland. He received the elements of his education in different schools, and was admitted, July 7, 1753, pensioner in the university of Dublin, whence he removed, November the 9th 1754, to St Peter's college in Cambridge, where he was likewise a pensioner. In January 1757 he proceeded to the degree of A. B. and his place in the distribution of academical honours was, on that occasion, second wrangler, the late eminent mathematician Dr Waring being the first. In 1758 he obtained the second prize of fifteen guineas, annually given by the university to the authors of the best compositions in Latin prose, being senior or middle bachelors of arts. Dr Roberts, afterwards provost of Eton college, obtained the first.

In the month of June 1760, Mr Jebb was admitted probationer fellow of St Peter's college, and proceeded to the degree of Master of Arts at the commencement in the same year; and on the first of July 1761, was confirmed fellow by Dr Mawson, bishop of Ely.

On the 6th of June 1762, he was ordained deacon at Bugden by Dr John Green, bishop of Lincoln;

Jebb. coln; and on the 25th of September, 1763, he was admitted by the fame bifhop into prieft's orders.

On the 22d of Auguft, 1764, Mr Jebb was collated by Dr Matthias Mawfon, bifhop of Ely, to the fmall vicarage of Gamlingay, near Potton, in Bedfordfhire, upon the recommendation of Dr Law, mafter of Peterhoufe. On the 17th of the following October, he was elected by the univerfity into the rectory of Ovington, near Watton, in Norfolk, after a competition with the Rev. Henry Turner, then fellow of St John's college, afterwards vicar of Burwell, in Cambridgefhire. Upon cafting up the votes, there appeared to be for Mr Jebb 91, for Mr Turner 73; and accordingly he was inftituted into the fame the 15th of December following.

On the 29th of the fame month, (December 1764) Mr Jebb married Anne, eldeft daughter of the Rev. James Torkington, rector of Little Stukeley, in Huntingdonfhire, and of lady Dorothy Sherard, daughter of Philip, fecond earl of Harborough.

Early in the year 1765, Mr Jebb, together with the Rev. Robert Thorpe, fellow of Peterhoufe, and the Rev. George Woolafton, fellow of Sidney college, publifhed, in a fmall quarto, a comment on thofe parts of Sir Ifaac Newton's *Principia* which more immediately relate to the fyftem of the world. The title of the joint work of thefe able and judicious philofophers was, "Excerpta quædam e Newtoni principiis philofophiæ naturalis, cum notis variorum." A work, of which the univerfity of Cambridge continues to bear teftimony to the excellence, by the general ufe of it in the courfe of academical education.

Mr Chappelow profeffor of Arabic, dying on the 14th of January 1768, Mr Jebb offered himfelf a candidate for the vacant chair; but it was given to Dr Hallifax, afterwards bifhop of Gloucefter; a man of deferved celebrity, of whom we regret that it was not in our power to give a biographical fketch.

On July 10. 1769, Mr Jebb was inftituted to the vicarage of Flixton, near Bungay, in Suffolk, on the prefentation of William Adair, Efq. of Flixton-hall; and on the 4th of April 1770, was inftituted to the united rectories of Homersfield and St Crofs, parifhes contiguous to Flixton, upon the fame prefentation: being alfo, in the fummer of the fame year, nominated chaplain to Robert earl of Harborough. In confequence of the acceffion of thefe preferments, though not confiderable in themfelves, he refigned, fome time in the month of October 1771, the rectory of Ovington, which he had received from the univerfity; and Mr Sheepfhanks, fellow of St John's college, was elected in his place.

Dr Hallifax fucceeding to the profefforfhip of civil law, in the month of October 1770, upon the death of Dr Ridlington, Mr Jebb once more folicited that of Arabic, which Dr Hallifax then vacated: but he had by this time difplayed fuch an innovating fpirit in religion, that the univerfity gave the vacant profefforfhip to Mr Craven, a man refpected even by Mr Jebb and his friends.

Early in the year 1771, a defign was formed of applying to parliament for relief in the matter of fubfcription to the liturgy, and thirty-nine articles of the Church of England; and in the profecution of this defign Mr Jebb took a very active part. He attended different meetings of the difcontented clergy, held at the Feathers tavern, London, affifted in the drawing up of their petition, and wrote their circular letter, which gave to the public an account of their aims. He bufied himfelf at the fame time in making various attempts to bring about what he called a reformation of the univerfity of Cambridge, but finding them fruitlefs, he retired, on the 25th of June 1772, to Bungay, where he ftudied French and Italian, and proceeded in a plan of fome *political* or *conftitutional lectures*. Jebb.

He had by this time ceafed to read the prayers of the church, though he ftill continued to preach occafionally; and the Archdeacon of Suffolk, holding, this year, his ufual vifitation of fome neighbouring parifhes in the church of Flixton, Mr Jebb preached fuch a fermon againft fubfcription, as drew upon himfelf a public rebuke from the Archdeacon, in the prefence of the clergy. "Much altercation, (fays he) enfued: and for fome days I expected a fummons to Norwich; but have heard no more of it. *I acted thus, with a view to call the attention of the Norwich clergy to our caufe;* and have in part fucceeded."

He acted much more honourably than this, when, in 1775, he refigned all his preferments in the church: which furely he ought not to have retained one day after his confcience would not permit him to read the prayers of the liturgy. He now refolved to become a phyfician; and after attending St Bartholomew's hofpital in London for fix months, as the pupil of Dr William Pitcairn, he received, on the 18th of March 1777, a diploma of Doctor of Phyfic from the univerfity of St Andrews!! He did not, however, commence practice till the 5th of February 1778; and even then he continued to attend the lectures of Dr Hunter, Mr John Hunter, and Dr Higgins. On the 18th of February 1779 he was elected a Fellow of the Royal Society.

Dr Jebb, at the breaking out of the American war, had fhewn himfelf at Cambridge a warm partizan of the revolting colonies; and of courfe a keen advocate for what he called, and, we doubt not, thought, the civil liberties of mankind. He now fignalized himfelf by "An addrefs to the Freeholders of Middlefex," affembled at Free mafon's tavern in Great Queen-ftreet, on Monday, December the 20th 1779, for the purpofe of eftablifhing meetings to maintain and fupport the freedom of election. Upon this occafion, he communicated to James Townfend, Efq. chairman of that meeting, the above addrefs, under the fignature of "Salus Publica;" prefuming, that if the fentiments "appeared to be founded in reafon, they would not be the lefs regarded on account of their being fuggefted by an unknown individual."

This addrefs was immediately printed, and very foon paffed through three editions, each being enlarged by the addition of frefh matter; and in 1782, followed the fourth edition corrected, which alfo bore our author's name in the title page.

About the end of February 1780, Dr Jebb was appointed by the committee of the county of Huntingdon, one of their deputies, to attend a meeting in London of reprefentatives from certain other petitioning counties, in order to concert meafures for the more effectual reform of the prefent conftitution of the houfe of commons. Soon afterwards he became one of the moft active members of "the fociety for conftitutional information;

Jebb.

information;" of which the object, according to their own account, was to diffuse throughout the kingdom, as universally as possible, a knowledge of the great principles of constitutional freedom, particularly such as respect the election and duration of the representative body. "With this view (say they), constitutional tracts, intended for the extension of this knowledge, and to communicate it to persons of all ranks, are printed and distributed gratis, at the expence of the society. Essays, and extracts from various authors, calculated to promote the same design, are also published under the direction of the society, in several of the newspapers; and it is the wish of the society to extend this knowledge throughout every part of the united kingdoms, and to convince men of all ranks, that it is their interest, as well as their duty, to support a free constitution, and to maintain and assert those common rights, which are essential to the dignity and to the happiness of human nature." Could Dr Jebb have foreseen all the mischiefs which have flowed from this institution; could he have foreseen the wonderful spawn of factious societies which have sprung from it as from a parent stock, our veneration for genius and learning will not permit us to believe, that he would have neglected the studies of his profession for the sake of taking the lead in party politics.

Dr Petit, one of the physicians of St Bartholomew's hospital, dying the 26th of May, Dr Jebb offered himself a candidate to succeed to that appointment. The election came on the 23d of June; when Dr Budd, his antagonist, succeeded by a great majority.

The opposition which was made to his election at St Bartholomew's, followed him in the winter, when he offered himself at St Thomas's hospital in the borough. Indeed he relinquished his pretensions there sooner than in the former place; but for no other reason than because he found that all his political principles were likely to be again objected to him, and to hazard his success.

In the year 1783 he concurred with others in forming "the society for promoting the knowledge of the scriptures," which met first on the 20th of September in that year, and whose meetings continued to be held, and, for ought we know to the contrary, are still held at Essex house. The sketch of their plan was chiefly written by Dr Jebb; and their object was to propagate the doctrines of Unitarianism, for which he was as great a zealot as for civil liberty.

His health now began to decline; but during his confinement, he studied the Saxon language, the Anglo-Saxon laws, English history and antiquities, with a view to examine into our criminal code, and particular points of liberty. The vigour of his mind was still equal to the furnishing himself with this fresh store of knowledge; he foresaw the advantage of such an acquisition in the investigation of the legal rights of Englishmen, and had designed to have employed it in the support of some great constitutional questions, which he considered as essential to the freedom of his country.

But as the year began to dawn, it was very observable to many of his friends that, according to every appearance, and without some very great and singular effort of nature, his increased debility would defeat every exertion of the most judicious medical assistance, and terminate the remaining sparks of human life.

In this enfeebled state, his mind was active. His "Thoughts on Prisons" were printed and circulated in the county of Suffolk in 1785, by his much valued friend Mr Lofft; and there is sufficient reason for concluding that this little tract had effect on the deliberations of the justices at Ipswich and Bury, then engaged in erecting a new gaol for the division of Ipswich, and a new house of correction for that of Bury.

Jeffersonia, | Jerboa.

The good effects of this very excellent tract, it was apprehended, would be extended by a more general publication. In this hope Dr Jebb revised and corrected it with his dying hand: and his surviving friend published it soon after his death, adding thereto "an abstract of felonies created by statute and other articles relative to the penal law.

He continued to linger till May the 2d 1786, when, about 8 o'clock in the evening, he breathed his last, leaving behind him, among men of different persuasions, very different characters. By the dissenters he is seldom mentioned but as the *Great Jebb;* by churchmen, his abilities are universally allowed, whilst regret is expressed that they were so often employed in support of faction and heresy. His moral character has never been aspersed.

JEFFERSONIA, a new plant lately discovered in Georgia by Dr Brickel of Savannah, and so named by him in compliment to the vice president of the United States. In the *Monthly Magazine* for July 1798 we have the following description of it:

JEFFERSONIA pentandria monogynia.

Calyx, below, composed of five short oval imbricated leaves; *corolla*, monophyllous, funnel shaped, on the receptacle, sub-pentangular, bearing the filaments near the base, its margin hypocrateriform, divided into five round ducts nearly equal; *style*, piliform, shorter than the petal, but longer than the stamens; *stigma*, quadrifid; *anthers*, erect, linear, sagittated; *fruit*, two univalved, carinated, polyspermous capsules, united at the base, opening on their tops and contiguous sides, having flat seeds, with a marginal wing.

Only one species is as yet discovered, *Jeffersonia sempervirens*. It is a shrub with round polished twining stems, which climb up on bushes and small trees; the petioles short, opposite; leaves oblong, narrow, entire, evergreen, acute; flowers axillary, yellow, having a sweet odour. The woods are full of this delightful shrub, which is covered with blossoms for many months in the year.

JERBOA, see MUS, *Encycl.* where descriptions are given of the jaculus or common jerboa, and of the Arabian, Egyptian, and Siberian jerboas. A variety of this animal has lately been found in Canada by Major-general Davies, F. R. S. and L. S. who says it belongs to Schreber's genus of Dipus, and may be thus characterised: DIPUS CANADENSIS *palmis tetradactylis, plantis pentadactylis, caudâ annulatâ undique setosâ, corpore longiore.* The truth, however, seems to be, that it is only a variety, if indeed a variety, of the Siberian jerboa. The beautiful figure indeed given by General Davies of the Canadian jerboa differs in some respects from our figure of the Sibericus. Its ears lie flat and farther down the neck; its belly is not so large; its toes are longer: and it has no brush at the end of the tail; but the habits of the two animals seem to be the same. This will

Jerboa. will be apparent from the following extracts of the General's letter to the Linnean Society:

"The first I was so fortunate to catch was taken in a large field near the falls of Montmorenci, and by its having strayed too far from the skirts of the wood, allowed myself, with the assistance of three other gentlemen, to surround it, and after an hour's hard chase to get it unhurt, though not before it was thoroughly fatigued; which might in a great measure accelerate its death.

"During the time the animal remained in its usual vigour, its agility was incredible for so small a creature. It always took progressive leaps of from three to four, and sometimes of five yards, although seldom above 12 or 14 inches from the surface of the grass; but I have frequently observed others in shrubby places and in the woods, amongst plants, where they chiefly reside, leap considerably higher. When found in such places, it is impossible to take them, from their wonderful agility, and their evading all pursuit by bounding into the thickest cover they can find."

That the Canadian, as well as the Siberian Jerboa sleeps through the winter, seems evident from a specimen having been found, towards the end of May, inclosed in a ball of clay, about the size of a cricket ball, nearly an inch in thickness, perfectly smooth within, and about twenty inches under ground. It was given to the General: who proceeds thus:

"How long it had been under ground it is impossible to say; but as I never could observe these animals in any parts of the country after the beginning of September, I conceive they lay themselves up some time in that month, or beginning of October, when the frost becomes sharp: nor did I ever see them again before the last week in May, or beginning of June. From their being enveloped in balls of clay, without any appearance of food, I conceive they sleep during the winter, and remain for that term without sustenance. As soon as I conveyed this specimen to my house, I deposited it, as it was, in a small chip box, in some cotton, waiting with great anxiety for its waking; but that not taking place at the season they generally appear, I kept it until I found it begin to smell: I then stuffed it, and preserved it in its torpid position. I am led to believe, its not recovering from that state arose from the heat of my room during the time it was in the box, a fire having been constantly burning in the stove, and which, in all probability was too great for respiration. I am led to this conception from my experience of the snow bird of that country, which always expires in a few days (after being caught, although it feeds perfectly well) if exposed to the heat of a room with a fire or stove; but being nourished with snow, and kept in a cold room or passage, will live to the middle of summer."

Another variety of this species is described by Benjamin Smith Barton, M. D. Professor of Botany and Natural History, in the University of Pennsylvania, in the fourth volume of the Transactions of the American Philosophical Society, p. 115 and 116. "This animal," says the Doctor, "is about the size of the common house-mouse. I weighed two of them. The difference in their weight was very small. That of which I have given a figure, and from which the following description is principally taken, weighed nine penny-weights, and twenty-two grains, soon after the death of the animal, and before the bowels were taken out. Like all the other species of Dipus, this is furnished with two *dentes primores*, or cutting teeth, in each jaw. These teeth are sharp at the points, and of a chesnut-brown colour. The upper-jaw projects considerably beyond the lower. The nostrils are open. The whiskers are long. The ears are small, somewhat oval, and covered. The fore-feet, or rather arms, are short, and are furnished with four toes or fingers, the nails of which are long, and very sharp. Besides these fingers, there is a kind of minute tuberculum, in place of a thumb. This tuberculum is entirely destitute of a nail. The hind legs are very long, and are furnished with five toes, the three middle ones being long, slender, and nearly of an equal length. The two side-toes are much shorter. The inner toe is the shortest of the five.

The head, the back, and the whole upper part of the body, are of a reddish-brown colour, somewhat inclining to yellow. The back is marked by a darker brown than the other parts. The whole under side of the body, beginning with the upper jaw, and ending at the anus, is of a cream colour; as are, likewise, the insides of the fore-legs, or arms, and the insides of the hind-legs.

A yellow streak, or band, beginning near the lower part of the nostrils, on each side, runs along the whole length of the head and neck, the upper and under side of the forelegs, from thence all along the body, terminating with the thighs, at the joint.

The tail is considerably longer than the body, gradually tapers from its origin, and is finely ciliated, or lightly covered with hairs, its whole length. It ends in a fine pencil of hairs. The upper side is of a slate-brown colour, the under side is of a yellowish-cream colour. It is composed of a great number of joints.

JETTE, the border made round the stilts under a pier, in certain old bridges, being the same with starling; consisting of a strong framing of timber filled with stones, chalk, &c. to preserve the foundations of the piers from injury.

IGNACIO, St, a town in the eastern part of Peru, and on the N. side of Amazon river.—*Morse.*

IGORNACHOIX, a bay in the island of Newfoundland, southward of St John's Bay.—*ib.*

Jillifree. JILLIFREE is a town on the northern bank of the river Gambia, opposite to James's island, where the English had formerly a small fort. The kingdom of Barra, in which it is situated, produces great plenty of the necessaries of life; but the chief trade of the inhabitants is in salt, which they carry up the river in canoes; and, in return, bring down Indian corn, cotton cloths, elephants teeth, small quantities of gold dust, &c. The number of canoes and people constantly employed in this trade, make the king of Barra (says Mr Park) more formidable to Europeans than any other chieftain on the river, and have encouraged him to establish those exorbitant duties, which traders of all nations are obliged to pay at entry, amounting nearly to L. 20 on every vessel, great and small. These duties, or customs, are generally collected in person by the alkaid or governor of Jillifree, who is attended by a numerous train of noisy and troublesome dependants, who, by their frequent intercourse with the English, have acquired a smattering of our language, and beg for every thing which they fancy with such earnestness, that traders, in

Ileignes, Illinois,

order to get quit of them, are frequently obliged to grant their requests. Lat. 13° 16′. Long. 16° 10′ east from Greenwich.

ILEIGNES, or *St Charles*, a town on the S. side of the island of St Domingo, and 200 fathoms from the city of St Domingo. It is inhabited by emigrants from the Canary islands, and has a few streets which run from the four cardinal points, and cut each other at right angles. The inhabitants are the most industrious people in the Spanish part of the island.—*Morse*.

ILHEOS, a captainship S. of that called Bay of All-Saints, and in the middle division of Brazil. Chief town, Paya. Ilheos, the capital of the above province, stands about 30 leagues N. E. of Porto Segaro, and as far S. W. of the Bay of All-Saints. It is watered by a river of the same name, and contains about 200 families. S. lat. 15° 40′, W. long. 34° 28′.—*ib.*

ILLINOIS, a large navigable river of the N. W. Territory, formed by the confluence of the rivers Plein, and Theakiki, in 41° 48′ N. lat. and in 88° 42′ W. longitude. This noble branch of the Mississippi, after running a serpentine S. W. course, through an extensive country of rich, fertile land, and receiving a vast number of rivers from 20 to 100 yards wide, which are navigable for boats from 15 to 180 miles, approaches within 5 miles of the Mississippi; from thence running eastward about 12 miles, it pays its tribute by a mouth 400 yards wide, in 38° 40′ N. lat. and in 92° 12′ W. longitude; opposite the large cave, 176 miles above the Ohio and 18 above the Missouri. The lands on the banks of the Illinois, particularly those on the S. E. side, are perhaps as fertile as any part of North-America. They produce in the most luxuriant plenty, wheat, rye, Indian corn, peas, beans, flax, hemp, tobacco, hops, grapes, apples, pears, peaches, dyeing roots, medicinal plants, &c. Here also grow large forests of hickory, oak, cedar, mulberry trees, &c. Savannas, or natural meadows are both numerous and extensive. In the forests are great variety of animals, as buffaloes, deer, &c. and in the rivers are plenty of fish, particularly cat, carp, and perch, of an enormous size. Such is the abundance of wild grapes in this country, that in the year 1769, the French planters upon this river made above 110 hhds. of strong wine, from these grapes. On the north-western side of this river is a coal mine, which extends for half a mile along the middle of its banks, and about the same distance below the coal mine are two salt ponds, 100 yards in circumference, and several feet in depth. The water is stagnant and of a yellowish colour; but the French and natives make good salt from it. The Illinois furnishes a communication with lake Michigan, by Chicago river, between which and the Illinois are two portages the length of which do not exceed 4 miles. The whole length of the river from the source of Theakiki, which is but a short distance from the river St Joseph, opposite to Fort St Joseph on the north, is 480 miles. The Indians have ceded to the United States, by the treaty of Greenville, in 1795, a tract of land 12 miles square, at or near the mouth of the Illinois; also a tract 6 miles square, at the Old Prarias fort and village near the south end of Illinois Lake. That lake is only a dilatation of the river, and is situated about 240 miles below the source of Theakiki, and 43 below the Salt Ponds. It is 20 miles long and 5 miles broad in the middle.—*ib.*

Illuminati.

ILLINOIS *Indians* inhabit near Cahokia on the Mississippi. Warriors 260.—*ib.*

1

Object of the Illuminati.

ILLUMINATI is the name which was assumed by a secret society or order, founded on the first of May 1776, by Dr Adam Weishaupt professor of canon law in the university of Ingolstadt. The real object of this order was, by clandestine arts, to overturn every government and every religion; to bring the sciences of civil life into contempt; and to reduce mankind to that imaginary state of Nature when they lived independent of each other on the spontaneous productions of the earth. Its avowed object, however, was very different. It professed to diffuse from secret societies, as from so many centres, the light of science over the world; to propagate the purest principles of virtue; and to re-instate mankind in the happiness which they enjoyed during the golden age fabled by the poets. Such an object was well adapted to make a deep impression on the ingenuous minds of youth; and to young men alone Weishaupt at first addressed himself.

It will naturally occur to the reader, that the means of attaining this glorious object should have been made as public as possible; and that the veil of secrecy thrown over the proceedings of the order was calculated to excite suspicion, and to keep even *young* men of virtue and sagacity at a distance. In any other country than Germany secrecy might perhaps have had this effect; but various circumstances conspired there to make it operate with a powerful attraction.

Ever since free-masonry had acquired such reputation throughout Europe, a multitude of petty secret societies had been formed in the universities of Germany, each having its lodge, its master, its mysteries, all modelled on those founded by masons coming from England and Scotland (A). Before the foundation of Weishaupt's order, these lodges, we believe, were in general harmless; or if they were productive of any evil, it was only by giving the youth of the universities a taste for secrecy and mysticism. Of this Weishaupt availed himself; and as soon as he had conceived the outlines of his plan, and digested part of his system, he initiated two of his own pupils, to whom he gave the names of

(A) Such, we are sorry to say, is the case still. In a letter, dated the 10th of May 1799, which we received from a gentleman of learning and honour then residing in Upper Saxony, is the following account of the university of Jena: "This university contains from two to three thousand students, who are almost all republicans, and go about the country in republican uniforms. They are all formed into clubs or *secret societies;* and the quarrel of one member of a club is taken up by all. The consequence is, that the number of duels among the different clubs is inconceiveable. The weapon is generally the sabre, and the duel often ends in the death of one of the combatants." Yet gentlemen of Great Britain send their sons to Germany to be educated!

of Ajax and Tiberius, assuming that of Spartacus to himself. These two disciples soon vying with their master in impiety (for it will be seen by and bye that he was most impious), he judged them worthy of being admitted to his mysteries, and conferred on them the highest degree which he had as yet invented. He called them *Areopagites*, denominated this monstrous association, THE ORDER OF ILLUMINATI, OR ILLUMINEES, and installed himself GENERAL of the order.

When public report spread the news in Germany of this new order having been founded in the university of Ingolstadt by Weishaupt, it was generally supposed to be one of those little college-lodges which could not interest the adepts after they had finished their studies. Many even thought that Weishaupt, who was at that time a sworn enemy to the Jesuits, had founded this lodge with no other view than to form a party for himself against these fathers, who after the suppression of their order, had been continued in their offices of public teachers at the university of Ingolstadt; and this opinion the illuminees were at pains to propagate. His character, too, was at this time such as to remove every suspicion from the public mind. A seeming assiduity in his duty, and a great shew of zeal and erudition in expounding the laws, easily misled people to believe that his whole time and talents were engrossed with the study of them; and if we are to credit his own account, Ingolstadt had never witnessed a professor so well calculated to add new lustre to its university.

2
Art of the founder.

This seems, indeed, to have been the general opinion as well as his own; for, some time after the foundation of his order, he applied himself with such diligence and apparent candour to the duties of his office, that he was chosen what Abbé Barruel's translator calls SUPERIOR of the university. This new dignity only added to his hypocrisy, and furnished him with fresh means of carrying on his dark designs. He converted his house into one of those boarding-houses where young men, perpetually under the eye of their masters, are supposed to be better preserved than anywhere else from the dangers which threaten them at that age. He solicited fathers and mothers to entrust their children to his care; and, counterbalancing in secret the lessons which he was obliged to give in public, he sent home his pupils well disposed to continue the same career of seduction which he himself carried on at Ingolstadt. Atrociously impious, we see him (says M. Barruel), in the first year of his illuminism, aping the God of Christianity, and ordering *Ajax*, in the following terms, to propagate the doctrines of his new gospel: "Did not Christ send his apostles to preach his gospel to the universe? You that are my Peter, why should you remain idle at home? Go then and preach."

These preachers had yet received no particular designation; for when his first adepts were initiated, he was far from having completed the code of his order. He knew that years and experience were necessary to perfect that gradual system of initiations and trials which, according to the plan he had conceived, his novices were to undergo; but he could not endure the idea of sacrificing years to mere theoretic projects; and he flattered himself with the hopes of supplying the deficiencies of his incomplete code by provisional regulations and private instructions, and of acquiring associates who would receive his new gospel implicitly, and co-operate with him in all his views.

3
The sect divided into classes of

At length, however, the code was completed, and the sect divided into two grand classes; and each of these again subdivided into lesser degrees, proportioned to the progress of the adepts.

4
Preparation and

"The *first* class is that of Preparation. It contains four degrees, viz. those of *Novice*, of *Minerval*, of *Minor Illuminee*, or *Illuminatus Minor*, and of *Major Illuminee*, or *Illuminatus Major*. To this class belong likewise some intermediary degrees, borrowed from free-masonry, as means of propagation. Of the masonic degrees, the code of the illuminati admits the first three without *any alteration*; but it adapts more particularly to the views of the sect the degree of *Scotch Knight*, and styles it the degree of *Directing Illuminee*, or *Illuminatus dirigens*.

5
The Mysteries.

The *second* class is that of the Mysteries, which are subdivided into the *lesser* and *greater mysteries*. The lesser comprehend the priesthood, and administration of the sect, or the degrees of *priests*, and of *regents* or *princes*.

In the *greater mysteries* are comprehended the two degrees of *Magus*, or philosopher, and of the *Man-king*. The *elect* of the latter compose *the council and degree of Areopagites*.

6
The recruiter.

"In all these classes, and in every degree (says the Abbé Barruel), there is an office of the utmost consequence, and which is common to all the brethren. It is that which is occupied by him who is known in the code by the appellation of *Recruiter*, or *Brother Insinuator*. This (continues our author) is not a term of my invention: it is really to be found in the code, and is the denomination of that illuminee whose employment is to entice members into the sect."

As the whole strength of the order depended upon the vigilant and successful exercise of this office, some brethren were carefully instructed for it who might afterwards visit the different towns, provinces and kingdoms, in order to propagate the doctrines of illuminism. Weishaupt proposed to select as his apostles either weak men who would implicitly obey his orders, or men of abilities, who would improve the office by artifices of their own. It was, however, a duty which every brother was obliged to exercise once or twice in his life, under the penalty of being for ever condemned to the lower degrees.

To stimulate the ardour of the brother insinuator, he was appointed superior over every novice whom he should convert. To assist his judgment, he was instructed in three important points concerning the description of men whom he ought to select for conversion, the means which he ought to employ for enticing them to enter the order, and the arts which he ought to study to form their character.

7
To pry into the characters of all men.

To enable the recruiter to determine whom he ought to select for conversion, he was to insinuate himself into all companies; he was to pry into the character of all whom he should meet with, whether friends, relations, strangers or enemies; he was to write down all his remarks regularly every day; to point out their strong and weak sides, their passions and prejudices, their intimacies, their interests, and their fortune. This journal was to be transmitted twice every month to the superiors; by which means the order would learn who were friendly or hoſtile to their views, and who were the individuals to whom they ought to direct their arts of ſeduction (B).

The perſons to be excluded were all ſuch as would expoſe the order to ſuſpicion or reproach. All indiſcreet talkers, all who were proved violent, and difficult to be managed, all addicted to drunkenneſs, and all Pagans, Jews, and Jeſuits, were to be rejected. As the patronage of princes would tend much to enrich and ſtrengthen the ſociety, it was agreed to admit them to the interior degrees, but they were never to be initiated into the grand myſteries; they were never to riſe beyond the degree of Scotch knight.

8 Perſons proper for the order,

The perſons to be ſelected were young men of all ſtations, from eighteen to thirty; but particularly thoſe whoſe education was not completed, and conſequently whoſe habits were not formed. "Seek me out (ſays Weiſhaupt in his directions to the inſinuator) the dexterous and daſhing youths. We muſt have adepts who are inſinuating, intriguing, full of reſource, bold and enterpriſing; they muſt alſo be flexible and tractable, obedient, docile, and ſociable." In another place he ſays, "Above all things pay attention to the figure, and ſelect the well made men and handſome young fellows. They are generally of engaging manners and nice feelings. When properly formed, they are the beſt adapted for negociations; for firſt appearances prepoſſeſs in their favour. It is true, they have not the depth that men of more gloomy countenances often have. *They are not the perſons to be entruſted with a revolt, or the care of ſtirring up the people;* but it is for that very reaſon we muſt know how to chooſe our agents. I am particularly fond of thoſe men whoſe very ſoul is painted in their eyes, whoſe foreheads are high, and whoſe countenances are open. Above all, examine well the eyes, for they are the very mirrors of the heart and ſoul. Obſerve the look, the gait, the voice. Every external appearance leads us to diſtinguiſh thoſe who are fit for our ſchool."

Though young men were preferred, yet perſons of all ages were to be admitted if their character accorded with the principles of the order. The inſinuator was deſired to ſeek out thoſe who were diſtinguiſhed by their power, riches, or learning. "Spare no pains (ſays Weiſhaupt), ſpare nothing in the acquiſition of ſuch adepts. If heaven refuſe its ſuccour, conjure hell.

9 To be ſeduced by whatever means;

Flectere ſi nequeas ſuperos, Acheronta moveto."

Perſons were to be ſingled out from thoſe profeſſions which give men influence over others, or put them in the moſt favourable ſituation for diſſeminating any peculiar opinions. With this view, ſchoolmaſters, and ſuperintendants of eccleſiaſtic ſeminaries, were to be ſought after with much care. Bookſellers, poſt-maſters, and the ſecretaries of poſt offices were alſo to be ſelected. Thoſe profeſſions which accuſtomed men to ſpeak and argue, as that of counſellors and attorneys, and even phyſicians, were alſo to be courted. "They are worth having (ſays Weiſhaupt), but they are ſometimes real devils, ſo difficult are they to be led; they are, however, worth having when they can be gained over." Every exertion was to be made to gain the officers of a prince, whether preſiding over provinces or attending him in his councils. "He that has done this, has done more than if he had engaged the prince himſelf."

There was alſo another deſcription of men of whom Weiſhaupt very wiſely judged that they would be admirably fitted for the diffuſion of his doctines. Theſe were the diſappointed and diſſatisfied. "Select thoſe in particular (ſays he) who have met with misfortunes, not from accidents, but from ſome injuſtice; that is to ſay, in other words, the diſcontented; for ſuch men are to be called into the boſom of illuminiſm as into their proper aſylum.

10 And their characters tranſmitted to the ſuperiors.

When the inſinuator has made choice of his victim, he is required to draw from his diary a view of his character, opinions, principles, and connections. This he is to tranſmit to the ſuperiors for their examination, and that they may compare it with the diaries which they have already received, perhaps from different inſinuators. When the choice of the inſinuator is approved, the ſuperiors determine which of the inſinuators will be beſt qualified to perform the taſk of ſeducing their candidate.

Two different methods were recommended; one of which

(B) As a ſpecimen of the journals kept by the inſinuators, and of the characters which the illuminees ſelected for propagating their principles, we ſhall give the character of Zwack, denominated *Cato*, as it is deſcribed in the tablet of his inſinuator Ajax (Maſſenhauſen).

"Francis Xaverius Zwack was ſon of Philip Zwack, commiſſary of the *Chambre des Comptes*, and was born at Ratiſbon; at the time of his initiation (29th May 1776) he was twenty years of age, and had finiſhed his college education.

"He was then about five feet high; his perſon emaciated with debauchery; his conſtitution bordering on melancholy; his eyes of a dirty grey, weak and languiſhing; his complexion pale and ſallow; his health weak, and much hurt by frequent diſorders; his noſe long, crooked and hooked; his hair light brown; gait precipitate; his eyes always caſt towards the ground; under the noſe and on each ſide of the mouth, a mole.

"His heart tender and philanthropic in an extraordinary degree; but ſtoic when in a melancholy mood; otherwiſe a true friend, circumſpect, reſerved, extremely ſecret; often ſpeaking advantageouſly of himſelf; envious of other people's perfections; voluptuous; endeavouring to improve himſelf; little calculated for numerous aſſemblies; choleric and violent, but eaſily appeaſed; willingly giving his private opinions when one has the precaution to praiſe him, though contradicting him; a lover of novelties. On religion and conſcience widely differing from the received ideas; and thinking preciſely as he ought, to become a good member of the order.

"His predominant paſſions are, pride, love of glory, probity; he is eaſily provoked; has an extraordinary propenſity for myſteries; a perpetual cuſtom of ſpeaking of himſelf and of his own perfections; he is alſo a perfect maſter in the arts of diſſimulation; a proper perſon to be received into the order, as applying himſelf particularly to the ſtudy of the human heart." Such is the character of the beloved diſciple of Weiſhaupt, the incomparable Cato, and a leader of the ſect of the illuminees!

which was to be employed in enticing men who were ſomewhat advanced in life or diſtinguiſhed by ſcience; the other was to be uſed in ſeducing young men whoſe character was not formed.

11 Proper methods of ſeducing men of knowledge,

With men of knowledge, who had already imbibed the principles of modern philoſophiſm (for no true philoſophers were to be attempted), the inſinuator was to aſſume the character of a philoſopher well acquainted with the myſteries of ancient times. He was to deſcant upon the importance of the ſecret doctrines tranſmitted by tradition, to quote the gymnoſophiſts of India, the prieſts of Iſis in Egypt, and thoſe of Eleuſis, with the Pythagorean ſchool in Greece. He was to learn by heart certain paſſages from Iſocrates, Cicero, and Seneca, that he might have them ready upon all occaſions. He was to throw out hints, that theſe ſecret doctrines explained the difficult queſtions concerning the origin and order of the univerſe, the Providence of God, the nature of the ſoul, its immortality and future deſtination; he was to inſpire them with the belief that the knowledge of theſe things would render life more agreeable and pain more ſupportable, and would enlarge their ideas of the majeſty of God: he was then to declare that he had been initiated into theſe myſteries. If the candidate expreſſed any curioſity to be made acquainted with them, the inſinuator was firſt to aſcertain his opinions upon ſome leading points, by propoſing to him to write a diſſertation upon certain queſtions. Should the anſwers not pleaſe the inſinuator, he was to relinquiſh his prey; but ſhould they be ſatisfactory, the candidate was to be admitted to the firſt degree.

12 And young men,

When the ſelected victim was young, and had not imbibed any of thoſe opinions which correſponded with the principles of the ſect, a different method was to be followed. "Let your firſt care (ſays the legiſlator to his inſinuators) be to gain the affection, the confidence, and the eſteem of thoſe whom you are to entice into the order. Let your whole conduct be ſuch, that they ſhall ſurmiſe ſomething more in you than you wiſh to ſhew; hint, that you belong to ſome ſecret and powerful ſociety; excite by degrees, and not at once, a wiſh in your candidate to belong to a ſimilar ſociety. Certain arguments and certain books, which the inſinuator muſt have, will greatly contribute to raiſe ſuch a wiſh; ſuch, for example, are thoſe which treat of the union and ſtrength of aſſociations."

Every inſinuator muſt be provided with books of this ſort. But that their ſucceſs might not depend ſolely upon books, Weiſhaupt gave to his diſciples a ſpecimen of the artifices which they might employ. The inſinuator might begin by obſerving, that a child in the cradle, abandoned to itſelf, is entirely helpleſs; and that it is by the aſſiſtance of others that it acquires ſtrength; and that princes owe their greatneſs and their power to the union of their ſubjects. Then the inſinuator might touch on the importance of knowing mankind, and the arts of governing them; that one man of parts might eaſily lead hundreds, even thouſands, if he but knew his advantages. He was next to dwell upon the defects of civil ſociety; to mention how little relief a man can obtain even from his beſt friends; and how very neceſſary it is for individuals to ſupport one another in theſe days: to add, that men would triumph even over heaven were they but united. He was to adduce as examples, the influence of the freemaſons and of the Jeſuits. He was to aſſert, that all the great events which take place in the world depend upon hidden cauſes, which theſe ſocieties powerfully influence. He was to awake in the breaſt of his pupil the deſire of reigning in ſecret; of preparing in his cloſet a new conſtitution for the world; and of governing thoſe who think they govern others.

After theſe, or other artifices of the ſame kind, have been employed, if the candidate be inſpired with an ardour to be initiated, and give ſatisfactory anſwers to the queſtions propoſed to him, he is immediately admitted a novice. But ſhould he reject all means of ſeduction, let him take heed to himſelf; "for the vengeance of ſecret ſocieties is not a common vengeance; it is the hidden fire of wrath. It is irreconcileable; and ſcarcely ever does it ceaſe the purſuit of its victims until it has ſeen them immolated." 13 Into the noviciate.

The period of the noviciate varied according to the age of the new convert to illuminiſm. At firſt it continued three years for thoſe under eighteen years of age, two years for thoſe between eighteen and twenty-four, and one year for thoſe who were near thirty; but it was afterwards ſhortened. 14 Period of the noviciate.

The novice was not acquainted with any of the order except his inſinuator, under whoſe direction he remained during his noviciate. The firſt leſſons which he was taught reſpected the inviolable nature of the ſecrecy which every illuminee was obliged to obſerve. He was told that ſilence and ſecrecy were the very ſoul of the order; that ingenuouſneſs was a virtue only with reſpect to his ſuperiors; and that diſtruſt and reſerve were fundamental principles. He was enjoined never to ſpeak of any circumſtance relating to the order, concerning his own admiſſion, or the degree which he had received, not even before brethren, without the ſtrongeſt neceſſity; and was required to ſign a declaration to this purpoſe.

The novice was next taught the dictionary of the order, its geography, calendar, and cypher. To prevent the poſſibility of diſcovery, every illuminee received a new name, which was characteriſtic of his diſpoſitions, or of the ſervices which were expected of him. Thus Weiſhaupt, as we have obſerved, was called *Spartacus*, becauſe he pretended to wage war againſt thoſe oppreſſors who had reduced mankind to ſlavery; and Zwack, as we have ſeen, was named *Cato*, becauſe he had written a diſſertation in favour of ſuicide, and had once determined to commit that crime. 15 Dictionary, geography, calendar, and cypher of the order.

According to the new geography of the order, Bavaria was called *Achaia*; Munich was called *Athens*; Vienna was named *Rome*; Wurtzburgh was denominated *Carthage*; and Ingolſtadt, the fountain of the order, was called *Epheſus*, and by the profound adepts *Eleuſis*. The novice had alſo to learn the Perſian calendar, which the order had adopted. Their era began A. D. 630. The months received new names: May was called *Adarpahaſcht*; June, *Chardad*; July, *Thermeh*; Auguſt *Merdedmeh*; and ſo on. The cypher conſiſted of numbers which correſponded to the letters of the alphabet, in this order *a*, *b*, *c*, *d*, anſwering to the numbers 12, 11, 10, 9.

The novice had next to ſtudy *the ſtatutes of the illuminees*, which he was aſſured contained nothing injurious to the ſtate, to religion, or to good morals. He was next deſired to apply himſelf to acquire the morality of the order: which he was to do, not by reading the goſpels,

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ſpels, but by peruſing Epictetus, Seneca, and Antoninus, and by ſtudying the works of the modern ſophiſts Weiland, Meiners, and Helvetius, &c. The ſtudy of man was alſo recommended as the moſt intereſting of all the ſciences. He was taught this ſtudy not merely as a ſcience, but as an art. A model of a journal was given him, and he was required to inſert in it obſervations upon the character of every perſon that he happened to meet with. To quicken his diligence, the inſinuator occaſionally examined his journal. In the mean time the inſinuator was watching him as a centinel, and noting down regularly obſervations upon the defects and merits of his pupil, which he always ſent to his ſuperiors.

16 Novice obliged to draw his own character.

The great object of the inſinuator was to entangle the novice, and to bind him indiſſolubly to the order. With this view he required the novice to draw a faithful picture of himſelf, under the pretence that he would thus know himſelf better. He deſired him to write down his name, his age, his country, his reſidence, and his employment; to give a liſt of the books in his library; to ſtate his revenue; to enumerate his friends and enemies, and the cauſe of his enmities. He was alſo to give a ſimilar account of his father and mother, his brothers and ſiſters, and to be very careful in pointing out their paſſions and prejudices, their ſtrong and weak ſides.

In the mean time, the inſinuator was occupied in drawing up a new ſtatement of every thing he had been able to diſcover of the character and conduct of the novice. This ſtatement was tranſmitted to the ſuperiors, and compared with the former. If the novice was approved, he was then admitted to the ſecond degree, upon his anſwering, in a ſatisfactory manner, twenty-four grand queſtions, which might enable the order to judge of his principles and the credit to which he was entitled, and would fix him down by ſtronger ties to the authority of the ſuperiors. The deteſtable principles of the illuminees now begin to appear, as will be evident from the following queſtions which we have ſelected:

17 Power of life and death claimed by the ſociety.

Have you ſeriouſly reflected on the importance of the ſtep you take, in binding yourſelf by engagements that are unknown to you? Should you ever diſcover in the order any thing wicked or unjuſt to be done, what part would you take? Do you, moreover, grant the power of life and death to our order or ſociety? Are you diſpoſed, upon all occaſions, to give the preference to men of our order over all other men? Do you ſubject yourſelf *to a blind obedience, without any reſtriction whatſoever?*

The novice having thus ſurrendered his conſcience, his will, and his life, to the devotion of the conſpirators, and thus ſubſcribed, with his own hand, and confirmed by his oath, a reſolution to become the moſt abject ſlave, was now deemed qualified to aſcend to the ſecond degree, called *Minerval*.

18 Admiſſion to the degree of Minerval.

In the dead hour of midnight he was conducted to a retired apartment, where two of the order were waiting to receive him. The ſuperior, or his delegate, appeared ſtanding in a ſevere and threatening poſture; he held a glimmering lamp in his hand, and a naked ſword lay before him. The novice was aſked, whether he ſtill perſiſted in his intention of adhering to the order? Upon anſwering in the affirmative, he was ordered into a dark room, there to meditate in ſilence on his reſolution. On his return, he was ſtrictly and repeatedly queſtioned if he was determined to give implicit obedience to all the laws of the order? The inſinuator became ſecurity for his pupil, and then requeſted for him the protection of the order, which the ſuperior granted with great ſolemnity, proteſting that nothing would be found there hurtful to religion, to morals, or to the ſtate. Having thus ſaid, the ſuperior takes up the naked ſword, and pointing it at the heart of the novice, threatens him with the fatal conſequences of betraying the ſecrets of the order. The novice again takes an oath, by which he binds himſelf, in the moſt unlimited manner, to ſerve the order with his life, honour, and eſtate, and to obſerve an inviolable obedience and fidelity to all his ſuperiors. He is then admitted a Minerval, and henceforth is allowed to attend the academy of the ſect.

Illuminati.

The Minerval academy was compoſed of 10, 12, or 15 Minervals, and placed under the direction of a major Illuminee. It met twice every month in an inner apartment, ſeparated from the other rooms of the manſion by an antichamber; the door of which was to be ſhut with care during the meeting, and ſtrongly ſecured by bolts. At the commencement of every meeting, the preſident read and commented upon ſome ſelect paſſages of the Bible, Seneca, Epictetus, Marcus Aurelius, or Confucius; evidently with a view of diminiſhing the reverence for the ſacred writings, by thus placing them on a level with the heathen moraliſts. Then each brother was aſked what books he had read ſince laſt meeting, what obſervations he had made, and what ſervices he had performed for promoting the ſucceſs of the order? 19 Minerval academy;

To each Minerval academy a library belonged. This was formed by the contributions of the brethren, by preſents of books, and by another method very extraordinary. All Illuminees acting as librarians, or keepers of archives, were admoniſhed to *ſteal* ſuch books or manuſcripts as might be uſeful to the order. At one time, ſending a liſt of the books which he wiſhed to be embezzled from the library of the Carmes, Weiſhaupt ſays, "All theſe would be of much greater uſe if they were in our hands. What do thoſe raſcals do with all theſe books?" 20 Its library.

Every brother at his admiſſion was required to declare to what art or ſcience he meant chiefly to apply; and it was expected, that he ſhould afterwards every year give an account of the diſcoveries or improvements which he had made. All the other brethren who were occupied in the ſame ſtudies, were deſired to give him every poſſible aſſiſtance. Thus a kind of academy was formed, to which thoſe who could not ſerve it by their talents might give pecuniary contributions. That this academy might have the appearance of a literary ſociety, prizes were annually diſtributed; the beſt diſcourſe was publiſhed, and the profits ſent to the coffers of the order.

Every month the preſident was to take a review of the faults which he had obſerved in his pupils, and examine them concerning thoſe which they might have been conſcious of in themſelves; and it would be an unpardonable neglect, ſay the ſtatutes, ſhould any pupil pretend, that during the ſpace of a whole month he had remarked nothing reprehenſible.

It is impoſſible to read theſe rules without admiring them. Were men but half as anxious, attentive, and careful, to render themſelves good citizens and good men

Illuminati. men, as these men were to render themselves successful conspirators, what a blessed world should we see!

21 Admission to the degree of minor illuminee. The Minerval was rigorously scrutinized, whether he was ready to submit to every torture, or even to commit suicide, rather than give any information against the order. Suicide was reckoned not only innocent, but honourable, and was also represented as a peculiar species of voluptuousness. In order to discover the sentiments of the Minervals upon this subject, they were required to write a dissertation upon the character and death of Cato, or any similar subject. They were also desired to discuss the favourite doctrine of Weishaupt, that *the end sanctifies the means*; a principle of the most pernicious tendency, which would render calumny, assassination, sedition, and treason, laudable, and excellent. Next, they were called upon to compose a dissertation, by which their opinions concerning kings and priests might be ascertained. If they performed all these tasks with the spirit of an infidel, and the desperate firmness of a conspirator, they were then judged worthy of being promoted to the degree of minor illuminee.

22 Minor illuminees trained for the degree of The minor illuminees held meetings similar to those of the Minerval academy. It was necessary that the president should be one who was raised to the degree of priest, and initiated in the mysteries: but he was required to persuade his pupils, that beyond the degree which he had attained there were no mysteries to be disclosed. The minor illuminees were to be so trained, that they might look upon themselves as the founders of the order; that by this powerful motive they might be animated to diligence and exertion. With this view, hints were scattered rather than precepts enjoined. It was insinuated, that the world was not so delightful as it ought; that the happiness for which man was made is prevented by the misfortunes of some, and the crimes of others; that the wicked have power over the good; that partial insurrection is useless; and that peace, contentment, and safety, might be easily obtained by means drawn from the greatest degree of force of which human nature is capable. Such views, it is added, actuating a secret society, would not only be innocent, but most worthy of the wise and well-disposed.

Weishaupt had formed, with peculiar care, a code for this degree, which was intitled *Instructions for forming useful Labourers in Illuminism*. These instructions discover an astonishing knowledge of human nature, and are drawn up with a degree of systematic coolness which perhaps no conspirator before him ever exhibited. He lays down rules, by which the character of almost any person may be ascertained. He recommends to the minor illuminees, to attend to the conduct of any person entrusted to their care, at two periods; when he is tempted to be what he ought not to be, and when, removed from the influence of every external temptation, he follows the dictates of his inclination. They were to study the peculiar habits and ruling passions of each; to kindle his ardour by descanting on the dignity of the order, and the utility of its labours; to infuse a spirit of observation, by asking questions, and applauding the wisdom of the answers; to correct the failings of their pupil, by speaking of them as if they were not his, and thus making him judge in his own cause; to instruct and advise, not by tedious declamation, but by sometimes dropping a few words to the purpose, when the mind should be in a proper state to receive them. Above all, they were directed to avail themselves of those moments when they observed a pupil discontented with the world. "It is then (says Weishaupt) you must press the swelling heart, stimulate the sensibility, and demonstrate how necessary secret societies are for the attainment of a better order of things." Illuminati.

Having passed with applause through the states of probation already described, the minor illuminee is promoted to the rank of major illuminee, or Scotch novice. As major illuminee, he is encompassed with more rigid chains; and as Scotch novice, he is dispatched as a missionary into masonic lodges, to convert the brethren to illuminism. 23 Scotch novice.

The candidate for this degree is strictly examined, in order to discover what opinions he now entertains concerning the object of the society; the motives that prompted him to join it; whether he is disposed still to co-operate with the rest of the brethren in accomplishing the grand object; and whether he be a member of any other society; and what are the duties which it requires.

The fertile genius of Weishaupt is not exhausted; he has still in reserve artifices more profound, and bonds more powerful; his resources keep pace with the progress of his schemes. He now lays a snare for his pupils, from which he hopes none can escape, and therefore he flatters himself they are his for ever. He demands of every candidate for higher degrees, to write, as a proof of confidence, a minute and faithful account of his whole life, without any reserve or dissimulation. Reserve or dissimulation would indeed be vain; for the most secret circumstances of his life are already well known to the adepts, my means of innumerable spies, who, by the appointment of the superiors, have, unknown to him, been watching and scrutinizing all his actions and words, his temper, passions, and opinions. 24 Candidates for higher degrees submit to new trials.

Now is presented to the candidate the code of the brother scrutator, called by the order the *nosce te ipsum* (know thyself). This is a catechism, containing from a thousand to fifteen hundred questions, concerning his person, his health, his education, his opinions, his inclinations, his habits, his passions, his prejudices, and even his weaknesses. Questions are also proposed respecting his acquaintances, his relations, friends, and enemies. The candidate is required to enumerate his favourite colours, to describe his language, the nature of his conversation, his gait and gestures. Nothing, in short, is omitted that can tend to distinguish his character as an individual, or as a member of society. Upon many qualities in his character, thirty, forty, or sometimes near a hundred questions are proposed. The following specimen will enable the reader to judge what astonishing care Weishaupt employed to discriminate characters.

Is his *gait* slow, quick, or firm? Are his steps long, short, dragging, lazy, or skipping? Is his *language* regular, disorderly, or interrupted? In speaking, does he agitate his hands, his head, or his body with vivacity? Does he close upon the person he is speaking to? Does he hold him by the arm, clothes, or button hole? Is he a great talker, or is he taciturn? If so, why? Is it through prudence, ignorance, respect, or sloth? &c. Concerning his *education*, he is questioned to whom does he owe it? Has he always been under the eyes of his parents? How has he been brought up? Has he

any

any esteem for his masters? Has he travelled, and in what countries?

By these questions his temper and dispositions might be accurately known. His leading passions would be discovered by the following queries. "When he finds himself with different parties, which does he adopt; the strongest or the weakest; the wittiest or the most stupid? Or does he form a third? Is he constant and firm in spite of all obstacles? How is he to be gained? by praise, by flattery, or low courtship; by women, money, or the entreaties of his friends? Does he love satire; and on what does he exercise that talent? on religion, hypocrisy, intolerance, government, ministers, monks?" &c.

All these questions are to be answered and illustrated by facts. It is necessary to observe, that the scrutators also give in written answers to all these questions. When the candidate has thus given a minute history of his life, and revealed all his secrets, his foibles, his errors, his vices, and his crimes, Weishaupt triumphantly exclaims, "Now I hold him; I defy him to hurt us; if he should wish to betray us, we have also his secrets."

The adept is next introduced into a dark apartment, where he solemnly swears to keep secret whatever he may learn from the order. He then delivers up the history of his life, sealed, when it is read to the lodge, and compared with the character drawn of him by the brother scrutators. A corner of the veil is now lifted up, still, however, with extreme caution. Nothing appears palpable but the purest principles and most generous designs. At the same time many things are darkly suggested, which are incompatible with purity and generosity; for while the utmost care is employed to deceive the understanding, nothing is neglected that can tend secretly to corrupt the heart. A number of questions are asked; the evident intention of which is to make the adept discontented with the present moral government of the world, and to excite the desire of attempting a great revolution. After answering these questions, the secretary opens the code of the lodge; and having informed the young illuminee that the object of the order is to diffuse the pure truth, and to make virtue triumph, he proceeds to show that this is to be accomplished by freeing men from their prejudices, and enlightening their understandings. "To attain this, (continues the secretary), we must trace the origin of all sciences, we must reward oppressed talents, we must undertake the education of youth; and, forming an indissoluble league among the most powerful geniuses, we must boldly, though with prudence, combat superstition, incredulity, and folly; and at length form our people to true, just, and uniform principles on all subjects." The secretary adds, that in attempting to divest vice of its power, that the virtuous may be rewarded even in this world, the order is counteracted by *princes and priests, and the political constitutions of nations*; that, however, it was not intended to excite revolutions and oppose force by force, but merely to bind the hands of the protectors of disorder, and to govern without appearing to command; that the powers of the earth must be encompassed with a legion of indefatigable men, all directing their labours towards the improvement of human nature. Were there but a certain number of such men in every country, each might form two others. "Let these (says he) only be united, and nothing will be impossible to our order." All this is very specious: it is well contrived to fascinate the imagination of the young, and the heart of the generous and benevolent, while, under all this pretended regard to virtue and to the happiness of mankind, is concealed a most formidable conspiracy against the peace of the world.

After this address is delivered, the major illuminee is presented with the codes of the insinuator and scrutator; for he must now inspect the pupils of the insinuators, and must exercise the office of scrutator while presiding over the Minerval academies.

25 The degree of Scotch knight.

The next degree, which is that of Scotch knight, is both intermediate and stationary. It is stationary for those who are not sufficiently imbued with the principles of the order, and intermediate for those who have imbibed the true spirit of illuminism. The Scotch knights were appointed the directors of all the preparatory degrees, and to watch over the interests of the order within their district. They were to study plans for increasing the revenues of the order, and to endeavour to promote to public offices of confidence, of power and wealth, as many of the adepts as possible; and to strive to acquire an absolute sway in the masonic lodges. They were to procure the management of the masonic funds; and while they were to persuade the brethren that these were expended according to their own orders, they were to employ them for promoting the views of the order. Thus one office of the Scotch knights was to embezzle the money that was entrusted to them, in order to diffuse truth, and to make virtue triumph.

After passing with applause through this long and tedious probation, the adept is introduced to the class of the mysteries. He is not yet, however, made acquainted with the whole secrets of the society; he must still submit to new trials; his curiosity must be farther excited, his imagination must be kept longer upon the stretch, and his principles of depravity be rendered more violent and inveterate before the vail be entirely withdrawn, which will discover to him Weishaupt and his infernal crew, plotting the destruction of the laws, sciences and religion of mankind. The degree of epopt or priest, to which the adept was next raised, opened to view, however, so great a part of the mysteries, that the reader will be fully prepared to expect the secrets which remain to be unfolded in the other degrees.

26 Preparations for the priesthood.

Before being admitted to the degree of epopt, the adept was required to give a written answer to ten preliminary questions. The insinuations against the established order of the world, which had formerly been slightly mentioned, increase now to an indirect proposal to attempt a complete revolution. The candidate is asked, whether he thinks the world has arrived at that happy state which was intended by nature? Whether civil associations and religion attain the ends for which they were designed? Whether the sciences are conducive to real happiness? or whether they are not merely the offspring of the unnatural state in which men live, and the crude inventions of crazy brains? It is then proposed as a question, whether there did not in ancient times exist an order of things more simple and happy? What are the best means for restoring mankind, Illuminati. kind to that state of felicity? Should it be by public measures, by violent revolutions, *or by any means that would ensure success?* Would it not be proper, with this view, to preach to mankind a religion more perfect, and a philosophy more elevated? And, in the meantime, is it not advisable to disseminate the truth in secret societies?

Should the answers given to these questions accord with the sentiments of the order, on the day fixed for the initiation, the candidate is blindfolded, and, along with his introducer, is put into a carriage, the windows of which are darkened. After many windings and turnings, which it would be impossible for the adept to trace back, he is conducted to the porch of the temple of the mysteries. His guide strips him of the masonic insignia which he wore as a knight, removes the bandage from his eyes, and presents him with a drawn sword; and then having strictly enjoined him not to advance a step till he is called, leaves him to his meditations. At length he hears a voice exclaiming, "Come, enter, unhappy fugitive; the fathers wait for you; enter, and shut the door after you." He advances into the temple, where he sees a throne with a rich canopy rising above it, and before it, lying upon a table, a crown, a sceptre, a sword, some pieces of gold, and precious jewels, interlaid with chains. At the foot of the table, on a scarlet cushion, lie a white robe, a girdle, and the simple ornaments of the sacerdotal order. The candidate is required to make his choice of the attributes of royalty, or of the white robe. If he chuse the white robe, which he knows it is expected he should do, the hierophant, or instructor, thus addresses him: "Health and happiness to your great and noble soul. Such was the choice we expected from you. But stop; it is not permitted you to invest yourself with that robe until you have heard to what we now destine you." The candidate is then ordered to sit down; the book of the mysteries is opened, and the whole brethren listen in silence to the voice of the hierophant.

27 Instructions previous to admission. The exordium is long and pompous; much artifice is concealed in it, and much eloquence displayed. It expatiates on the sublime and generous views of the society; evidently with the desire of lulling asleep the suspicion of the candidate, of exciting him to admiration, and of inspiring him with enthusiasm. The hierophant then proceeds to unveil the mysteries. He launches out into a splendid description of the original state of mankind; when health was their ordinary state, when meat, and drink, and shelter, were their only wants. At that period (says he) men enjoyed the most inestimable blessings, *equality and liberty;* they enjoyed them to their utmost extent: but when the wandering life ceased, and property started into existence; when arts and sciences began to flourish; when a distinction of ranks and civil associations were established, "liberty was ruined in its foundation, and equality disappeared. The world then ceased to be a great family, to be a single empire; the great bond of nature was rent asunder." Wants now increased, and the weak imprudently submitted to the wise or the strong, that they might be protected. As the submission of one person to another arises from wants, it ceases when the wants no longer exist. Thus the power of a father is at an end when the child has acquired his strength. Every man, having attained to years of discretion, may govern himself; when a whole nation, therefore, is arrived at that period, there can exist no farther plea for keeping it in wardship.

Such a state as that of civil society, is then represented as incompatible with the practice of virtue. "With the division of the globe, and of its states, benevolence (says the hierophant) was restrained within certain limits, beyond which it could no longer be extended. Patriotism was deemed a virtue; and he was styled a patriot who, partial towards his countrymen, and unjust to others, was blind to the merits of strangers, and believed the very vices of his own country to be perfections. We really beheld (continues he) patriotism generating localism, the confined spirit of families, and even egoism. Diminish, reject that love of country, and mankind will once more learn to know and love each other as men. Partiality being cast aside, a union of hearts will once more appear, which will expand itself over the globe."

These unphilosophical declamations, enthusiastically pronounced, at length make the proselyte exclaim, in unison with his master, "Are such then the consequences of the institution of states, and of civil society? O folly! Oh people! that you did not foresee the fate that awaited you; that you should yourselves have seconded your despots in degrading human nature to servitude, and even to the condition of the brute!"

Having wrought up the proselyte to this pitch of frenzy, and enumerated all the evils which, according to Weishaupt, arise from political association, the hierophant comes to reveal the means by which the grievances of the human race may be redressed. "Providence (he says) has transmitted the means to us of secretly meditating, and at length operating, the salvation of human kind. These means are the secret schools of philosophy. These schools have been in all ages the archives of nature, and *of the rights of man.* These schools shall one day retrieve the fall of human nature, and PRINCES AND NATIONS SHALL DISAPPEAR FROM THE FACE OF THE EARTH; and that without any violence. Human nature shall form one great family, and the earth shall become the habitation of the man of reason. *Reason shall be the only book of laws, the sole code of man.* This is one of our *grand mysteries.* Attend to the demonstration of it; and learn how it has been transmitted down to us."

This pretended demonstration makes part of the same sophistical harangue; and consists in panegyrics on the dignity of human nature; in a baseless morality; and in a scandalous perversion of the Christian scriptures, with a blasphemous account of the ministry of the Saviour of the world.

"What strange blindness (continues the hierophant) can have induced men to imagine, that human nature was always to be governed as it has hitherto been? Where is the being, who has condemned men, the best, the wisest, and the most enlightened men, to perpetual slavery? Why should human nature be bereft of its most perfect attribute, that of governing itself? Why are those persons to be always led who are capable of conducting themselves? Is it then impossible for mankind, or at least the greater part of them, to come to majority? Are we then fallen so low as not even to feel our chains, as to hug them, and not cherish

Illuminati. cherish the flattering hope of being able to break them, and recover our liberty? No; let us own that it is not impossible to attain UNIVERSAL INDEPENDENCE."

28
The illuminees enemies to commerce.

The principal means which Weishaupt offers to his adepts for the conquest of this land of promise, is to diminish the wants of the people; and accordingly the code denounces eternal war with every species of commerce. Hence the hierophant proceeds to inform the candidate, that he who wishes to subject nations to his yoke, need but to create wants, which he alone can satisfy." "Confer (says he) upon the *mercantile tribe* some rank or some authority in the government, and you will have created perhaps the most formidable, the most despotic of all powers. He, on the contrary, who wishes to render mankind free, teaches them how to refrain from the acquisition of things which they cannot afford: he enlightens them, he infuses into them bold and inflexible manners. If you cannot diffuse, at the same instant, this degree of light among all men, at least begin by enlightening yourself, and by rendering yourself better. The mode of diffusing universal light is, not to proclaim it at once to the whole world, but to begin with yourself; then turn to your next neighbour: you two can enlighten a third and a fourth: let these in the same manner extend and multiply the number of the children of light, until *numbers and force shall throw power into your hands*. You will soon acquire sufficient force to *bind the hands of your opponents, to subjugate them*, and to stifle wickedness in the embryo;" *i. e.* you will soon be able to stifle every principle of law, of government, of civil or political society, whose very institution, in the eyes of an illuminee, is the germ of all the vices and misfortunes of human nature.

29
Their morality;

The hierophant, continuing to insist on the necessity of enlightening the people to operate the grand revolution, seems to be apprehensive that the candidate may not yet clearly conceive the real plan of this revolution, which is in future to be the sole object of all his instructions. Let your instructions and lights be universally diffused; so shall you render mutual security universal; *and security and instruction will enable us to live without prince or government*. The instruction which is to accomplish this great end, is instruction in *morality*, and *morality alone;* for "*true morality* is nothing else than the art of teaching men to *shake off their wardship*, to attain the age of manhood; and thus to need neither princes nor governments. The morality which is to perform this miracle, is not a morality of vain subtleties. It is not that morality which, degrading man, renders him careless of the goods of this world, forbids him the enjoyment of the innocent pleasures of life, and inspires him with the hatred of his neighbour. *Above all*, it must *not* be that morality which, adding to the miseries of the miserable, throws them into a state of pusillanimity and despair, *by the threats of hell and the fear of devils*. It must be a divine doctrine, such as Jesus taught to his disciples, and of which he gave the real interpretation in his secret conferences."

30
And blasphemies of Christ.

The impious hierophant then proceeds, with matchless blasphemy, to represent the Redeemer of mankind as teaching, like the Grecian sophists, an exoteric and an esoteric doctrine. He describes him as the grand master of the illuminees; and affirms, that the object of his *secret*, which is lost to the world in general, has been preserved in their mysteries. It was "to reinstate mankind in their ORIGINAL EQUALITY and LIBERTY, and to prepare the means. This explains in what sense Christ was the *Saviour and Redeemer of the world*. The doctrine of original sin, of the fall of man, and of his regeneration, can now be understood. The state of pure nature, of fallen or corrupt nature, and the state of grace, will no longer be a problem. Mankind, in quitting their state of *original liberty, fell* from the state of nature, and *lost their dignity*. In their civil society, under their governments, they no longer live in the state of *pure* nature, but in that of *fallen* and *corrupt* nature. If the moderating of their passions, and the diminution of their wants, reinstate them in their primitive dignity, that will really constitute their *redemption* and their *state of grace*. It is to this point that morality, and the most perfect of all morality, that of Jesus, leads mankind. When at length this doctrine shall prevail throughout the world, the reign of the good and of the elect shall be established."

This language (as M. Barruel observes) is surely not enigmatical; and the proselyte who has heard it without shuddering, may flatter himself with being worthy of this Antichristian priesthood. He is led 31
back to the porch, where he is invested with a white Preparatory rites to
tunic and broad scarlet belt of silk. The sleeves of the tunic, which are wide, are tied in the middle and at the extremities with ribbons likewise of scarlet; and the candidate is recalled into the temple of mysteries. He is met by one of the brethren, who does not permit him to advance till he has declared "whether he perfectly understands the discourse which has been read to him; whether he has any doubts concerning the doctrines taught in it; whether his heart is penetrated with the sanctity of the principles of the order; whether he is sensible of the call, feels the strength of mind, the fervent will, and all the disinterestedness requisite to labour at the *grand undertaking;* whether he is ready to make a sacrifice of *his will*, and to suffer himself to be *led* by the most *excellent superiors of the order*."

The rites of the preceding degree were in impious de- 32
rision of the sacrament of the Lord's supper; those of the Initiation
presentare an atrocious mimicry of sacerdotal ordination; to the
at which, as every one knows, the Lord's supper is like- priesthood.
wise celebrated. A curtain is drawn, and an altar appears with a crucifix upon it. On the altar is a bible; and the ritual of the order lies on a reading desk, with a censer and a phial full of oil beside it. The dean, or president, who acts the part of a bishop, blesses the candidate, cuts hair from the crown of his head, anoints him, clothes him in the vestments of the priesthood, and pronounces prayers after the fashion of the order. He presents him with a cap, saying, "Cover thyself with this cap; it is more precious than the royal diadem." The mock communion is then distributed; and it consists of milk and honey, which the dean gives to the proselyte, saying, "This is that which nature gives to man. Reflect how happy he would still have been, if the desire of superfluities had not, by depriving him of a taste for such simple food, multiplied his wants, and poisoned the balm of life."

The

Illuminati.

The ceremonies are terminated by delivering to the epopt that part of the code which relates to his new degree.

33 Duties of the prieſt or epopt.

Among the inſtructions which it contains, the following are more particularly worthy of notice. The epopt, ſays the code, "will take care that the writings of the members of the order ſhall be cried up, and that the trumpet of fame ſhall be ſounded in their honour. He will alſo find means of *hindering the reviewers from caſting any ſuſpicions* on the writers of the ſect." He is likewiſe inſtructed to *bribe* the common people into the intereſts of the order, and to corrupt their minds, by getting poſſeſſion of ſchools and other ſeminaries of learning. But "if it be neceſſary for us to be maſters of the ordinary ſchools (ſays the impious legiſlator), of how much more importance will it be to gain over the *Eccleſiaſtic ſeminaries and their ſuperiors!* With them we gain over the chief part of the country; we acquire *the ſupport of the greateſt enemies to innovation;* and the grand point of all is, that through *the clergy* we become *maſters of the middle and lower claſſes of the people.*"

34 Qualifications for the degree of regent.

From the degree of epopt or prieſt are choſen the *regents* or *prince illuminees.* On making this choice, ſays the code, three things of the utmoſt conſequence are to be obſerved. "*1ſt,* The greateſt reſerve is neceſſary with reſpect to this degree: *2dly,* Thoſe who are admitted into it, muſt be as much as poſſible *free men,* and *independent of princes: 3dly,* They muſt have clearly manifeſted their *hatred of the general conſtitution,* or the *actual ſtate* of mankind; and have ſhewn how evidently they wiſh for a *change in the government of the world.*" If theſe requiſites be found in an epopt who aſpires to the degree of regent, ſix preliminary queſtions are put to him; of which the obvious meaning is to diſcover, whether he deems it lawful and proper to teach ſubjects to throw off the authority of their ſovereigns, or, in other words, to deſtroy every king, miniſter, law, magiſtrate, and public authority on earth.

When theſe queſtions are anſwered to the ſatisfaction of his examiner, he is informed, "that as, in future, he is to be entruſted with papers belonging to the order of far greater importance than any which he has yet had in his poſſeſſion, it is neceſſary that the order ſhould have farther ſecurities. He is, therefore, commanded to make his *will,* and inſert a clauſe with reſpect to any private papers which he may leave, in caſe of ſudden death. He is to get a formal or juridical receipt for that part of his will from his family, or from the public magiſtrate; and he is to take their promiſes in writing, that they are to fulfil his intentions." This precaution being taken, and the day fixed for his inauguration, he is admitted into an antechamber hung with black, where he ſees a ſkeleton, elevated two ſteps, with a crown and ſword lying at its feet. Having given up the written diſpoſitions, &c. reſpecting his papers, his hands are loaded with chains as if he were a ſlave, and he is left to his meditations. A dialogue then takes place between his introducer and the provincial, who is ſeated on a throne in a ſaloon adjoining. It is in a voice loud enough to be heard by the candidate, and conſiſts of various queſtions and anſwers; of which the following may ſerve for a ſpecimen:

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35 Admiſſion to this degree.

Prov. Who has reduced him to this ſtate of ſlavery?

Anſ. by the Introd. SOCIETY, GOVERNMENTS, the SCIENCES, and falſe RELIGION.

Prov. And he wiſhes to caſt off this yoke, to become a ſeditious man and a rebel?

Anſ. No; he wiſhes to unite with us, to JOIN IN OUR FIGHTS AGAINST THE CONSTITUTION OF GOVERNMENTS, the corruption of morals, and the profanation of religion. He wiſhes, through our means, to become POWERFUL, that he may attain the GRAND ULTIMATUM.

Prov. Is he ſuperior to *prejudices?* Does he prefer the *general intereſt of the univerſe* to that of *more limited aſſociations?*

Anſ. Such have been his promiſes.

Prov. Aſk him, whether the ſkeleton which is before him be that of a *king,* a *nobleman,* or a *beggar?*

Anſ. He cannot tell; all that he ſees is, that this ſkeleton was a man like us; and the character of *man* is all that he attends to.

After a great deal of inſidious mummery like this, the epopt is admitted to the degree of prince; but before his inveſtiture with the inſignia of that order, he is exhorted to be *free, i. e.* to be a man, and a man who knows how to *govern himſelf;* a man who knows his duty, and his *impreſcriptible rights;* a man who ſerves the *univerſe alone;* whoſe actions are ſolely directed to the *general benefit* of the world and of human nature. "Every thing elſe (ſays the provincial) is INJUSTICE." A long panegyric is then made on the happineſs which will be experienced by mankind, when *every father* of a family ſhall be *ſovereign* in his tranquil cot! when he that wiſhes to invade theſe *ſacred rights* ſhall not find an aſylum on the face of the earth! when idleneſs ſhall be no longer ſuffered; and when *the clod of uſeleſs ſciences ſhall be caſt aſide* (c)!

36 [illegible]

The *ſign* of this degree conſiſted in extending out the arms to a brother with the hands open: the *grip* was to ſeize the brother by the two elbows, as it were to prevent him from falling; and the *word* was REDEMPTION! The epopt was inveſted with his principality by receiving a buckler, boots, a cloak, and a

hat;

(c) This will naturally ſurpriſe our readers; but it could not ſurpriſe him to whom it was addreſſed; for when candidate for the prieſthood, he had been aſked, "Do the ſciences which men cultivate furniſh them with real lights? Are they conducive to real happineſs? Are they not, on the contrary, the offspring of numberleſs wants, and of the unnatural ſtate in which men live? Are they not the crude inventions of crazy brains?" There were, however, to be academies for the cultivation of ſuch ſciences as ſuited the deſigns of the order. Each academy was to conſiſt of nine epopts, of whom ſeven were to preſide reſpectively over ſo many departments of ſcience, whilſt the other two were to officiate as ſecretaries. One of the departments included the occult ſciences, to which belonged the art of *raiſing the ſeals of the letters* of all who belonged not to the order, and of ſecuring their own letters againſt ſimilar practices!!

hat; and on receiving the boots, he was deſired to *fear no road* which might lead to the propagation or diſcovery of *happineſs*. Thus decorated, the prince illuminee received the *fraternal embrace*, and heard the inſtructions for his new degree.

One would think that the adept had now arrived at the very acmé of profaneneſs, and treaſonable conſpiracy. He has been initiated in myſteries which burleſque Chriſtianity and its Divine Author, and at the ſame time vow vengeance againſt all government, all law, and all ſcience; yet Weiſhaupt, in a letter to Cato Zwack, his incomparable man, ſays, that he has compoſed four degrees above that of regent, or prince-illuminee; with reſpect even to the *loweſt* of which, his degree of prieſt will be found no more than child's play. "The ritual of theſe degrees, (ſays he), I never ſuffer to go out of my hands. It is of too ſerious an import; it is the key of the ancient and modern, the religious and political, hiſtory of the univerſe."

This caution of the chief conſpirator has deprived us of the power to give ſo particular an account of theſe degrees as we have done of the preceding; but the Abbé Barruel aſſures us that they were reduced to two, viz. that of Magus, and that of the Man-king; and that theſe two conſtituted the GREATER MYSTERIES. When the adept was admitted to the degree of *magus*, he was illuminized only in philoſophy and religion; when to that of *man-king*, new lights were given him reſpecting property, and every ſpecies of political aſſociation. The Abbé quotes a paſſage from *the Critical hiſtory of all the degrees of illuminiſm*, written by a man of honour, who had paſſed through them all, which will give the reader a ſufficient idea of the object of theſe laſt degrees.

37 Objects of the degrees of magus and man-king.

"With reſpect to the two degrees of *magus* and of *man-king* (ſays this writer), there is no reception, that is to ſay, there are no ceremonies of initiation. Even the elect are not permitted to tranſcribe theſe degrees; they only hear them read, and that is the reaſon why I do not publiſh them with this work. The firſt is that of Magus, called alſo philoſopher. It contains the fundamental principles of Spinoziſm. Here every thing is *material;* God and the world are but one and the ſame thing; all religions are inconſiſtent, chimerical, and the invention of ambitious men."

That this is the doctrine of Spinoza, and that Spinoza was an atheiſt, is moſt certain; but though nothing can be *eſſentially* worſe than atheiſm, we are ſtrongly inclined to ſuſpect that, at the initiation of the Magus, expreſſions muſt have been uſed more *ſhocking at leaſt to the ear* than the philoſophic jargon of the apoſtate Jew. It is long ſince the philoſophy of Spinoza was in Germany recommended from the preſs (ſee Spinoza, *Encycl.);* it is but very lately that a profeſſor in the univerſity of Jena publiſhed a book, in which he teaches that there is *no God*, and that we abſurdly give that title to *the relations of Nature* (D); and ſomething approaching ſo near to atheiſm had been communicated to the adept when he was admitted to the prieſthood, that we are perſuaded Weiſhaupt muſt have alluded to *language* at leaſt different from that in which Spinoza taught his dark doctrines, and that language, accompanied perhaps with impious and audacious geſtures, when he ſaid that, compared with his higher myſteries, his degree of prieſt was but child's play.

What gives ſome degree of probability to this conjecture, if it be nothing more, is the following fact related by the Abbé Barruel. During the French revolution (ſays that able and well informed writer), a comedian appeared (E), dreſſed in the ſacerdotal robes of the illuminees, and perſonally defying Almighty God. "No! (ſaid the impious wretch) thou doſt not exiſt. If thou haſt power over the thunderbolts, graſp them; aim them at the man who dares ſet thee at defiance in the face of thy altars. But no! I blaſpheme thee, and I ſtill live. No! thou doſt not exiſt." It will be ſeen by and bye, that the chiefs of the revolution, and even numbers of their tools, were illuminized; and it is improbable that this blaſphemer, who was arrayed in the inſignia of the epopts, made uſe of the language and geſtures of the higher myſteries? Whether it be or not, M. Barruel has proved, even from the writings of Weiſhaupt himſelf, that the magi were at leaſt atheiſts of the ſchool of Spinoza. 38 Atheiſm and

"The ſecond degree of the grand myſteries, called the *Man-king*, teaches (according to the author of the Critical Hiſtory), that every inhabitant of the country or town, every father of a family, is ſovereign, as men formerly were in the times of the patriarchial life, to which mankind is once more to be carried back; that in conſequence all authority and all magiſtracy muſt be deſtroyed."

This may appear to be nothing more than what the adept has been already taught in the leſſer myſteries; 39 Savagiſm.
and it is in fact nothing more than that to which he muſt have ſeen theſe myſteries tending; but the reader underſtands not the language of the illuminees, if he ſuppoſes that, by the patriarchal ſtate, they mean ſuch a ſtate as that of the patriarchs of the Old Teſtament. No! their patriarchal ſtate is the fancied ſavage ſtate of the atheiſtical philoſophers of Greece and Rome, when mankind had neither property nor fixed habitation. This is evident from one of the diſcourſes of the hierophant; in which he tells the adept, that it would have been happy for man "had he known how to preſerve himſelf in the primitive ſtate in which Nature had placed him! But ſoon the unhappy germ developed itſelf in his heart, and reſt and happineſs diſappeared. As families multiplied, the neceſſary means of ſubſiſtence began to fail. *The Nomade or roaming life ceaſed; property began; men choſe fixed habitations; agriculture brought them together;* LIBERTY WAS RUINED IN ITS FOUNDATIONS, AND EQUALITY DISAPPEARED."

To reſtore that liberty and equality, therefore, which is the ultimate object of the order, and conſtitutes the Man-king, all property muſt be aboliſhed, every houſe burnt, as well the cottage of the peaſant as the palace of the prince; and mankind muſt once more inhabit woods and caverns without clothes and without fire, and ſally out occaſionally to encounter their fellow-brutes,

(D) We learned this from the letter already quoted in note (A.)

(E) He does not ſay where this appearance was made; but the circumſtances related lead us to ſuppoſe that it was in a church.

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brutes, and to search for food among the wild herbs of the desert. According to Mochus the Phenician, and the Greek philosophers of this hopeful school, this was the original state of man* ; and to this state it was the object of Weishaupt and his adepts to reduce man again. Hence we hear them lavishing the most rapturous encomiums on the Goths and Vandals who over-ran the Roman empire, annihilated the arts, put a stop to agriculture, and burnt the towns and villages of civilized Europe! It was thus, according to the illuminees, that those barbarians regenerated mankind: but the regeneration was not complete; for the Goths and Vandals could not preserve themselves from the contagion of civil life; and their fall from savagism to science drew from Weishaupt's hierophants the most piteous lamentations!

* See Doig's *Letter on the Savage State.*

40
The last secret of the order.

The last secret communicated to the most favoured adepts was the novelty of the order. Hitherto their zeal had been inflamed, and their respect demanded to an institution pretended to be of the highest antiquity. The honour of instituting the mysteries had been successively attributed to the children of the Patriarchs, to ancient philosophers, even to Christ himself, and to the founders of the masonic lodges (see MASONRY in this *Suppl.*) But now the time is come when the adept, initiated in the higher mysteries, is supposed to be sufficiently enthusiastic in his admiration of the order, to be entrusted with the history of its origin. Here then they inform him, that this secret society, which has so artfully led him from mystery to mystery; which has with such persevering industry rooted from his heart every principle of religion, all love of his country, and affection for his family; all pretensions to property, to the exclusive right to riches, or to the fruits of the earth;—this society, which has taken so much pains to demonstrate the tyranny and despotism of all laws human and divine, and of every government, whether monarchical, aristocratical, or republican; which has declared him free, and taught him that he has no sovereign on earth or in heaven; no rights to respect in others, but those of perfect equality, of savage liberty, and of the most absolute independence; that this society is not the offspring of an ignorant and superstitious antiquity, but of modern philosophy; in one word, that the true father of illuminism is no other than Adam Weishaupt, known in the society by the name of SPARTACUS! This *important* secret, however, remained a mystery even to the greater part of the *magi* and the *man-kings*, being revealed only to the grand council of *areopagites*, and to a few other adepts of distinguished merit.

41
Proposal for a female order,

So zealously was the order bent upon propagating its execrable principles through the whole world, that some of the chiefs had planned an order of female adepts, in subserviency to the designs of the men. "It will be of great service, (says *Cato*-Zwack), it will procure us both information and money, and will suit charmingly the taste of some of our truest members, who are lovers of the sex." An assessor of the Imperial chamber at Wetzlar, of the name of Dittfurt, but known among the illuminees by that of *Minos*, expressed even his despair of ever bringing men to the grand object of the order without the support of female adepts; and he makes an offer of his own wife and his four daughters-in-law to be first initiated. This order was to be subdivided into two classes, each forming a separate society, and having different secrets. The first was to be composed of virtuous women; the second of the wild, the giddy, and the voluptuous. The brethren were to conduct the first, by promoting the reading of good books; and to train the second to the arts of *secretly gratifying their passions*. The wife of an adept named Ptolemy Magus was to preside over one of the classes; which (says Minos) will become, under her management and his, a very pretty society. "You must contrive pretty degrees, and dresses, and ornaments, and elegant and decent rituals. No man must be admitted. This will make them more keen, and they will go much farther than if we were present, or than if they thought that we knew of their proceedings. Leave them to the scope of their own fancies, and they will soon invent mysteries which will put us to the blush, and mysteries which we can never equal. They will be our great apostles. Reflect on the respect, nay, the awe and terror, inspired by the female mystics of antiquity. Ptolemy's wife must direct them, and she will be instructed by Ptolemy; and my step-daughters will consult with me. We must always be at hand to prevent the introduction of any improper question. We must prepare themes for their discussion: thus we shall confess them, and inspire them with our sentiments. No man, however, must come near them. This will fire their roving fancies, and we may expect rare mysteries!"

But notwithstanding all the plans and zeal of this profligate wretch and others of the fraternity, it does not appear that the General *Spartacus* ever consented to the establishment of the sisterhood. He supplied, however, the want of such an institution, by secret instructions to the regents, on the means of making the influence of women over men subservient to the order, without entrusting them with any of the secrets. "The fair sex (says he) having the greatest part of the world at their disposal, no study is more worthy the adept than the *art of flattery*, in order to gain them. They are all more or less led by vanity, curiosity, pleasure, or the love of novelty. It is on that side, therefore, they are to be attacked, and by that to be rendered subservient to the order." That Weishaupt's sagacity had not on this occasion forsaken him, is very evident; since it has been proved that the German fair, who were the correspondents of the illuminees, welcomed the French invaders of their native country.* Nay, so lately as last winter, our correspondent in Saxony heard several of these illuminized ladies express a wish that the French might invade and conquer England; for then, said they *tea and coffee would be cheaper!* 42

42
Rejected by Spartacus.

* Dr Robison's *Proofs of a Conspiracy.*

It is not enough for the founder of a sect of conspirators to have fixed the precise object of his plots. His accomplices must form but one body, animated by one spirit; its members must be moved by the same laws, under the inspection and government of the same chiefs. A full account of the government of Weishaupt's order will be found in the valuable work of Abbé Barruel; our limits permit us to give only such a general view of it as may put our readers on their guard against the secret machinations of these execrable villains, whose lodges are now recruiting, under different denominations, in every country in Europe.

Wherever illuminism has gained a footing, as the means of of subordination, there is a general division of command as well as of locality. The *candidates* and *novices* are each

43 Subordination of the illuminees.

under the direction of his own insinuator, who introduces him into the *Minerval lodges*; each *Minerval lodge* has a superior from among the preparatory class, under the inspection of the intermediary class. So many lodges constitute a district, under the direction of a superior, whom the order calls *dean*. The dean is subjected to the *provincial*, who has the inspection and command of all the lodges and deaneries of the province. Next in order comes the *national superior*, who has full power over all within his nation, provincials, deans, lodges, &c. Then comes the supreme council of the order, or the *areopagites*, over which presides the *general* of illuminism. Thus has the order formed within itself a supreme tribunal, to whose inquisition all nations are to be subjected. The areopagites, consisting of twelve fathers of the order, with the general at their head, form the centre of communication with all the national superiors on earth; each *national* is the centre of one particular nation; the *provincial*, of one province; the *dean*, of the lodges within his deanery; the *minerval master*, of his academy; the *venerable*, of his masonic lodge; and the *insinuator* or *recruiter*, of his *novices* and *candidates*.

44 Their mode of correspondence;

The higher degrees (says Weishaupt in one of his instructions to the regents) must always be hidden from the lower. The simple illuminee, therefore, corresponds with his immediate superior, knowing perhaps no other member of the order; the latter, with his dean; and thus gradually ascending to the national superiors, who alone are acquainted with the residence of the areopagites, as they again are with the name and residence of the general. Any member, however, of the inferior degrees, may occasionally correspond with his unknown superiors, by addressing his letters *Quibus licet*; and in these letters he may mention whatever he thinks conducive to the advancement of the order. If he be a novice, he may in these letters inform his superiors how his instructor behaves to him, or may draw the character of any person whatever. When the letter of any adept contains secrets, or complaints which he chuses to conceal from his immediate superior, he directs it *Soli* or *Primo*; and then it can be opened only by the *provincial*, the *national superior*, the *areopagites*, or the *general*, according to the rank of the writer, which is by some contrivance unknown to M. Barruel, indicated on the outside of the letter. The *provincial* opens the letters of the *minor* and *major* illuminees which are directed *Soli*; the *Quibus licets* of the epopts; and the *Primos* of the novices; but he cannot open either the *Primo* of the minerval, the *Soli* of the Scotch knight, or the *Quibus licet* of the regent. He can only form a conjecture as to the persons who open his own letters, and those which he is not permitted to open himself.

45 And of giving importance to their order.

When it considered, that by one of Weishaupt's statutes, the provincial has in each chapter or district a confidential epopt, who is his *secret censor* or *spy*; that these spies are to insinuate themselves into all companies, and collect *anecdotes of secret history*; that the historian of the province is to insert these anecdotes into a journal kept for that purpose; and that the provincials are obliged to forward the contents of these journals to the high superiors of the order—some notion may be formed of the influence of the general and areopagites in every country into which illuminism has found its way. "The means of acquiring an ascendancy over men (says Weishaupt) are incalculable. Who could enumerate them all? They must vary with the disposition of the times. At one period, it is a taste for the marvellous that is to be wrought upon. At another, the lure of secret societies is to be held out. For this reason, it is very proper to make your inferiors believe, without telling them the real state of the case, that all other secret societies, particularly that of *Freemasonry, are secretly directed by us.* Or else, and IT IS REALLY THE FACT IN SOME STATES, THAT POTENT MONARCHS ARE GOVERNED BY OUR ORDER. When any thing remarkable or important comes to pass, hint that it *originated with our* order. Should any person by his merit acquire a great reputation, let it be generally understood that *he is one of us*.

46 By every means, good or bad.

"If our order cannot establish itself in any particular place, with all the forms and regular progress of our degrees, *some other form must be assumed.* Always have *the object* in view; that is the essential point. No matter what *the cloak* be, provided you succeed; *a cloak*, however, *is always necessary*, for *in secrecy our strength lies.* The INFERIOR LODGES OF FREEMASONRY ARE THE MOST CONVENIENT CLOAKS for our GRAND OBJECT; because the world is already familiarized with the idea, that *nothing of importance* or *worthy of their attention can spring from masonry.*" No artifice, however, is to be left untried. "You may attend large and commercial towns during the times of fairs in different characters; as *a merchant, an officer, an abbé*. Everywhere you will personate an extraordinary man, having important business on your hands; but all this must be done with a great deal of *art and caution*, lest you should have the appearance of an adventurer. You may write your orders with a *chymical preparation of ink*, which *disappears after a certain time.* Never lose sight of the *military schools*, of the *academies, printing presses, libraries, cathedral chapters*, or *any public establishments* that can influence *education* or *government*. Let our regents perpetually attend to the various means, and form plans, for MAKING US MASTERS *of all these establishments.* When an author sets forth principles true in themselves, but which do not as yet suit *our general plan of education for the world*, or principles, the publication of which is premature; every effort must be made to *gain over the author*: but should all our attempts fail, and we should prove unable to entice him into the order, *let him be discredited by every possible means.*"

Of their methods of discrediting authors, one has come to our knowledge, which must be interesting to some of our readers. Dr Robison's work, entitled *Proofs of a Conspiracy*, &c. which first unmasked these hypocrites in this country, found its way into Germany, and was translated into the German language, and exposed to sale at the Leipsic fairs. The illuminees, under the disguise of *merchants* and *abbés*, attended, and bought up the whole impression, which they committed to the flames. A second edition was published, and it shared the same fate (F). This was a more compendious way of answering the learned author

(F) This information was communicated to us by a gentleman of character, who was at Leipsic when the

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thor than that which has been adopted by the Jacobin journalists in London; but perhaps it may convince the readers of these journals, that the Doctor has not so far mistaken the sense of the writings of *Philo* and *Spartacus*, as their illuminized masters wish them to believe.

When these arts of disseminating the disorganizing and impious principles of the order are duly considered, and when it is remembered that its emissaries dare not disobey a single injunction of the high superiors, without exposing themselves to poison, or to the daggers of a thousand unseen assassins, no man can be surprised to learn that the illuminees contributed greatly to the French revolution. The philosophers of France had indeed prepared the public mind for embracing readily the doctrines of illuminism; and so early as 1782, *Philo* and *Spartacus* had formed the plan of illuminizing that nation; but they were afraid of the vivacity and caprice of the people, and extended not their attempts, at that time, beyond Strasbourg. Already, however, there existed some adepts in the very heart of the kingdom; and the Marquis de Mirabeau, when ambassador at the court of Berlin, was initiated at Brunswick by a disciple of Philo Knigge's. On his return to France he began to introduce the new mysteries among his masonic brethren.

47 Illuminism of France

The state of free masonry was at that time peculiarly adapted to the views of the conspirators. The French had engrafted on the old and innocent British masonry a number of degrees gradually rising above each other, to the very mysteries of illuminism itself (See MASONRY, in this *Suppl.*). These were called the *philosophical* degrees, and comprehended the *knights of the sun*, the higher *Rosicrucians*, and the *knights Kadosh*. At the head of all these societies, whether ancient or modern, were three lodges at Paris, remarkable for the authority which they exercised over the rest of the order, and Philip of Orleans was the grand-master. So early as the year 1787, France contained 282 towns, in which were to be found regular lodges under the direction of that execrable wretch. He increased their number, by introducing to the *masonic* mysteries the lowest of the rabble, as well as those French guards whom he destined to the subsequent attack of the bastile, and to the storming of the palace of his near relation and royal master. In every country town and village lodges were open for assembling the workmen and peasantry, in hopes of heating their imaginations with the sophisticated ideas of equality and liberty, and the rights of man; and it was then that Mirabeau invited a deputation from the order of Weishaupt, which very quickly diffused the light of illuminism through the whole kingdom. Instead of *Spartacus*-Weishaupt, *Cato*-Zwack, and *Philo*-Knigge, we find wielding the firebrands of revolution in the capital of France, *Philip of Orleans*, *Mirabeau*, *Syeyes*, and *Condorcet*. The day of general insurrection was fixed by these miscreants for the 14th of July 1789. At the same hour, and in all parts of France, the cries of *equality* and *liberty* resounded from the lodges. The Jacobin clubs were formed; and hence sprung the revolution, with all its horrors of atheism, murder and massacre!

48 By means of free masonry.

In support of this account of the illuminees we have not loaded our margin with authorities; because our detail has been taken wholly from the valuable works of Abbé Barruel and Dr Robison, to which we refer our readers for much curious information that our limits do not permit us to give. We cannot, however, conclude the article, without making some remarks on that specious principle by which the conspirators have deluded numbers, who abhor their impieties, and who would not go all their length, even in rebellion; we mean the maxim, that "it is our duty to love all men with an equal degree of affection, and that any partial regard for our country, or our children, is unjust."

That this maxim is false, every *Christian* knows, because he is enjoined to "do good indeed unto all men, but *more especially* to them who are of the household of faith;" because he is told that "if any man provide not for his *own*, and especially for those of his *own house*, he hath denied the faith, and is worse than an infidel;" because his divine master, immediately after resolving all duty into the love of God and man, delivers a parable to shew, that we neither can, nor ought to love all men *equally*; and because the same Divine Person had one disciple whom he loved more than the rest. But we wish those *philosophers*, who talk perpetually of *the mechanism* of the human mind, and at the same time affect to have no *partial* fondness for any individual, but to love all with the same degree of *rational* affection, to consider well whether such philanthropy be consistent with what they call (very improperly indeed) *mechanism*. If this mechanism be (as one of them says it is) nothing more than *attraction* and *repulsion*, we know that it *cannot* extend with equal force over the whole world; because the force of attraction and repulsion varies with the distance. If by this absurd phrase, they mean a set of *instinctive* propensities, or feelings, we know that among savages, who are more governed by instinct than civilized men, philanthropy is a feeling or propensity of a very limited range. If they believe all our passions to originate in self love, then is it certain that our philanthropy must be progressive; embracing first, and with strongest ardour, our relations, our friends and our neighbours; then extending gradually through the society to which we belong; then grasping our country, and last of all the whole human race. Perhaps they may say that reason teaches us to love all men equally, because such equal love would contribute most to the sum of human happiness. This some of them indeed have actually said; but it is what no man of reflection can possibly believe. Would the sum of human happiness be increased, were a man to pay no greater attention to the education of his own children than to the education of the children of strangers? were he to do nothing more for his aged and helpless parents than for any other old person whatever? or were he to neglect the poor in his neighbourhood, that he might relieve those at the distance of 1000 miles? These questions are too absurd to merit a serious answer.

49 Reflections on the fundamental principles of illuminism;

When a man, therefore, boasts of his universal benevolence, declaring himself ready, without fee or reward, to sacrifice every thing dear to him for the benefit

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two impressions of the book were thus disposed of. The Abbé Barruel's work has no doubt been answered in the same way, though we cannot say so upon the same authority.

fit of strangers whom he never saw; and when he condemns, in the cant phrase of faction, that narrow policy which does not consider the whole human race as one great family—we may safely conclude him to be either a consummate hypocrite who loves none but himself, or a philosophical fanatic, who is at once a stranger to his duty and to the workings of his own heart.

50 Exemplified in the conduct of the illuminees.

If this conclusion require any farther proof, we have it in the conduct of Weishaupt and his areopagites. In the hand writing of *Cato*, his *incomparable man*, was found the description of a strong box, which, if forced open, would blow up and *destroy its contents;* several receipts for *procuring abortion;* a composition which *blinds or kills* when spurted in the face; *tea* for procuring abortion; *Herbæ quæ habent qualitatem deleteream;* a method for filling a bed chamber with *pestilential vapours;* how to take off impressions of seals, so *as to use them afterwards as seals;* a receipt *ad excitandum furorem uterinum;* and a dissertation on *suicide*. Would genuine philanthropists have occasion for such receipts as these? No! the order which used them was founded in the most consummate villany, and by the most detestable hypocrite. The incestuous Weishaupt seduced the widow of his brother, and solicited poison and the dagger to murder the woman whom he had fondly pressed in his arms. "Execrable hypocrite (says M. Barruel), he implored, he conjured both art and friendship, to destroy the innocent victim, the child, whose birth must betray the morals of his father. The scandal from which he shrinks, is not that of his crime: it is the scandal which, publishing the depravity of his heart, would deprive him of that authority by which, under the cloak of virtue, he plunged youth into vice and error. *I am on the eve* (says he) *of losing that reputation which gave me so great authority over our people: My sister-in-law is with child. I will hazard a desperate blow, for I neither can nor will lose my honour.*" Such is the benevolence of those who, banishing from their minds all partial affection for their children and their country, profess themselves to be members of one great family, the family of the world!

IMAGINARY QUANTITIES, or *Impossible Quantities*, in algebra, are the even roots of negative quantities; which expressions are Imaginary, or impossible, or opposed to real quantities; as $\sqrt{-aa}$, or $\sqrt[4]{-a^4}$, &c. For as every even power of any quantity whatever, whether positive or negative, is necessarily positive, or having the sign $+$, because $+$ by $+$, or $-$ by $-$, give equally $+$; hence it follows that every even power, as the square for instance, which is negative, or having the sign $-$, has no possible root; and therefore the even roots of such powers or quantities are said to be impossible or imaginary. The mixt expressions arising from imaginary quantities joined to real ones, are also imaginary; as $a - \sqrt{-aa}$, or $b + \sqrt{-aa}$.

IMAGINARY Roots of an equation, are those roots or values of the unknown quantity, which contain some imaginary quantity. Thus, the roots of the equation $xx + aa = 0$, are the two imaginary quantities $+\sqrt{-aa}$ and $-\sqrt{-aa}$, or $+a\sqrt{-1}$ and $-a\sqrt{-1}$.

IMPACT, the simple or single action of one body upon another to put it in motion. Point of impact is the place or point where a body acts.

IMPERFECT NUMBER, is that whose aliquot parts, taken all together, do not make a sum that is equal to the number itself, but either exceed it, or fall short of it; being an abundant number in the former case, and a defective number in the latter. Thus, 12 is an abundant imperfect number, because the sum of all its aliquot parts, 1, 2, 3, 4, 6, makes 16, which exceeds the number 12. And 10 is a defective imperfect number, because its aliquot parts, 1, 2, 5, taken all together, make only 8, which is less than the number 10 itself.

IMPERIALE, a city of Chili in South-America, 6 leagues from the South Sea, having the river Cauten to the south and another river to the west, both navigable. It is situated on a rising steep neck of land, hard to be ascended. In 1600, it was taken by the Indians, after a year's siege; most of the inhabitants having perished by famine. They burnt the town, and then laid siege to Soforno. In this war Valdivia, Argol, Sancta Cruz, Chilla, and Villa Rica were taken. After which they became so confident of their strength, that they fought the Spaniards bravely, and in some measure revenged the cruelties they had committed upon their countrymen. The Spaniards afterwards built a town here called *Conception*. S. lat. 38° 42′, W. long. 73° 25′.—*Morse*.

IMPOST, in architecture, a capital or plinth, to a pillar, or pilaster, or pier, that supports an arch, &c.

Doctrine of Impulsion.

IMPULSION, is the term employed in the language of mechanical philosophy, for expressing a supposed peculiar exertion of the powers of body, by which a moving body changes the motion of another body by hitting or striking it. The plainest case of this action is when a body in motion hits another body at rest, and puts it in motion by the stroke. The body thus put in motion is said to be IMPELLED by the other; and this way of producing motion is called IMPULSION, to distinguish it from PRESSION, THRUSTING, or PROTRUSION, by which we push a body from its place without striking it. The term has been gradually extended to every *change* of motion occasioned by the collision of bodies.

1 History of it.

When speculative men began to collect into general classes, the observations made during the continual exertions of our own personal powers on external bodies, in order to gain the purposes we had in view, it could not be long before they remarked, that as we, by the strength of our arm, can move a body, can stop or anyhow change its motion; so a body already in motion produces effects of the same kind in another body, by hitting it. Such observations were almost as early and as interesting as the other; and the attention was very forcibly turned to the general facts which obtained in this way of producing motion; that is, to the expiscation of the general laws of impulsion. We do not find, however, in what remains of the physical science of the ancients, that they had proceeded far in this classification. While mechanics, or the science of machines, had acquired some form, and had been the subject of successful mathematical discussion, we do not find that any thing similar had been done in the science of impulse. Yet the artillery of ancient times was very ingenious and powerful. But although Vegetius, and Ammianus Marcellinus, and Hero, describe the mechanism of these engines with great care, and frequently with mathematical skill, we see no attempts to ascertain with precision the force of the missile weapon, or to state the efficacy of the battering

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battering ram, by measures of the momentum, and comparison of it with the resistance opposed to it. The engineers were contented with very vague notions on these points.

Aristotle, in his 20th Mechanical Question, and Galen in some occasional observations, are the only authors of antiquity whom we recollect as treating the force of impulse as a quantity susceptible of measure. Their observations are extremely vague and trivial, chiefly directed, however, to the discrimination of the force of impulse from that of pressure.

In more modern times, great additions had already been made to the assistance we had derived from the impulsive efficacy of bodies in motion. Water-mills and wind-mills had been invented, and had been applied to such a variety of purposes, that the engineers were fast acquiring more distinct notions of the force of impulse. Naval construction was changed in such a manner, that there hardly remained any thing of the ancient rigging. The oblique action of wind and water were now found even more effective than the direct; and ships could now sail with almost any wind. All these things fixed the attention of the engineers and of the speculatist on the numberless modifications of the force of impulse.

But it soon appeared that this was a refined branch of knowledge, and required a more profound study than any other department of the science of motion. At the same time, it was equally clear, that it was also of superior importance. Mills worked by cattle, or by men's hands, were everywhere giving place to wind and water-mills; and a ship alone appeared to every intelligent mechanician to be the greatest effort of human invention, and most deserving his careful study. All these improvements in the arts of life derived their efficacy from the impulse of bodies. The laws of impulsion, therefore, became the objects of study to all who pretended to philosophical science. But this is a branch of study wholly new, and derives little assistance from the mechanical science already acquired; for that was confined to the determination of the circumstances which regulated the equilibrium of forces, either in their combined action on bodies in free space, or by the intervention of machines. But in the production of motion by impulse, the equilibrium is not supposed to obtain; and therefore its rules will not solve the most important question, " What will be the precise motion?"

Galileo, to whom we are indebted for the first discoveries in the doctrine of free motions, was also the first who attempted to bring impulsion within the pale of mathematical discussion. This he attempted, by endeavouring to state what is the force or energy of a body in motion. The very obscure reflections of Aristotle on this subject only served to make the study more intricate and abstruse. Galileo's reflections on it are void of that luminous perspicuity which is seen in all his other writings, and do not appear to have satisfied his own mind. He has recourse to an experiment, in order to discover what pressure was excited by impulsion. A weight was made to fall on the scale of a balance, the other arm of which was loaded with a considerable weight; and the force of the blow was estimated by the weight which the blow could thus start from the ground. The results had a certain regularity, by which some analogy was observed between the weights thus started and the velocity of the impulse; but the anomalies were great, and the analogy was singular and puzzling; it led to many intricate discussions, and science advanced but slowly.

2
Laws of impulsion discovered by Wallis, Wrenn, and Huyghens.

At last the three eminent mathematicians, Dr Wallis, Sir Christopher Wrenn, and Huyghens, about the same time, and unknown to each another, discovered the simple and beautiful laws of collision, and communicated them to the Royal Society of London in 1668 (Phil. Trans. n° 43—46). Sir Christopher Wrenn also invented a beautiful method of demonstrating the doctrine by experiment. The bodies which were made to strike each other were suspended by threads of equal length, so as to touch each other when at rest. When removed from this their vertical situation, and then let go, they struck when arrived at the lowest points of their respective circles, and their velocities were proportional to the chords of the arches through which they had descended. Their velocities, after the stroke, were measured, in like manner, by the chords of their arches of ascent. The experiments corresponded precisely with the theoretical doctrine.

In the mean time, this subject had keenly occupied the attention of philosophers, who found it to be of a very abstruse nature; or, which is nearer the truth, they indulged in great refinement in prosecuting the study. The first attempts to measure the impulsive force of bodies, by setting it in opposition to pressures, which had long been measured by weights, gave rise to some very refined reflections on the nature of these two kinds of forces. Aristotle had said that they were things altogether disparate. If so, there can be no proportion between them. Yet the analogy observed in the experiments above mentioned of Galileo, shewed that impulse could be gradually augmented, till it exceed any pressure. This indicates sameness in kind, according to Euclid himself. A curious experiment of Galileo's, in which the impulse of a vein of water was set in equilibrio with a weight, seemed not only to establish this identity beyond a doubt, but even to shew the origin of pressure itself. The weight in one scale is sustained as long as the stream of water continues to strike the other scale. In this experiment, therefore, pressure is equivalent to continual impulse. But *continual* impulse is not conceivable: we must consider the impulse of the stream as the *successive* impulse of the different particles of water, at intervals which are altogether indistinguishable.

From these considerations were deduced two very momentous doctrines: 1. That pressure is nothing but repeated impulse; 2. That although pressure and impulse are the same in kind, they are incomparable in magnitude. The impulse is equal to the weight of a column of water, whose length is the height necessary for communicating the velocity. Now this is incessant; and the weight is sustained during any the smallest moment of time, by the impulse, not of the whole column, but of the insensible portion of it which is then making its stroke. Impulse, therefore, is infinitely greater than pressure.

3
[illegible] the only cause of motion.

These abstruse speculations have a charm for certain ingenious speculative minds; and when indulged, will lead them very far. Accordingly, it was not long before some of the most ingenious philosophers of Europe taught that impulse was the sole origin of pressure.

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There is but one moving power (said they) in mechanical nature: This is impulse.—*Nihil movetur* (says Euler) *nisi a contiguo et moto.* Moreover, having been long and familiarly conversant with the actions of animals, and the actions of moving bodies, and conceiving, with sufficient distinctness, that impenetrable bodies cannot move without moving those with which they are surrounded and in contact, they imagined that they fully understood how all this displacement of bodies is carried on; and therefore they maintained, that any motion is fully explained when it is shewn to be a case of impulsion. But they saw many cases of motion where this impulsion could not be exhibited to the senses. Thus, the fall of heavy bodies, the mutual approach or recess of magnetic and electric bodies, exhibited no such operation. But even here their experience helped them to an explanation. Air is an invisible substance, and its very existence was for a long time known to us only by means of its impulse. As we see that pressures are generated by the impulse of water and of air, may there not be fluids still more subtle than air, by whose invisible impulse bodies are made to fall, and magnets are made to approach or avoid each other? The impossibility of this cannot be demonstrated, and the laws of impulse had not as yet been so far investigated as to shew that they were incompatible with those productions of motion. It was therefore an open field for discussion; and the philosophers, without farther hesitation, adopted, as a first truth, that ALL MOTION WHATEVER IS PRODUCED BY IMPULSION. The business of the philosopher, therefore (say they), is to investigate what combination of invisible impulsions is competent to the production of any observed motion; such as the fall of a heavy body, the elliptical motion of a planet, or the polarity of a magnetic needle. The curious disposition of iron-filings round a magnet encouraged this kind of speculation: It looks so like a stream of fluid; but it is a number of quiescent fragments of iron. This does not hinder us from *supposing* such a stream, not of iron-filings, but of a magnetic fluid, which will arrange (say the atomists) those fragments, just as we see the flote-grass in a brook arranged by a stream of water. Fluids, therefore moving in streams, vortices, and a thousand different ways, have been supposed, in order to *explain*, that is, to bring under a general known law of mechanical Nature, all those cases of the production of motion where impulsion is not observed by the senses.

As we have gradually become better acquainted with the laws of the production of motion by impulsion, we have been able to explode many of those proffered explanations, by shewing that the genuine results of the supposed invisible motions, that is, the impulsions which they would produce, are very unlike the motions which we attempt to explain. It has been shewn, that the vortices supposed by Des Cartes, or by Leibnitz, or by Huyghens, cannot exist; and they have been given up. But it is answered to all those demonstrations of futility, that still the axiom remains. Motion is produced only by impulse; but we have not yet discovered all the possibilities of impulsion; and we must not despair of discovering that precise set of invisible motions, and consequent impulsions, of which the phenomenon before us is the necessary result.

4
The application of this principle is hazardous.

But this is by no means sufficient authority for deserting the rule of philosophizing, so prudently and judiciously recommended by Sir Isaac Newton; namely, not to admit as the cause of a phenomenon any thing that is not *seen* to operate in its production. The prudence of this restriction is evident; and it has also been sufficiently shewn (PHILOSOPHY, *Encycl.* n° 48 &c.), that true philosophical explanation, or extension of knowledge, is unattainable, if this rule be not strictly adhered to. We therefore require a cogent reason for a practice that opens the door to every absurdity, and that cannot give us the knowledge which we are in quest of. What, then, is the reason that always induces philosophers to have recourse to impulsion for the explanation of a phenomenon, and to rest satisfied in every case where it can be clearly proved that the phenomenon is really a case of impulsion? We say that we inquire into the reason why a body falls, and that we will be satisfied if it can be shewn us that it has received a number of impulsions downward. Do we inquire why a body in motion puts another body in motion by hitting it? And if we do, have we discovered the reason? We believe that none of the philosophers, who have recourse to invisible impelling fluids, ever ask a reason for motion by impulsion. Indeed they should not, otherwise it would cease to be a first principle of explanation. Other philosophers, indeed (namely, such as ask no reason for the weight of a body, but the FIAT of the ALMIGHTY), require an explanation of motion by impulse, and think that, in almost every case, they have found it out.

If the philosophers ask no reason for this production of motion, they must (that it may serve as a principle of explanation) say that impulsiveness is an original property of matter, either contingent or essential. Accordingly, we believe that this, or something like this, has been assumed as a principle by the greater part of mechanicians. It has been assumed, as we have observed in the article DYNAMICS, *Suppl.* that a *moving body* possesses the power of producing motion in another body by hitting it; and they call it the IMPULSIVE FORCE *of moving bodies*—the FORCE INHERENT *in a moving body*. The reader will have observed, in our manner of treating that article, and also in several passages of different articles of the *Encyclopædia*, that we do not consider this assumption as very clearly authorised by observation, or deducible by abstract reasoning, from the first principles of philosophy. There is no branch of natural philosophy on which so many ingenious dissertations have been written; and perhaps there is none that has been more successfully prosecuted: Yet this is the only part of the science of motion that has given rise to a serious dispute; a dispute that has divided, and still divides, the mechanicians of Europe.

Some may think it presumptuous in us, in a Work of this kind, which only aims at collecting and exhibiting in one view the *existing science* of Europe, to pretend to give new doctrines, or to decide a question which has called forth all the powers of a Leibnitz, a Bernoulli, a Jurin, a M'Laurin, &c. But we make no such pretensions; we only hope that, by separating the question from others with which it has, in every instance, been complicated, and by considering it apart, such notions may be formed, in perfect conformity to the principles adopted by all parties, that the mystery, which has gradually gathered like a cloud, may be dispelled,

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pelled, and all cause of difference taken away. We apprehend that this requires no very extensive knowledge, but merely a strict attention to the conceptions which we form of the actions of bodies on each other, and a precision in the use of the terms employed in the discussion.

5 Inquiry into its truth. We trust that our philosophical readers perceive and approve of our anxiety to establish (in the article DYNAMICS, *Suppl.*) the leading principles of mechanical philosophy, from which we are to reason in future on acknowledged FACTS, or LAWS of human thought. It is not so much the question, What is the essence of material Nature, from which all the appearances in the universe proceed? as it is, What do we know of it? how do we come by this knowledge? and what use can we make of it? The tænia knows nothing of the solar system, and man is ignorant of the cause of impulsiveness. Other intelligent creatures may have senses, of which this is the proper object; and others, of a still more exalted rank, may perceive the operations of mind as clearly as we perceive those of matter, while they are equally ignorant with ourselves of the causes which connect the conjoined events in either of those operations. But "known unto GOD, and to HIM alone, are ALL His works!"

6 We learn the existence of matter chiefly by means of touch. To accomplish this purpose, we directed the reader's attention to what passes in his own mind when he thinks on the mechanical phenomena of Nature; on what he calls body; on the perceptions which bring it into his view, and which give him all the notions that he can form of its distinguishing, its characteristic properties. How does he learn that there is matter in a particular place? He has more than one mean of information; and each of these informs him of peculiar qualities of the thing which he calls *matter*. Many appearances suggest to his mind the presence of a body. Show a monkey or a kitten (and even sometimes a human infant) a mirror, and it will instantly grope round it to find a companion. Why does the creature grope about so? It is not contented with the first indication of matter, and nothing will satisfy it but touching or grasping what is behind the mirror. It is by our sense of touch alone that we get the irresistible conviction that matter or body is perceived by us, and it never fails to give us the perception; nay, we have the perception even in some cases where the experienced philosopher thinks himself obliged to doubt of its truth. Some sensations, arising from spasm, cannot be distinguished from the feelings of touch; and the patient insists that something presses on the diseased part, while the physician knows that it is only a nervous affection. Every person will think that a cobweb touches his face when an electrified body is brought near it, and will try to wipe it off with his hand. But the modern philosopher sees good reason for asserting, that in this instance our feeling gives us very inaccurate, if not erroneous, information. He shews, that the fact, of which our feeling truly informs us, is the bending of the small hairs or down which grow on the face, and that these only have been touched; and the followers of Æpinus deny that even this has been demonstrated.

7 The excitement of touch is accompanied by the feeling of exerted pressure. The philosopher adopts this mode of perception as unquestionable, and allows that, and that alone, to be matter, which invariably produces this sensation by contiguity. But engaged in speculations which fix his attention on the external object, he neglects and overlooks the instrument of information, and its manner of producing the effect, just as the astronomer overlooks the telescope, and the union and decussation of the rays of light which form the picture by which he perceives the satellite of Jupiter travel across his disk. The philosopher finds it convenient to generalise the immense variety of touches which he feels from external bodies, and to consider them as the operations of one and the same discriminating quality, a PROPERTY inherent in the external substance BODY; and he gives it a name, by which he can excite the same notion in the minds of his hearers. It is worth while to attend to what has been done in this matter, because it gives much information concerning the first principles of mechanism. An exquisite painting has sometimes such an appearance of prominence, that one is disposed to draw the finger along it, and we expect to feel some roughness, some *obstruction*, something that prevents the finger from going over the place. Perhaps we doubt, and want to be assured. We press a little closer; but feel no obstruction; and we desist. The very first appearance, therefore, which this indicating quality, viewed as the *property* of external matter, has in our conceptions, is that of an obstruction, an obstacle, to the exertion of one of our natural powers. The power exerted on this occasion is familiarly and *distinctively* known by the name of PRESSURE. This is the name of our own exertion, our own action; and, in this instance, and (we think) in this alone, the word is used purely, primitively, and without figure. When we say that a stone presses on the ground, we speak figuratively, as truly as when we say that the candlestick stands, and the snuffers lie, on the table. It is a personification, authorised by the similarity of the effects and appearances. Further, when we speak of our pressure on any thing, with the intention of being precise in our communication, we speak only of what obtains in the touching parts of the finger and the thing pressed, paying no attention to the long train of intermediate exertions of the mind on the nerves, the nerves on the muscular fibre, the fibre on the articulated machine, and the machine on the touching part of the finger. And thus the exertion of the sentient and active being is attributed to the particles of lifeless inactive matter at the extremity of the finger, and these are said to press immediately on the touching parts of the external body. And, lastly, as this our exertion is unquestionably the perceived employment of a faculty in us, which we call *force, power, strength*, distinguishing it from every other faculty by these names; we say (but figuratively), that force or power is exerted at the tips of the fingers, and we call it the FORCE OF PRESSURE.

8 [illegible] By far the greatest part of our actions on external bodies is with the intention of putting them out of their present situations; and we can hardly separate the thought of exerted pressure from the thought of motion produced by it. Therefore, almost at its first appearance in the mind, pressure comes before us as a MOVING POWER. Nay, we apprehend, that the more we speculate, and the more we aim at precision in our conceptions, we shall be the more ready to grant that we have no clear *conception* of any other moving power. No man will contend that he has any conception at all of the power exerted by the mind in moving the body.

It

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It is of importance to reflect on the manner in which this notion is extended to all other productions of motion. We think that this will shew, that in every case we suppose pressure to be exerted.

9 Examination of the instances of this perception.

The philosopher proceeds in his speculations, and observes, that one man can press on another, and can push him out of his place, in the same way as he removes any other body; and he cannot observe any difference in his own exertions and sensations in the two cases. But the man who is pushed has the same feelings of touch and pressure. By withdrawing from the pressure, he also withdraws from the sensation; by withstanding or resisting it, he feels the pressure of the other man; and what he feels is the same with what he feels when he presses on the other person, or on any piece of matter. The same sensations of touch are excited. He attributes them to the pressure of the other person. Therefore he attributes the same sensations to the counter-pressure of any other body that excites them. Farther, he can resist to such a degree, that he is not pushed from his place. In this case, the greatest pressure is exerted, and is felt by both. Each feels that the more he resists, the greater is the mutual pressure. And each feels that, unless he *not only do not resist, but also withdraw himself* from the pressure of the other, he will be pressed, and the other will feel counter-pressure, the same in kind with what is produced by his resistance, though less in degree.

10 They are generally figurative.

All these things are distinctly and invariably felt; but they require attention, in order to be subjects of recollection and after-consideration. From this, and no other source, are derived all our notions of corporeal pressure, of counter pressure, of action, re-action, of *resistance*, and of *inactivity* or *inertia*. Our notions of moving power, of the mobility of matter, and of the necessity of this power to produce motion in matter, have the same origin. Our notions also of the resistance of inanimate matter, indicated by the expenditure of actual pressure, are formed from the same premises: the counter-pressure, or what at least produces the same feelings in the person who is the mover, is considered as the property of dead matter; because we feel, that if *we* do not exert real force, we are displaced by the same pressure that would displace a lifeless body of the same bulk.

11 We observe many pressures.

These direct inferences are confirmed as we extend our acquaintance with things around us. We can exert our force in bending a spring, and we feel its counter-pressure, precisely similar to that of another man. We feel that we must continue this pressure, in order to keep it bent; and that as we withdraw our pressure, the spring follows our hand, still producing similar feelings in our organs of touch, and requiring similar exertions of our strength to keep it in any state of tension. These phenomena are interpreted as indications of pressures actually exerted by the spring, and quite different from what we should feel from its mere resistance to being moved. This action resembles our own exertion in every particular; it produces all the effects of pressure; it will squeeze in the soft flexible parts of our body with which we act on it; it will compress any soft body, just as we do ourselves; it will put bodies in motion. Farther, we can set the action of one spring in opposition to that of another, and observe that each is bent by bending the other; and we see that their touching parts exert pressure, for they will compress any soft body placed between them.

Thus, then, in all those cases, we have the same notion of the power immediately exerted between the two bodies, animated or inanimated. It is always pressure. If indeed we begin to speculate about the *modus operandi* in any one of these instances, we find that we must stop short. How our pressure excites the feeling of pressure in the other person, or how it produces motion, eludes even conjecture—So it is—Nay, how our intention and volition causes our limb to exert this pressure, or how the springiness of a spring produces similar effects, remains equally hid from our ken. Unwearied study has greatly advanced our knowledge of these subjects in one respect. It has pointed out to us a train of operations, which go on in our animal frame before the ostensible pressure is produced: we have discovered something of their kind, and of the order in which they proceed; we have gone farther, and have discovered, in some of the pressures exerted by lifeless matter, similar trains of intervening operations. In the case of a spring, we have discovered that there is a certain combination of the properties of all its parts necessary for the visible exertion. But what is the principle which thus makes them co-operate, we cannot tell, any more than in our own exertions of pressure. Such being the origin of our notions on these subjects, it is no wonder that all our language is also derived from it. Force, power, pressure, action, re-action, resistance, impulsion, are, without any exception, words immediately expressive of our own exertions, and applied metaphorically to the phenomena of matter and motion.

Lastly, when we see a body in motion displace another body by hitting it, and endeavour to form a notion of the way in which this motion is immediately produced, fixing our attention on what passes in the very instant of the change, we find ourselves still obliged to suppose the thing we call pressure. We can have no other conception of it; and there is no violence in this act of the imagination. For we know, that if we are jostled from our place, and forcibly driven against another person, we put that person in motion without any intention or action of our own; and we experience, in doing this, that the very same feelings of touch and pressure are excited as in the instances of the same motions produced by exerted pression. We also see, that when a body strikes another, and puts it in motion, it makes an impression or dimple in it if soft, or breaks it if brittle; and in short, produces every effect of pressure. A ball of soft clay makes a dimple in the ball of soft clay which it displaces, and is dimpled by it. Springy bodies compress each other in their collisions, and resile from each other. In short, in every case of this class, mutual pressure, indicated by all its ordinary effects, appears to be the intermedium by which the changes of motion are immediately produced; and the previous motion of the striking body seems to be only the method of producing this pressure.

From this copious induction of particulars, and careful attention to the circumstances of each, we think it plain, that pressure is the only clear notion that a mind, not familiar with scrupulous discussion, forms of moving power; and therefore that it is very singular to think of excluding it from the list, and saying that impulsion 12 Pressure is the only distinct notion of a moving power.

Impulsion. pulsion is the only power in nature, and the source of all pressure.

It may perhaps be said, that the mutual immediate action to which the vulgar, and many philosophers, have erroneously given the metaphorical name pressure is, indeed, the real cause of motion or change of motion; but still it is now properly called impulsion, because it is occasioned only by the previous motion of the impelling body. We conceive clearly, (they may say) how this previous motion produces the impulsion. Since matter is impenetrable, we see clearly that a solid body, or a solid particle, cannot proceed without displacing the bodies with which it comes into contact; we have notions of this as clear as those of geometry; whereas, how pressure is produced, is inconceivable by us. If we press a ball ever so strongly against another, and remove the obstacle which prevented its motion, it will not move an inch, unless we *continue* to follow it, and press it forward; but we see a moving body produce compression, bend springs, make pits in soft bodies, and produce all the effects of real animal pressure. Impulse, therefore, is the true cause of motion, and the solicitation of gravity is nothing but the repeated impulse of an invisible fluid.

But, in the first place, let it be observed, that both parties profess to *explain* the phenomena of mechanical nature, that is, to make them easier conceived by the mind. Now it may be granted, that could we have any previous conviction of a fluid continually flowing toward the centre of the earth, we could have some notion of the production of a downward motion of bodies, but not more explanation than we have without it, because impulsiveness is as little understood by us as pressure.

13 Many pressures are inexplicable by impulsion.

But there are thousands of instances of moving forces where we cannot conceive how they can be produced by the impulse of a body already in motion. There appear to be many moving powers in nature, independent of, and inexplicable by, any previous motion; these may be brought into action, or occasions may be afforded for their action, in a variety of ways. The mere will of an animal brings some of them into action in the internal procedure of muscular motion; mere vicinity brings into action powers which are almost irresistible, and which produce most violent motions. Thus a little aquafortis poured on powdered chalk contained in a bombshell, will burst it, throwing the fragments to a great distance. A spark of fire brings them into action in a mass of gunpowder, or other combustibles. And here it deserves remark, that the greater the mass is to which the spark is applied, the more violent is the motion produced. It would be just the contrary, if the motion were produced by impulse. For in all cases of impulsion, the velocity is inversely proportional to the matter that is moved. When a spring is bent, and the two ends are kept together by a thread, a pressure is excited, which continues to act as long as the thread remains entire. What contrivance of impelling fluid will *explain* this, or give us any conception of the total cessation of this pressure, when the thread is broken, and the spring regains its quiescent form?

14 All pressures do not produce a sensible motion.

We can explain, in a most intelligible manner, why the hardest pressure produces no sensible motion in the case referred to above. We can conceive, with sufficient distinctness, a tube filled with steel wires, coiled up like cork screws, and compressed together into $\frac{1}{10}$th of their natural length. A tube of 10 inches long will contain 100 of them. While in this state, compressed by a plug, we can suppose each of the springs to be tied with a thread. Suppose now that the thread of the spring next the piston is burnt or cut; it will press on the piston, and force it out, accelerating its motion till it has advanced one inch; after this, the piston will proceed with a uniform motion. It is plain, that the velocity will be moderate, perhaps hardly sensible, because the pressure acted on it during a very short time. But if two springs have been set at liberty at the same instant, the pressure on the piston will be continued through a space of two inches, and the final velocity will be greater, because the same (not a double) pressure will be exerted through a double space. Unbending four springs at once, will give the piston a double velocity (See Dynamics, *Suppl.* n° 95). Now the effect of the motion of the second spring is to keep the pressure of the first in action during a longer time, by following it, and keeping it in a state of compression. There is nothing supposed of this kind in the case of strong pressure alluded to; and therefore no motion is produced when the obstacle is removed, except what the insensible compression produces by accelerating the body along an insensible space. If all the 100 springs are disengaged at once, the piston will be accelerated through 100 inches, and will acquire ten times the velocity that one spring can communicate (*N. B.* The force expended in moving the springs themselves is not considered here).

It is in this way only that the previous motion of the impelling body acts in producing a considerable motion. The whole process will be minutely considered by and bye.

15 Impulsion is not more clearly conceived than pressure.

We may now ask, how it is so clear a point, that a solid body in motion must displace other bodies? This seems to be the very point in question, Is the affirmative deduced from our notion of solidity? What is our notion of solidity, and whence is it derived? We apprehend, that even this primary notion is derived from pressure. It is by handling a thing, and finding that we cannot put our hand into the place where it is without displacing it, that we know that it is material. All this is indicated to us by the feeling excited by our pressure. We feel this property always as an obstacle; and therefore say, that by this property it resists our pressure. Nay, there are cases where even the philosopher prefers this quality to impulsiveness as a test of matter. To convince another that the jar out of which he has poured the water that filled it is not empty, but full of matter, he dips the mouth of the jar into water, and shows, that although he press it down till the surrounding water is above the bottom of it, the water has hardly gotten half an inch into the jar; there is something there which keeps it out; there is matter in it. He then opens a hole in the bottom of the jar; the water immediately rises on the inside of the jar, and fills it. He says that the pressure of the water has driven the matter out by the hole; and he *confirms* the materiality of what is expelled, by holding a feather above the hole; it is agitated, shewing that the expelled thing has impulsiveness, another property (he says) of matter; what filled the jar was air, and air in motion is wind. The philosopher can exhibit some new cases, where something like impulsiveness appears.

A slender magnet may be set on one end, the south pole, for instance, and will stand in that tottering situation. If a person bring the north pole of a powerful magnet hastily near the upper end, it will be thrown down, just as it may be blown down by a puff of wind; therefore (says the philosopher) there may be appearances of impulsion, and I may imagine that there is impelling matter; but nothing but matter excludes all other matter from its place: this property, therefore, is the surest test of its presence.

Thus we see, that our notion of solidity or impenetrability (a name still indicating an obstacle to pressure), gives us no clearer conception of the productions of motion by impulsion than pressure does; for it is the same, or indicated by the same sensations.

16 Motion does not impel by transfusing inherent force or inherent motion.

The question now seems to be reduced to this—Since the strongest pressure of a quiescent body does not produce motion, or excite that kind of pressure which is the immediate cause of motion, while a body in motion, exciting but a very moderate pressure (as may be seen by the trifling *compression* or dimpling,) produces a very considerable motion, how is the previous motion conducive to this purpose? The answer usually given is this: A body in motion (by whatever cause), perseveres in that motion by the *inherent force*; when it arrives at another body, it cannot proceed, without displacing that body; the nature of the inherent force is such, that none of it is lost, and that a portion of it passes into the other body, and the two bodies instantly proceed with the same quantity of motion that was in the impelling body alone. This is an exact enough narrative of the general fact, but it gives no great *explanation* of it. If the impelling body perseveres in its motion, by means of its inherent force, that force is exerted in performing its office, and can do no more. The impelled body seems as much to possess an inherent force; for the same marks and evidences of pressure on both sides are observed in the collision. If both bodies are soft or compressible, both are dimpled or compressed. We are as much entitled, therefore, to say, that part of the force by which it perseveres at rest, passes into the other body. But the rest, or quiescence of a body, is always the same; yet what passes into the impelling body is different, according to its previous velocity. We can form no conception how the half of the inherent force of the impelling body is expended by every particle, passes through the points of contact, and is distributed among the particles of the impelled body: nay, we cannot conceive this halving, or any other partition of the force. Is it a thing *sui generis*, made up of its parts, which can be detached from each other, as the particles of salt may be, and really are, when a quantity of fresh water is put into contact with a quantity of brine? We have no clear conception of this; and therefore this is no elucidation of the matter, although it may be an exact statement of the visible fact.

17 This involves absurdities.

Let us take the simplest possible case, and suppose only two particles of matter, one of which is at rest, and the other moves up to it at the rate of two feet per second. The event is supposed to be as follows: in the instant of contact, the two particles proceed with half of the former velocity. Now this instant of time, and this precise point of space, in which the contact is made, is not a part of either the time or space before collision, or of those after collision; it is the boundary between both; it is the last instant of the former time, and the first instant of the latter time; it belongs to both, and may be said to be in both. What is the state or condition of the impelling particle in this instant? In virtue of the previous motion, it has the determination, or the force, or the power, to move at the rate of two feet per second; but, in virtue of the motion after collision, it has the determination or power of moving at the rate of one foot per second. In one and the same instant, therefore, it has two determinations, or only one of them, or neither of them. And it may, in like manner, be said of the impelled body, that in that instant, it was both at rest, and moving at the rate of one foot per second. This seems inconceivable or absurd.

18 Impulsiveness is not an intuitive property of matter,

It is not perhaps very clear and demonstrable, nor is it intuitively certain, that the moving body or particle must displace the other at all. All that we know is, that matter is moveable, and that causes of this motion exist in nature. When they have produced this motion, they have performed their task, and the motion is their complete effect. The particle continues in this condition forever, unless it be changed by some cause; but we do not see any thing in this condition that enables us to say what causes are competent to this change and what are not. Is it either intuitive or demonstrable, that the *mere existence* of another particle is not a sufficient or adequate cause? Is it certain that the arrival at another particle is an adequate cause? or can we prove that this will not stop it altogether? The only conclusion that we can draw with any confidence is, that "two particles, or two equal bodies, meeting with equal velocities in opposite directions, will stop." But our only reason for this conclusion is, that we cannot assign an adequate reason why either should prevail. But this form of argument never carries luminous conviction, nor does it even give a decision at all, unless a number of cases can be specified, which include *every possible result*. This can hardly be affirmed in the present case.

19 But an observed fact.

We apprehend, that the next case, in point of simplicity, has still less intuitive or deductive evidence; namely, when bodies meet in opposite directions with equal quantities of motion. It is by no means easy, if it be at all possible, to shew that they must stop. The proof proceeds on some notion of the manner in which the impulsion, exerted on one particle, or on a few of each body, namely, those which come into contact, is distributed among all the particles. A material atom is moved only when a moving force acts on it, and each atom gets a motion precisely commensurate to the force which actuates it. Now, it is so far from being clear, how a force impressed on one particle of a solid body, occasions an equal portion of itself to pass into every particle of that body, and impel it forward in the same direction, that the very authors who assume the present proposition as an elementary truth, claim no small honour for having determined with precision the moving forces that are exerted on each particle, and the circumstances that are necessary for producing an equal progressive motion in each. It was by no means an easy problem to shew, that the motion of the body (estimated by an average taken of the motions of every particle) is precisely that which is announced by this proposition.

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proposition. We must also consider how this investigation is conducted. It is by assuming, that whatever force connects a particle *a* with a particle *b*, or whatever force *a* exerts on *b*, the particle *b* exerts an equal force on *a* in the opposite direction—Surely no logician will say that this is an intuitive truth. The contrary is most distinctly conceivable. It was a *discovery* of the astronomers, that every deflection toward the sun is accompanied by an equal deflection of the sun. It was a *discovery* that a piece of iron attracts a loadstone; and it was a *discovery* (and we dare not yet affirm it to be without exception) that every action of bodies is accompanied by an equal and contrary re-action. But this is by no means a first principle. It is the expression of a most generally observed fact, a sum total of knowledge. When received on this authority, it is fully competent to solve every case of impulsion, independent of all obscure and illogical doctrines of force inherent in moving bodies, of force of inertia, of communication of motion, &c.

The impossibility of conceiving the detachment of part of the *force* inherent in A, and transferring *this* part into B, and the similar impossibility of conceiving the imparting to B some of the *motion* that was in A, should make us reject any proposition involving such conceptions, and refuse its admission as an elementary truth. Much more should we reject a proposition that obliges us to suppose that a particle of matter has two determinations, forces, motions, or call them by any other name, in one and the same instant. One of these necessarily excludes the other. Indeed this was so evident, even to the most eminent partizans of the doctrine of the transfusion of inherent force, and others consequent on it, that they found themselves obliged to deny that there was such a thing in the world as a perfectly hard body, in which the motion must be instantaneously changed into another, differing from it by any sensible quantity. The existence of perfectly hard bodies is positively denied by the celebrated mathematician of Basle, John Bernoulli, in his Dissertation on the Communication of Motion, which contended for the prize given by the Academy of Sciences at Paris 1710. His reason for this rejection is singular, and somewhat amusing. "In the collision of perfectly hard bodies, the *conservatio virium vivarum*, demonstrated by the most eminent mathematician (Mr Leibnitz), to be a law of nature, would be broken without any effect being produced. He does not observe, that it is as completely broken by elastic bodies in the instant of greatest compression. A British philosopher, *nullius addictus jurare in verba magistri*, asked, What will be the case of two encountering atoms of matter? Without calling them hard, we must conceive that they acquire their changes of motion in the instant of mutual contact, and that they acquire them *totally*, being ἄτομοι, indivisible. No answer has been given, or indeed can be given, but what implies the same difficulty. From all that has been said, we must conclude, that this branch of mechanical philosophy is not put, by those philosophers, into the condition of an elementary foundation of clear and demonstrative science; that the transfusion or transference, either of force or motion, is not a thing of which we have a distinct conception; and that it necessarily leads us into very untenable doctrines. Far less does it seem safe for us to confide so much in its clearness and certainty, as to affirm, that impulsion is the sole moving force in mechanical nature, and the source of what we call pressure.

All this difficulty and obscurity has arisen from our arrogant notion that we are competent judges of first *principles*; whereas we must acknowledge, that we can only perceive such as are properly related or accommodated to our intellectual powers: these powers, being specific and peculiar, cannot judge of principles of the first class, but of those only that are *suitably* compounded. We can never know or comprehend any essential property of matter—we can only know the *relative* properties of *such matter as we see*.

20 Therefore to be learned only by observing nature.

Therefore let us quit entirely the barren and trackless fields of abstraction, and rest satisfied with contemplating *what* the Author of Nature has exhibited to our view, and *such* as he has been pleased in his wisdom to exhibit it. We grant that there are no bodies open to our inspection which are perfectly hard, receiving finite changes of motion in an instant. It has not pleased God to put any such within our reach. When God created matter, it was with the purpose of forming a beautiful universe of this matter. He therefore gave it properties which fitted it for this purpose. It is this matter only that he has exposed to the wondering view of man. Thanks to his bounty, he has also given us properties of mind, by which this adaption, when perceived by us, becomes a source of dignified pleasure to the observer. A Newton, to whom "*Jovis omnia plena*," a Daniel Bernoulli, were rapt almost into ecstacy by a single atom, when they observed how its properties, and only such properties, fitted it for making part of a world, which

Unwearied, and from day to day,
Should its CREATOR's power display.

Let the unhappy La Place consider these properties, which ensure the permanency of the solar system through ages of ages, as proofs of fatalism, as qualities essential to matter. But this Gallic torch effaces the bloom of life from the universe, the expression of the Supreme Mind which shines from within; and it spreads over the countenance of Nature the ghastly paleness of universal death. But let us Britons rather follow the example of our illustrious countryman, and solace ourselves with every discovery which tends to quicken our perception of Nature's *animated* charms. Let us listen to the conjectures of him who had already discovered so many, and who endeavoured to remove the veil which concealed the rest.

21 Moving powers are inherent in all matter. Newton's conjecture improved by Boscovich.

Newton, in his maturity of judgment, after having collected much information from his unwearied experiments in magnetism, in chemistry, in optics, &c. said, that "he strongly suspected, that, in the same manner as the bodies of the solar system were connected by gravitation, so the particles of sublunary bodies were connected together, and affected each other, by means of forces which acted at small, and, in many cases, insensible distances; producing the phenomena of cohesion, in all its forms of hardness, elasticity, ductility, softness, fluidity, by which their mechanical actions on each other were modified and regulated." Father Boscovich, one of the first mathematicians of Europe, was the first who gave this conjecture of Newton's ton's the attention that it so highly deserved. Other writers, indeed, such as Keill, Freind, Boerhaave, &c. took occasional notice of it, and even made some use of it in their attempts to explain some complicated phenomena of nature. But they were so careless in their employment of Newton's conjecture, so completely neglected his cautious manner of proceeding, indulged so wantonly in hypothetical assumptions, and reasoned so falsely from them, that they brought his conjecture into discredit. Boscovich, on the contrary, copied Newton with care, and secured his progress as he advanced, by the aid of geometry; establishing a set of uncontrovertible propositions, which must be the inevitable results of the premises adopted by him. He then proceeded to compare these with the phenomena of nature; and he shews that the coincidence is as complete as can be desired. All this is done in his *Theoria Philosophiæ Naturalis*, first published at Vienna in 1759. We have given a very short account of it in the article Boscovich, *Suppl.*; but it hardly goes beyond the enunciation of the general principle, and the indication of its applicability to the purposes intended. His application to the production of motion by the collision of bodies, is peculiarly satisfactory. But as the work is written chiefly with the view of gaining the approbation of persons well instructed in natural philosophy, it can hardly be called an elementary work, or be employed for the instruction of persons entering on the study. We shall attempt to explain this important law of mechanism in a way that will give our readers a distinct notion (and, we apprehend, a just one) of the procedure of Nature in all the cases of impulsion *that we can observe*. We hope to do this, by considering the changes of motion produced by moving bodies in a certain series of familiar cases, where the procedure of nature may be distinctly observed, and where it is uniformly conceived by every spectator; and which will gradually lead the mind to those cases where the procedure is not observed with distinctness; but the similarity to the former case is concluded by so fair analogy, that we imagine no person will controvert it. We shall begin by attending to the manner in which two magnets in motion affect each other's motions; a phenomenon that is familiarly known in the general, although, perhaps, few persons have attended to it minutely.

Plate XXIX. 22 Examination of the mutual actions of magnets.

Let us, therefore, suppose two magnets, A and B (fig. 1.) equal in weight (in the first instance). Let them be made to float on water, by placing them on pieces of cork. Let them be placed with their north poles touching each other. Let A be held fast, and let B be at liberty to move. We know that it will gradually recede from A, with a motion that would continually accelerate, were it not for the resistance of the water. What is the inference drawn from this appearance? Surely this, that either a moving power, inherent in A, repels B, or that B avoids A, by an evasive power inherent in itself. It is immaterial for our purpose which opinion we adopt. Let us say that A repels B. This admits more concise language than the other. If we prevent this motion of B by means of a very slender spring applied to its remote end, we shall observe that the spring is bent back a little, just as if we were pushing away the magnet gently with the finger; and we observe, that the bending of the spring is so much the greater as B is nearer to A. We can judge of the intensity of the force by which B is actuated, by the bending of the spring—This force is equal to the *weight* of any body that will bend the spring to the same degree. This force is analogous, therefore, to the weight, the pressure of gravity, and we may call it a pressure, and measure it by grains weight. Every force that can bend a spring will move a body. This is a well known fact. Therefore it is next to certain, that it is this force which causes B to recede from A; nay, if we compare the motion of B with what *should* result from the action of a force having this very intensity, and varying in the same manner by a change of distance from A, taking in the diminution which the resistance of the water must occasion, we shall find the motions precisely the same. All this can be discovered by Dynamics, n° 95, &c. Therefore we must conclude that this, and no other, is the cause of the recess of B.

If, instead of placing B in contact with A, we place it at a distance from it, and push it toward A with an initial velocity, somewhat less than it would have acquired in that place by its recess from A, we shall find that it will approach A with a motion gradually retarded, till it stop at a small distance from A; and will now recede from it again with an accelerated motion. In short, we shall find that its whole motion to and from A is precisely the same with what results from a similar computation by n° 95. of Dynamics.

The whole of this phenomenon is conceived by every beholder, who has not imbibed some peculiar theory of a stream of impelling fluid, as the indication and effect of a repulsive force exerted by A on B, or of a quality of B, by which it recedes from A.

If now B be held fast, and A be set at liberty, it is observed to be repelled by B, or to recede from B, in the same manner, and with the same force.

Thus, the two magnets appear to affect each other's motions, and are thought, and said, by all to repel each other. The effect appears curious, but excites no farther thought in most minds: it is only the speculatist that begins to suspect that he has not conceived it properly.

Now, let us suppose that B is afloat on the surface of the water, and at rest; and that A is pushed towards it, by a single stroke, causing it to move so moderately that it shall not strike B, but have its motion destroyed by the repulsion before it reaches it; and let us farther suppose, that the initial velocity of A was exactly measured—the fact will be as follows. As soon as A comes within a certain distance of B, its motion begins to be affected; it gradually diminishes, and at length it ceases entirely, and A remains ever after perfectly still. But it is also observed, that in the instant that A slackens its motion, B begins to move; that it gradually accelerates in its motion, and at last acquires the initial velocity of A, with which it proceeds, till the resistance of the water brings it to rest, perhaps at a considerable distance from A. This experiment is very amusing, and the initial velocity of A may be increased in each succeeding trial, till at last it strikes B. Even then the general appearance remains the same: A is brought to rest and remains at rest, neither resiling nor advancing forward; and B moves off with the initial velocity of A. What we wish to be

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be particularly noticed is, that as long as the initial velocity of A is less than a certain quantity (depending on the strength of the magnets), the motion is communicated to B, or, to express it more cautiously, motion is produced in B, without any thing happening that can get the name of impulsion with propriety. In the ordinary conceptions and language of mankind, impulse always supposes actual contact; and impulsion is equivalent to a blow or a stroke. Both of these are indeed metaphorical terms, as well as impulsion. Perhaps the word "to hit," expresses this particular case more purely, and it is perhaps without any figure, and is the appropriate word. We do not speak at present of the conception and language of philosophers, but of persons taking an unconcerned view of things, without any intention of speculating farther about the matter.

Appearances perfectly similar are observed in electrified bodies. If we hang two equal bunches of very light downy feathers by two equal linen threads, so as to hang close by each other like pendulums without touching, and if, after having electrified them so that they repel each other to some distance, we draw one of them, which we shall call A, considerably aside from the perpendicular, and then let it go to swing like a pendulum; we shall observe, that instead of accelerating till it reach the lowest point of its vibration, its motion will be retarded; it will stop entirely when its thread is perpendicular, and will remain at rest. In the mean time, the other bunch B will acquire motion, which will gradually increase till it equal the motion of A in its maximum state; and with this it would proceed for ever, were it not rising like a pendulum in the arch of a circle. The general fact is the same as in the case of the magnets. The moving body is brought to rest, in which state it continues, and the quiescent body moves off with an ultimate velocity, equal to the initial velocity of the other; and all this happens without contact or impulsion, but is produced by the mutual repulsion of the electrified bodies.

If this general fact be compared with what happens in the collision of two billiard balls, it will be found perfectly similar in every respect, but that of the contact and the impulsion, properly so called. The impelling ball is brought to rest, and remains at rest; and the impelled ball moves off with the velocity of the impelling ball.

This being the case, it is plain that we may derive some information from the motion of the magnets, that must greatly assist us in our conceptions of what passes in the rapid, if not instantaneous, production of motion in a billiard ball, by hitting it with another. In the case of the magnets, we perceive, and can discriminate, a progressive train of changes, which terminate in a final change, perfectly similar to the change in the impulsion of the billiard ball. This will justify a very minute attention to, and statement of, all the circumstances.

23 First case. A moving toward B at rest.

Let us attend to the process of this operation, and the production of motion in the magnet originally at rest, and the abolition of it in the one originally in motion; and let us reflect on what passes in our minds when we try to explain it to ourselves. The trials mentioned at first, when one magnet was held fast, shew us that each magnet repels or avoids the other, and that this action is found to be equal on both sides, producing equal compression of the spring employed for ascertaining the intensity of this repulsion when the distances are the same. This is the fact. It is no less a fact, that equal moving forces, such as equal pressures must be supposed to be, produce equal changes of motion in their own direction. Therefore, as soon as A comes to such a distance from B that the mutual action takes place, both magnets are affected, and equally affected; that is, equal changes of motion are produced on each, but in opposite directions. The motion of A is diminished, perhaps $\frac{1}{100}$th part, in $\frac{1}{10}$th of a second, and (let it be carefully remembered) while A passes over a certain space, suppose the 10th of an inch. During this small portion of time, B acquires as much motion as A loses. This is not the motion lost by A. This is inconceivable; for motion is not a thing, but a condition. But it is an *equal degree* of motion. B has passed over a small space during this time, perhaps the 50th part of an inch, with an almost imperceptible motion, that is gradually accelerated from nothing. Since A is moving faster than B, it must still gain upon it; and therefore the mutual repulsion will increase; and in the next 10th of a second this force will take another and greater portion of A's original velocity from it, and will add a greater velocity to that already acquired by B. And thus, in every succeeding minute portion of time, the motion of A will be more and more diminished, and that of B as much increased, by the equal, though continually increasing, simultaneous repulsions acting in opposite directions. It is evident, that it is possible that the velocity of A may be so much diminished, and that of B so much increased, that the remaining velocity of A shall be just equal to the acquired velocity of B. Till this happens, the distances of the magnets have been continually diminishing; for A has been moving faster than B, and gaining on it. If the operation of the mutual repulsions could be stopped at this instant, both magnets would move forward for ever with equal velocities.

24 They acquire a common velocity

It is of particular importance to know what this common velocity is. This is determined by our previous knowledge, that the magnets repel or avoid each other with equal forces. These forces may vary by a variation of distance; but the force acting on A is always equal and opposite to the force acting at the same time on B. This is the uncontroverted fact (the authority for which shall soon be considered). These equal forces must therefore produce equal and opposite changes of motion. The motion acquired by B is equal to that lost by A. But the magnets being supposed equal, and moving with equal velocities, they have equal quantities of motion. Therefore the motion acquired by B, or that lost by A, is equal to what remains in A; that is, A has lost half of its motion, and therefore half of its velocity; or the common velocity is half of the primitive velocity of A.

It was for the sake of a somewhat easier discussion that we supposed the magnets to be of equal weights. But it is almost equally easy to ascertain what this common velocity will be in any other proportion of the quantities of matter in A and B. It is a matter of unexcepted experience, that whatever be the weight or strength of two magnets, their actions on each other are always equal. Therefore the simultaneous force must always produce.

produce equal changes of motion in the two bodies. But the change of motion is expreſſed by the product of the quantity of matter and the change of velocity. Therefore let A and B repreſent the quantities of matter in the magnets; and let a be the primitive velocity of A, and x the velocity which obtains when both are moving with one velocity. The velocity loſt by A is $a - x$. Therefore we muſt have $Bx = A \times \overline{a - x}$, $= Aa - Ax$; and $Aa = Ax + Bx$, $= \overline{A + B} \times x$, and $x = \frac{Aa}{A+B}$. *The common velocity is therefore obtained by dividing the primitive quantity of motion by the ſum of the quantities of matter.*

25 Namely. $x = \frac{A \times a}{A+B}$.

This may be conceived more compendiouſly in another way. Since B acquires as much motion as A loſes, the whole quantity of motion is the ſame as before: Therefore the common velocity muſt be had by dividing this quantity of motion by the whole quantity of matter. But we wiſhed to make the reader keep his attention fixed on the ſteps of procedure, and ſee the connection of each with the cauſes.

We ſhall find that this period of the whole proceſs, namely, the moment when both bodies have acquired a common velocity, and the preciſe magnitude of this velocity, are points of peculiar importance in the doctrine of impulſion; indeed they almoſt comprehend the whole of it.

26 But this does not continue, and the magnets ſeparate.

But this is a ſtate that cannot continue for a moment in the example before us. The repulſive or evaſive forces are ſtill acting on both magnets, and ſtill diminiſh the motion of A, and equally increaſe the motion of B. Therefore the velocity of A, in the very next moment, muſt be leſs than that of B; and B has, during this moment, gained on A, or has removed farther from it. This continues; A is ſtill retarded, and B is accelerated; and therefore gains more and more upon A, or ſeparates farther and farther from it. This muſt continue as long as the mutual repulſions are ſuppoſed to act. If we ſuppoſe that the *ſenſible* action of theſe forces is limited to ſome determinate diſtance, the mutual action will ceaſe when B has got to that diſtance before A. We may call it *the inactive diſtance.* After this, A and B will proceed with the velocities which they have at that inſtant. Let us inquire into theſe final velocities; and thus complete our acquaintance with the proceſs.

27 The common velocity is attained at the inſtant of neareſt approach.

We ſee (and it is important) that the magnets are in their ſtate of greateſt proximity at the inſtant of their moving with a common velocity, and that after this they gradually ſeparate, till they are again at their inactive diſtance. During this ſeparation they attain diſtances from each other equal to what they had during the period of their mutual approach. At theſe diſtances the repulſions are the ſame as before, and act in the ſame direction. Therefore, in each moment of ſeparation, and at each diſtance, A ſuſtains the ſame diminution, and B gets the ſame augmentation of its motion, as when they were at the ſame diſtance in the period of their mutual approach. The ſums total, therefore, of theſe equal augmentations and diminutions muſt be equal to the augmentation and diminution during the approach. Therefore the whole diminution of A's motion muſt be double of the diminution ſuſtained during the approach; and the whole augmentation of B's motion muſt, in like manner, be double of that acquired during the approach of A. Hence we eaſily ſee, that when the magnets are ſuppoſed equal, A muſt be brought to reſt; for in the period of approach it had loſt half of its velocity. It muſt now have loſt the whole. For ſimilar reaſons B muſt finally acquire the primitive velocity of A; for in the inſtant of greateſt proximity, it had acquired the half of it.

28 Repulſion is a cauſe adequate to the obſerved effect.

Thus we ſee, that the equal mutual repulſions are preciſely adequate to the production of the changes of motion that are really obſerved; and muſt therefore be admitted as the immediate cauſes of theſe changes.

29 Effect when the magnets are unequal.

It is equally eaſy to aſcertain the final velocities when the magnets are of unequal ſizes; for the equality of their mutual repulſions is not affected by any inequality of their magnitudes. Their ſeparations, and the changes of motion during theſe ſeparations, will be the ſame with their approaches and the correſponding changes of motion; and the whole change on each will be double of the change ſuſtained at the inſtant of greateſt proximity and common velocity. Hence we learn, that the final velocity of B is $2x$, or $\frac{2Aa}{A+B}$; and the final velocity of A is $\frac{\overline{A-B} \times a}{A+B}$. For the primitive velocity of A being a, and the common velocity, in the inſtant of neareſt approach, being $\frac{Aa}{A+B}$ the loſs of velocity is $a - \frac{Aa}{A+B}$, $= \frac{Aa + Ba - Aa}{A+B}$, $= \frac{Ba}{A+B}$. Therefore the final loſs of velocity is $\frac{2Ba}{A+B}$, and the remaining final velocity is $a - \frac{2Ba}{A+B}$, $= \frac{Aa + Ba - 2Ba}{A+B}$, $= \frac{\overline{A-B} \times a}{A+B}$.

30 II. Caſe. Both magnets in motion in one direction.

Let us, in the next place, ſee what will be the reſult when both of the magnets are in motion at the beginning of their mutual action. And, firſt, let both move in one direction. Let A, moving with the velocity a, overtake B, moving in the ſame direction with the velocity b, leſs than a. Moreover, let the velocities a and b be ſuch, that their difference $a - b$ is ſomewhat leſs than the ſum of the velocities α and β, which the mutual repulſions of the magnets would generate in them, if the magnets were placed in contact, and allowed to recede from each other till they get beyond their acting diſtance.

Theſe things being premiſed, let the magnets be ſet in motion in the ſame direction with the above-mentioned velocities a and b. The magnet A muſt gain on B, and at laſt come ſo near it, that the mutual repulſions begin to act on both. It is plain, that the motion of A will be diminiſhed, and that of B increaſed, by equal quantities, during every minute portion of the time of their mutual action. It is alſo evident, that the velocity of A may be ſo much diminiſhed, and that of B ſo much increaſed, that they ſhall be rendered equal. Alſo this will happen before the magnets touch one another; becauſe the original difference of their quantities of motion has been ſuppoſed leſs than the motion which the repulſive forces are able to generate or extinguiſh, by acting on them through the whole diſtance which gives occaſion to their action. Therefore

Impulſion. fore the difference of the velocities is leſs than the ſum of the velocity α, which the mutual repulſion can take from A, and the velocity β, which it can give at the ſame time to B. The magnets will gradually approach, and the mutual repulſions, and conſequent diminution of A's, and augmentation of B's motion, will gradually increaſe, till the ſum of α and β is juſt equal to the difference of a and b; that is, till the bodies are moving with one velocity. If the mutual repulſions were annihilated at this inſtant, the bodies would move forward with this common velocity. What this is we determine with great facility, as we did in the former caſe: Becauſe the repulſions produce equal and oppoſite changes of motion in the magnets, as much is taken from $A \times a$ as is added to $B \times b$; and the ſum of $A \times a$, and $B \times b$, is equal to the ſum of $A \times x$ and $B \times x$, or $\overline{A+B} \times x = A \times a + B \times b$, and $x = \frac{Aa + Bb}{A + B}$. Therefore *the common velocity is had by dividing the ſum of the primitive quantities of motion by the ſum of the quantities of matter.*

31 Common velocity $= \frac{Aa + Bb}{A + B}$, but the magnets ſeparate, and the change is doubled in each.

But the repulſive forces continue to act as in the former caſe. The motion of A is ſtill more diminiſhed, and that of B augmented: Therefore the velocity of B muſt now exceed the velocity of A, and the magnets muſt ſeparate. Reaſoning in the ſame way as in the former caſe, it is evident that the mutual action does not ceaſe till the magnets have ſeparated to their inactive diſtance from each other, and that the whole change of motion in each is double of the change that it had ſuſtained when they were in their greateſt proximity, and moving with a common velocity. Theſe conſiderations enable us to aſcertain the final ſtate of each. The common velocity is $\frac{Aa + Ab}{A + B}$. Therefore the change made on the velocity of A, at the inſtant of greateſt proximity, is $a - \frac{Aa + Bb}{A + B}$, or $= -\frac{B \times \overline{a - b}}{A + B}$, and the final velocity of A is $a - \frac{2B \times \overline{a - b}}{A + B}$. In like manner, the change produced on the velocity of B is $= \frac{Aa + Bb}{A + B} - b$, or $= + \frac{A \times \overline{a - b}}{A + B}$, and the final velocity of B is $b + \frac{2A \times \overline{a -}}{A + B}$. We may alſo obtain the final velocity of each, by taking its initial velocity from twice the common velocity.

If, in this example of two magnets in motion, we ſuppoſe them of equal weight, we ſhall find that they will finally proceed with exchanged velocities. For when $A = B$, it is plain that $a - \frac{2B \times \overline{a - b}}{A + B}$ is $= a - 1 \times \overline{a - b}, = a - a + b, = b$: and $b + \frac{2A \times \overline{a - b}}{A + B}$ is $= b + 1 \times \overline{a - b}, = b + a - b, = a$. This caſe is eaſily ſubjected to experiment, and will be found fully confirmed, if we take into account the retardations occaſioned by the reſiſtance of the water to the motions.

Let us, in the next place, ſuppoſe the magnets to be moving in oppoſite directions with the velocities a and b; and (in order that the magnets may not ſtrike each other) let the ſum of a and b be leſs than the ſum of α and β, which the repulſions of the magnets would produce by repelling them from contact to their inactive diſtance. Impulſion. 32 Magnets moving in oppoſite directions.

As ſoon as the magnets arrive at their acting diſtance, their mutual and equal repulſions immediately begin to diminiſh both of their motions; and in any minute portion of the period of their approach, equal quantities of motion are taken from each. It is evident, that if the primitive quantities of motion have been equal; that is, if A and B have been moving with velocities reciprocally proportional to their quantities of matter, then, when the motion of one of them has been annihilated by their mutual repulſion, the motion of the other will be deſtroyed at the ſame time, and both will be brought to reſt. Were the repulſions annihilated at this inſtant, they would remain at reſt. But becauſe thoſe forces continue their actions, the magnets will ſeparate again, regaining, at every diſtance, the velocity which they had, when at that diſtance, during their mutual approach; and when they have reached their inactive diſtance, they will have regained each its original momentum and velocity, but in the oppoſite direction. This needs no farther comment; but muſt be kept in mind, becauſe this caſe has a preciſe counterpart in the colliſion of ſolid bodies, meeting each other in oppoſite directions with equal momenta. But if the momentum of one exceed that of the other, thus, if $A \times a$ be greater than $B \times b$, then, when the magnet B is brought to reſt, A has ſtill a momentum remaining equal to $Aa - Bb$. Having therefore a certain velocity, while B has none, it muſt approach ſtill nearer to B, and a ſtill greater repulſion will be exerted on B than if A had alſo been brought to reſt, but ſtill repelling B. Since B is now acquiring motion in the direction oppoſite to its former motion, and A is ſtill loſing motion, a time muſt come when the motion of A is ſo much diminiſhed, and that of B ſo much augmented, that they are moving with a common velocity in the direction of A's primitive motion. The reaſoning employed in the foregoing examples ſhews us, that, in the preſent caſe alſo, this ſtate of common velocity is alſo the ſtate of the greateſt proximity, and that the magnets ſeparate again, till they attain their diſtance of inaction, and that the total change in each is double of what it was in their ſtate of greateſt proximity.

To find this common velocity, recollect, that when the momentum of B was extinguiſhed, that of A was ſtill $= Aa - Bb$. From what has been already ſaid on the other caſes, we know that when the common velocity obtains, the whole momenta are ſtill equal to $Aa - Bb$. Therefore the common velocity x muſt be $= \frac{Aa - Bb}{A + B}$. 33 Common velocity $= \frac{Aa - Bb}{A + B}$; but the change is doubled by the ſubſequent ſeparation.

The velocity left by A muſt therefore be $a - \frac{Aa - Bb}{A + B}, = \frac{B \times \overline{a + b}}{A + B}$, and the final velocity will be $a - \frac{2B \times \overline{a + b}}{A + B}$. The final motion of A will be in the ſame direction as at firſt, if a be greater than

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$\frac{2\,B\,\overline{a+b}}{A+B}$, otherwise it will be in the opposite direction.

In like manner, the change of velocity in B is $b + \frac{A\,a - B\,b}{A+B}$, because the former velocity b is destroyed, and the new velocity is $\frac{A\,a - B\,b}{A+B}$ in the opposite direction. This is $= \frac{A \times \overline{a+b}}{A+B}$, and the final velocity of B is $= b - \frac{2\,A \times \overline{a+b}}{A+B}$.

34
The changes of motion in the magnets are similar to those in the collision of bodies.

Thus we have shewn, in the case of magnets acting on each other by repulsive forces, or actuated by forces equivalent to repulsive forces, how changes of motion are produced, which have a great resemblance to those which are seen in the collision of solid bodies. The motions which obtain in the instant of greatest proximity are precisely similar to what *are observed* in the collision of unelastic bodies. Their common velocity after collision is always $= \frac{A\,a + B\,b}{A+B}$, or $= \frac{A\,a - B\,b}{A+B}$, according as the bodies were moving in the same or in opposite directions. The final motions of the magnets are also precisely similar to what *are observed* in the collision of perfectly elastic bodies. We took the instance of magnets, because the object is familiar; but we can substitute, in imagination, an abstract repulsive force in place of magnetism, and we can assign it any intensity, and any law and limits of action we please. We can imagine it so powerful, that although its action be limited to a very small, and even insensible distance, it shall always reduce the meeting bodies to a common velocity before they come into actual contact; and therefore without any real impulsion, as impulsion is commonly conceived.

There are some farther general observations that may be made on those motions which are of importance.

35
These changes are proportional to the relative motion.

1. We see that the changes of motion, and consequently the actions, are dependent on the relative motions only, whatever the absolute motions may be: For changes are always as $a - b$ when the bodies are moving in one direction, and as $a + b$ when they are moving in opposite directions. Now $a \mp b$ is the relative motion.

36
And reciprocally as the quantities of matter.

2. The change of velocity in each of the two bodies is inversely as its quantity of matter, or is proportional to the quantity of matter in the other body. The changes in A and B are $\frac{B \times \overline{a \mp b}}{A+B}$ and $\frac{A \times \overline{a \mp b}}{A+B}$. The changing forces being equal on both sides, produce equal changes in the quantities of motion; and therefore produce changes of velocity that are inversely as the quantities of matter.

37
CONSERVATIO MOMENTORUM.

3. During the whole process, the sum of the momenta, or quantities of motion, remains the same, if the bodies are moving in one direction: if they are moving in opposite directions, it is the difference of momenta that remains the same; for in every instant of the process equal changes of momentum are made in opposite directions. When the motions are in the same direction, as much is taken from the one as is added to the other; and therefore the *sum* remains unchanged. When the motions are in opposite directions, equal quantities are taken from both; and therefore the *difference* remains unchanged. This is called the CONSERVATIO MOMENTORUM; and it is usually enunciated by saying, that the quantity of motion, estimated in one direction, is not changed by the equal and opposite actions of the bodies. This is a particular case of a general law affirmed by Des Cartes, that the quantity of motion in the universe remains always the same when estimated in *any* one direction.

38
CONSERVATIO VIRIUM VIVARUM.

4. When the whole process is completed, the sum of the products made by multiplying each body by the square of its final velocity, is equal to the sum of the products made by multiplying each body into the square of its initial velocity. For when the process is completed, the two bodies are at the same distance from each other as when the mutual action began. Therefore, during the process, each body has passed over an equal space, and in every similar point it has been acted on by an equal force (although this force be different in different points of this space). Therefore, in every instant, the simultaneous products of the quantity of matter by the momentary variation of the square of the velocity are equal on both sides; and therefore the products of the quantity of matter by the whole change of the square of the velocity are also equal on both sides. See DYNAMICS, *Suppl.* n° 95. and 110. where $v\dot{v} = \frac{f\dot{s}}{m}$; and therefore $m\,v\,\dot{v} = f\dot{s}$, and $m \times V^2 - v^2$, or $n \times v^2 - V^2 = \int f\dot{s}$. Now, since these changes are in opposite directions, as much is added to one product as is taken from the other, and the sum of the products of the quantities of matter by the squares of the final velocities, is equal to the sum of the products of the same quantities of matter by the squares of the initial velocities.

These two theorems are not principles, but general facts.

This is a particular case of the famous CONSERVATIO VIRIUM VIVARUM, claimed as a mighty discovery by the partizans of Leibnitz, and ascribed to him; but he has no claim whatever to the discovery. It was communicated to the Royal Society of London in 1668 by Huyghens, as one of the general laws of impulsion, obtaining in what he calls *hard bodies*. Several of the Leibnitzian school, indeed, extended it farther than Huyghens had done; some of them indeed very lately. The observation of this general law was soon applied to many excellent purposes in the solution of very intricate problems; because it often saved the trouble of tracing the intermediate steps of a complicated process. Assured that these products were invariable, the mathematician found it an easy matter to state what conditions of the question insured this equality of products; and thus the problem was solved. In this manner Daniel Bernoulli gives most elegant solutions of some, otherwise almost intractable, problems in Hydraulics. For such reasons, as a mighty aid in mechanical investigation, the discovery of Huyghens is extremely valuable. Its merit in this respect is perfectly similar (though perhaps somewhat greater) to Des Cartes's observation of the *conservatio momentorum*. It is also like the observation or discovery of Maupertuis, which he calls *the law of smallest action* (indeed it is the same under a different

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ferent aspect), or La Grange's *law of virtual velocities*, or D'Alembert's *law of equilibrium of action*;—all of these are general facts, laws by which the changes of motion are *observed* to proceed. But their authors have vaunted them as principles, as causes, from which to conclude effects; whereas they are really inductions from particular instances. We must also observe, that this law of *conservatio virium vivarum* was not deduced either by Huyghens or any of the Leibnitzian school, by reasoning from more general principles. It was an expiscation of sameness in events, diversified by other circumstances. We do not recollect any author who has given what can be called a demonstration of it, deducing it from principles or laws still more general. We apprehend, that the present case of its truth has been so demonstrated by us. The *principle* is, that "a moving force is to be measured by the change of motion produced by it:" And the law to which this principle is applied is, that "the mutual repulsions of magnets are equal and opposite;" and the application is made by means of the "39th proposition of the first book of Newton's *Principia*." Our principle, which is the same with Sir Isaac Newton's second law of motion, is really an axiom of human thought. The proposition is the consequence logically drawn from this axiom; and the law of magnetism is an observed fact. We hope to shew by and bye, that this proposition, which is our n° 95 of Dynamics, is found to obtain in *every* instance that has been or can be given of the *conservatio virium vivarum*, and that this *conservatio* is only another way of expressing the proposition. Having done this, we shall not think ourselves chargeable with vanity when we say, that we have given the first demonstration of this famous law. We cannot refuse ourselves some satisfaction at having done this; because it has been so highly esteemed, chiefly for the support derived from it for the Leibnitzian measurement of the force of moving bodies by the *square of the velocity* which it communicates; whereas it is the logical consequence of the force being proportional to the *simple velocity*. We have only taken a weapon out of the hands of a plunderer, and restored it to its lawful owner, Sir Isaac Newton. *Non ita certandi cupidus, quam propter amorem:* For we must say,

Tu pater et rerum inventor, tu patria nobis
Suppeditas precepta, tuisque ex, inclute, chartis
Floriferis ut apes in saltibus omnia libant,
Omnia nos itidem depascimur aurea dicta
Aurea, perpetuâ semper dignissima vitâ.

We trust that our reader will not think that this minute discussion of the mutual actions of magnets or other repelling bodies, in which we have engaged him, has been thrown away, since it has enabled us to apprehend clearly a case of two such general laws as the *conservatio momentorum*, and the *conservatio virium vivarum*.

5. In the moment of greatest vicinity and common velocity, there is a certain determinate loss of the *vires vivæ*, or products of the matter by the square of the velocity; and this loss is proportional to the square of the relative motion. The *vires vivæ*, at the commencement of the mutual action, are $= A a^2 + B b^2$ (I.). In the moment of greatest proximity, the quantity of matter $A + B$ is moving with the common velocity $\frac{A a + B b}{A + B}$; therefore the *vires vivæ* are $= \overline{A + B} \times \frac{\overline{A a + B b}^2}{\overline{A + B}^2} = \frac{\overline{A a + B b}^2}{A + B}, = \frac{A^2 a^2 + B^2 b^2 + A B \times 2 a b}{A + B}$ (II.). — 39 *Vis viva* lost in the collision of unelastic bodies.

$$\text{I.} \times \overline{A + B} = A^2 a^2 + B^2 b^2 + A B \times a^2 \times b^2.$$
$$\text{II.} \times \overline{A + B} = A^2 a^2 + B^2 b^2 + A B \times 2 a b.$$
$$\text{Difference} \quad - \quad - \quad - \quad A B \times \overline{a - b}^2.$$

Loss of *vis viva* $= \frac{A B}{A + B} \times \overline{a - b}^2$, a quantity that is proportional to $\overline{a - b}^2$, the square of the relative velocity $a - b$.

Had the bodies been moving in opposite directions then (II.) $\times \overline{A + B}$ would have been $A^2 a^2 + B^2 - A B \times 2 a b$, and the difference from $\overline{A a^2 + B b^2} \times \overline{A + B}$ would have been $= A B \times \overline{a + b}^2$, proportional to the square of the relative velocity $a + b$.

Such is the fact; and we shall find it of importance in the great debate about the force of moving bodies. Let us inquire into the physical or mechanical cause of it. In the moment of common velocity, the bodies are nearer to each other than they are at the beginning and at the end of their mutual action. Therefore (when they are moving in one direction) the body A, which follows, has been retarded through a space which is greater than the space along which the preceding body B has been accelerated. But, because the simultaneous forces acting on the bodies along these unequal spaces are always equal, the area which measures the diminution of the square of A's velocity (Dynamics, n° 95.) must exceed the area which expresses the augmentation of the square of B's velocity, and there must be a loss of *vires vivæ*. Now, we learned above, that the mutual action is the same when the relative velocity is the same; and therefore the approximation, which is the occasion of this action, must be the same. And it is demonstrated in Dynamics, n° 95. that the area, whose abscissa is the space described, and ordinates the forces, expresses the square of the generated or extinguished velocity. This is evidently the relative velocity of the bodies, because they are brought to a common velocity in the instant of greatest proximity; that is, their relative velocity is destroyed. — Physical cause of this loss.

6. During the whole process, the common centre of position or gravity (A) is moving uniformly with the velocity — 40 The motion of the common centre of gravity is not changed by the mutual action.

(A) See the article Position in this *Supplement*; where it will be demonstrated, that the centre of gravity (determined in the usual manner) is the point by whose situation and motion we estimate with the greatest propriety the situation and motion of the assemblage, of which it is the centre: it is therefore called the centre of position. The reader is only desired at present to recollect, that the centre of gravity, or position of two bodies, is situated in the line joining their centres; and that its distance from each is inversely as their quantities of matter; and that the distance and motion of the centre is the medium or average of all the distances or motions.

Impulsion. velocity $\frac{Aa \pm Bb}{A+B}$. For the motion of the centre of position is the average of the motion of every particle of matter in both bodies. Aa is the sum of the motions of every particle of matter in A, and Bb is the sum of the motions of every particle in B, before the mutual actions began. Therefore $Aa + Bb$ is the whole motions when the bodies are moving in the same direction with their different velocities. The number of particles is $A + B$: Therefore, if the whole motions be equally divided among all the particles, the velocity of each must be $\frac{Aa + Bb}{A+B}$. This is the average motion, or the motion of the centre of position, deduced from the notion we wish to impress of the character of this centre, as the index of the position and motion of any assemblage of matter. This velocity may be deduced more easily from its geometrical property. It is a point so situated between A and B, that its distance from each is reciprocally proportional to the quantities of matter in A and B, as is well known of the centre of gravity. It is equally plain, that when the bodies are moving in opposite directions, the average velocity x must be $= \frac{Aa - Bb}{A+B}$. Thus we see that the motion of the centre of position, before the magnets have begun to act on each other, is the same with its motion when their mutual repulsion is the greatest; namely, at the moment of their greatest vicinity. It has continued the same during the whole process: for we have already seen, that the sum or difference of the momenta, or $Aa \pm Bb$, remained always the same; consequently $\frac{Aa \pm b}{A+B}$, or x, the motion of the centre, remains always the same. Therefore the proposition is demonstrated. It is, indeed, a truth much more general than appears in the present instance. *If any number of bodies be moving with any velocities, and in any directions, the motion of the centre of position is not affected by their mutual, equal, and opposite, actions on each other.*

41 The motions, in relation to the centre, are reciprocally as the bodies.

7. During the whole motion, the motion of the bodies relative to each other, is to the motion of one of them, relative to the centre of position, as the sum of the bodies is to the other body: For when they were moving with a common velocity, this velocity was the same with that of the centre; and they are then at rest, relative to each other, and relative to the centre. And because their distances from the centre are inversely as the bodies, their changes of distance, that is, their motions relative to the centre, are in the same proportion; and the sum of their motions relative to the centre is the same with their motions relative to each other. Therefore $A + B : A = a - b$: motion of B relative to the centre. Indeed we saw, that in their mutual action, the change of B's motion was $= \frac{A \times \overline{a-b}}{A+B}$, and the change of A's motion was $= \frac{B \times \overline{a-b}}{A+B}$.

42 The bodies separate with the same relative velocity which they approached.

Hence we learn, that while the centre moves uniformly, the bodies approach it, and then recede from it, with velocities reciprocally proportional to their quantities of matter. This will be found a very useful corollary. We may also see that their final velocity of mutual recess is equal to that of their first approach, or, their relative motions are the same in quantity after the action is over as before it began, but in opposite directions.

All these general facts, which are distinctly appreciable, and very perceivable, in this example of magnets, or electrified bodies, are equally appreciable in all cases of mutual repulsions, however strong these may be; and although the space through which they are exerted should be so small as to elude observation, and though the whole process should be completed in an insensible moment of time.

43 An interposed spring has the same effect with the mutual repulsions.

It scarcely needs any comment to make it clear that the very same changes of motion must take place, if a solid body A should come up to another solid body B, at rest, or moving more slowly in the same direction, or moving in the opposite direction; provided that there be a spring interposed between them, which may hinder A from striking B; for, as soon as A touches the spring, it begins to press it against B, and, therefore, to compress the spring. It cannot carry the spring before it, without the spring's pushing B before it. Pressure on B is required for this purpose. This is supplied by that natural power which we call elasticity, which is inherent in the spring, whether it be in motion or at rest. It is not in *action*, but in *capacity*, *faculty*, *capability*, *power*, or by whatever name we may choose to express the possession. The occasion required for its exertion is compression. This is furnished by the motion of A; for A cannot advance without compressing it. This inherent force of the spring is *known* to act with perfect equality at both ends, in opposite directions. It exerts equal and opposite pressures on A and on B; it diminishes the motion of A, and equally augments the motion of B (if both are moving that way). A is retarded, and B is accelerated; A is still moving faster than B; and therefore the compression and the consequent reaction of the spring increases, and still more retards A and accelerates B. After some time, both bodies, with the spring compressed between them, are moving with equal velocities; the spring, however, is strongly reacting on both, and must now cause them to separate; still retarding A and accelerating B—They must separate more and more, till the spring regain its quiescent form, and its elastic reaction cease entirely. During its restitution, its pressures are the same as during its compression; therefore, the whole change produced on each of the bodies must be double of what it was when the spring was in its state of greatest compression, and the bodies were moving with a common velocity. In short, the whole process in this example must be precisely similar to that of the magnets in every circumstance relating to the changes of motion in A and B. The common velocity must be $= \frac{Aa \pm Bb}{A+B}$. The final velocity of A must be $= a - \frac{2B\overline{a \mp b}}{A+B}$, and that of B must be $= b + \frac{2A\overline{a \mp b}}{A+B}$. The motion of the common centre must be unaffected by the action of the spring, and the motion of each body, relative to the centre, must be reciprocally as its quantity of matter, &c. &c.

We

Impulsion.

44 The changes of motion are produced by the inherent forces which connect the particles.

We apprehend that this process can scarcely be called impulsion; A has not struck B. The changes of motion can scarcely be ascribed to forces inherent in A or B, in consequence of their being in motion. Any person, not already warped by a theory, will (we think) ascribe them to a force inherent in the spring; inherent in it, whether at rest or in motion, and only requiring a *continued* compression as the proper opportunity for its continued exertion. This spring may be supposed to make a part of B, or of A, or of both; and then indeed, the force may be said to be inherent in either, or in both. But it is not the peculiar force inherent in motion, or in moving bodies *only*—it is the force of *elasticity*, inherent in part of the body, but requiring a continued *compression* for the production of a continued *repression*. The effect of this reaction is modified by the very occasion of the compression. This may be the elasticity of another spring. In this case it will only compress that spring—It may be the advance of a body in motion; the reaction produces a retardation of that motion; it may be the obstacle of a quiescent body—It will give it motion; or, it may be the obstruction by a body moving more slowly away than the spring is pressed forward—it will accelerate that motion. Thus, in all these cases, we cannot help distinguishing the immediate cause of these changes of motion from the supposed force of a moving body. Nay, the process of motion is similar, even when we suppose that the spring is not a thing external to the body, although attached to it; but that the whole body, or both bodies, are springy, elastic, and therefore compressible. As soon as the bodies come into sensible contact, compression *must* begin; for we may suppose the bodies to be two balls, which will therefore touch only in one point. The mutual pressure, which is necessary in order to produce the retardation of A, and the acceleration of B, is exerted only on the foremost particle of A, and the hindmost particle B; but no atom of matter can be put in motion, or have its motion any way changed, unless it be acted on by an adequate force. The force urging any individual particle, must be precisely competent to the production of the very change of motion which obtains in that particle. Except the two particles which come into contact in the collision, all the other particles are immediately actuated by the forces which connect them with each other; and the force acting on any one is generally compounded of many forces which connect that particle with those adjoining. Therefore, when A overtakes B, the foremost particle of A is immediately retarded—the particles behind it would move forward, if their mutual connection were dissolved in that instant; but, this remaining, they only approach nearer to the foremost striking particles, and thus make a compression, which gives occasion for the inherent elasticity to exert itself, and, by its reaction, retard the following particles. Thus each stratum (so to conceive it), continuing in motion, makes a compression, which occasions the elasticity to react, and, by reacting, to retard the stratum immediately behind it. This happens in succession: the compression and elastic reaction begin in the anterior stratum, and take place in succession backward, and the whole body gets into a state of compression. Things happen in the same manner in B, but in the contrary direction, the foremost strata being the last which are compressed. All this is done in an instant (as we commonly, but inaccurately speak), that is, in a very small and insensible moment of time; but in this moment there is the same gradual compression, increase of mutual action, greatest compression, common velocity, subsequent restitution, and final separation, as in the case of bodies with a slender spring interposed, or even in the case of the mutually repelling magnets. In all the cases, the changes of motion are produced by the elasticity or the repulsion, and not by the transfusion of the force of motion. The changing force is indeed inherent in the bodies, but not because they are in motion; the use of the motion is to give occasion, by continued compression, for the continued operation of the inherent elasticity. The whole process may be very distinctly viewed, by making use of bodies of small firmness, such as foot-balls, or blown bladders. If blown bladders are used, each loaded with sand, or something that will require more force, and consequently more compression to impel it forward; we shall observe the compression of both to be very considerable, and that a very sensible time elapses during the process of collision. This may even be observed very distinctly in a foot-ball, which is always seen to rest a little on the toe before it flies off by the stroke. When one foot-ball is strongly driven against another, they plainly adhere together for some time, and then the stricken ball flies off.

45 Internal process of change through the substance of each body.

If we return to the example of the two balls with the spring interposed, we may make some farther useful observations. When the spring is in its state of greatest compression, and the balls are moving with a common velocity, we can suppose that the spring is arrested in that situation by a catch. It is evident that the two bodies will now proceed in contact with this velocity, which we have shewn to be $= \frac{Aa \mp Bb}{A+B}$.

46 Nature of imperfect elasticity.

Now, in the constitution of such masses of tangible matter as we have the opportunity of subjecting to our experiments, we find a state of aggregation which very much resembles this. Some bodies are almost perfectly elastic, that is, when their shape is changed by external pressure; and that pressure is removed, they recover their former shape completely, and they recover it with great promptitude. Glass, ivory, hard steel, are of this kind. But most bodies either do not recover it completely, or they recover it very slowly—some hardly recover it at all. A rod of iron will, when considerably bent, not nearly recover its shape; a rod of lead still less; and a rod of soft clay will hardly recover it in any degree. These, however, are but gradations of one and the same quality: if the quiescent form of a body is very little disturbed, it will recover it again. Thus, a common soft iron wire of No 6. and 12 inches long, if twisted once round, will return completely to its original form, and will allow this to be repeated for ever; but if it be twisted 1½ turns, it will untwist only 1: and in this new form it will twist and untwist one turn as often as we please. Even a rod of soft clay $\frac{1}{5}$th of an inch in diameter, and 7 feet long, will bear one twist as often as we please: but if twisted 4 times, will untwist itself only one turn, and will do this as often as we choose. In short, it appears that the particles of bodies, usually called unelastic, will admit a small change of distance

or

or fituation, and will recover it again, exhibiting perfect elafticity, in oppofition to very fmall forces; but if they are forced too far from this fituation, they have no tendency to return to it completely, but find intermediate fituations, in which they have the very fame connections with the furrounding particles; and in this new fituation they can again exhibit the fame perfect elafticity, in oppofition to very fmall forces. Mr Coulomb conceives fuch bodies to confift of elaftic particles: they manifeft perfect elafticity, fo long as the forces employed to change their fhape do not remove the particles from their prefent contacts; but if they are removed from thefe, they flide on to other fituations, where they again exhibit the fame appearances. To underftand this fully, the reader may confult the article Boscovich of this *Supplement*—The fact is fufficient for our prefent purpofe. Now, in this variable conftitution, where the particles may take a thoufand different fituations, and ftill cohere, it is plain, that when a body has been dimpled by compreffion, the particles have nothing to bring them back to their firft fituation when the compreffing force is removed: the utmoft elafticity to be expected, is that which will not extend to one fhift of fituation; therefore, the reftitution is altogether infenfible. This is the cafe with all foft bodies, fuch as clay—the fame quality is manifefted in all ductile bodies, fuch as lead, foft iron and fteel, foft copper, foft gold.

47 Effect of this collifion.

Now let one of thefe bodies ftrike another. The compreffion, or the fliding of the particles over each other, requires force, or mutual preffure—This being accompanied by a reaction perfectly equal, muft operate, during the compreffion, precifely as the equal repulfive forces did. It will take as much momentum from A as it gives to B; fo that $\text{A}\,a \mp \text{B}\,b$ will remain invariably the fame, and a common velocity will at laft obtain, $= \frac{\text{A}\,a \mp \text{B}\,b}{\text{A} + \text{B}}$. The compreffion can proceed no farther, and the two bodies muft now proceed in contact with this velocity.

And thus we fee, that in the cafe of compreffible, but unelaftic bodies, the changes of motion are produced by the cohefive forces inherent in the bodies; but not inherent in them becaufe they are in motion. We fee clearly in this way, how the pendulum ufed by Robins and his followers gave a true meafure of the velocity of the ball. All the while that it was penetrating into the pendulum, overcoming the cohefion as it went in, this cohefion was acting equally in both directions. While the fibre was breaking, it was pulling both ways; it was holding back the ball which was breaking it, and it was pulling forward the parts to which it ftill adhered; and when it broke at laft, it had produced equal effects on the ball and on the pendulum in oppofite directions. By fuch a procefs, the pendulum was gradually accelerated, and acquired its utmoft velocity when the ball had ceafed to penetrate: Therefore, this velocity muft be $= \frac{\text{A}\,a}{\text{A} + \text{pend}^{\text{m}}}$.

What fhould we now expect to happen in the collifion of bodies? Such bodies as exhibit perfect elafticity, when examined by bending, or other fit trials, fhould have their motions changed precifely like the magnets, or bodies which repel or avoid each other at fenfible diftances. Bodies which exhibit no elafticity whatever, fhould continue in contact after collifion. The common velocity in thefe fhould be $\frac{\text{A}\,a \mp \text{B}\,b}{\text{A} + \text{B}}$. The perfectly elaftic bodies fhould fuftain changes of motion which are precifely double of the changes fuftained by unelaftic bodies, and fhould feparate after collifion with a relative velocity of recefs or feparation, precifely equal to their relative velocity of mutual approach. And bodies poffeffing imperfect elafticity, fhould fuftain changes of motion, which differ from the changes on unelaftic bodies, precifely in proportion to the degree of elafticity which they are *known* to poffefs. And, laftly, if the changes of motion which obtain in the collifion of bodies, are precifely thofe which would refult from the operation of thofe inherent forces of elafticity and cohefion, NO OTHER FORCE WHATEVER CONCURS IN THEIR PRODUCTION: For we know that thofe forces *do operate* in the collifion; we fee the compreffion and reftitution which are their effective caufes, and their immediate effects. If any other force were fuperadded, we fhould fee its effects alfo, and the motions would be different from what they are.

Now the fact is, that *we have never feen a body that is not, in fome degree, compreffible.* It has not pleafed the Almighty Creator to make any fuch here below. Affuredly He has not found fuch to be of ufe for the purpofes He had in view in this our fublunary world. We know of no body that is perfectly unchangeable in its fhape and dimenfions. It is therefore no lofs whatever to us, although we fhould not be able to fay *à priori* what their motions will be in collifion. We cannot even fairly guefs them, by reafoning from what we obferve in other bodies: For it is juft as likely that their motions may refemble thofe of perfectly elaftic bodies as thofe of unelaftic bodies; for we find that bodies of the moft extreme hardnefs are generally highly elaftic. Diamond, cryftal, agate, quartz, and fuch like, are the moft elaftic bodies we know. Philofophers, however, rather think that the motions of perfectly hard bodies will refemble thofe of unelaftic bodies; becaufe elafticity fuppofes compreffion. We do not pretend to fay with confidence, what would be the motion of a fingle atom of matter (which cannot admit of compreffion) which is hit by another in motion. We fee all the particles of terreftrial matter connected with each other by certain modifications of the general force of cohefion, fo as to produce various forms of aggregation; fuch as aërial fluidity, liquid fluidity, rigidity, foftnefs, ductility, firmnefs or hardnefs; all of which are combined with more or lefs elafticity. Thefe tangible forms refult from certain pofitive properties of the material atoms of which the particles are compofed; and, in all the cafes which come under our obfervations, thefe properties produce preffures of one kind or another; all of which are moving forces. They are inherent in the particles and atoms: therefore when fuch atoms are in motion, thefe forces are in a condition which affords occafion for a *continuation* of this preffure that is competent to the production of motion in another particle. But what would be the event of the meeting of atoms divefted of fuch forces, we profefs not to know, or even to conceive.

The fact alfo is, that all the changes of motion, commonly called impulfions, *which have been obferved*, are precifely precisely such as have been described. Unelastic bodies proceed in contact with the velocity $\frac{Aa \pm Bb}{A + B}$. Perfectly elastic bodies separate after collision, and each sustains double of the change that is sustained by an unelastic body. Bodies of imperfect elasticity differ from the two simple cases, precisely in the proportion of the elasticity discoverable by other trials. The mutual actions are observed to be in the proportion of their relative motions, whatever the real motions may be. For not only are the changes of progressive motion exactly in this proportion, but the compressions and changes of figure, which we consider as the immediate occasions of those actions, are also observed to be in the same proportions, *in all cases that we can observe and measure with accuracy.* All these things can be ascertained with great precision by means of the collision of pendulous bodies in the way pointed out by Sir Christopher Wren (a method attributed by the French to their countryman Mariotte, but really invented by Wren, and exhibited to the Royal Society of London the week after he communicated his theory of impulsion).

48
The observed effects of collision are perfectly conformable to the propositions now established.

49
Extensive proof of the universality of equal action and reaction.

We must also infer from these facts, that the actions of bodies on each other are mutual, equal, and opposite. This is really an inference from the phenomena, and not an original or first principle of reasoning. The contrary is conceivable, and therefore not absurd. In the same way that we can conceive a magnet repelling iron, without imagining that the iron repels the magnet, we may conceive a golden ball capable of impelling a leaden ball before it, without conceiving that the leaden ball will impell the golden ball. We do not find this easy indeed; because the contrary is so familiar, that the one idea instantly brings the other along with it. We apprehend it to be impossible to demonstrate, that a leaden ball will not stop as soon as it hits the golden ball, or *vice versa*. But all our experience shews us, that the pressures exerted in contact are mutual, equal, and opposite. The same thing is observed in the forces which connect the parts of bodies. A quantity of sand or water balanced in a scale will remain in equilibrio in whatever way it is stirred about; its parts always exert the same pressure on the scale: so does a body suspended by a string or resting on the scale, by whatever points it is supported. This could not be if the particles did not exert mutual and equal forces; nor could the phenomena called impulsions be what they are, if the pressures occasioned between the particles by the compressions and dilatations were not mutual and equal. This law of action and reaction must be admitted as universal, though contingent, like gravity. Doubtless it results from the properties which it has pleased the great Artist to give to the matter of which He has formed this world. There is one way in which we can conceive, most distinctly, how this may be a universal property of matter. If we grant the reality of attractions and repulsions *e distanti*, and suppose that every primary atom of matter is precisely similar to every other atom in all its properties, and that this assemblage of properties constitutes it a material atom; it follows, that every atom exerts the same attractions and repulsions, or has the same uniting and evasive tendencies, and then the law of action and equal reaction follows of course. This is surely the very notion that any person is disposed to entertain of the matter. And if mechanical force and mobility are the qualities which distinguish what is material from mind or other immaterial substances, the law of equal and contrary reaction seems nearly allied to the class of first principles.

Of all the phenomena that indicate this perfect equality of action and reaction, the most susceptible of accurate examination is the sameness or equality of action when the relative motions are equal. Now there is no phenomenon more certain than this. In consequence of the rotation of the earth round its axis, and its revolution round the sun, it is plain that all our experiments and observations are on relative motions only. Now, we not only find that the actions of two bodies subjected to experiment are equal when the relative motions are equal, but we find that all our measures of action on a single body are proportional to the apparent motions which they produce. It requires precisely the same force to impel a ball eastward, westward, south, or north, at 12, or 3, or 6, or 9 o'clock: yet the real motions are immensely different in all these cases, and it is only the relative motions that have the proportions which we observe. Another very important point deducible from our experiments is, that the same *pressure* produces the same change of motion, whatever may be the velocity. We know this by observing, that when the mutual dimpling or compression is the same, the change of motion is the same, whatever be the hour of the day. This could not be if it required a greater pressure to change the velocity 100000 into 100001, than to change the velocity 1 into the velocity 2. Yet this is one of Leibnitz's great metaphysical arguments for proving that the force accumulated, and now inherent, in a moving body, is proportional to the square of its velocity. We beg that this may be kept in remembrance.

It must be granted, that what we have already said on the subject of impulsion may be called an *explanation*; for it deduces the phenomena from general and unquestionable principles, and from acknowledged laws of Nature. The only principle used is, that a moving force is indicated, characterised, and measured, by the motion which it produces. It is an acknowledged law of Nature, that pressures are moving forces; also, that moving forces appear in cases where we observe neither pressures nor impulsions, and which we call repulsions or evasive tendencies; that these are mutual and equal: and we have shewn, how a certain set of changes of motion result from them, and have stated distinctly the whole process: we shewed, that these phenomena are similar to those of common impulsion; and we then shewed in what manner the motion of a body *gives occasion* to the exertion of various moving forces, called *elasticity*, *cohesion*, &c. and that this exertion must produce motions similar to those produced by repulsions *e distanti*; and, lastly, we inferred, from the perfect sameness of those results with the actual phenomena of impulsion, that those corpuscular forces are the immediate and *only* causes of the changes called impulsions, and commonly ascribed to a *peculiar* force inherent in a moving body.

50
Why does the philosopher attempt to explain gravitation, &c. by impulsion?

From a collective view of the whole, we think it clear, that the opinion that impulsion is the sole cause of motion is unwarranted. We see that the phenomena of impulsion are brought about by the *immediate* operation of pressure; and we see numberless instances of pressure, in which we cannot find the ſmalleſt trace of impulſion. It is therefore a moſt violent and unwarranted opinion, which aſcribes to repeated unperceived impulſions all theſe ſolicitations to motion by which, or in conſequence of which, the motions of bodies are affected by diſtant bodies, or bear an evident relation to the ſituation and diſtance of other bodies; as in the examples of planetary deflection, terreſtrial gravitation, magnetical and electrical deflexions, and the like. There is nothing in the phenomenon of the preſſure of gravity that ſeems to make impulſion more neceſſary or more probable than in the preſſure of elaſticity, whether that of a ſpring or of an expanſive fluid. The admiſſion of an unperceived fluid to effect thoſe impulſions is quite unwarranted, and the explanation is therefore unphiloſophical, even although we ſhould perceive intuitively that an atom in motion will put another into motion by hitting it. We apprehend that this cannot be affirmed with any clear perception of its truth.

51 Impulſion is ſuppoſed to be better underſtood and more familiar.

On the whole, therefore, we muſt aſcribe that contented acquieſcence in the explanations of gravitation, and other attractions and repulſions, by means of impulſe (if the acquieſcence be not pretended), to the frequency and familiarity of impulſion, and perhaps to the perſonal ſhare and intereſt we have in this mode of producing motion. We know that it is always objected that nothing is explained, when we ſay that A repels B, or that B avoids A; but we muſt ſay in return, that nothing is explained, when we ſay that A impels B by hitting it, or that B flies away from the ſtroke. Why ſhould it not be allowed to uſe the term repelling power, when it is allowed to uſe the term impelling power, the force of impulſe, inertia? All theſe terms only expreſs phenomena. Does the word body expreſs any more?

52 It is not better underſtood.

The maxim, that a body cannot act *where* it is not, any more than *when* it is not, is a quaint and lively expreſſion, and therefore has conſiderable effect: It may be granted; for we apprehend that we underſtand ſo little about *when* and *where*, that we cannot demonſtrate the affirmative or negative in either caſe, and that they are on a par with reſpect to our knowledge of them. We can have no doubt, however, of the fact, that our mind can be affected by an external object that is merely recollected. And we apprehend, that we know nothing of the difference between body and mind but what we have learned by experience. Body, for any thing that we aſſuredly know to the contrary, may affect, or be affected by, a diſtant body, as well as mind may be. It is therefore worth while to pay ſome farther attention to the phenomena, in order to ſee whether this experience is ſo univerſal and unexcepted as is believed. As Mr Cotes, and many of Newton's diſciples, are accuſed of explaining many phenomena by attraction and repulſion which their opponents affirm to be caſes of impulſion; it is not impoſſible but that ordinary obſervers, who have no preconceived theories, may imagine impulſions to obtain in caſes where a more accurate inſpection would convince them that no impulſion has happened.

53 Enquiry into the familiarity of impulſion. Inſtances of a foot-ball.

When we kick away a foot-ball, we conſider it as a ſort of ſolid continuous body; yet we know that it muſt be filled with compreſſed air. It may not be impoſſible to have it of its round ſhape without being ſo filled: but we know that, in this condition, it would not fly away from our foot by the ſtroke; we ſhould only force in the ſide which we kick, and the flaccid ſkin would lie at our feet. But when it is filled with ſtrongly compreſſed air, we can form to ourſelves a pretty diſtinct notion how it is made to move off. Our foot preſſes on a part of the ſkin: this compreſſes the air againſt the anterior part of the bag, and forces it away. If we reflect more ſeriouſly on the proceſs, we can ſtill conceive it clearly enough, by thinking on a row of aereal particles, reaching from the part ſtruck by the foot to the anterior part, each touching the other, and therefore forcing the anterior part forward. The air is conceived to conſiſt of a number of little ſpherules in contact, each of which is compreſſible; and we think the operation illuſtrated by ſuppoſing each to be like a little veſicle or bladder. This we believe to be the uſual way of conceiving the conſtitution of expanſive fluids: But this will not agree at all with the known properties of air; for it can be ſtrictly demonſtrated, that if ſuch a collection of elaſtic veſicles be compreſſed into the half of their ordinary bulk, every veſicle will be changed from a ſphere into a perfect cube, touching the adjoining cubes in every point of its ſix ſides, and ſtrongly preſſed againſt them. It can alſo be demonſtrated, that if a leaden cube of one inch be included in the box, and placed with its ſides parallel to the ſides of the box, and the compreſſion be then made, all the little cubic veſicles will acquire the ſame poſition. If the box be now turned upſide-down, it can be demonſtrated that the weight of this leaden cube will not be ſufficient for overcoming the reſiſtance of the compreſſed cubes. This compreſſed maſs will not be fluid, but will require a very conſiderable force to preſs the leaden cube through it, juſt as we find ſuch a force neceſſary for moving a body through melted glaſs: the particles no longer ſlide on each other like uncompreſſed ſpherules; each will require about half of the compreſſing force, in order to overcome the friction, or obſtruction like friction, produced in ſliding along the ſurface of the contiguous cubes. But we know that air remains perfectly fluid, although vaſtly more compreſſed than this. This, therefore, cannot be like the conſtitution or form of air. Moreover, it is well known that air has been made ten times denſer than its ordinary ſtate, and is then perfectly fluid. It has alſo been made a hundred times rarer, and it ſtill remains perfectly fluid. In this ſtate its particles muſt be ten times farther removed from each other than in the former ſtate, of a thouſand times greater denſity. Yet we know that this rare air is compreſſed with a force equal to the weight of a ſtratum of mercury $\frac{1}{3}$d of an inch in thickneſs, and that if $\frac{1}{3}$d of this preſſure be removed, it will expand till it is 150 times rarer than common air; that is, there is ſome force which puſhes the particles ſtill farther from each other. This force evidently extends beyond the tenth particle of air that is made ten times denſer than common air. Therefore the elaſticity of air does not ariſe from the contact of particles, which are elaſtic like blown up bladders, but from ſome force which extends beyond the adjoining particles. There is no greater reaſon, therefore, for ſuppoſing, that the particles of air touch each other, than for ſuppoſing that the two magnets touch each other becauſe they repel. A row of magnets floating on quickſilver, and placed with their ſimilar poles fronting

ing each other, and very near, will tend to separate, and they require to be held in by a stop put at each end of the canal; and if one stop be gradually withdrawn, the magnets will all separate, and exhibit the general mechanical effects of a row of aereal particles separating by the removal of pressure. There seems, therefore, to be the same necessity for the operation of an intervening impelling fluid for producing this separation or elasticity of the aereal mass, as for separating the magnets.

Is very doubtful.

The result of these remarks seems to be, that the impulsion of a foot-ball is not brought about in the way that is commonly imagined, by the excitement of corporeal pressure at the points of contact of the two foot-balls. For we see it almost demonstrated, that the progressive motion of the anterior part of one of the balls has been produced without contact, or, at least, by the *intervention* of repulsions acting at a distance.—May not this obtain, even in the points in which we suppose the two balls actually to touch, in the act of impulsion?

54 Many cases of doubtful contact.

But farther—Every person has observed the brilliant dew drops lying on the leaves of plants. Every person acquainted with Newton's optical discoveries, must be convinced that the dew-drop is not in mathematical contact with the leaf; if it were, it could have no brilliancy. Most persons have observed the rain drops of a summer shower fall on the surface of water, and roll about for a few seconds, exhibiting the greatest brilliancy. They cannot, therefore, be in mathematical contact with the water. There must be a small distance between them, and therefore some force which keeps them asunder, and carries the weight, that is, counteracts the downward pressure of the rain drop. We know that some insects with long legs can run about on the surface of water; and if we lift them carefully, and set them on glass, their feet do not wet it. Put a little spirit of wine into this water, and make it lukewarm, and the insect instantly sinks up to the belly, and cannot move about as before: Its feet will now wet a glass. A well-polished steel needle, even of considerable size, if perfectly clean and dry, will float on water without being wetted: It is observed to make a considerable depression on the surface of the water, just as a heavy bar of iron would make when laid on a feather bed—the needle displaces a quantity of water equal to itself in weight, yet does not touch it, for it is not wetted. If it be previously wetted, it will not displace any water, and will not float. There is something, therefore, which keeps the water at a distance from the feet of the insect, and from the needle, exerting a certain upward pressure on them. The pressure and the reaction are indeed very small; but they would produce a very sensible motion if continued sufficiently long in proper circumstances. Here would be a production of motion, which most persons would call an impulsion—yet there would be no stroke, no contact, and therefore no true impulsion.

55 Very remarkable case of convex lenses falsely seeming to touch.

We now beg the reader to attend minutely to Newton's famous experiment with the object glasses of long telescopes, which we have mentioned circumstantially in the article OPTICS, *Encycl.* nº 63—68.

When the upper glass is very thin and light, no colour appears at the point of contact: but by pressing it down with sufficient force, we shall have a black or unreflecting spot in the middle, surrounded by a silvery ring, and then by a series of rings of various colours, according to the distance between the parts of the glasses where the colours appear. Newton has counted 50 of these rings. He shews, by a careful computation from the known figure of the glasses, that the differences between the distances which exhibit these colours are all precisely equal, and that each is about $\frac{1}{89000}$ of an inch. Therefore, supposing that the glasses are in mathematical contact where the unreflecting spot appears, making one continuous mass of glass, their distance at the outermost ring must not be less than $\frac{50}{89000}$ of an inch, or $\frac{1}{1780}$ of an inch. Therefore, when one glass carries the other, without any appearance of colour at the middle, we must conclude that there is a repulsion exerted between the nearest parts, at a distance not less than $\frac{1}{1780}$ of an inch, sufficient for supporting the upper glass. It requires an increase of pressure to produce the first appearance of colour; and when the pressure is still more increased, new colours appear in the middle, and the colour formerly there is now seen in a surrounding ring; these multiply continually, by new ones spreading from a central spot. A great pressure at last produces the unreflecting spot in the centre, which, unlike to all the coloured spots which had emerged in succession, is sharply defined, and never round, but ragged, and it is immediately surrounded by a bright silvery reflection. The shape of this spot depends on the figure of the surfaces; for, on turning the upper lens a little round its axis, the inequalities of the edge of the spot turn, in some degree, with it. This seemingly trifling remark will be found important by the mechanician: A still farther increase of pressure enlarges the unreflecting spot, and the dimensions of all the rings—When the pressure is gradually withdrawn, the rings shrink in their dimensions, the unreflecting spot disappears first, and each ring in succession contracts into a spot, and vanishes. Here we have, by the way, an explanation of the brilliancy of dew-drops: they come so near, perhaps, that the nearest point reflects the silvery appearance—but they do not touch; the instant that they touch a wetted part, making one mass of transparent matter, all brilliancy is gone.

56 They repel each other;

Here then are incontestible proofs of a force, be its origin what it may, which keeps the glasses asunder, and even causes them to separate; which manifests itself by withstanding pressure; and therefore is, itself, a pressure, or equivalent to a pressure—It varies in its intensity by a change of distance; but we have not been able to ascertain by what law. It must not be measured by the simple variation of the external pressure; for since we see that, even before any colour appears in the centre, the weight of the upper lens is supported, we must conclude that the glasses are exerting at least an equal force all around the circumference of the outermost ring. It is evident, that the computation of the whole force, exerted over all the coloured surface, must be difficult, even on the simplest hypothesis concerning the law of repulsion: we can only say that it increases by a diminution of distance. It is very easy to compute the increase of external pressure, which would suffice if the repelling force were equal at all distances; or if it varied according to any single power of the distances. We have tried the inverse simple,

 duplicate,

Impulsion. duplicate, and triplicate ratio; but the fact deviated widely from them all. The repulsion does not change nearly so much as in the simple inverse ratio of the distances, if the glasses be supposed to touch in the whole surface of the unreflecting spot. But we found, that if we suppose them separated, though at a distance equal to forty times the difference of distance at which the colours change, that is, $\frac{1}{11}\frac{1}{1}$ of an inch, the pressures employed in the experiment accord pretty well with a repulsion inversely as the distance, but still with a very considerable deviation in the great pressures. In the course of a number of experiments with a favourite pair of lenses, we broke the uppermost by too strong a pressure. We then cut out of it, with a lapidary's hollow drill, a piece of $\frac{1}{4}$ of an inch in diameter, and perfectly round, and we squeezed it on the other by a measured pressure, till we produced a colourless spot of nearly $\frac{1}{6}$th of an inch in diameter, with a silvery margin. Computing from this, we thought ourselves warranted to say, that not less than 800 pounds are necessary for producing a black spot of one inch square!

57 And may impel without touching.

Now, what is the consequence of all this in the doctrine of impulsion? Surely this:—If a lump of this glass strike another lump, and put it in motion, and if the mutual pressure in the act of collision do not exceed 700 pounds on the square inch, the motion has been produced without mathematical contact, and the production can no more be called impulse than the motion of the magnet in our first experiment. The changes of motion have been the operation of moving forces, similar to the force of magnetism; and if a stream of truly impelling fluid be necessary for producing the motion of the magnet, it is equally necessary for producing the motion of the piece of glass.

It may be said here, that we cannot compare impulse and pressure. A slight blow will split a diamond which could support a house. A slight blow may therefore be enough for exciting all the pressure necessary for producing mathematical contact. We must here appeal to what every man feels on this occasion. We doubt exceedingly whether any person will think that, when one piece of glass gives another a gentle blow, and puts it into motion, with the velocity of a few inches per second, a blow which he distinctly hears, there has been exerted a pressure at all approaching to 800 pounds per square inch.—We have suspended a pair of lenses, by an apparatus so steady and firm, that they could touch only at the centres of each surface; and, having placed ourselves properly, we could see, with sufficient distinctness, the momentary appearance of the coloured spot at the instant of collision. We saw this, with the fullest confidence that it was of no considerable breadth in a moderate stroke, and that it was very sensibly broader when the stroke was more violent. We did not trust our own eye alone, but shewed it to persons ignorant of philosophy, and even to children, often without telling them what to look for, but asking them what they saw. From all the information that we could gather, none of the pressures came near to what must have been necessary for producing the black spot. This could not be mistaken: for although the outer rings are but faint, there are five or six near the centre which are abundantly vivid for affecting the eye by the momentary flash. Besides, the dimensions of the lenses, and the weight of the metal cells in which they were fixed, were such as must have caused them to split before the black spot could be produced in the centre.

And certainly do so, even in violent strokes.

These things being maturely considered, we imagine that few persons will now doubt the justice of our assertion, that in all these examples, the motions have been produced without mathematical (or rather geometrical) contact.—And we imagine also, that few will refuse granting that this is not peculiar to glass, but obtains also in the collision of other bodies. We have not thought of any method for putting this beyond doubt; but we have better reasons than mere likelihood for being of this opinion. Every one acquainted with the Newtonian discoveries in optics, knows that this curious appearance of the coloured rings is the consequence of the action of transparent bodies on the rays of light, by which these are bent aside from their rectilineal course, and that this deflection takes place at a distance from the diaphanous body; a distance which the sagacity of the great philosopher has enabled us to measure. Now, it is known that metals and other opake bodies produce the very same deflections of the rays, bending them toward themselves at one distance, and from them at other distances; in short, attracting or repelling them as the distance varies. Nothing but prepossession can hinder a person from ascribing similar effects to similar causes; and, therefore, thinking it almost certain, that this mutual repulsion is not peculiar to glass, but common to all solid bodies.

To all this we may surely add the celebrated experiment of Mr Huyghens; in which it is evident, that a smooth plate of metal attracts another, even although there be a silk fibre interposed between them. (See Phil. Transf. n° 86). Is it not highly probable, that at a smaller distance the bodies repel each other? For we observe, that metals, as well as transparent bodies, attract the rays at one distance and repel them at another.

58 Impulsion is not so familiar as is believed.

Surely our readers will now grant, that the production of motion by impulsion, as distinguished from the production by action *e distanti*, is not so familiar a phenomenon as was imagined, and that it may even be said to be rare in comparison: for the instances of moderate impulses are numberless. The claim of this mode of explaining difficult phenomena by impulsion, has therefore lost much of its force: and we see much less reason for calling in the aid of invisible fluids, in order to *explain* the action of gravity, magnetism, and electricity.

59 Still greater doubts. Observations on a soap bubble.

But we have still more important information from the optical discovery of Newton. Let the reader turn again to Optics, *Encycl.* n° 65, and read the account of the phenomena exhibited by the soap-bubble. The bubble is thinner and thinner as we approach the very uppermost point of it. It also exhibits luminous rings, which vary in their colour, in the same order as in the space between the lenses. These rings come to view in the same manner. First, a coloured spot appears in the summit of the bubble; this becomes a ring, and is succeeded by another spot, as the bubble grows thinner in that part, by the gradual subsiding of the watery film. At last a black spot appears at top, well defined, but of irregular shape, surrounded by a silvery ring. This spot, when viewed very narrowly, is observed to reflect a very minute portion of light, without

Impulfion.

out *feparating* the differently colorific rays of which it confifts; but it *contains* them all, as may be proved by viewing it through a prifin. After fome little time, the bubble burfts.

Surely we muft infer from this, that there is a certain thicknefs of the tranfparent plate which renders it unfit for the vivid reflection of light. Does it not legitimately follow from this, that the unreflecting fpot between the lenfes ceafes to entitle us to fay, that they are in contact in that place? All that we can conclude from its appearance is, that the diftance ftill between the glaffes is too fmall to fit the place for the vivid reflexion of light. This conclufion is indifputable. Were it refufed, we are furnifhed with an inconteftible proof by the fame bountiful hand. Newton afcribed the colours to the reflection of the plate of air between the glaffes, and expected the ceffation of them when the air is removed. His friend Mr Boyle had lately invented a commodious air pump. The trial was made, and young Newton found himfelf miftaken; for the colours ftill appeared, and he even thought them more brilliant. He then tried the effect of water, expecting that this would diminifh their luftre. So it did; and he found that the dimenfions of the rings were diminifhed in the proportion of 4 to 3; namely, the proportion of the refractions of glafs and water. By this time Newton had difcovered the curious mechanical relation between bodies and the rays of light; and his mind was wholly abforbed by the difcovery, and by the revolution he was about to make in the mathematical doctrines of optics. Unfortunately for us, he did not, at that time, attend to the mighty influence which the difcovery would have on the whole of mechanical philofophy, and therefore occupied himfelf only with fuch phenomena as fuited his prefent purpofe. A moft important phenomenon paffed unnoticed. In repeating Sir Ifaac Newton's experiments, we found that the diameters of the rings decreafed in the proportion of 4 to 3 only in certain circumftances. When the upper lenfe was preffed on the other by a heavy metal ring, fo as to produce three or four coloured rings, we found, that when water got between them, fometimes no colours whatever appeared; fometimes there was a ring or two, and the diameters were diminifhed in a much greater proportion than Newton had affigned. Well affured of the extreme nicety of all his proceedings, we were much puzzled with this difcrepancy, and mentioned it to a moft refpectable and intelligent friend, the late Dr Reid of the univerfity of Glafgow, a mathematician and naturalift of the firft rank. He thought it not improbable that the glaffes feparated from each other, lifting up the weight, by attracting the water into the interftice, in the fame manner that we obferve wood to fwell with moifture. We immediately got an apparatus which compreffed the glaffes by means of four fcrews; and now we faw Newton's proportion moft ftrictly obferved. But in profecuting the experiment, we found that the introduction of the water *always* effaced a very fmall fpot. This happened after precautions had been taken to prevent all feparation of the glaffes. As the proportion of 4 to 3 has a relation to refractive power, although we have not been able to deduce it as a neceffary confequence, we neverthelefs confidered it as a fufficient proof, that the diftance of the glaffes *had not changed* by introducing the water between them. Therefore we think ourfelves well entitled to conclude, that the difappearance of the black fpot was not owing to a feparation of the glaffes, which admits the water into the empty fpace; and we affirm, that before the entry of the water, there was room for it in the place which reflected no light; that is, that although the glaffes were preffed together with a very great force, they were not in contact.

Remark.

It deferves remark, that in endeavouring to produce the black fpot, when water is between the glaffes, we found great and unaccountable anomalies. Sometimes a moderate increafe of preffure produced it, and fometimes we were not able to produce it by any preffure. Several lenfes were broken in the trial. We are led to think that the thicknefs which gives the filvery reflection is much greater than the 8900th part of an inch, and that it is not the fame in all glaffes. But we were interrupted in thefe experiments, and indeed in all active purfuits, by bad health, which has never permitted their renewal. The fubject is of great importance to the curious mechanicians, and we earneftly recommend it to their attention. There is fomething very remarkable in the abrupt ceffation of the coloured reflection. At a certain thicknefs *all* colours are reflected, without feparation, producing the whitenefs of filver. The fmalleft diminution of it hinders the *vivid* reflection of *all* colours, and then there feems to fucceed a thicknefs which equally reflects a fmall proportion of *all* without feparation. The fineft polifh that can be given to glafs in the tool of the artift, leaves irregularities which occafion the irregular ragged figure of the fpot. It is worth trying, whether fmoothing the furfaces (both) by a foftening heat will remove this ruggednefs. If it does, without deftroying the fharp termination, it will prove the abrupt paffage from *effe* to *noneffe*.

The laft remark to be made on this important experiment in optics is, that the diftance between the glaffes which is unfit for vivid reflection, cannot be determined by means of the other meafurable intervals. It may be equal to many of them taken together. The fame muft be granted with refpect to the thicknefs of the black fpot on the top of the foap bubble. We attempted to meafure this thicknefs by letting a drop (of a known weight) of fpirit of turpentine fpread on the furface of water. As it flowly enlarged in furface, it decreafed in thicknefs, and produced, in regular order, feveral of the more compounded colours of the Newtonian feries. But before it came to the 20th ring from the centre, it became very irregular and fpotty.

60
Contact is not proved in collifion.

The inference to be drawn from this combination of the two optical facts is remarkable and important. It is, that we have no authority for affirming that the changes of motion by the collifion of bodies is brought about by abfolute contact in any inftance whatever. The glaffes are not in contact where there is vivid reflection: and we have no proof that they are in contact in the black fpot, however great the compreffion may be.

61
Therefore impulfion cannot explain gravitation;

It is hardly neceffary now to fay, that all attempts to explain gravitation, or magnetifm, or electricity, or any fuch apparent action at a diftance by the impulfions of an unfeen fluid, are futile in the greateft degree. Impulfion, by abfolute contact, is fo far from being a familiar phenomenon, that it may juftly be queftioned whether we have ever obferved a fingle inftance of it. The

Impulsion.

The supposition of an invisible impelling fluid is not more gratuitous than it is useless; because we have no proof that a particle of this fluid does or can come into contact with the body which we suppose impelled by it, and therefore it can give no explanation of an action that is apparently *e distanti*.

62
But impulsion may be explained by continued pressure.

The general inference from the whole seems to be, that, instead of explaining pressure by impulse, we must not only derive all impulse from pressure, but must also ascribe all pressure to action from a distance; that is, to properties of matter by which its particles are moved without geometrical contact.

This collection of facts conspires, with many appearances of fluid and solid bodies, to prove that even the particles of solid, or sensibly continuous bodies, are not in contact, but are held in their respective situations by the balance of forces which we are accustomed to call attractions and repulsions. The fluidity of water under very strong compressions (which have been known to compress it $\frac{1}{78}$ of its bulk), is as inconsistent with the supposition of contact as the fluidity of air is. The shrinking of a body in all its dimensions by cold, nay, even the bending of any body, cannot be conceived without allowing that *some* of its ultimate unalterable atoms change their distances from each other. The phenomena of capillary attraction are also inexplicable, without admitting that particles act on others at a distance from them. The formation of water into drops, the coalescence of oil under water into spherical drops, or into circular spots when on the surface, shew the same thing, and are inexplicable by mere adhesion. In short, all the appearances and mutual actions of tangible matter concur in shewing, that the atoms of matter are endowed with inherent forces, which cause them to approach or to avoid each other. The opinion of Boscovich seems to be well founded; namely, that at all sensible distances, the atoms of matter tend toward each other with forces inversely as the squares of the distances, and that, in the nearest approach, they avoid each other with *insuperable* force; and, in the intermediate distances, they approach or avoid each other with forces varying and alternating by every change of distance. See the article BOSCOVICH, *Suppl.*

63
Physical contact explained.

FROM all that has been said, we learn that physical or sensible contact differs from geometrical contact, in the same manner as physical solidity differs from that of the mathematician. Euclid speaks of cones and cylinders standing on the same base, and between the same parallels. These are not material solids, one of which would press the other out of its place. Physical contact is indicated, immediately and directly, by our sense of touch; that is, by exciting a pressure on our organ of touch when it is brought sufficiently near. It is also indicated by impulsion; which is the immediate effect of the pressure occasioned by a sufficient approximation of the body impelling to the body impelled. The impulsion is the completion of the same process that we described in the example of the magnets; but the extent of space and of time in which it is completed is so small that it escapes our observation, and we imagine it to be by contact and in an instant. We now see that it is similar to all other operations of accelerating or retarding forces, and that no change of velocity is instantaneous; but, as a body, in passing from one point of space to another, passes through the intermediate space; so, in changing from one velocity to another, it passes through all the intermediate degrees without the smallest *saltus*.

We thus avoid many absurdities.

And, in this way, is the whole doctrine of impulsion brought within the pale of dynamics, without the admission of any new principle of motion. It is merely the application of the general doctrines of dynamics to cases where every accelerating or retarding force is opposed by another that is equal and contrary. We have found, that the opinion, that there is inherent in a moving body a peculiar force, by which it perseveres in motion, and puts another in motion by shifting into it, is as useless as it is inconsistent with our notions of motion and of moving forces. The impelled body is moved by the insuperable repulsion exerted by all atoms of matter when brought sufficiently near. The retardation of the impelling body does not arise from an *inertia*, or resisting sluggishness of the body impelled, but because this body also repels any thing that is brought sufficiently near to it. We can have no doubt of the existence of such causes of motion. Springs, expansive fluids, cohering fibres, exhibit such active powers, without our being able to give them any other origin than the FIAT of the Almighty, or to comprehend, in any manner whatever, how they reside in the material atom. But if once we admit their existence and agency, every thing else is deduced in the most simple manner imaginable, without involving us in any thing incomprehensible, or having any consequence that is inconsistent with the appearances. Whereas both of these obstructions to knowledge come in our way, when we suppose any thing analogous to force inherent in a moving body solely because it is in motion. It forces us to use the unmeaning language of force and motion passing out of one body into another; and to speak of force and velocity as things capable of division and actual separation into parts. The force of inertia is one of the bitter fruits of this misconception of things. It is amusing to see how metaphysicians of eminence, such as D'Alembert, endeavour to make its operations tally with acknowledged principles. In his celebrated work on dynamics, the most elaborate of all his performances, he explains how a body, whose mass is 1, moving with the velocity 2, must stop another body whose mass is 2, moving with the velocity 1, in the following manner: He supposes the velocity 2 to consist of two parts, and that, in the instant of collision, one of these parts destroys the motion of one half of the other body, and then the other part destroys the motion of the other half. These are words; but in vain shall we attempt to accompany them by clear conceptions. His distinction between the force of inertia and what he calls the active forces of bodies, such as the force of bodies which strike each other in opposite directions, is equally unsusceptible of clear conceptions. Active forces (says he) absorb a part of the motion; but when inertia takes part of the motion from the striking body, this motion passes wholly into the body that is stricken, none of it being absorbed or really destroyed. He demonstrates this by the equation $A \times \overline{a-x} = B \times \overline{x-b}$, which is a mere narration of facts, but no deduction from the nature of inertia, nor even any establishment of that nature by philosophical argument. And in attempting to give still clearer notions (being sensible that some

great

great obscurity still hangs about it), he says, "Inertia therefore, and properly speaking, is the mean of communicating motion from one body to another. Every body resists motion; and it is by resisting that it receives it; and it receives precisely as much as it destroys in the body which acts on it." Surely almost every word of this sentence is doing violence to the common use of language. What can be more incomprehensible than that a body resists motion only when it receives it! Should a man be thought to resist being pushed out of his place when he actually allows another to displace him, and not to resist when he firmly keeps his place? All these difficulties and puzzling questions vanish when we give over speaking of inertia as something distinguishable from the active forces or causes of motion which we find in bodies, and distinguish by the names of elasticity, cohesion, magnetism, electricity, weight, &c. and which philosophers have classed under one name, accelerating or retarding force, according as its direction chances to be the same, or the opposite to that of the motion under consideration. To suppose it a *peculiar* faculty by which a body maintains its condition of motion or rest, is contrary to every conception that we can annex to the words faculty, power, force. It is frivolous in the extreme to say, that snow has the faculty of continuing white or cold; or that it resists being melted because it melts, or because heat must be employed to melt it.

64
Strongest argument for inertia is the composition of force with a previous motion.

The only argument that we know for giving the name force to the perseverance of matter in its state of motion (or rather for ascribing this perseverance to the exertion of a peculiar faculty), which appears to deserve any attention, is one that we do not recollect the express employment of for this purpose, namely, the composition of a previous motion with the motion which a known force would produce in the body at rest. We know, that if a body be moving eastward at the rate of four feet per second, and a force act on it which would impel it from a state of rest at the rate of three feet per second to the south, the body will move at the rate of five feet per second in the direction E. 36° 52′ S. We know also, that if a force act on this body at rest, so as to give it a motion eastward at the rate of four feet per second, and if another force act on it at the same instant, so as to give it a motion to the south at the rate of three feet per second, the body will move at the rate of five feet per second in the direction E. 36° 52′ S. In this instance, the body previously in motion seems to possess something equivalent to what is allowed to be a moving force. Why therefore refuse it the name? The answer is easy. The term force has been applied, by all parties, to whatever produces a *change* of motion, and is measured by the *change* which accompanies its exertion. There is some difference between the parties about the way of estimating this measure; but all agree in making, not the motion, but the change of motion, the basis of the measurement. Now we

Answered.

shewed, at great length, in the article Dynamics, that the *change* of motion, in every case, is that motion which, when compounded with the former motion, constitutes the new motion. Did we take the new motion itself as the characteristic and measure of the changing force, it would be different in every different previous state of the body, and would neither agree with our general notion of force, nor with the knowledge that we have of the actual pressures and other moving forces that we know. The sole reason why the previous motion is equivalent with a force is, that the only mark or knowledge that we have of a moving force is the motion which it is conceived to produce. The force is equivalent with the previous motion, because we know nothing of it but that motion; and the name that we give it, only marks some external thing to which it has an observed relation. We call it magnetism or electricity, because we observe that a magnet or an electrified body gives *occasion* to its appearance. We never observe the resistance of *inertia*, except in cases where we know, from other circumstances, that moving forces inherent in bodies are really brought into action. The inertia of the ball which has been moved by a stroke of another, is inferred from the diminution of that other's motion. But this is occasioned precisely in the same way as the diminution of the motion of the magnet A in the first example; an event which every unprepossessed person ascribes to the repulsion of B in the opposite direction, and not to its inertia.

We trust that our readers are not displeased with this detail of the procedure of Nature in the phenomena of impulsion. It has been prolix; because we apprehend, that the too synoptical manner in which the laws of collision have always been delivered, leaves the mind in great obscurity concerning the connection of the events. General facts have been taken for philosophical principles and elementary truths; whereas they were deductions from the sum total of our knowledge. They were very proper logical principles for a synthetical discussion; but their previous establishment as general facts was necessary. We have established the two most general facts from which the result of every collision may be deduced with the utmost ease. The first is, that in the instant of greatest compression, the common velocity is $= \frac{A\,a \pm B\,b}{A + B}$; and we have shewn, that this is applicable to the collision of unelastic bodies. The second is, that the change in perfectly elastic bodies is double of the change in unelastic bodies. The *conservatio momentorum*, and the *conservatio virium vivarum*, are also general facts; or rather they are the same mentioned with those above, considered in another aspect. They may all be used as the principles of a synthetic treatise of impulsion; and they have been so employed. Each has its own advantages.

Mr Maupertuis gives a treatise on the Communication of Motion, that is, of impulsion or collision, which has the appearance of being deduced from a new principle, which he calls the principle of smallest action. He supposes, that perfect wisdom will accomplish every thing by the smallest expenditure of action; and he chanced to observe, in the equations employed in the common doctrine of impulsion, a quantity which is always a minimum. He chooses to consider this as the expression of the action. 65

65
Principle of least action.

His principle or axiom, deduced from the perfect wisdom of God, is thus expressed: "When any change happens in nature, the quantity of action necessary for it is the smallest possible." And then he adds,

"In mechanical changes, the quantity of action is the product of the quantity of matter in the body by the space passed over, and by the velocity of the motion." This is evidently the measure adopted long before by

Leibnitz

Impulsion.

Leibnitz (see *Phil. Transf.* vol. xliii. p. 423, &c.), and it is equivalent to $m v^2$; because the space multiplied by the velocity is as the square of either. We refer to Dr Jurin's remarks on this passage for proof that this is by no means a just measure of action; and only observe here, that we can form no other notion of velocity than that of a certain space described in a given time. The change produced is not the actual description of a line, but the determination to that motion. It is in this respect alone that the condition of the body is changed; and therefore the product $m v$, and not $m s v$, is the proper measure of the action. On the authority of this maxim of divine conduct, Maupertuis investigates the results which will make this quantity a minimum, and asserts that these *must* be the laws of collision. Luckily this investigation is extremely simple, and very neat and perspicuous; and it gives very easy solutions. For example, the unelastic body A, moving with the velocity a, overtakes the unelastic body B, moving with the velocity b. Both move after the collision with the velocity x. This velocity is required. To determine this, we must make $A \times \overline{a-x}|^2 + B \times \overline{x-b}|^2$ a minimum: or $A a^2 - 2 A a x + A x^2 + B x^2 - 2 B b x + B b^2$ is a minimum. Therefore $-2 A a \dot{x} + 2 A x \dot{x} + 2 B x \dot{x} - 2 B b \dot{x} = 0$, or $2 A a + 2 B b = 2 A x + 2 B x$, and $x = \frac{A a + B b}{A + B}$; as we have already shewn it to be.

The amiable and worthy author grew more fond of his theory, when he saw what he imagined to be its influence extended to an immense variety of the operations of nature. Euler demonstrated, that the quantity called *action* by Maupertuis was a minimum in the planetary motions, and indeed in all curvilineal motions in free space. But all the while, this principle of least action is a mere whim, and the formula which is so generally found a minimum has no perceptible connection with the quantity of action. In many cases to which Maupertuis has applied it, the conclusions are in direct opposition to any notion that we can form of the economy of action. Nay, it is very disputable whether it does not, on the contrary, express the greatest want of economy; namely, a minimum of effect from a given expenditure of power. In the case of impulsion, this minimum is the mathematical result of the equality and opposition of action and reaction. Maupertuis might have pleased his fancy by saying, that it became the infinite wisdom of God to make every primary atom of matter alike; and this would have answered all his purpose.

66 Enquiry into the distribution of impulse from the point that is struck.

There still remains to be considered a very material circumstance in the doctrine of impulsion, which produces certain modifications of the motions that are of mighty practical importance. We have contented ourselves with merely stating the moving force that is brought into action in the points of physical contact; but have not explained how this produces the progressive motion of every particle of the impelled body, and what motion it really does produce in the remote particles. A body, besides the general progressive motion which it receives from the blow, is commonly observed to acquire also a motion of rotation, by which it whirls round an axis. It has not been shewn, that when a body has received an impulse by a blow in a particular direction on one point, it will proceed in that direction, or in what direction it will proceed. Experience shews us, that this depends on circumstances not yet considered. The billiard player knows, that by a stroke in one direction he can make his antagonist's ball move in a direction extremely different.

These are questions of great intricacy and difficulty, and would employ volumes to treat them properly. We have already enlarged this article till we fear that we have exhausted the reader's patience, and deviated from the proportion of room justly allowable to IMPULSION. We must therefore limit our attention to such things only as seem elementary, and indispensably necessary for a useful application of the doctrine of impulsion.

With respect to the *direction* of the motion produced by impulsion, the very example just now borrowed from billiard playing, shews that it is important, and by no means obvious. We are sorry to say, that we have nothing to offer in solution of this question that will be received by all as demonstration. It is comprehended in the following proposition, which we bring forward merely as a matter of fact.

67 Action of bodies by contact is perpendicular to the touching surface.

The direction of the stroke or pressure exerted by two bodies in physical contact, is always perpendicular to the touching surfaces. Of this truth we have a very distinct and pretty example and proof by the billiard table. If two balls A and B (fig. 2.) are laid on the table in contact, and A is smartly struck by a third ball C in any direction C c, so that the line a A, which joins the point of contact a with the centre A, may make an obtuse angle with the line A B, joining the centres of the two balls, the ball B will always fly off in the direction ABF. The pressure on B, which produces the impulsion, is evidently exerted at the point b of contact, and the direction BF is perpendicular to the plane G b H, touching both balls in the point b. The primary stroke is at a, and acts in the direction a A, although C moved in the direction C c. Had A been alone, it would have gone off in the direction a A produced. But the force acting in the direction a A is equivalent to the two forces $a d$ and d A, of which d A presses the ball on B at b, and produces the motion. In like manner, another ball E, so laid that b B e is obtuse, will fly off in the direction ED, which may even be opposite to C c. These are matters of fact; not indeed precisely so, because billiard balls are not perfectly elastic, restoring their figure with a promptitude equal to that of their compression; and also because there is a little friction, by which the point a of the ball A is dragged a little in the direction of C's motion. This may both give a twirl to A, and diminish its pressure on B. The general result, however, is abundantly agreeable to the doctrines now delivered. But we wish to shew on what properties of tangible matter this depends; and although we dare not hope for implicit belief, we expect some credit in what we shall offer.

Demonstration.

We have evident proof, that at a distance which is not unmeasurable by its minuteness, and certainly far exceeds the 900th part of an inch, bodies repel each other with very great force. This distance also far exceeds the distance between the particles, if these are discrete. Let $m n$ (fig. 3.) be the distance at which a particle repels another, and let P be a particle situated at at a lefs diftance than mn from the furface AC of a folid body. With a radius PA, equal to mn, defcribe a fegment of a fphere ABC, and draw PB perpendicular to AC. It is plain, that every particle of matter in the fegment ABC repels the particle P, and that it is not affected by any more. Let D be any fuch particle. It repels P in the direction DP. But there is another particle d fimilarly fituated on the other fide of PB. This will repel P with equal force in the direction dP. Therefore the two particles D and d will produce a joint repulfion in the direction BP. The like may be faid of every particle and its correfponding one on the other fide of PB. Therefore the joint repulfion of all the matter in the fegment will have the direction BP. It is plain, that the radius of curvature of every fenfible figure may be confidered as immenfely great in comparifon of mn; and therefore the propofition is manifeft.

This is a propofition of very great importance to the artift and the engineer, as well as to the philofopher. In all the connections of engines and machines, the mutual action is regulated by this fact. The mutual preffure at the contacts of the teeth of wheels and pinions depend fo much on it, that it is eafy to make them of fuch a fhape that they fhall produce no force whatever that is of any fervice; and it requires a fkilled attention to their forms to obtain the fervice we want. This will be confidered with fome care in the article MACHINE.

Having thus difcovered the *direction* of the real impulfion, and that it may be very different from that of the force exerted, we proceed to confider what will be the direction and velocity of the motion, and whether it will be accompanied with any rotation.

68
A ftroke, whofe action paffes through the centre of a pofition of folid body, impels it without rotation.

Our readers are acquainted with the elementary mechanical property of the centre of gravity. If a body be fupported at this point by a force acting vertically upwards, and equal to the united weight of every particle of matter in it, it will not only remain at reft, but will have no tendency to incline to either fide; that is, the upward force balances the weight of the whole body, and the mechanical momenta of all the heavy particles balance each other, like the weights in the fcales of a fteelyard. That this may be the cafe, we know that if the weight of every particle be multiplied into the horizontal lever by which it hangs (which is a line drawn from the particle perpendicular to a vertical plane paffing through the centre of gravity), the fum of all the products on one fide muft be equal to the fum of all the products on the other fide. Therefore, if we fuppofe the particles all equal, and reprefent each by unity, the fums of all the perpendiculars themfelves muft be equal. How is this balancing effected? Every particle tends downwards with a certain force. It muft therefore be kept up by a force *precifely* equal and oppofite. This muft be propagated to the particle by means of the connecting corpufcular forces. The force propagated to any particle is equal and oppofite to the force acting on that particle, which it balanced; and if not balanced, it would produce a motion equal and oppofite to that produced by the other force. Gravity would caufe every particle to defcend equally; therefore the force which, by acting on one point, excites thofe balancing forces on each particle, would caufe them to move equally upwards. And fince this is true in *any* attitude of the body, it follows, that a force, acting in *any* direction through the centre of gravity, will caufe all the particles to move in that direction equally; that is, without rotation.

Hence we learn, that when the direction of the ftroke given to any body paffes through the centre of gravity, the body will move in that direction without any rotation. If the quantity of matter, or number of equal particles in the body, be m, the moving power P will imprefs on each particle an accelerating force f, equal to the mth part of P. Therefore $f = \frac{P}{m}$, and $P = mf$. An accelerating force is eftimated by the velocity v, which it generates by acting uniformly during fome time t, or $v = ft$, and $f = \frac{v}{t}$, and $P = m\frac{v}{t}$, and $v = \frac{P}{m}t$. The fymbol t may be omitted, if we reckon every force by the velocity which it can produce in a fecond. Thus may all forces be compared with gravity, by taking 32 feet for the meafure of gravity. Then mv will exprefs the number of pounds which give a preffure equal to the force under confideration. Thus if the force can generate the velocity 48 feet per fecond in 100 pounds of matter, by acting on it uniformly during a fecond, its preffure is equal to the weight of 150 pounds.

This is direct impulfion.

When a body A, moving with the velocity a, overtakes or meets a body B, moving with the velocity b, and the line perpendicular to their touching furfaces paffes through the centres of both in the direction of their motion, all the circumftances of the collifion are determined by the rules already laid down. This is called DIRECT IMPULSE; and it is this which admits the application of the fimple doctrines of impulfion, deduced, as we have done it, from the action of accelerating forces. All that was faid of the changes of motion produced in the magnets obtain here without any farther modification.

We may juft be allowed to take notice of a curious obfervation of Mr Huyghens on the collifion of perfectly elaftic bodies. Inftead of impelling the elaftic ball C by the ftroke of the elaftic ball A, we may caufe A to ftrike an intermediate ball B (alfo perfectly elaftic), which is lying in contact with C. In many cafes, the ball B will not ftir fenfibly from its place, and C alone will fly off. Nay, if a long row of equal billiard balls lie in contact, and one of the extreme balls be hit by another ball in the direction of the row, only the remote ball of the row will fly off. All this is eafily feen and underftood, by confidering them as bodies mutually repelling, and placed at the limits of their mutual action. Or even fuppofing them elaftic balls, at a very fmall diftance from each other: The ball employed to ftrike the firft comes to reft, and the ftricken ball moves off with its velocity: It ftrikes the fecond ball of the row, and is brought to reft: The fecond ftrikes the third, and is brought to reft: And this goes on in fucceffion to the laft, which is the only one that can fly off. The curious obfervation of Mr Huyghens is, that a greater velocity will be communicated by a large ball to a fmall one, if we employ the intermediation of another ball of a fize between the two; and that the velocity will be the greateft poffible when the interme-

 diate

Impulsion. diate ball is a mean proportional (geometrical) between the two. This is also easily deduced from the similar attention to the action of the accelerating forces, or from the supposition of successive impulses. From this it also follows, that a greater velocity will be produced by the intervention of two, three, or more, mean proportionals.

69 Oblique Impulsion. But the direction of the stroke may not be the same with that of the motion. This is called OBLIQUE IMPULSE. The cases of oblique collisions are extremely different, according to the directions of the motions; and the results are, in many of them, far from being obvious. But we have not room for a particular treatment of them. We shall therefore avail ourselves of some of the general facts mentioned above, by means of which we may reduce all the varieties to some easy cases. The most serviceable general facts are: 1. That the actions of bodies on each other depend on their relative motions; and, 2. That the motion of the common centre is not changed by the collision. These enable us to reduce all to the case of a body in motion striking another at rest. We have only to determine their relative motion by the proposition in DYNAMICS, n° 67. and then to superadd the common motion, which changes the relative into the true motions. Thus, if two bodies A and B (fig. 4.) meet in D, describing the lines AD, BD, the collision is the same as if B had remained at rest, and A had come against it with the motion AB. In the mean time, the common centre of position has described CD. If the bodies are unelastic, they remain united, and proceed in the line CD produced toward E, and their common velocity will be represented by DE equal to CD, if AD and BD represented their initial velocities. If the bodies are elastic, they separate again, and they separate from the common centre in the opposite direction, and with the same velocities with which they approached it. Therefore draw *a* E*b* parallel to ACB, and make E *a*, E *b* equal to CA and CB, and then D *a* and D *b* are the paths and velocities of the bodies. All this is abundantly plain, and is a necessary deduction from the general principle, that the motion of the centre is not affected by any equal and opposite forces which connect the bodies of a system.

70 Often accompanied by rotation. But this great simplicity is not sufficient for ascertaining the results of collision which occur in many of the most important cases. It not only supposes that AD and ED are exactly proportional to the velocities of A and B, but also that they meet, so that the plane of mutual contact is perpendicular to the line AB, and that the stroke on each is directed to its centre. These circumstances will not always be combined, even in the case of spherical bodies. The consequence will be, that although the motion of the centre remains the same, that of the bodies may sometimes be different. We must therefore give a general proposition, which will, with a little trouble, enable the reader to determine all the motions which can take place, whether progressive or rotative.

71 General theorem. Let the body A (fig. 5.), moving with the velocity V, in the direction AD, strike the body B at rest. Let F be the point of mutual contact, and *b* FH a plane touching both bodies in F. Draw AFP perpendicular to this tangent plane, and through G, the centre of position of B, draw PGC perpendicular to FP, and GI parallel to FP. Let C, in the line PG, be the spontaneous centre of conversion (ROTATION, *Encycl.* n° 77, &c.), corresponding to the point of percussion F. Join CF. Let the direction cut the tangent plane in H, and PF in A; and let AH represent the velocity V.

The impulse is made at the point F, in the direction AF or FP, and the centre of position of the body B will advance in the direction GI parallel to FP, the direction of the effective impulse. But, because this does not pass through the centre G, the body will advance, and will also turn round an axis passing through G, perpendicular to the plane of the lines GP, PF, and the spontaneous axis of conversion will pass through some point C of the line PG, and will also be perpendicular to the same plane. All this has been demonstrated in the article ROTATION, n° 94, &c. Complete the parallelogram AFHE. It is plain, that the motion AH is equivalent to AE and AF. By the motion AE, A only slides along the surface of B, without pressing it, or causing any tendency to motion in that direction, except perhaps a little arising from friction. It is by the motion AF alone that the impulse is made.

Therefore let v be $= V \times \frac{AF}{AH}$; and then $A \times v$ may be called the *efficient impulse* of the body A in the present circumstances, and v the *efficient velocity*. This will be diminished by the collision. Let x be the unknown velocity remaining in A after the collision, or rather in the instant of the greatest compression and common motion of the touching points of A and B, estimated in the direction FP. The effective momentum lost by A must therefore be $A \times \overline{v-x}$: but the same must be gained by B, and its centre G must move in the direction GI, parallel to FP, with this momentum; and therefore with the velocity $\frac{A \times \overline{v-x}}{B}$. That this may be the case, the point of percussion F must yield with the velocity x, because the bodies are in contact. But because C is the spontaneous axis of conversion, every particle is *beginning* to describe an arch of a circle round this axis. Therefore F is beginning to move in the direction F*g*, perpendicular to the momentary radius vector CF. Let F*g* be a very minute arch, described in a moment of time. Draw *gf* perpendicular to FP. Then F*f* is the motion F*g* reduced to the direction FP, and will express the yielding of B in the direction of the impulse, while G describes a space equal to $\frac{A \times \overline{v-x}}{B}$, and A describes a space x. Therefore F*g* will express x. Let P*p* be the space described in the same time that F*g* is described. Draw *p*C, cutting GK in the point I. GI is the yielding of the body B to the impulse, and must therefore be equal to $\frac{A \times \overline{v-x}}{B}$.

72 Efficient velocity.

The triangles F*fg* and CPF are similar; for the angle CFP is the complement of *f*F*g* to a right angle: It is also the complement of PCF to a right angle. Therefore F*g* : F*f* = FC : CP. But F*g* : P*p* = FC : CP; because the little arches F*g*, P*p* have the same angle at C. Therefore P*p* = F*f*, = x. It is plain, that CG : CP = GI : P*p*. Therefore CG : CP =

Fig. 1.

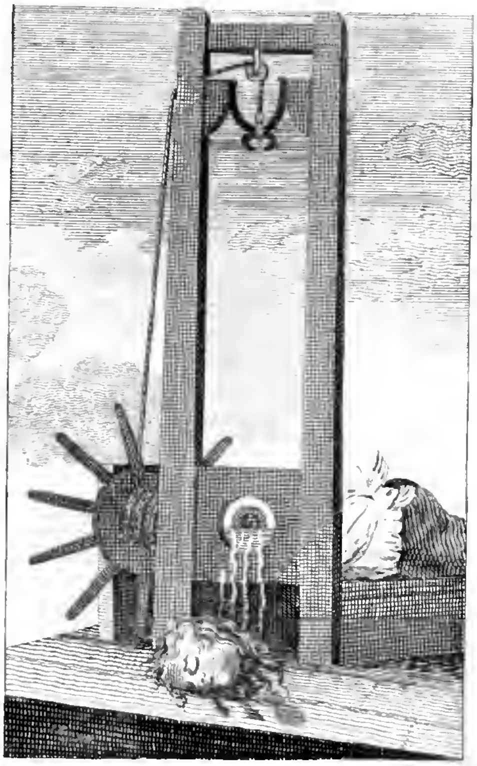
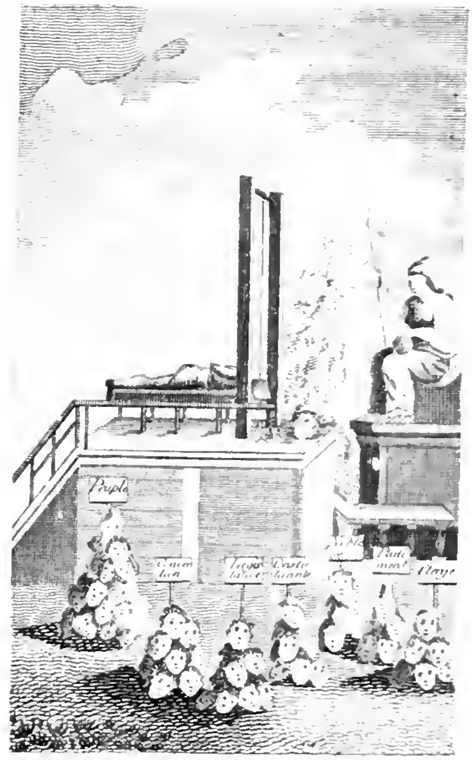


Fig. 2.



IMPULSION

Fig. 1.

Fig. 2.

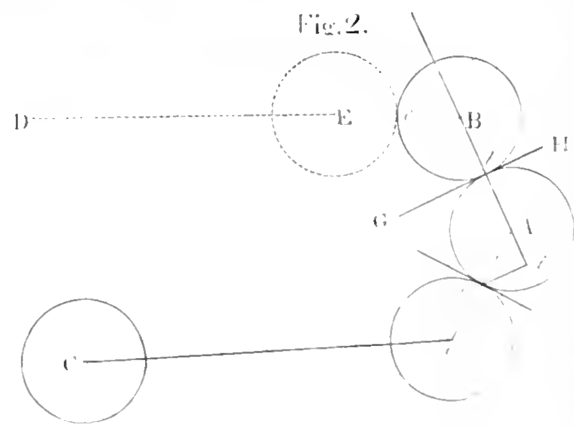


Fig. 3.

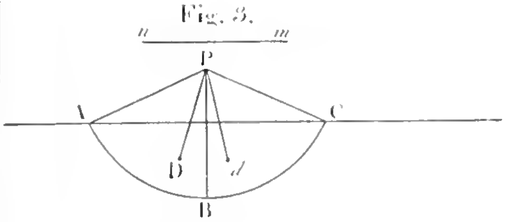


Fig. 5.

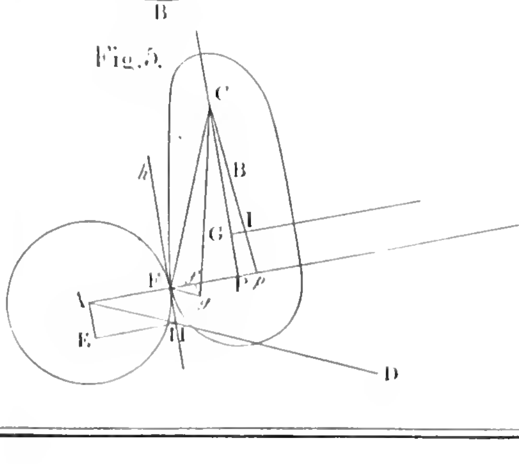
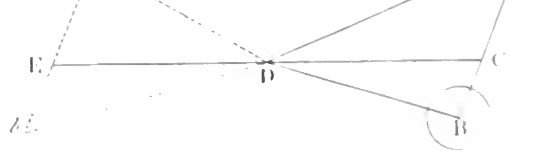


Fig. 4.



Impulsion.

$= \frac{A\times\overline{v-x}}{B} : x$, and $x = \frac{A\times\overline{v-x}\times CP}{B\times CG}$, or $x = v\times\frac{A\times CP}{B\times CG} - x\times\frac{A\times CP}{B\times CG}$; wherefore $x \times B\times CG + x\times A\times CP = v\times A\times CP$, and $x\times\overline{B\times CG + A\times CP} = v\times A\times CP$, and $x = v\times\frac{A\times CP}{B\times CG + A\times CP}$, = the velocity remaining in A, estimated in the direction FP.

73 Unelastic bodies may separate.

And u, the velocity with which G will advance, is $x\frac{CG}{CP}$; for CP : CG = Pp : GI, = $x : u$. It is evident that A will change its direction by the collision: For in the instant of greatest compression it was reacted on by a force $= A\times\overline{v-x}$ in the direction FA. This must be compounded with $A\times V$, in the direction AH, in order to obtain the new motion of A; or it may be found by compounding x, which is retained by A, with FH, which has suffered no change by the collision. The bodies will therefore separate, although they be unelastic: If they are elastic, we must double these changes on each. If B was also in motion before the collision, the motion of A must be resolved into two, one of which is equal and parallel to the motion of B: the other must be employed as we have employed the motion AH.

Expressions still more general may be obtained for x and u; namely, by taking the formulæ for the centres of conversion and percussion (Rotation, n° 96, 99.)

$$CG = \frac{\int p\,r^2}{B\times GP},\ \text{and}\ CP = \frac{\int p\,r^2 + B\times CP^2}{B\times GP},$$

where p stands for a particle of matter, and r for its distance from an axis passing through G perpendicularly to the plane of the lines GP and PF. In this way we obtain $x = v\,\frac{A\cdot\int p\,r^2 + A\cdot B\cdot GP^2}{A+B\cdot\int p\,r^2 + A\cdot B\cdot GP^2}$.

74 Change of progressive motion greatest when the direction of the effective stroke passes thro' the centres.

It is plain, from this proposition, that the progressive motion of the body depends, not only on the momentum of the impelling body, but also on the place where the other stroke is: For even although the original momentum of A be the same, and the obliquity of the stroke making v the same, and the body (and consequently $\int p\,r^2$) also remain the same, we see that x and u depend on the ratio of CP to CG. Now C and P are always on opposite sides of G: Consequently, by removing the direction FP of the impulsion farther from G, we diminish CG and increase CP; and therefore increase the value of $x = v\,\frac{A\cdot CP}{B\cdot CG + A\cdot CP}$; and consequently diminish the value of $A\times\overline{v-x}$, to which $B\times u$ is equal. The greatest momentum of B is produced when the direction of the impulse passes through G, and no rotation is produced. Indeed we are led, by a sort of common sense, to expect this.

75 Importance of this theory to seamanship, &c.

This investigation is by no means a piece of mere speculative curiosity. It is the solution of the greatest problem in practical mechanics. It is in this way that we must proceed in computing the actions of the wind and water on the sails and hull of a ship. Were it not that many circumstances concur in determining several of the preparatory steps, it is evident that the task must be almost impracticable. But the pressure and its direction are generally determined by experiment, without the trouble of computation; and we are seldom solicitous about the subsequent motion of the wind or water.

76 Impulsion on bodies confined to particular paths.

There is another question in impulsion which is of the first practical importance—namely, when the impulse is exerted on the parts of a machine, where the body struck is not at liberty to yield freely to the stroke, but must slide along some solid path, or turn round some axis, or take some other constrained motion. The operations of most engines depend on this. The operation of wedges, axes, and many cutting and piercing instruments, and the penetration of piles, impelled by a rammer, are all ascertained by the same doctrines. But the particular applications can scarcely be elucidated by any classification that occurs to us, the circumstances of the case making such great difference in the result, both in kind and degree. For example, in the simplest case that occurs, the driving of piles, the penetration of the pile depends, in the first place, on the momentum of the rammer. If the mass of the pile be neglected, the penetration through a uniformly resisting substance will be as the square of the velocity of the rammer, (Dynamics, *Suppl.* n° 95), and its absolute quantity may be determined from a knowledge of the proportion of the weight of the rammer to the resistance of the earth. But when we consider that we have to put in motion the whole matter of the pile, we learn that a great diminution of the effect must take place. We still can compute what this must be, because we have the same momentum, with a velocity diminished in a certain proportion of the sum of the matter in the rammer and pile, to that in the rammer alone.—Another defalcation arises from friction, which continually increases as the pile goes deeper;—and a still greater defalcation proceeds from the nature of the pile. If it is a piece of very dry straight grained fir, it is very elastic, and acquires almost a double velocity from the stroke of a rammer of cast iron. If it is moist and soft, especially if it is oak, or other timber of an undulated fibre, it does not acquire so great velocity, and the penetration is very much diminished. It is probable that a pile, headed with moist cork, could not be driven at all. The writer of this article found a remarkable effect of the elasticity in the process of boring limestone. When the boring bit was made entirely of steel, and tempered through its whole length to a hard spring temper, the workman bored three inches, in the same time that another bored two inches with a bit made of soft iron; and he would never use any but steel bits, if they could be hindered from chipping by the hammer (which must also be of tempered steel throughout). This has hitherto baffled many attempts. A pretty large round head, like a marlin spike, has succeeded best: but even this cracks after some days use. The improvement is richly worth attention; for the workman is delighted by feeling the hammer rise in his hand after every stroke, and says that the work is not so hard by half. *N. B.* The stone cutters at Lisbon and Oporto use iron mallets.

Impulsion on machines.

The case of impulsion made on part of a machine moveable round an axis has been considered in the article Rotation, *Encycl.* n° 72; where x is shewn to be be $= v \times \frac{A.CP^2}{\int p r^2 + A.CP^2}$. But, in this formula, r denotes the distance of p from the point C, and not from G. $\int p r^2$ in this formula, is B. CG. CP; whereas, in the formula for a free body, where r is the distance of a particle from G, $\int p r^2$ is $=$ B. CG. GP.

In the practical consideration of this question, the reader will do well to consider the whole of that article with attention. Many circumstances occur, which make a proper choice of the point of impulse, and the direction of the tangent plane, of the greatest consequence to the good performance of the machine; and there is nothing in which the scientific knowledge of the engineer is of more essential service to him. An engineer of great practice, and a sagacious combining mind, collects his general observations, and stores them up as rules of future practice. But it is seldom that he possesses them with that distinctness and confidence that can enable him to communicate his knowledge to others, or even secure himself against all mistakes; whereas a moderate acquaintance with these *elements* of real mechanics, may be applied with safety on all occasions, because arithmetical computations, when rightly made, afford the most certain of all results.

78 Great loss of power by the yielding and bending of the material.

There is a circumstance which greatly affects the performance of machines which are actuated by impulses, namely, the yielding and bending of the parts. When the moving power acts by repeated small impulsions, it may sometimes be entirely consumed, without producing any effect whatever at the remote working point of the machine; and the engineer, who founds his constructions on the elementary theories to be had in most treatises of mechanics, will often be miserably disappointed. In the usual theories, even as delivered by writers of eminence, it is asserted, that the smallest impulse will start the greatest weight. But since impulse is only a continued pressure, and requires time for the transmission of its effect through the parts of a yielding solid, it is plain that the motion of the impelling body may be extinguished before it has produced compression enough for exciting the forces which are to raise the remote parts of a heavy body from the ground. What blow with a hammer could start a feather bed? Much oftener may we expect, that a blow, given to one arm of a long lever, will be consumed in bending the whole of its length, so as to bring the remote end into action. Therefore great stiffness, and perfect elasticity, both in the moving parts and in the points of support, are necessary for transmitting the full, or even a considerable part, of the power of the impelling body. Perhaps not the half of the blow given by the wipers of a great forge or tilting mill to the shank of the hammer is transmitted in the *proper* instant of time to the hammer-head. The hammer, while it is tossed up by the blow, is quivering as it flies. Should it reach the spring above it in the time of its downward vibration, it will not be returned with such force as if it had hit the spring a moment before or after. A quarter of an inch will produce a great effect in such cases. It is found, that the minute impulses given to the pallets of a clock or watch lose much of their force by the imperfect elasticity of the pendulum or balance. We must therefore make all the parts which transmit the blow to the regulating mass of matter as continuous, hard, elastic, and stiff, as possible. The performance of ruby pallets is very sensibly weakened by putting oil on the face of them, especially in the detached scapements, which act partly by impulse. A wheel of hard tempered steel, working on a dry ruby pallet, excels all others. The intelligent engineer, seeing that, after all his care, much impulsion is unavoidably lost, will avoid employing a first mover which acts in a subsultory manner, and will substitute one of continued pressure when it is in his power. This is one chief cause of the great superiority of overshot water-wheels above the undershot.

We can now understand how it happens that Galileo, Mersennus, and others, could compare the impulse given by a falling body with the pressure of a weight in the opposite scale of a balance, and can see the reason of the immense differences, yet accompanied by a sort of regularity, in the results of the experiments. Galileo, Mersennus, and Riccioli, found them to be proofs that the forces of moving bodies are as their velocities; because the heights from which the body fell were as the squares of the weights started from the ground. Gravesande found the same thing as long as he held the same opinion; but when he adopted the Leibnitzian measure, he found many faults in the apparatus employed in his former illustrations, and altered it, till he obtained results agreeable to his new creed. But any one who examines with attention all that passes in the bending of the apparatus, and takes into account the mass of matter which must be displaced before the opposite arm rises so far as to detach the spring which gives indication of the magnitude of the stroke, must see that the agreement is purely accidental, and may be procured for any theory we please (see *Gravesande's Nat. Phil.* translated by Desaguliers, vol. i. p. 241. &c.). The proposition, n° 95, Dynamics, suffices for explaining every thing that can happen in such experiments. And it will shew us, that although the motion of impulsion is produced by pressure alone, yet impulse is incomparable with mere pressure: It is not infinitely greater, but disparate. A weight (which is a pressure) bends a spring to a certain degree, and will derange to a certain degree the fibres of a body on which it presses, before it be balanced. The same weight, falling on this spring from the *smallest* height, will bend it farther, and may crush or shiver to pieces the body which would have carried it for ever. We shall make some further remarks on this subject, of great practical importance, under the word Percussion.

The method which we have pursued in considering the doctrines of impulsion, differs considerably from that which has generally been followed; but we trust that it will not be found the less instructive. Although the reader should not adopt our decided opinion, that we have no proof of pure impulsion ever being observed, and that all the phenomena which go by that name are really the effects of pressures, analogous to gravity, he perceives that our opinion does not lead to any general laws of impulsion that are different from those which are acknowledged by all. We differ only, by exhibiting the internal procedure by which they are *unquestionably* produced in a vast number of cases, and which takes place in all that we have seen, in some degree. Our method has undoubtedly this advantage, 79 Conclusion.

vantage, that it requires no principle but one, namely, that accelerating forces are to be estimated by the acceleration which they produce. Even this may be considered, not as a principle, but merely as a definition—We get rid of all the obscurity and perplexity that result from the introduction of inertia, considered as a power—a power of doing nothing—and we are freed from the unphilosophical fiction (adopted by all the abettors of that doctrine, and even by many others) of conceiving the space, in which motions are performed, and bodies act, to be carried along with the bodies in it.—This furnishes, indeed, in some cases, a familiar way of conceiving the thing, by supposing the experiments to be made in a ship under sail, and by appealing to the fact, that all our experiments are made on the surface of a globe that is moving with a very great velocity. But it is an absurdity in philosophy, and, when minutely or argumentatively used, it does not free us from one complication of action; for, before we can make use of this substitution, we must demonstrate, that the actions depend on the relative motions only: And this, when demonstrated, *obliges* us to measure forces by the velocity which they produce.

As no part of mechanical philosophy has been so much debated about as impulsion, it will surely be agreeable to our readers to have a notice of the different treatises which have been published on the subject:

Galilei Opera, T. I. 957. II. 479, &c.

Jo. Wallisii Tractatus de Percussione. Oxon. 1669.

Chr. Hugenius de Motu Corporum ex Percussione. Op. II. 73.

Traité de la Percussion des Corps, par Mariotte, Op. I. 1.

Hypothesis Physica Nova, qua phenomenorum causæ ab unico quodam universali motu in nostro globo supposito repetuntur. Auct. G. G. Leibnitzio. Moguntiæ 1671.—Leibn. Op. T. II. p. II. 3.

Ejusdem Theoria Motus Abstracti. Ibid. 35.

Hermanni Phoronomia. Amst. 1716.

Discours sur les Loix de la Communication de Mouvement, par Jean Bernoulli, Paris, 1727. Jo. Bern. Oper. III.

Dynamique de D'Alembert.

Euleri Theoria Corporum solidorum seu rigidorum, 1765.

Borelli (Alphons) de Percussione.

See also M'Laurin's Fluxions, and his Account of Newton's Philosophy, for his Dissertation crowned by the Acad. des Sciences at Paris.—Also Dr Jurin's elaborate dissertations in the Phil. Trans. N° 479.—Also Gravesande's Nat. Philosophy, where there is a most laborious collection of experiments and reasonings; all of which receive a complete explanation by the 39th Prop. Princip. Newtoni I. or our n° 95. Dynamics. There are also many very acute philosophical observations in *Lambert's Gedanken über die Grundlehren des Gleichgewichts, und der Bewegung*, in the second part of his Gebrauch der Mathematik.—Also, in the works of Kaestner, Hamberger, and Busch. Muschenbroeck also treats the subject at great length, but not very judiciously. We do not know any work which treats it with such perspicuous brevity as M'Laurin's Account of Newton's Philosophy.

INAGUA, *Great and Little*, two small islands in the Windward Passage, N. W. of the island of St Domingo, and N. E. of the island of Cuba.—*Morse*.

INATTENDUE *Island*, (the Gower Island of Carteret) so named by Surville, lies on the north side of the islands of Arsacides, 2° 4′ east of Port Praslin.—*ib*.

INCAI, a southern branch of Amazon river, in S. America.—*ib*.

INCREMENT, is the small increase of a variable quantity. Newton, in his Treatise on Fluxions, calls these by the name *Moments*; and observes, that they are proportional to the velocity or rate of increase of the flowing or variable quantities in an indefinitely small time. He denotes them by subjoining a cypher o to the flowing quantity whose moment or increment it is; thus, xo the moment of x. In the doctrine of Increments, by Dr Brooke Taylor and Mr Emerson, they are denoted by points below the variable quantities; as $\underset{.}{x}$. Some have also denoted them by accents underneath the letter, as $\underset{,}{x}$; but it is now more usual to express them by accents over the same letter; as x'.

Method of INCREMENTS, a branch of Analytics, in which a calculus is founded on the properties of the successive values of variable quantities, and their differences or increments.

The inventor of the method of increments was the learned Dr Taylor, who, in the year 1715, published a treatise upon it; and afterwards gave some farther account and explication of it in the Philos. Trans. as applied to the finding of the sums of series. And another ingenious and easy treatise on the same, was published by Mr Emerson, in the year 1763. The method is nearly allied to Newton's Doctrine of Fluxions, and arises out of it. Also the Differential method of Mr Stirling, which he applies to the summation and interpolation of series, is of the same nature as the method of increments, but not so general and extensive.

INDEPENDENCE, MOUNT, is situated on the strait through which the waters of Lake George and East Bay flow into Lake Champlain, in the N. W. part of the town of Orwell in Rutland county, Vermont, and opposite to Ticonderoga.—*Morse*.

INDETERMINATE Problem. See Algebra, Part I. Chap. VI. *Encycl.*

Diophantus was the first writer on indeterminate problems, which, after the publication of his work in 1621 by Bachet, employed much of the time of the most celebrated mathematicians in Europe. Afterwards such problems were neglected as useless, till the public attention was again drawn to them by Euler and la Grange. The example of such men was followed by Mr John Leslie, a very eminent and self-taught mathematician; who, in the second vol. of the Transactions of the Royal Society of Edinburgh, has published an ingenious paper on indeterminate problems, resolving them by a new and general principle. "The doctrine of indeterminate equations (says Mr Leslie) has been seldom treated in a form equally systematic with the other parts of algebra. The solutions commonly given are devoid of uniformity, and often require a variety of assumptions. The object of this paper is to resolve the complicated expressions which we obtain in the solution of indeterminate problems, into simple equations, and to do so, without framing a number of assumptions, by help of a single principle, which, though extremely ſimple, admits of a very extenſive application.

"Let $A \times B$ be any compound quantity equal to another, $C \times D$, and let m be any rational number aſſumed at pleaſure; it is manifeſt that, taking equimultiples, $A \times m B = C \times m D$. If, therefore, we ſuppoſe that $A = mD$, it muſt follow that $mB = C$, or $B = \frac{C}{m}$. Thus two equations of a lower dimenſion are obtained. If theſe be capable of farther decompoſition, we may aſſume the multiples n and p, and form four equations ſtill more ſimple. By the repeated application of this principle, an higher equation, admitting of diviſors, will be reſolved into thoſe of the firſt order, the number of which will be one greater than that of the multiples aſſumed."

For example, reſuming the problem at firſt given, viz. to find two rational numbers, the difference of the ſquares of which ſhall be a given number. Let the given number be the product of a and b; then by hypotheſis, $x^2 - y^2 = ab$; but theſe compound quantities admit of an eaſy reſolution, for $\overline{x + y} \times \overline{x - y} = a \times b$. If, therefore, we ſuppoſe $x + y = ma$, we ſhall obtain $x - y = \frac{b}{m}$; where m is arbitrary, and if rational, x and y muſt alſo be rational. Hence the reſolution of theſe two equations gives the values of x and y, the numbers ſought, in terms of m; viz.

$$x = \frac{m^2a + b}{2m}, \text{ and } y = \frac{m^2a - b}{2m}.$$

INDIAN OLD TOWN, a town in Lincoln county, in the Diſtrict of Maine, ſituated on an iſland in Penobſcot river, juſt above the Great Falls, and about 60 below the Forks. Here are about 100 families, who are Roman Catholics, the remains of the Penobſcot tribe, and the only Indians who reſide in the Diſtrict of Maine. They live together in a regular ſociety, and are increaſing in number; the Sachems having laid an injunction on the young people to marry early. In a former war, this tribe had their lands taken from them; but at the commencement of the American revolution, the Provincial Congreſs granted them a tract of land, 12 miles wide, interſected in the middle by the river. They have a right, in preference to any other tribe, to hunt and fiſh as far as the mouth of the bay of Penobſcot extends. In their town is a decent church with a bell; and a prieſt reſides among them to adminiſter the ordinances.—*Morſe.*

INDIAN ORCHARD, a tract of land in Northampton county, Pennſylvania, on the W. ſide of Delaware river, on the river Lexawacſein.—*ib.*

INDIANA, a territory in Virginia, lying between Ohio river and the Laurel Mountain, containing about $3\frac{1}{2}$ millions of acres It is nearly of a triangular form, and extends in length from the Pennſylvania line to the waters of the Little Kanhaway. It was granted to Samuel Wharton, William Trent, and George Morgan, eſquires, and a few other perſons, in the year 1768, by the Shawaneſe, Delaware and Huron tribes of Indians, as a compenſation for loſſes to the amount of £85,916 : 10 : 8 currency, which theſe people had ſuſtained by the depredations of the Indians, in the year 1763. It is a valuable tract of land; but the title of the proprietors, though pronounced good by a Committee of Congreſs in 1782, is at preſent embarraſſed in conſequence of the revolution.—*ib.*

INDIAN RIVER, or *Cypreſs Swamp*, lies partly in the States of Maryland and Delaware. This moraſs extends 6 miles from eaſt to weſt, and nearly 12 from north to ſouth, including an area of nearly 50,000 acres of land. The whole of this ſwamp is a high and level baſon, very wet, though undoubtedly the higheſt land on that part of the coaſt. Falſe Cape, at the mouth of Indian river, and the N. E. part of Cedar Neck is in 38° 35′ 15″ N. lat and $11\frac{1}{4}$ miles ſouth of the lighthouſe at Cape Henlopen. Cedar Swamp contains a great variety of plants, trees, wild beaſts, birds, and reptiles.—*ib.*

INDIAN RIVER, on the eaſt coaſt of the peninſula of E. Florida, riſes a ſhort diſtance from the ſea-coaſt, and runs from north to ſouth, forming a kind of inland paſſage for many miles along the coaſt. It is alſo called Rio Ays, and has on the north ſide of its mouth the point El Palmar, on the ſouth that of the Leech. N. lat. 27° 30′, W. long. 80° 40′.—*ib.*

INDIANS. The amount of Indian population, in America, can only be gueſſed at. The new diſcovered iſlands in the South Sea, and part of the N. W. coaſt are probably the moſt populous. The beſt informed have conjectured the number of aboriginal inhabitants, or Indians, in America, to be under two millions and a half. The decreaſe ſince the diſcovery of America, has been amazing: At that period, the iſland of Hiſpaniola alone contained at leaſt a million of inhabitants; Bartholomew de las Caſas eſtimated the number at three millions. Millions were buried in the mines or hunted to death by the Spaniards, both on the iſlands and continent. In the northern parts of America, numbers were doubtleſs deſtroyed in forming the Engliſh, Dutch, and French colonies; but notwithſtanding the ruptures between the coloniſts and the Indians, very few comparatively periſhed by war. Famine, and its companion the peſtilence, frequently deſtroy whole tribes. The diſeaſes alſo introduced by the Europeans, have made great havock; the ſpirituous liquors in the uſe of which they have been initiated by the whites, prove perhaps moſt of all repugnant to population. They wane as the Europeans advance; they moulder away, and diſappear. The moſt numerous tribes are at the greateſt diſtance from the ſettlements of the whites, and it is very certain that in proportion to their diſtance they are unacquainted with the uſe of fire-arms. All the nations north of lake Superior, and thoſe beyond the Miſſiſſippi, uſe only bows and arrows, ſo that when their ſcattered ſituation is conſidered, the various cuſtoms and ſuperſtitions which it would be neceſſary to reconcile, in order to produce unity of action, and what a ſmall proportion of them have the apparatus, or underſtand the uſe of muſquetry, or poſſeſs reſources to enable them to carry on laſting hoſtilities againſt the power of the United States, it muſt be obvious that even partial defeats of the federal troops will haſten their ruin, notwithſtanding the wonderful dexterity and intrepidity which they exhibited in ſeveral actions with the regular troops in the late war. But this neither is nor ought to be the wiſh of the inhabitants of the United States; they ought to teach them the bleſſings of peace, and curb the exorbitant luſt of farther extent of territory.

Indians.

A liſt of Indian tribes, in Imlay's Hiſtory of Kentucky, makes the aggregate number leſs than 60,000 who inhabit the country from the gulf of Mexico on both ſides of the Miſſiſſippi, to the gulf of St Lawrence, and as far weſt as the country has been generally explored, that is, to the head water of the Miſſiſſippi, and from thence a good way up the Miſſouri, and between that river and Santa Fe. To give any account of the nations farther ſouth, far leſs in S. America, would be a taſk beyond all bounds; the chief of theſe are noticed under their reſpective names.

The population of the Indian nations in the ſouthern parts of the United States, ſomewhat different from Imlay, is, according to Mr Purcell, who reſided among them in 1780, as follows:

	Gun-men.	Total.
Muſcogees, commonly called Creeks	5,860	17,280
Chactaws	4,131	13,423
Chickaſaws	575	2,290
Cherokees	2,800	8,550
Catabaws	150	490
	13,516	42,033

The above red nations have increaſed in a ſmall degree ſince the general peace eſtabliſhed among them in 1777. The whites incorporated among them are few in number, and lead a vagabond life, going from tribe to tribe as their reſtleſs diſpoſition leads them. The increaſe of population is conſiderably checked by the quantities of adulterated and poiſonous ſpirituous liquors, and the venereal diſtemper introduced among them by the whites.

Major Gen. Anthony Wayne put an end to the deſtructive war with the Indians by a treaty of peace and friendſhip concluded at Greenville Aug. 3, 1795, which was ratified by the Preſident of the United States, Dec. 22, 1795. The Indian tribes ſigned the treaty in the following order: *Wyandots*, *Delawares*, *Shawanoes*, *Ottawas*, *Chipawas*, *Ottawa*, *Patawatames* of the river of St Joſeph, *Patawatames* of Huron, *Miamis*, *Miamis* and *Eel River*, *Eel River* tribe, *Miamis*, *Kickapoos* and *Kaſkaſkias*, *Delawares* of Sanduſky, and ſome of the *Six Nations* living at Sanduſky. Theſe Indians ceded to the United States various tracts of land from 2 to 12 miles ſquare, near the different poſts in the N. W. Territory. The United States delivered to the Indian tribes above named in goods to the value of 20,000 dollars; and agreed to deliver in goods to the value of 9,500 dollars annually, forever. The portion which each tribe is to receive will be ſeen in the account of the particular nation or tribe.

Little is yet known of the Indians in the interior parts of North-America. In 1792, Mr Stewart, ſaid to be in the employ of the Britiſh court, returned from four years travels through the hitherto unexplored regions to the weſtward. Taking his courſe weſt-ſouth-weſterly from the poſts on the lakes, he penetrated to the head of the Miſſouri, and from thence due W. to within 500 miles of the ſhores of the Pacific ocean. He joined the interior Indians in ſeveral battles againſt the ſhore Indians, all which coming ſhort of his object, the procuring a peace, ſo that he might explore the continent from ſea to ſea; after ſome ſtay, he returned nearly by the ſame route he had purſued in going out. Beyond the Miſſouri, Mr Stewart met with many powerful nations, in general hoſpitable and courteous. The Indian nations he viſited weſtward, appeared to be a poliſhed and civilized people, having towns regularly built, and being in a ſtate of ſociety not far removed from that of the Europeans, and only wanting the uſe of iron and ſteel to be perfectly ſo. They are always clad in ſkins, cut in an elegant manner, and in many reſpects preferable to the garments in uſe among the whites. Adjacent to theſe nations is a vaſt ridge of mountains, which may be called the Allegany of the weſtern parts of America, and ſerves as a barrier againſt the too frequent incurſions of the coaſt Indians, who entertain a mortal antipathy to the nations and tribes inhabiting the country eaſtward of the mountains.—*ib.*

Indian, ‖ Induction.

INDIAN-TOWN, in Maryland, a village ſituated on Indian Creek, on the S. E. bank of Choptank river, and in Dorcheſter county, 3 miles S. W. of New-Market.—*ib.*

INDIAN-TOWN, a ſmall poſt-town of N. Carolina, 10 miles from Sawyer's Ferry, and 52 from Edenton.—*ib.*

INDUCTION, in logic, is that proceſs of the underſtanding by which, from a number of *particular* truths perceived by ſimple apprehenſion, and diligently compared together, we infer another truth which is always *general* and ſometimes *univerſal*. It is perhaps needleſs to obſerve, that in the proceſs of induction the truths to be compared muſt be of the ſame kind, or relate to objects having a ſimilar nature; for the mereſt tyro in ſcience knows that phyſical truths cannot be compared with moral truths, nor the truths of pure mathematics with either.

That the method of induction is a juſt logic, has been ſufficiently evinced elſewhere (ſee LOGIC, Part III. chap. V. and PHILOSOPHY, nº 73—78. *Encycl.*), and is now indeed generally admitted. It is even admitted by Britiſh philoſophers to be the only method of reaſoning by which any progreſs can be made in the phyſical ſciences; for the laws of Nature can be diſcovered only by accurate experiments, and by carefully noting the agreements and the differences, however minute, which are thus found among the phenomena apparently ſimilar. It is not, however, commonly ſaid that *induction* is the method of reaſoning employed by the mathematicians; and the writer of this article long thought, with others, that in pure geometry the reaſoning is ſtrictly *ſyllogiſtical*. Mature reflection, however, has led him to doubt, with Doctor Reid,* the truth of the generally received opinion, to doubt even whether by categorical ſyllogiſms any thing whatever can be proved.

* Appendix to Vol. III. of Sketches of the Hiſtory of Man.

To the idolaters of Ariſtotle we are perfectly aware that this will appear an extravagant paradox; but to the votaries of truth, we do not deſpair of making it very evident, that for ſuch doubts there is ſome foundation.

We are led into this diſquiſition to counteract, in ſome degree, what we think the pernicious tendency of the philoſophy of Kant, which attempts have been lately made to introduce into this country. Of this philoſophy we ſhall endeavour to give ſomething like a diſtinct view in the proper place. It is ſufficient to obſerve here, that it reſts upon the hypotheſis, that "we are in poſſeſſion of certain notions *à priori*, which are abſolutely *independent of all experience*, although the *objects of experience* correſpond with them; and which are diſtinguiſhed by *neceſſity* and ſtrict *univerſality*." Theſe notions

and

Induction.

and univerfal notions, Kant confiders as a fet of *categories*, from which is to be deduced all fuch knowledge as deferves the name of fcience; and he talks, of courfe, or at leaft his Englifh tranflators reprefent him talking, with great contempt, of inductive reafoning, and fubftituting fyllogiftic demonftration in its ftead.

As his categories are not familiar to our readers, we fhall, in this place, examine fyllogifms connected with the categories of Ariftotle, which are at leaft more intelligible than thofe of Kant, and which, being likewife general notions, muft, in argument, be managed in the fame way. Now the fundamental axiom upon which every categorical fyllogifm refts, is the well known propofition, which affirms, that "whatever may be predicated of a whole *genus*, may be predicated of every *fpecies* and of every *individual* comprehended under that genus." This is indeed an undoubted truth; but it cannot conftitute a foundation for reafoning from the *genus* to the *fpecies* or the *individual*; becaufe we cannot poffibly know what can be predicated of the *genus* till we know what can be predicated of all the *individuals* ranged under it. Indeed it is only by afcertaining, through the medium of induction, what can be predicated, and what not, of a number of individuals, that we come to form fuch notions as thofe of *genera* and *fpecies*; and therefore, in a fyllogifm ftrictly categorical, the propofitions, which conftitute the *premifes*, and are taken for granted, are thofe alone which are capable of proof; whilft the conclufion, which the logician pretends to demonftrate, muft be evident to intuition or experience, otherwife the premifes could not be known to be true. The analyfis of a few fyllogifms will make this apparent to every reader.

Dr Wallis, who, to an intimate acquaintance with the Ariftotelian logic, added much mathematical and phyfical knowledge, gives the following fyllogifm as a perfect example of this mode of reafoning in the firft figure, to which it is known that all the other figures may be reduced:—

Omne animal eft *fenfu præditum.*
Socrates eft *animal.* Ergo
Socrates eft *fenfu præditus.*

Here the propofition to be demonftrated is, that Socrates is endowed with fenfe; and the propofitions affumed as felf-evident truths, upon which the demonftration is to be built, are, that "every animal is endowed with fenfe;" and that "Socrates is an animal." But how comes the demonftrator to know that "every animal is endowed with fenfe?" To this queftion we are not aware of any anfwer which can be given, except this, that mankind have agreed to call every being, which they perceive to be endowed with fenfe, an *animal*. Let this, then, be fuppofed the true anfwer: the next queftion to be put to the demonftrator is, How he comes to know that *Socrates* is an *animal?* If we have anfwered the former queftion properly, or, in other words, if it be effential to this genus of beings to be endowed with fenfe, it is obvious that he can know that Socrates is an *animal* only by perceiving him to be *endowed with fenfe*; and therefore, in this fyllogifm, the propofition to be proved is the very firft of the three of which the truth is perceived; and it is perceived intuitively, and not inferred from others by a procefs of reafoning.

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Though there are ten categories and five predicables, there are but two kinds of categorical propofitions, viz. Thofe in which the property or accident is predicated of the fubftance to which it belongs, and thofe in which the *genus* is predicated of the *fpecies* or *individual*. Of the former kind is the propofition pretended to be proved by the fyllogifm which we have confidered; of the latter, is that which is proved by the following:

Quicquid fenfu præditum, eft animal,
Socrates eft fenfu præditus. Ergo
Socrates eft animal.

That this is a categorical fyllogifm, legitimate in mode and figure, will be denied by no man who is not an abfolute ftranger to the very firft principles of the Ariftotelian logic; but it requires little attention indeed to perceive that it proves nothing. The impofition of names is a thing fo perfectly arbitrary, that the being, or clafs of beings, which in Latin and Englifh is called *animal*, is with equal propriety in Greek called ζωον, and in Hebrew נפש. To a native of Greece, therefore, and to an ancient Hebrew, the major propofition of this fyllogifm would have been wholly unintelligible; but had either of thofe perfons been told by a man of known veracity, and acquainted with the Latin tongue, that every thing endowed with fenfe was, by the Romans, called *animal*, he would then have underftood the propofition, admitted its truth without hefitation, and have henceforth known that Socrates and Mofes, and every thing elfe which he perceived to be endowed with fenfe, would at Rome be called *animal*. This knowledge, however, would not have refted upon demonftrative reafoning of any kind, but upon the credibility of his informer, and the intuitive evidence of his own fenfes.

It will perhaps be faid, that the two fyllogifms which we have examined are improper examples, becaufe the truth to be proved by the former is felf-evident, whilft that which is meant to be eftablifhed by the latter is merely verbal, and therefore arbitrary. But the following is liable to neither of thefe objections:

All animals are *mortal.*
Man is *an animal;* therefore
Man is *mortal.*

Here it would be proper to afk the demonftrator, upon what grounds he fo confidently pronounces all animals to be mortal? The propofition is fo far from expreffing a felf-evident truth, that, previous to the entrance of fin and death into the world, the firft man had furely no conception of mortality. He acquired the notion, however, by experience, when he faw the animals die in fucceffion around him; and when he obferved that no animal with which he was acquainted, not even his own fon, efcaped death, he would conclude that all animals, without exception, are mortal. This conclufion, however, could not be built upon fyllogiftic reafoning, nor yet upon intuition, but partly upon experience and partly on analogy. As far as his experience went, the proof, by induction, of the mortality of all animals was complete; but there are many animals in the ocean, and perhaps on the earth, which he never faw, and of whofe mortality therefore he could affirm nothing but from analogy, *i. e.* from concluding, as the conftitution of the human mind compels us to conclude,

conclude, that Nature is uniform throughout the universe, and that similar causes, whether known or unknown, will, in similar circumstances, produce, at all times, similar effects. It is to be observed of this syllogism, as of the first which we have considered, that the proposition, which it pretends to demonstrate, is one of those truths known by experience, from which, by the process of induction, we infer the major of the premises to be true; and that therefore the reasoning, if reasoning it can be called, runs in a circle.

Yet by a concatenation of syllogisms have logicians pretended that a long series of important truths may be discovered and demonstrated; and even Wallis himself seems to think, that this is the instrument by which the mathematicians have deduced, from a few postulates, accurate definitions, and undeniable axioms, all the truths of their demonstrative science. Let us try the truth of this opinion by analysing some of Euclid's demonstrations.

In the short article Principle (*Encycl.*), it has been shewn, that all our *first* truths are *particular*, and that it is by applying to them the rules of induction that we form general truths or axioms—even the axioms of pure geometry. As this science treats not of real external things, but merely of *ideas* or *conceptions*, the creatures of our minds, it is obvious, that its definitions may be perfectly accurate, the induction by which its axioms are formed complete, and therefore the axioms themselves *universal* propositions. The use of these axioms is merely to shorten the different processes of geometrical reasoning, and not, as has sometimes been absurdly supposed, to be made the *parents* or *causes* of *particular* truths. No truth, whether general or particular, can, in any sense of the word, be the cause of another truth. If it were not true that all individual figures, of whatever form, comprehending a portion of space equal to a portion comprehended by any other individual figure, whether of the same form with some of them, or of a form different from them all, are equal to one another, it would not be true that "things in *general*, which are equal to the same thing, or that magnitudes which coincide, or exactly fill the same space," are respectively equal to one another; and therefore the first and eighth of Euclid's axioms would be false. So far are these axioms, or general truths, from being the parents of particular truths, that, as conceived by us, they may, with greater propriety, be termed their *offspring*. They are indeed nothing more than general expressions, comprehending all particular truths of the same kind. When a mathematical proposition therefore is enounced, if the terms, of which it is composed, or the figures of which a certain relation is predicated, can be brought together and immediately compared, no demonstration is necessary to point out its truth or falsehood. It is indeed intuitively perceived to be either comprehended under, or contrary to some known *axiom* of the science; but it has the evidence of truth or falsehood in itself and not in *consequence* of that axiom. When the figures or symbols cannot be immediately compared together, it is then, and only then, that recourse is had to demonstration; which proceeds, not in a series of syllogisms, but by a process of ideal mensuration or induction. A figure or symbol is conceived, which may be compared with each of the principal figures or symbols, or, if that cannot be, with one of them, and then another, which may be compared with it, till through a series of well known intermediate relations, a comparison is made between the terms of the original proposition, of which the truth or falsehood is then perceived.

Thus in the 47th proposition of the first book of Euclid's Elements, the author proposes to demonstrate the equality between the square of the hypothenuse of a right angled triangle, and the sum of the squares described on the other two sides; but he does not proceed in the way of categorical syllogisms, by raising his demonstration on some universal truth relating to the *genus* of *squares*. On the contrary, he proceeds to *measure* the three squares of which he has affirmed a certain relation; but as they cannot be immediately compared together, he directs the largest of them to be divided into two parallelograms, according to a rule which he had formerly ascertained to be just; and as these parallelograms can, as little as the square of which they are the constituent parts, be compared with the squares of the other two sides of the triangle, he thinks of some intermediate figure which may be applied as a common measure to the squares and the parallelograms. Accordingly, having before found that a parallelogram, or square, is exactly double of a triangle standing on the same base and between the same parallels with it, he constructs triangles upon the same base, and between the same parallels with his parallelograms, and the squares of the sides containing the right angle of the original triangle; and finding, by a process formerly shewn to be just, that the triangles on the bases of the parallelograms are precisely equal to the triangles on the bases of the squares, he perceives at once that the two parallelograms, of which the largest square is composed, must be equal to the sum of the two lesser squares; and the truth of the proposition is demonstrated.

In the course of this demonstration, there is not so much as one truth *inferred* from another by *syllogism*, but all are perceived in succession by a series of simple apprehensions. Euclid, indeed, after finding the triangle constructed on the base of one of the parallelograms to be equal to the triangle constructed on the base of one of the squares, introduces an *axiom*, and says, "but the doubles of equals are equal to one another; *therefore* the parallelogram is equal to the square." But if from this mode of expression any man conceive the axiom or universal truth to be the *cause* of the truth more particular, or suppose that the *latter* could not be apprehended without a *previous* knowledge of the former, he is a stranger to the nature of evidence, and to the process of *generalization*, by which axioms are formed.

If we examine the problems of this ancient geometrician, we shall find that the truth of them is proved by the very same means which he makes use of to point out the truth of his theorems. Thus, the first problem of his immortal work is, "to describe an equilateral triangle on a given finite straight line;" and not only is this to be done, but the method by which it is done must be such as can be shewn to be incontrovertibly just. The sides of a triangle, however, cannot be applied to each other so as to be immediately compared; for they are conceived to be immoveable among themselves. A common measure, therefore, or something equivalent to a common measure, must be found, by which the triangle may be constructed, and the equality

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lity of its three sides afterwards evinced; and this equivalent Euclid finds in the *circle*.

By contemplating the properties of the circle, it was easy to perceive that all its *radii* must be equal to one another. He therefore directs two circles to be described from the opposite extremities of the given finite straight line, so as that it may be the radius of each of them; and from the point in which the circles intersect one another, he orders lines to be drawn to the extreme points of the given line, affirming that these three lines constitute an equilateral triangle. To convince his reader of the truth of this affirmation, he has only to put him in mind, that from the properties of the circle, the lines which he has drawn must be each equal to the given line, and of course all the three equal to one another; and this mutual equality is perceived by simple apprehension, and not inferred by syllogistic reasoning. Euclid, indeed, by introducing into the demonstration his first axiom, gives to it the form of a syllogism: but that syllogism proves nothing; for if the equality of the three sides of the triangle were not intuitively perceived in their position and the properties of the circle, the first axiom would itself be a falsehood. So true it is that categorical syllogisms have no place in geometrical reasoning; which is as strictly experimental and inductive as the reasoning employed in the various branches of physics.

But if this be so, how come the truths of pure geometry to be necessary, so that the contrary of any one of them is clearly perceived to be impossible; whilst physical truths are all contingent, so that there is not one of them of which the direct contrary may not easily be conceived?

That there is not one physical truth, of which the contrary may not be conceived, is not perhaps so certain as has generally been imagined; but admitting the fact to be as it has commonly been stated, the apparent difference between this class of truths and those of pure geometry, may be easily accounted for, without supposing that the former rests upon a kind of evidence totally different from that which supports the fabric of the latter.

The objects of pure geometry, as we have already observed, are the creatures of our own minds, which contain in them nothing concealed from our view. As the mathematician treats them merely as measurable quantities, he knows, with the utmost precision, upon what particular properties the relation affirmed to subsist between any two or more of them must absolutely depend; and he cannot possibly entertain a doubt but it will be found to have place among all quantities having the same properties, because it depends upon them, and upon them alone. His process of induction, therefore, by a series of ideal measurements, is always complete, and exhausts the subject; but in physical enquiries the case is widely different. The subjects which employ the physical enquirer are not his own ideas, and their various relations, but the properties, powers, and relations of the bodies which compose the universe; and of these bodies he knows neither the substance, internal structure, nor all the qualities: so that he can very seldom discover with certainty upon what particular property or properties the phenomena of the corporeal world, or the relations which subsist among different bodies, depend. He expects, indeed, with confidence, not inferior to that with which he admits a mathematical demonstration, that any corporeal phenomenon, which he has observed in certain circumstances, will be always observed in circumstances exactly similar; but the misfortune is, that he can very seldom be ascertained of this similarity. He does not know any one piece of matter *as it is in itself*; he cannot separate its various properties; and of course cannot attribute to any one property the effects or apparent effects which proceed exclusively from it. Indeed, the properties of bodies are so closely interwoven, that by human means they cannot be completely separated; and hence the most cautious investigator is apt to attribute to some one or two properties, an event which in reality results perhaps from many. (See PHILOSOPHY and PHYSICS, *Encycl.*). This the geometrician never does. He knows perfectly that the relation of equality which subsists between the three angles of a plain triangle and two right angles, depends not upon the size of the triangles, the matter of which they are conceived to be made, the particular place which they occupy in the universe, or upon any one circumstance whatever besides their triangularity, and the angles of their corrolets being exactly right angles; and it is upon this power of discrimination which we have in the conceptions of pure geometry, and have not in the objects of physics, that the truths of the one science are perceived to be necessary, while those of the other appear to be contingent; though the mode of demonstration is the same in both, or at least equally removed from categorical syllogisms.

Induction, || Inflammation.

INERTIA. See DYNAMICS and IMPULSION in this *Supplement*.

INFLAMMATION has been sufficiently explained in the *Encyclopædia*, and in the article CHEMISTRY in this *Supplement*; but it cannot be improper, in this place, to give an account of some remarkable

Spontaneous INFLAMMATIONS, which, as different substances are liable to them, have been, and may again be, the cause of many and great misfortunes.

The spontaneous inflammation of essential oils, and that of some fat oils, when mixed with nitrous acid, are well known to philosophers: so also is that of powdered charcoal with the same acid (lately discovered by M. Proust), and those of phosphorus, of pyrophorus, and of fulminating gold. These substances are generally to be found only in the laboratories of chemists, who are perfectly well acquainted with the precautions which it is necessary to take to prevent the unhappy accidents which may be occasioned by them.

The burning of a store-house of sails, which happened at Brest in the year 1757, was caused by the spontaneous inflammation of some oiled cloths, which, after having been painted on one side, and dried in the sun, were stowed away while yet warm; as was shewn by subsequent experiments.*

Vegetables boiled in oil or fat, and left to themselves, after having been pressed, inflame in the open air. This inflammation always takes place when the vegetables retain a certain degree of humidity; if they are first thoroughly dried, they are reduced to ashes, without the appearance of flame. We owe the observation of these facts to MM. Saladin and Carette.†

The heaps of linen rags which are thrown together in paper manufactories, the preparation of which is hastened

* See *Memoires de l'Academie de Paris*, 1760.

† *Journal de Physique*, 1784.

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hastened by means of fermentation, often take fire, if not carefully attended to.

The spontaneous inflammation of hay has been known for many centuries; by its means houses, barns, &c. have been often reduced to ashes. When the hay is laid up damp, the inflammation often happens; for the fermentation is then very great. This accident very seldom occurs to the first hay (according to the observation of M. de Bomare), but is much more common to the second; and if, through inattention, a piece of iron should be left in a stack of hay in fermentation, the inflammation of that stack is almost a certain consequence. Corn heaped up has also sometimes produced inflammations of this nature. Vanieri, in his *Prædium Rusticum*, says,

Quæ vero (gramina) nondum satis insolata recondens
Imprudens, subitis pariunt incendia flammis.

Dung also, under certain circumstances, inflames spontaneously.

In a paper, published in the *Repertory of Arts and Manufactures*, by the Rev. William Tooke, F. R. S. &c. we have the following remarkable instances of spontaneous inflammation. "A person of the name of Rüde, an apothecary at Bautzen, had prepared a pyrophorus from rye-bran and alum. Not long after he had made the discovery, there broke out, in the next village of Nauslitz, a great fire, which did much mischief, and was said to have been occasioned by the treating of a sick cow in the cow-house. Mr Rüde knew, that the countrymen were used to lay an application of parched rye-bran to their cattle for curing the thick neck; he knew also, that alum and rye-bran, by a proper process, yielded a pyrophorus; and now he wished to try whether parched rye-bran alone would have the same effect. Accordingly, he roasted a quantity of rye-bran by the fire, till it had acquired the colour of roasted coffee. This roasted bran he wrapped up in a linen cloth; in the space of a few minutes there arose a strong smoke through the cloth, accompanied by a smell of burning. Not long afterwards the rag grew as black as tinder, and the bran, now become hot, fell through it on the ground in little balls. Mr Rüde repeated the experiment at various times, and always with the same result. Who now will any longer doubt, that the frequency of fires in cow-houses, which in those parts are mostly wooden buildings, may not be occasioned by this common practice, of binding roasted bran about the necks of the cattle? The fire, after consuming the cattle and the shed, communicates itself to the adjoining buildings; great damage ensues; and the ignorant look for the cause in wilful and malicious firing, consequently in a capital crime."

The same author informs us, that in the spring of the year 1780, a fire was discovered on board a Russian frigate lying in the road of Cronstadt; which, if it had not been timely extinguished, would have endangered the whole fleet. After the severest scrutiny, no cause of the fire was to be found; and the matter was forced to remain without explanation, but with strong surmises of some wicked incendiary being at the bottom of it. In the month of August, in the same year, a fire broke out at the hemp-magazine at St Petersburgh, by which several hundred thousand poods‡ of hemp and flax were consumed. The walls of the magazine are of brick, the floors of stone, and the rafters and covering of iron; it stands alone on an island in the Neva, on which, as well as on board the ships lying in the Neva, no fire is permitted. In St Petersburgh, in the same year, a fire was discovered in the vaulted shop of a furrier. In these shops, which are all vaults, neither fire nor candle is allowed, and the doors of them are all of iron. At length the probable cause was found to be, that the furrier, the evening before the fire, had got a roll of new cere-cloth (much in use here for covering tables, counters, &c. being easily wiped and kept clean), and had left it in his vault, where it was found almost consumed.

‡ A pood consists of 40 pounds Russ, or 36 English.

In the night between the 20th and 21st of April 1781, a fire was seen on board the frigate Maria, which lay at anchor, with several other ships, in the road off the island of Cronstadt; the fire was, however, soon extinguished; and, by the severest examination, little or nothing could be extorted concerning the manner in which it had arisen. The garrison was threatened with a scrutiny that should cost them dear; and while they were in this cruel state of suspence, an order came from the sovereign, which quieted their minds, and gave rise to some very satisfactory experiments.

It having been found, upon juridical examination, as well as private inquiry, that in the ship's cabin, when the smoke appeared, there lay a bundle of matting, containing Russian lamp-black prepared from fir-soot, moistened with hemp-oil varnish, which was perceived to have sparks of fire in it at the time of the extinction, the Russian admiralty gave orders to make various experiments, in order to see whether a mixture of hemp-oil varnish and the forementioned Russian black, folded up in a mat and bound together, would kindle of itself.

They shook 40 pounds of fir-wood soot into a tub, and poured about 35 pounds of hemp-oil varnish upon it; this they let stand for an hour, after which they poured off the oil. The remaining mixture they now wrapped up in a mat, and the bundle was laid close to the cabin, where the midshipmen had their birth. To avoid all suspicion of treachery, two officers sealed both the mat and the door with their own seals, and stationed a watch of four sea officers, to take notice of all that passed the whole night through; and as soon as any smoke should appear, immediately to give information to the commandant of the port.

The experiment was made the 26th of April, about 11 o'clock A. M. in presence of all the officers named in the commission. Early on the following day, about six o'clock A. M. a smoke appeared, of which the chief commandant was immediately informed by an officer: he came with all possible speed, and through a small hole in the door saw the mat smoking. Without opening the door, he dispatched a messenger to the members of the commission; but as the smoke became stronger, and fire began to appear, the chief commandant found it necessary, without waiting for the members of the commission, to break the seals and open the door. No sooner was the air thus admitted, than the mat began to burn with greater force, and presently it burst into a flame.

The Russian admiralty, being now fully convinced of the self-enkindling property of this composition, transmitted their experiment to the Imperial Academy of Sciences; who appointed Mr Georgi, a very learned and able adjunct of the academy, to make farther experiments on the subject. Previous to the relation of these experiments, it is necessary to observe, that the Russian fir-black is three or four times more heavy, thick, and unctuous, than that kind of painters black which the Germans call *kien-rahm*. The former is gathered at Ochta, near St Petersburgh, at Mosco, at Archangel, and other places, in little wooden huts, from resinous fir-wood, and the unctuous bark of birch, by means of an apparatus uncommonly simple, consisting of pots without bottoms set one upon the other; and is sold very cheap. The famous fine German *kien-rahm* is called in Russia *Holland's black*. In what follows, when raw oil is spoken of, it is to be understood of linseed-oil or hemp-oil; but most commonly the latter. The varnish is made of five pounds of hemp-oil boiled with two ounces and a half of minium. For wrapping up the composition, Mr Georgi made use of coarse hemp-linen, and always single, never double. The impregnations and commixtures were made in a large wooden bowl, in which they stood open till they were wrapped up in linen.

Three pounds of Russian fir-black were slowly impregnated with five pounds of hemp-oil varnish; and when the mixture had stood open five hours, it was bound up in linen. By this process it became clotted; but some of the black remained dry. When the bundle had lain sixteen hours in a chest, it was observed to emit a very nauseous, and rather putrid, smell, not quite unlike that of boiling oil. Some parts of it became warm, and steamed much; this steam was watery, and by no means inflammable. Eighteen hours after the mixture was wrapped up, one place became brown, emitted smoke, and directly afterwards glowing fire appeared. The same thing happened in a second and a third place, though other places were scarcely warm. The fire crept slowly around, and gave a thick, grey, stinking smoke. Mr Georgi took the bundle out of the chest, and laid it on a stone pavement; when, on being exposed to the free air, there arose a slow burning flame, a span high, with a strong body of smoke. Not long afterwards there appeared, here and there, several chaps or clefts, as from a little volcano, the vapour issuing from which burst into flame. On his breaking the lump, it burst into a very violent flame, full three feet high, which soon grew less, and then went out. The smoking and glowing fire lasted for the space of six hours; and afterwards the remainder continued to glow without smoke for two hours longer. The grey earthy ashes, when cold, weighed five ounces and a half.

In another experiment, perfectly similar to the foregoing, as far as relates to the composition and quantities, the enkindling did not ensue till 41 hours after the impregnation: the heat kept increasing for three hours, and then the accension followed. It is worthy of remark, that these experiments succeeded better on bright days than on such as were rainy; and the accension came on more rapidly.

In another experiment, three pounds of Russian fir-black were slowly impregnated with three pounds of raw hemp-oil; and the accension ensued after nine hours.

Three quarters of a pound of German *rahm* were slowly impregnated with a pound and a half of hemp-oil varnish. The mixture remained 70 hours before it became hot and reeking; it then gradually became hotter, and emitted a strong exhalation; the effluvia were moist, and not inflammable. The reaction lasted 36 hours, during which the heat was one while stronger, and then weaker, and at length quite ceased.

Stove or chimney soot, mostly formed from birch-wood smoke, was mingled with the above-mentioned substances and tied up; the compound remained cold and quiet.

Russian fir-black, mixed with equal parts of oil of turpentine, and bound up, exhibited not the least reaction or warmth.

Birch oil, mixed with equal parts of Russian fir-black, and bound up, began to grow warm and to emit a volatile smell; but the warmth soon went off again.

From the experiments of the admiralty and of Mr Georgi, we learn, not only the decisive certainty of the self-accension of soot and oil, when the two substances are mixed under certain circumstances, but also the following particulars:

Of the various kinds of soot, or lamp-black, the experiments succeeded more frequently and surely with the coarser, more unctuous, and heavier, like Russian painters black, than with fine light German *rahm*, or with coarse chimney-soot. In regard to oils, only those experiments succeeded which were made with drying oils, either raw or boiled. The proportions of the soots to the oils were, in the successful experiments, very various; the mixture kindled with a tenth, a fifth, a third, with an equal, and likewise with a double, proportion of oil. In general, however, much more depends on the mode of mixture, and the manipulation, and, as Mr Georgi often observed, on the weather; for in moist weather the bundles, after becoming warm, would frequently grow cold again.

The instances of spontaneous inflammation hitherto mentioned have been only of vegetable substances; but we have examples of the same thing in the animal kingdom. Pieces of woollen cloth, which had not been scoured, took fire in a warehouse. The same thing happened to some heaps of woollen yarn; and some pieces of cloth took fire in the road, as they were going to the fuller. These inflammations always take place where the matters heaped up preserve a certain degree of humidity, which is necessary to excite a fermentation; the heat resulting from which, by drying the oil, leads them insensibly to a state of ignition; and the quality of the oil, being more or less deficcative, very much contributes thereto.

The woollen stuff prepared at Sevennes, which bears the name of Emperor's stuff, has kindled of itself, and burnt to a coal. It is not unusual for this to happen to woollen stuffs, when in hot summers they are laid in a heap in a room but little aired.

In June 1781, the same thing happened at a wool-comber's in a manufacturing town in Germany, where a heap of wool-combings, piled up in a close warehouse seldom aired, took fire of itself. This wool had been by little and little brought into the warehouse; and, for want of room, piled up very high, and trodden down, that more might be added to it. That this combed wool, to which, as is well known, rape-oil mixed with butter is used in the combing, burnt of itself, was sworn by several witnesses. One of them affirmed

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firmed that, ten years before, a ſimilar fire happened among the flocks of wool at a clothier's, who had put them into a caſk, where they were rammed hard, for their eaſier conveyance. This wool burnt from within outwards, and became quite a coal; it was very certain that neither fire nor light had been uſed at the packing, conſequently the above fires aroſe from ſimilar cauſes. In like manner, very credible cloth-workers have certified, that, after they have bought wool that was become wet, and packed it cloſe in their warehouſe, this wool has burnt of itſelf; and very ſerious conſequences might have followed, if it had not been diſcovered in time.

Nay, there are inſtances, though they be but rare, of human bodies being conſumed by ſpontaneous inflammation. In the Philoſophical Tranſactions, and in the Memoirs of the Academies of Paris and Copenhagen, it is related that an Italian lady (the Counteſs Cornelia Bandi) was entirely reduced to aſhes, except her legs; that an Engliſh woman, called Grace Pitt, was almoſt entirely conſumed by a ſpontaneous inflammation of her viſcera; and, laſtly, that a prieſt of Bergamo was conſumed in the ſame manner. Theſe ſpontaneous inflammations have been attributed to the abuſe of ſpirituous liquors; but though the victims of intemperance are indeed very numerous, theſe certainly do not belong to that number.

The mineral kingdom alſo often affords inſtances of ſpontaneous inflammation. Pyrites heaped up, if wetted and expoſed to the air, take fire. Pitcoal alſo, laid in heaps, under certain circumſtances, inflames ſpontaneouſly. M. Duhamel has deſcribed two inflammations of this nature, which happened in the magazines of Breſt, in the years 1741 and 1757. Cuttings of iron, which had been left in water, and were afterwards expoſed to the open air, gave ſparks, and ſet fire to the neighbouring bodies. For this obſervation we are obliged to M. de Charpentier.

The cauſes of theſe phenomena the chemiſt will aſſign; but they are here recorded as a warning to tradeſmen and others. It is evident, from the facts which have been related, that ſpontaneous inflammations being very frequent, and their cauſes very various, too much attention and vigilance cannot be uſed to prevent their dreadful effects. And conſequently it is impoſſible to be too careful in watching over public magazines and ſtorehouſes, particularly thoſe belonging to the ordnance, or thoſe in which are kept hemp, cordage, lampblack, pitch, tar, oiled cloths, &c. which ſubſtances ought never to be left heaped up, particularly if they have any moiſture in them. In order to prevent any accident from them, it would be proper to examine them often, to take notice if any heat is to be obſerved in them, and, in that caſe, to apply a remedy immediately. Theſe examinations ſhould be made by day, it not being adviſable to carry a light into the magazines; for when the fermentation is ſufficiently advanced, the vapours which are diſengaged by it are in an inflammable ſtate, and the approach of a light might, by their means, ſet fire to the ſubſtances whence they proceed. Ignorance of the fore-mentioned circumſtances, and a culpable negligence of thoſe precautions which ought to be taken, have often cauſed more misfortunes and loſs than the moſt contriving malice: it is therefore of great importance that theſe facts ſhould be univerſally known, that public utility may reap from them every poſſible advantage.

Informed, || Ink.

INFORMED Stars, or Informes Stellæ, are ſuch ſtars as have not been reduced into any conſtellation; otherwiſe called Sporades.—There was a great number of this kind left by the ancient aſtronomers; but Hevelius, and ſome others of the moderns, have provided for the greater part of them, by making new conſtellations.

INGRAHAM, *Port*, on the weſtern ſide of Waſhington Iſland, on the N. W. coaſt of N. America, is divided into two parts by Young Frederick's Iſland. It is a fine harbour for wintering in, being near the ſea, and having deep water. N. lat. 53° 37′, W. long. 133° 18′.—*Morſe.*

Ingraham *Iſles*, in the South Pacific ocean, lie N. N. W. of the Marqueſas Iſlands, from 35 to 50 leagues diſtant, and are 7 in number, viz. *Ooboona*, or Waſhington; *Wooapoo*, or Adams; Lincoln; *Nooheeva*, or Federal; *Tatoo-e-tee*, or Franklin; Hancock, and Knox. The names in Italic are thoſe by which they are known to the natives. The others were given them by Captain Joſeph Ingraham, of Boſton in Maſſachuſetts, commander of the brigantine Hope of Boſton, who diſcovered them on the 19th of April, 1791, a day remarkable in the annals of America, the revolutionary war having commenced on that day in 1775, and the firſt diſcoveries made under the flag of the United States marked its 16th anniverſary. Theſe iſlands, lying between 8° 3′ and 9° 24′ S. lat. and between 140° 19′ and 141° 18′ W. long. from Greenwich, are moſtly inhabited, and appear to be generally variegated with hills and vallies, abounding with timber, and very pleaſant. *Nooheeva*, or Federal iſland, is repreſented by the natives to be the largeſt, moſt populous and productive of the whole; which, they ſay, are 10 in number. The people reſemble thoſe of the Marqueſas Iſlands; as do their canoes, which are carved at each end. Cotton of a ſuperior quality grows here. The natives were friendly. Before Ingraham's diſcovery was known, Captain Joſiah Roberts, of Boſton, ſailed in the ſhip Jefferſon for the N. W. Coaſt, and likewiſe diſcovered theſe iſlands. As theſe iſlands lie in that part of the Pacific Ocean, through which veſſels from Europe or America, bound to the N. W. Coaſt, muſt paſs, and are not far out of their uſual track, they may be viſited for refreſhment in caſe of need.—*ib.*

INIRCHIA RIVER, or *Caguela*, the name of Orinoco river, at its ſource in the mountains, weſtward, between New Granada and Peru, not far from the South Sea.—*ib.*

Sympathetic INK is an old invention. Among the methods by which Ovid teaches young women to deceive their guardians, when they write to their lovers, he mentions that of writing with new milk, and of making the writing legible by coal-duſt or ſoot.

Tuta quoque eſt, fallitque oculos, e lacte recenti
Litera: carbonis pulvere tange, leges.

It is obvious, that any other colourleſs and glutinous juice, which will hold faſt the black powder ſtrewed over it, will anſwer the purpoſe as well as milk; and therefore Pliny recommends the milky juice of certain plants to be uſed.

There

There are several metallic solutions perfectly colourless, or, at least, without any strong tint, which being wrote with, the letters will not appear until the paper be washed over with another colourless solution, or exposed to the vapour of it; but among all these there is none which excites more astonishment, or from which naturalists can draw more conclusions, than that which consists of a solution of lead in vegetable acid, and which by the vapour of arsenical liver of sulphur becomes black, even at a considerable distance. This ink, which may be used by conjurors, proves the subtlety of vapour, and the porosity of bodies; as the change or colouring takes place even when the writing is placed on the other side of a thin wall.

We knew before, that a solution of lead, treated in this manner, would answer the purpose of a sympathetic ink (see that article *Encycl.*); but we did not know, nor do we yet believe, that the sulphuric vapours will act upon the writing through *a wall*. Such, however, is the affirmation of Professor Beckmann, who gives an account of a still more wonderful ink from Peter Borel. This author, in a book called *Historiarum et observationum medico-physic. centuriæ quatuor*, printed at Paris, first in 1653, and afterwards in 1657, gives a receipt for making this ink, which he calls *magnetic waters which act at a distance*. The receipt is as follows:

"Let quick-lime be quenched in common water, and while quenching, let some orpiment be added to it (this, however, ought to be done by placing warm ashes under it for a whole day), and let the liquor be filtered, and preserved in a glass bottle well corked. Then boil litharge of gold, well pounded, for half an hour with vinegar, in a brass vessel, and filter the whole through paper, and preserve it also in a bottle closely corked. If you write any thing with this last water, with a clean pen, the writing will be invisible when dry; but if it be washed over with the first water it will become instantly black. In this, however, there is nothing astonishing; but this is wonderful, that though sheets of paper without number, and even a board, be placed between the invisible writing and the second liquid, it will have the same effect, and turn the writing black, penetrating the wood and paper without leaving any traces of its action, which is certainly surprising; but a fetid smell, occasioned by the mutual action of the liquids, deters many from making the experiment. I am, however of opinion, that I could improve this secret by a more refined chemical preparation, so as that it should perform its effect through a wall. This secret (says Borel) I received, in exchange for others, from J. Brosson, a learned and ingenious apothecary of Montpelier."

For making a sympathetic ink of the fifth class mentioned in the *Encyclopædia*, the following process by M. Meyer may be worthy of the reader's notice. It was entered upon in consequence of a receipt for rose-coloured sympathetic ink shewn to him by a traveller. In that receipt cobalt was the principal ingredient, and therefore the first object was to procure cobalt; but M. Meyer, being unwilling to sacrifice pure pieces of cobalt of any considerable size, made choice of one, which was visibly mixed with bismuth, iron, and quartz. He endeavoured to separate the bismuth as much as possible, and also the arsenic, if it should contain any, by bringing it slowly to a red heat; and he succeeded pretty well, as the bismuth flowed from it in abundance; and the arsenic, the quantity of which was small, was volatilised: many globules of bismuth still adhered to it. By bringing it repeatedly to a red heat, and then quenching it in water, it was reduced to such a state as to be easily pulverised. Having poured nitrous acid upon the powder, he obtained by digestion a beautiful rose-red solution; the siliceous earth was separated in the form of a white slime, and by diluting it with water there was deposited a white powder, which was oxyd of bismuth. The solution being filtered, he added to it a solution of potash, and obtained a precipitate inclining more to a yellow than to a red colour. He again poured over it a little of the nitrous acid, by which a part of the oxyd was re-dissolved of a red colour: the remaining part, which had a dark brown colour, was oxyd of iron. From the solution, by the addition of potash, a precipitate was formed, which was now reddish. Having by this process obtained it pure, that he might now prepare from it the wished for red ink, he dissolved the washen pure oxyd of cobalt in different acids. That dissolved in the nitrous acid with a mixture of nitre, gave a green ink like the common: that dissolved in the sulphurous acid, without the addition of salts, gave a reddish ink, which remained after it was exposed to heat, and would not again disappear, even when a solution of nitre was applied; and that dissolved in the muriatic acid, gave a green ink, darker and more beautiful than the common. By dissolving it, however, in the acetous acid, and adding a little nitre, he obtained what he had in view; for it gave, on the application of heat, an ink of a red colour, like that of the *rosa centifolia*, which again disappeared when the paper became cold.

INNA-QUITO, one of the spacious plains upon the N. side of Quito, in Peru.—*Morse*.

INORDINATE Proportion, is where the order of the terms compared is disturbed or irregular. As, for example, in two ranks of numbers, three in each rank, viz. in one rank, - - - - 2, 3, 9,
and in the other rank, - - - - 8, 24, 36,
which are proportional, the former to the latter, but in a different order, viz. - - 2 : 3 : : 24 : 36,
and - - 3 : 9 : : 8 : 24.
then, casting out the mean terms in each rank, it is concluded that - - - - - 2 : 9 : : 8 : 36,
that is, the first is to the 3d in the first rank,
as the first is to the 3d in the 2d rank.

INSCUA RIVER, is laid down in some maps as the north-western and main branch of St Croix river, an eastern water of the Mississippi, rising in the 48th degree of north latitude.—*Morse*.

INSECTS (See *Encycl.*). A number of non-descript little animals was discovered by La Martiniere the naturalist when accompanying Perouse on his celebrated voyage of discovery. These animals he called *insects*, and to many of them he gave particular names. Of these we shall give his description in this place, leaving our readers, as he has left his, to arrange them properly according to the Linnæan classification.

"The insect, which is figured N° 1. inhabits a small prismatic triangular cell, pointed at the two extremities, of the consistence and colour of clear brittle ice; the body of the insect is of a green colour, spotted with small bluish points, among which are some of a golden tinge; it is fixed by a ligament to the lower part of its small

small habitation: its neck is terminated by a small blackish head composed of three converging scales, in the form of a hat, and enclosed between three fins, two of them large and channelled in the upper part (A) and one small, semicircular (B). When it is disturbed, it immediately withdraws its fins and its head into its cell, and gradually sinks into the water by its own specific gravity. Fig. 2. represents the under side of the prism, shewing in what manner it is channelled, in order to allow free passage to the animal when it wishes to shut itself up in it. Fig. 3. represents the profile of the same. The movement carried on by the two larger fins, which are of a softish cartilaginous substance, may be compared to that which would be produced by the two hands joined together in the state of pronation, and forming, alternately, two inclined planes and one horizontal plane: it is by means of this motion that it supports itself on the top of the water, where it probably feeds on fat and oily substances on the surface of the sea." Our author found it near Nootka, on the north-west coast of America, during a calm.

Fig. 4. represents a collection of insects, as our author calls them, consisting only of oval bodies, similar to a soap bubble, arranged in parties of three, five, six, and nine: among them are also some solitary ones. These collections of globules, being put into a glass filled with sea-water, described a rapid circle round the glass by a common movement, to which each individual contributed by simple compression of the sides of its body, probably the effect of the re-action of the air with which they were filled. It is not, however, easy to conceive how these distinct animals (for they may be readily separated without deranging their economy) are capable of concurring in a common motion. "These considerations (says our author), together with the form of the animal, recalled to my mind, with much satisfaction, the ingenious system of M. de Buffon; and I endeavoured to persuade myself, that I was about to be witness to one of the most wonderful phenomena of Nature, supposing that these molecules, which were now employed in increasing or diminishing their number, or performing their revolutions in the glass, would soon assume the form of a new animal of which they were the living materials. My impatience led me to detach two from the most numerous group, imagining that this number might perhaps be more favorable to the expected metamorphosis. I was, however, mistaken. These I examined with more attention than the rest; and the following account is of their proceedings alone. Like two strong and active wrestlers, they immediately rushed together, and attacked each other on every side: sometimes one would dive, leaving its adversary at the surface of the water; one would describe a circular movement, while the other remained at rest in the centre; their motions at length became so rapid as no longer to allow me to distinguish one from the other. Having quitted them for a short time, on my return I found them reunited as before, and amicably moving round the edge of the glass by their common exertions."

Fig. 5. represents a singular animal, which has a considerable resemblance to a little lizard; its body is of a firm, gelatinous consistence; its head is furnished on each side with two small gelatinous horns, of which the two hindermost are situate the furthest inward: its body is provided with four open fan-like paws, and some appendages near the insertion of the tail, and terminates like that of a lizard: the ridge of the back is divided the whole way down by a band of a deep blue; the rest of the body, as well as the inside of its paws, is of a bright silvery white. It appears to be very sluggish in its motions; and when disturbed by the finger, merely turned itself belly upwards, soon afterwards resuming its former position. Fig. 6. represents it reversed. Martiniere caught it during a calm at the landing place on the Bashee-Islands.

INSTITUTE is a name which has lately been substituted for *school* or *academy*. Formerly *institution*, in the propriety of the English language, was sometimes used as a word of the same import with *instruction*; and now *institute* is employed, especially by the admirers of French innovations, to denote what had hitherto been called an academy. When royalty was abolished in France, it would have been absurd to continue the titles *Royal* Academy of Sciences, *Royal* Academy of Inscriptions, &c.; but instead of merely abolishing the word *royal*, and substituting *national* in its stead, it occurred to the fertile brain of Condorcet, to abolish the seven academies themselves, or rather to melt them all down into one great academy; to which was given the appellation of the

National Institute, or *New Academy of Arts and Sciences*. This academy, founded on a decree of the new constitution, was opened on the 7th of December 1795, when Benezech, the then minister for the home department, attended, and the decree of foundation was read; which was to the following purport:

"The Academy of Arts and Sciences belongs to the whole republic, and Paris is its place of residence. Its employment is to aim at bringing all arts and sciences to the utmost perfection of which they are capable. It is to notice every new attempt, and all new discoveries, and to keep up a correspondence with all foreign literary societies. And by the particular orders of the Executive Directory, its first studies are to be directed to those subjects which more immediately tend to the reputation and advantage of the French republic."

The academy is to consist of 288 members, half of whom are to reside in Paris, the other half in the departments; and to them is to be added a certain number of foreigners, as honorary members, confined at present to twenty-four.

The academy is divided into three classes, each class into sections, each section to contain twelve members.

1st class. Mathematics and natural philosophy. This class is divided into ten sections. 1. Mathematics. 2. Mechanical arts. 3. Astronomy. 4. Experimental philosophy. 5. Chemistry. 6. Natural history. 7. Botany. 8. Anatomy and animal history. 9. Medicine and surgery. 10. Animal œconomy, and the veterinary science.

2d class. Morality and politics. This class consists of six sections. 1. Analysis of sensations and ideas. 2. Morals. 3. Legislature. 4. Political economy. 5. History. 6. Geography.

3d class. Literature and the fine arts. This class consists of eight sections. 1. Universal grammar. 2. Ancient languages. 3. Poetry. 4. Antiquities. 5. Painting. 6. Sculpture. 7. Architecture. 8. Music.

For each class a particular room in the Louvre is appropriated. No one can be a member of two classes at the

the same time, but a member of one class may be present at the meetings of any other. Each class is to print, yearly, an account of its transactions.

Four times a-year there are to be public meetings. On these occasions, the three classes meet together. At the end of each year, they are to give a circumstantial account to the legislative body of the progress made in that year in the arts and sciences. The prizes given yearly by each class are to be publicly notified at certain times. The sums requisite for the support of the institution are to be decreed yearly by the legislative body, upon a requisition made by the Executive Directory.

The first forty-eight members were chosen by the Executive Directory, to whom the choice of the remaining members was confided. To the members, residentiary in Paris, is reserved the choice both of the department and the foreign members. On a vacancy in any class, three candidates are named by the class for the choice of the body at large.

Each class is to have, at its place of meeting, a collection of the products, both of nature and art, and a library, according to its particular wants.

The regulations of the institution, with respect to the times of meeting, and its employments, are to be drawn up by the body at large, and laid before the legislative assembly.

The hall in which the body at large holds its meetings, forms part of the west wing of the Old Louvre, at present called the Museum. It formerly went by the appellation of the Hall of Antiques *(Salle des Antiques)*; and as long as the kings inhabited this part of the palace, was occupied by their guards, from which circumstance it obtained the name of the Hall *des Cent Suisses*. It was likewise appropriated to banquets and entertainments, given by the court on gala days; and it was to this place that Henry IV. was conveyed, on his assassination by Ravaillac, in the *Rue de la Ferronnerie*.

It was built at the same time with the rest of this part of the Louvre, about the year 1528, after the designs of Pierre Lescot, abbot of Clagny. It is 144 feet in length, and 40 in breadth, and holds from 1000 to 1200 persons. In order to adapt it to its new destination, the floor has been sunk, which gives a greater air of lightness to the roof. In the centre stands a double table, in the form of a horse-shoe, supported by sphinxes, at which the members of the institute take their seats. This table is surrounded by two tiers of benches, which are raised for the accommodation of spectators, who have likewise seats provided for them in the vast embrasures of the windows, and at each extremity of the hall.

Whether science will be advanced by the seven royal academies having been melted into one, time must determine; but candour compels us to acknowledge, that the proceedings of the national institute have hitherto been abundantly interesting. Intimately connected with the national institute is the French system of

National Instruction, which is likewise novel, and therefore sufficiently curious to deserve notice in a Work of this kind. When the Christian religion was abolished in France, it was impossible to continue the universities and other seminaries which were founded by Christians, and obliged by their constitution to teach, whether pure or not, the doctrines of Christianity. They were accordingly all swept away, and a new system of education planned, which was to be carried on in what they call

The Primary Schools.
The Central Schools.
The School of Health.
The School of Oriental Languages.
The Polytechnic School.
The National institute.
The Jury of Public Instruction.
The Commission of Public Instruction.
The Legislative Committee of Instruction. And various other national establishments for the improvement of particular sciences.

The first degree of public instruction is to be met with in the *Ecoles Primarées*, established by a decree of the convention of the second *Pluviose*, in the second year of the republic (A). Every district is furnished with one of these schools; the professors or masters in which are paid from the national treasury; and to which every head of a family, without exception, is compelled by law to send its children for instruction. The subjects taught in these primary or elementary schools are divided into nine classes:

1st, Instructions connected with the physical and moral situation of children, prior to their entering into these schools. *2d*, Similar instructions as a guide to teachers in the national schools. *3d*, The arts of reading and writing. *4th*, The elements of French grammar. *5th*, Elements of arithmetic and geometry, with the theory of the new mensuration. *6th*, The elements of geography. *7th*, Explanations of the principal phenomena and productions of nature. *8th*, Elements of agriculture. *9th*, Elements of republican morals.

Next to the primary schools in rank and consequence are the *Ecoles Centrales*, which were established by a decree of the Convention of the seventh *Ventose* in the third year. They are situated in the capital of every department, bearing the proportion of one central school to 300,000 inhabitants. In these schools the republican youths are taught the sciences, and their application in real life. In each of them are professors for the following branches:

1. For mathematics. 2. Experimental philosophy and chemistry. 3. Natural history. 4. Agriculture and commerce. 5. Logic and metaphysics. 6. Political economy and legislation. 7. The philosophical history of nations. 8. The art of healing. 9. Arts and manufactures. 10. Universal grammar. 11. The belles lettres. 12. The ancient languages. 13. The modern languages. 14. The fine arts.

Each central school is furnished with an extensive public library—a botanic garden—a cabinet of natural history—an apparatus for experimental philosophy—and

(A) We would translate this chronological jargon into the language of Christian Europe, were we not persuaded that the French calendar, the French constitution, and the French institutes, will have the same duration: we trust in God not a long duration. For *Pluviose*, and the other fantastical names of months introduced into this article, see Revolution, *Encycl.* n° 184.

and a collection of machines and models connected with the arts and manufactures.

The professors of each school hold, every month, a public sitting, in which conferences are held relative to subjects connected with the improvement of letters, the sciences, and the arts, which are the most beneficial to society.

The object in the establishment of the primary and central schools was, the general instruction of all classes of the citizens; and it being incompatible with the perfect completion of that important purpose, to expect from them the propagation of particular branches of science, it became necessary to establish other literary and scientific academies.

Accordingly, the French government have founded, *1st*, Schools of health *(les ecoles de fante)*, in Paris, Strasburgh, and Montpelier, where medicine and surgery are studied; which schools are affirmed, by those who find nothing wrong in France, to be the most perfect of their kind, as well as new and unparalleled models for such institutions.

2d, Two schools for Oriental languages, in the national library, and in the college of France.

3d, The Polytechnic school in Paris, or central school for the direction of public works. This establishment is very generally admired and considered as a model for imitation. It contains more than 400 young persons, previously educated in the mathematics, and the majority of them intended for engineers in various lines; and they labour under the immediate direction of their tutors nine hours every day. It occupies the principal part of the *Palais de Bourbon* in Paris, and is furnished with a large collection of instruments and models. The journal of the Polytechnic school, which is published by the booksellers Regent and Bertrand at Paris, is a perfectly original work, and admirably calculated to convey useful information.

Of the national institute a sufficient account has been given in the preceding article. We proceed therefore to the jury of public instruction *(Le Jury Central d'Instruction)*, of which the principal business is to superintend the primary and central schools. It appoints the professors in these schools, and examines into their conduct. Like the legislative body it is renewed by a third every half year. When they have chosen a professor for a central school, they submit their choice to the department; and, in case of disapprobation, they make another appointment. To this jury of public instruction the professors in the central schools are amenable for all misconduct connected with their offices; it may expel them, but all its decisions must be submitted for confirmation to the tribunal of the department.

There is also established at Paris a supreme council, called The commission of Public Instruction, to which is entrusted the whole executive department. The preservation of the national monuments, of public libraries, museums, cabinets, and valuable collections; the superintendance of all the schools and the modes of instruction; all new inventions and scientific discoveries; the regulation of weights and measures; national statistics and political economy, are all placed under the authority of this supreme commission. For the commodious and regular execution of so many complicated branches of business, there is a large office, called *Le Secretariat*, which is divided into three departments.

1. For the regulation of the different kinds of instruction; of the modes of education in the schools; and for the choice of elementary books. 2. For weights and measures; inventions and discoveries; libraries and bibliography; museums, works of art, and literary rewards and encouragements. 3. For theatres, national feasts, republican institutions, and the erection of monuments.

As all public establishments require the superintendance and occasional correction of the legislature, in addition to that of their own immediate executive authority, it has been deemed necessary to appoint a permanent committee of instruction in the legislative body, to provide such sums as may be necessary for the preservation and improvement of this system of instruction. This legislative committee are invested with due authority for these purposes. Their objects are precisely the same as those of the commission of public instruction above described, only with this difference, that the latter superintends the execution of existing laws, whilst the former receives and improves them, or proposes new ones. This committee is divided into three departments, as is the commission, with exactly the same arrangement of their respective labours. The committee being charged with the enaction of all new laws, its members, with a view to obtain accurately all the requisite information relative to the numerous branches of the arts, have procured from the legislative body the appointment of a *commission temporaire des arts* to be annexed to them, and to meet in the same house with them; which temporary commission is divided into sixteen classes: viz. 1. For Zoology; 2. Botany; 3. Mineralogy; 4. Physics; 5. Chemistry; 6. Anatomy; 7. Machinery; 8. Geography; 9. Artillery and Fortification; 10. Medals and Antiquities; 11. Bibliography; 12. Painting; 13. Architecture; 14. Sculpture; 15. Bridges and Causeways; and, 16. Musical Instruments.

The improvements of the national literary and scientific establishments are numerous and important.

1st, By a decree of the convention of the 11th *Prairial*, in the second year, it was enacted, that means should be adopted by which every possible advantage might be derived from the botanic gardens of the republic, in Turkey and other foreign countries. This politic decree clearly tended to render France, in the language of the reporter. *L'abregé de tous les climats, et l'entrepôt de l'Europe.* "The epitome of every climate, and the magazine of Europe." These plants which thrive between the tropics may be cultivated in the south of France; and those which are the produce of northern climates, may be cultivated in the northern departments; by which means, France will be in possession of all foreign plants and drugs, without the exportation of specie.

2d, The National Bibliography was decreed in the sitting of 22d *Germinal*, in the second year. It consists of a complete catalogue of books of all descriptions, the property of the nation; it was then ascertained, that the republic possessed more than ten millions of books. The titles of them were to be adjusted by actual comparisons; the manuscripts to be registered separately; anonymous productions were to be arranged according to their subjects; and those of known authors in the alphabetical order of the names. The several editions to be classed according to their dates; and what may be deemed more important, this French National Bibliography will contain a dictionary of anonymous books, as well as those published under fictitious names, a desideratum in the republic of letters.

3d, The annihilation of all *patois*, or dialects, decreed in the sitting of the 16th *Prairial*, in the second year. Notwithstanding the universality of the French language, and that it was exclusively spoken in the majority of the inland departments, yet there existed thirty various dialects in France. It is more astonishing that Rozier had remarked, that between one neighbouring village and another, there was so considerable a difference in the dialect, that the inhabitants could not understand each other; and the vinestock had thirty different names. The naturalist, Villars, has stated, that in the nomenclature of vegetables, in the departments, he had only met with an hundred which had a common appellation.

4th, The establishment of the *Conservatoire des Arts et Métiers*, was decreed in the sitting of the 8th of *Vendemiaire*, in the third year. This consists of a spacious hall, in the form of an amphitheatre, and contains the instruments and the models of machinery connected with the arts, and a description of their uses, with every book relating to them. Annexed to this establishment are three expositors and a draughtsman, who explain to the students the use of each instrument, and who register every new discovery, which is presented to the *Bureau de Consultation*, to the lyceum of arts, the *ci-devant* academy of sciences, or to the board of commerce.

5th, The establishment of the board of longitude was decreed in the sitting of the 7th of *Messidor*, third year. It was certainly a disgrace under the monarchy, that an astronomical and nautical establishment, which had already proved so beneficial to Great Britain, should not have been adopted in France. In consequence of this decree, the French board is now as complete as the English. It consists of ten members, and has under its jurisdiction the national observatory at Paris, and all the astronomical instruments belonging to the republic. It corresponds with foreign astronomers; delivers public lectures on astronomy and navigation; and its proceedings are annually recited in a public sitting.

6th, The general school of the Oriental languages was established by a decree of the 10th of *Germinal*, in the fourth year. This school adjoins to the national library, and all the books and manuscripts relative to Oriental literature are deposited in it.

7th, The national museum of antiquities was decreed in the sitting of 20th of *Prairial*, fourth year. A school of this description was successfully established at Vienna, by Eckel; at Gottingen, by Heyne; at Leipsick, by Ernest; and even at Strasburgh, by the celebrated Oberlin: Paris was, however, without one. This national archeology, or science of antiquity, is divided into nine different classes: inscriptions, characters, statues, *bas reliefs*, sculptures, paintings, mosaics, medals, civil, religious, and military instruments. This extensive establishment is under the direction of two principal professors; *le Conservateur Professeur, et le Conservateur Bibliothecaire*. The province of the former is to deliver public lectures on the several branches of antiquities, to teach the theory of medals and engravings, the history of the arts among the ancients, &c. The duties of the latter are merely of a bibliographical nature.

8th, The new modelling of the Grand National Library, was decreed in the sitting of 25th *Vendemiaire*, in the fourth year. By virtue of this decree, the place of librarian in chief was suppressed, and the whole establishment placed under a *conservatoire* of eight members; of whom two were appointed for the superintendance of printed books; two for manuscripts; two for antiquities; and two for engravings. From these a temporary director is annually chosen, who superintends the whole, acts occasionally as president of this assembly, and maintains a regular correspondence with the constituted authorities relative to the concerns of the library.

9th, The augmentation of the Museum of Natural History, formerly called *Le Jardin Royal des Plantes*. This establishment was decreed the 15th *Brumaire*, third year, upon a report of Thibadeau, in the name of the committee of Public Instruction. Besides the addition of large rooms, and various other buildings, there are new collections of natural curiosities and productions; and the library is much increased. It is open to the public three times a week. At stated periods all the naturalists in Paris deliver courses of lectures in the various branches of natural history. The museum is said to have received greater improvements from this augmentation than from all the labours of Buffon, or from its foundation, since the time of Tournefort.

10th, The *Ecole des Mines* was established in the *Hotel des Monnaies*, and has for its direction the naturalist Le Sage. This institution is unrivalled in Europe; and the collection of mineralogical curiosities surpasses whatever can be conceived.

11th, The society of natural history in Paris, deservedly classes among those which have rendered the greatest services to the cause of science since the revolution. A lecture of public instruction is held every ten days, which is generally given by one of the members, and which is open to all the lovers of natural history. Premiums are proposed for dissertations; one of which, by the late C. Herman, jun. (whose early decease was a great loss to the republic of letters) on the *apterous* class of insects, may be said to constitute an epocha in the annals of natural history. The society has published a volume of memoirs, in folio, entitled, "*Transactions of the Society of Natural History*." It has likewise erected a statue to the great Linnæus, in the national garden of plants; and, at the period when every public instruction was suspended, gave lectures on the different branches of science belonging to its department. Several intelligent and skilful navigators, among others those sent in search of the unfortunate La Pérouse, as well as those which accompanied Buonaparte on his romantic expedition to Egypt, were members of this society.

This statement of facts relative to the present state of public instruction, the sciences, the arts, and the progress of national literature in France, has been taken from a miscellany, of which the principal writers are well acquainted with what is doing in that distracted country. They call it a sublime system; and seem to consider the increase of the national library, the improvement of the botanic gardens, and the discoveries that have been made by the different schools or institutes, as furnishing a demonstration that the republican government is more favourable to the advancement of

science

science, than the monarchical, whether absolute or limited. But it should not be forgotten, that this system is yet in its infancy; and that in prosecuting new schemes, all men, and more especially Frenchmen, are actuated by an enthusiasm which gradually cools as their pursuits become familiar. We shall therefore venture to predict, that the different schools will not display such ardour twenty years hence as they do at present; and that if the republican government continue thirty years in France, the progress of science in that country will not be more rapid than it was under the monarchy. We must remember, too, that the French libraries, museums, and picture galleries, have been improved by means which the morals of other governments do not employ--by rapine and robbery.

That something may be learned from this system to improve the modes of education in other countries, we admit; and it is for that reason that we have inserted an account of it. But if it contains something worthy of imitation, it contains likewise much to be shunned. We do not think it consistent with the *rights of man* to *compel* parents to send their children to be educated in *particular* schools; especially in schools where not only religious instruction is omitted, but where, there is reason to believe, that the professors are at pains to raze all religious impressions from the youthful mind. In a nation denying the truth of Christianity, it is not to be supposed that the Christian religion will be publicly taught; but in a nation of philosophers, as the French call themselves, it might have been expected that the laws of religious toleration would have been so far regarded, that Christian parents would not have been *compelled* to send their children to *antichristian* schools! But it is not Christianity alone that is neglected in this *sublime* system of education. Though the legislative body has some time ago decreed that there is a God, there is not in any one of those schools the smallest care taken to instruct the republican youth in the principles even of natural religion! We might indeed have looked for it under the title *Metaphysics*, had not the constitution of the National Institute taught us, that French metaphysics attend to nothing but the analysis of sensations and ideas. Yet the legislators might have listened on this subject to a republican as sound as themselves, and who was likewise no friend to superstition. "Nam et Majorum instituta tueri sacris, ceremoniisque retinendis sapientis est. Non solum ad religionem pertinet, sed etiam ad *civitatis* statum, ut sine iis, qui sacris publice præsunt, religioni privatæ satisfacere non possint." *Cicero de Nat. Deorum.*

INSURANCE, in law and commerce, though an excellent institution, is not of high antiquity. The oldest laws and regulations concerning insurance, with which the indefatigable Beckmann is acquainted, are the following:

On the 28th of January 1523, five persons appointed for that purpose drew up at Florence some articles which are still employed on the exchange at Leghorn. These important regulations, together with the prescribed form of policies, which may be considered as the oldest, have been inserted, in Italian and German, by Magens, in his Treatise on Insurance, average, and bottomry, published at Hamburgh in 1753.

There is still preserved a short regulation of the 25th May 1537, by the Emperor Charles V. respecting bills of exchange and insurance, in which the strictly fulfilling only of an agreement of insurance is commanded.

In the year 1556, Philip II. king of Spain, gave to the Spanish merchants certain regulations respecting insurance, which are inserted by Magens, with a German translation, in his work before-mentioned. They contain some forms of policies on ships going to the Indies.

In the year 1598, the *Kamer van assurantie*, chamber of insurance, was established at Amsterdam. An account of the first regulations of this insurance office may be seen in Pontanus's History of the city of Amsterdam, and in other works.

In the year 1600, regulations respecting insurance were formed by the city of Middelburg in Zealand.

It appears that the first regulations respecting insurances in England, which may be seen in *Anderson's History of Commerce*, were made in the year 1601. We find by them, that insurers had before that period conducted themselves in such a manner, that the utmost confidence was reposed in their honesty, and that on this account few or no disputes had arisen.

Of the various policies for insurance in England, a pretty accurate account will be found in the *Encyclopædia*; but there is one of them, of which our account must be acknowledged to be now defective. This is,

Insurance on lives; which is a policy that has greatly increased, in consequence of its utility being more generally understood. Of the two offices for life-assurances, noticed in that article, the former, entitled the *Amicable Society*, has extended the number of its shares to 4000; but, as we have already observed, the nature of the institution is too limited to become of general importance. The latter, entitled, the *Society for Equitable Assurances on Lives and Survivorship*, is undoubtedly one of the most important institutions of the kind, as will appear by the following account, with which we have been favoured by an obliging correspondent, and upon the accuracy of which our readers may depend:

The members of the equitable society, finding, in June 1777, that their affairs were in a flourishing situation, resolved to reduce their annual premiums one tenth; and in 1782, adopted new tables agreeable to the probabilities of life at Northampton, in lieu of those they had hitherto used, formed from the London bills of mortality. But though it was evident, that the new tables were much better adapted for assuring promiscuously persons residing in the country, or in large towns, it was thought proper, for greater security, to make an addition of 15 per cent. to the real value of the assurances, as computed from the table of mortality at Northampton; and with the view of making an adequate compensation to the assured for their former payments, which had been so much higher than would be required by the new rates, an addition was made to their claims of L.1 : 10s. per cent. for every premium they had paid. The consequence of these measures proved highly favourable to the society; for its business increased so fast, that in 1785 it was nearly doubled; the sums assured amounting to upwards of L.720,000. At this period, the favourable result of a minute and very laborious investigation of the state of the society, induced them to take off the 15 per cent. charged upon the premiums in 1782, and make a further addition to the claims of L.1 per cent. for every payment made prior to the 1ſt January 1786. A ſtill greater increaſe of ſucceſsful buſineſs determined them, in 1791, to make another addition of L.1 per cent. to the claims; and in the following year, a further addition of L.2 per cent.; by which the claims upon aſſurances of the year 1770 were more than doubled; and thoſe of an earlier date increaſed in a ſtill higher proportion. By theſe advantages to its members, and the honourable and truly equitable manner in which the concerns of the ſociety are tranſacted, the augmentation of their buſineſs has been ſo great, that on the 31ſt December 1792, the ſums aſſured (without including the additions made to them) amounted to upwards of L.3,000,000; and on the 31ſt December 1795, to about L.4,000,000.

The rates of aſſurance, as reduced to their real values in 1786, and according to which the ſociety now tranſact buſineſs, are as follows:

Sum Aſſured £.100.

Age.	*One Year.*	*Seven Years.*	*Whole Life.*
15	£.0 17 11	£.1 2 11	£.1 18 7
20	1 7 3	1 9 5	2 3 7
25	1 10 7	1 12 1	2 8 1
30	1 13 3	1 14 11	2 13 4
35	1 16 4	1 18 10	2 19 10
40	2 0 8	2 4 1	3 7 11
45	2 6 8	2 10 10	3 17 11
50	2 15 1	3 0 8	4 10 10
55	3 5 0	3 12 0	5 6 4
60	3 18 1	4 7 1	6 7 4
65	4 15 2	5 10 10	7 16 9

The other offices in London for the aſſurance of lives are, the *Royal Exchange Aſſurance*, the *Weſtminſter, Society*, and the *Pelican Life Office*.

The corporation of the *Royal Exchange Aſſurance* was empowered to aſſure lives by its ſecond charter, dated 29th April 1721; but the original object of the company being ſea aſſurances, and the true principles of aſſuring on lives being at that time little underſtood, this branch of their buſineſs was at firſt comparatively ſmall: they generally required a premium of five or ſix guineas per cent. without any regard to the age; and the aſſurance, which was uſually for a ſmall ſum, was ſeldom for a greater term than one year. In this manner they continued to aſſure upon lives till the end of the year 1783, when the increaſing importance of this part of their buſineſs, which they had ſome years felt, induced them to adopt a regular table of rates of aſſurance, according to the Northampton regiſters of mortality, but with a greater addition to the real values than had been made by the "Society for Equitable Aſſurances on Lives and Survivorſhip." This was thought proper, from the conſideration that the aſſurers with the Royal Exchange company are not in any caſe liable to a call upon them beyond the premium they engage to pay, and have the ſecurity of the capital and funds of the company ariſing from the other branches of their buſineſs; however, the company, finding themſelves ſucceſsful in their life aſſurances, determined, in 1790, to reduce their premiums; and in 1797 made a ſtill greater reduction, by which they are brought very near to thoſe above ſtated. This company have agents in all the principal towns of Great Britain, and are impowered to aſſure lives in all parts of the world.

The *Weſtminſter Society* was eſtabliſhed in 1792, for aſſuring lives, and granting annuities. Their terms are nearly the ſame as thoſe of the Royal Exchange Aſſurance; but not being a corporate body, every perſon aſſuring ſigns a declaration, that he accepts the joint ſtock of the ſociety as his ſecurity.

The *Pelican Life Office* was inſtituted in 1797, by ſome of the principal proprietors of the Phœnix Fire Office. The rates which they have publiſhed vary conſiderably from thoſe of the other offices; but whether they are founded on more juſt principles, time and experience muſt determine. This ſociety alſo makes a new ſpecies of aſſurance, by way of endowment for daughters, or for children generally, when they ſhall attain the age of twenty-one years.

INTEGRAL CALCULUS, in the new analyſis, is the reverſe of the differential calculus, and is the finding of the integral from a given differential; being ſimilar to the inverſe method of fluxions, or the finding the fluent to a given fluxion. See FLUXIONS, *Encycl.*

INTEREST, is the allowance given for the uſe of money by the borrower to the lender, and is either *ſimple* or *compound*. The method of computing both intereſts is explained in the article ALGEBRA, (*Encycl.*) page 427, &c.; and the ſubject of ſimple intereſt is again reſumed in ARITHMETIC, (*Encycl.*) n° 20. The application of the canons for the computation of compound intereſt, to the value of annuities, the only caſe in which that intereſt is allowed by the laws of this country, may be ſeen in the articles ANNUITY and SURVIVORSHIP, (*Encycl.*); where various tables are given to facilitate the different computations. Some of our readers, however, have expreſſed a wiſh to have the rule for computing compound intereſt ſo ſtated, as to be underſtood by thoſe who are unacquainted with algebraic ſymbols. Their wiſh may be eaſily gratified.

The general formula $S = p R^t$ anſwers for the amount of any ſum, whether the intereſt be payable yearly, half-yearly, quarterly, or daily. Let R denote the amount of one pound for the firſt payment, and t the number of payments, the unit being from the commencement till the firſt payment is due; alſo, let l denote the logarithm of any quantity before which it is wrote; then, from the known property of logarithms, the theorem may be expreſſed thus, $l. S = l. p + l. R \times t$.

Required the amount of L.250 at 5 per cent. compound intereſt, for 12 years, reckoning the intereſt payable yearly, half-yearly, quarterly, and daily?

Yearly. $p = 250$, $R = 1{\cdot}05$, $t = 12$.

$$\begin{array}{r} 0{\cdot}0211893 = l.\,R \\ 12 \\ \hline {\cdot}2542716 = l.\,R \times t. \\ 2{\cdot}3979400 = l.\,p. \end{array}$$

$l. S = 2{\cdot}6522116$—L.448 : 19 : $3\frac{1}{4}$ = Amount.
250

198 : 19 : $3\frac{1}{4}$ = Comp. intereſt.

Half

Half yearly, $p = 250$, $R = 1{\cdot}025$, $t = 24$.

$$\begin{array}{r} 0{\cdot}0107239 = l.\ R. \\ 24 \\ \hline 428956 \\ 214478 \\ \hline {\cdot}2573736 = l.\ R \times t. \\ 2{\cdot}3979400 = l.\ p. \\ \hline \end{array}$$

$l.\ S = 2{\cdot}6553136$ — L.452 : 3 : $7\frac{1}{4}$ = Amount.
250
202 : 3 : $7\frac{1}{4}$ = Interest.

Quarterly. $p = 250$, $R = 1{\cdot}0125$, $t = 48$.

$$\begin{array}{r} 0{\cdot}0053950 = l.\ R. \\ 48 \\ \hline 431600 \\ 215800 \\ \hline {\cdot}2589600 = l.\ R \times t. \\ 2{\cdot}3979400 = l.\ p. \\ \hline \end{array}$$

$l.\ S = 2{\cdot}6569000$ — L.453 : 16 : $8\frac{3}{4}$ = Amount.
250
203 : 16 : $8\frac{3}{4}$ = Interest.

Daily, $p = 250$, $R = 1 + \frac{\cdot 05}{365} = \frac{365{\cdot}05}{365}$, $t = 365 \times 12$.

$$\begin{array}{r} 2{\cdot}5623524 \\ 2{\cdot}5622929 \\ \hline {\cdot}0000595 = l.\ R. \\ 4380 \\ \hline 47600 \\ 1785 \\ 2380 \\ \hline {\cdot}2606100 = l.\ R \times t. \\ 2{\cdot}3979400 = l.\ p. \\ \hline \end{array}$$

$l.\ S = 2{\cdot}6585500$ — L.455 : 11 : $3\frac{1}{2}$ = Amount.
250
205 : 11 : $3\frac{1}{2}$ = Interest.

INTERPOLATION, in the modern algebra, is used for finding an intermediate term of a series, its place in the series being given. See ALGEBRA and SERIES, *Encycl.*

The method of interpolation was first invented by Mr Briggs, and applied by him to the calculation of logarithms, &c. in his Arithmetica Logarithmica, and his Trigonometria Britannica; where he explains, and fully applies, the method of interpolation by differences. His principles were followed by Reginal and Mouton in France, and by Cotes and others in England. Wallis made use of the method of interpolation in various parts of his works; as his arithmetic of infinites, and his algebra, for quadratures, &c. The same was also happily applied by Newton in various ways: by it he investigated his binomial theorem, and quadratures of the circle, ellipse, and hyperbola. See Wallis's Algebra, chap. 85. &c. Newton also, in lemma 5. lib. 3. Princip. gave a most elegant solution of the problem for drawing a curve line through the extremities of any number of given ordinates; and in the subsequent proposition, applied the solution of this problem to that of finding, from certain observed places of a comet, its place at any given intermediate time. And Dr Waring, who adds, that a solution still more elegant, on some accounts, has been since discovered by Mess. Nichol and Stirling, has also resolved the same problem, and rendered it more general, without having recourse to finding the successive differences. *Philos. Trans.* vol. 69. part 1. art. 7.

INTERSCENDENT, in algebra, is applied to quantities, when the exponents of their powers are radical quantities. Thus $x^{\sqrt{2}}$, $x^{\sqrt{a}}$, &c. are interscendent quantities.

INTERSTELLAR, a word used by some authors to express those parts of the universe that are without and beyond the limits of our solar system.

INTRADOS, the interior and lower side, or curve, of the arch of a bridge, &c. In contradistinction from the extrados, or exterior curve, or line on the upper side of the arch. See ARCH in this *Suppl.*

INVERNESS, NEW, a town on the river Alatamaha, in Georgia, built by a company of emigrants from the Highlands of Scotland, 130 of whom were brought over by Gen. Oglethorpe in 1734. It is about 20 miles from Frederica. These settlers presented a most pathetic and prophetic remonstrance to Gen. Oglethorpe in January, 1738, against the introduction of slaves into the colony.—*Morse.*

INVOLUTION and EVOLUTION, are terms introduced into geometry by the celebrated Mr Huyghens, to express a particular manner of describing curvilineal spaces which occurred to him when occupied in the improvement of his noble invention of pendulum clocks. Although he was even astonished at the accuracy of their motion, and they soon superseded all balance clocks, he knew that the wide vibrations were somewhat slower than the narrow ones, and that a circle was not sufficiently incurvated at the sides to render all the vibrations isochronous. The proper curve for this purpose became an interesting object. By a most accurate investigation of the motions of heavy bodies in curved paths, he discovered that the cycloid was the line required. Lord Brouncker had discovered the same thing, as also Dr Wallis. But we do not imagine that Huyghens knew of this; at any rate, he has the full claim to the discovery of the way of making a pendulum oscillate in a cycloidal arch. It easily occurred to him, that if the thread by which the pendulum hangs be suspended between two curved cheeks, it would alternately lap on each of them in its vibrations, and would thus be raised out of the circle which it describes when suspended from a point. But the difficulty was to find the proper form of those cheeks. Mr Huyghens was a most excellent geometer, and was possessed of methods unknown to others, by which he got over almost every difficulty.

difficulty. In the present case there was fortunately no difficulty, the means of solution offering themselves almost without thought. He almost immediately discovered that the curve in question was the same cycloid. That is, he found, that while a thread unwinds from an arch of a cycloid, beginning at the vertex, its extremity describes the complementary arch of an equal cycloid.

Thus he added to this curve, already so remarkable for its geometrical properties, another no less curious, and infinitely exceeding all the others in importance.

The steps by which this property was discovered are such direct emanations from general principles, that they immediately excited the mind of Mr Huyghens, which delighted in geometry, to prosecute this method of describing or transforming curve lines by evolution. It is surprising that it had not ere this time occurred to the ancient geometers of the last century, and particularly to Dr Barrow, who seems to have racked his fancy for almost every kind of motion by which curve lines can be generated. Evolution of a thread from a curve is a much more obvious and conceivable genesis than that of the cycloid invented by Mersennus, or that of the conchoid by Nicomedes, or those of the conic sections by Vieta. But except some vague expressions by Ptolemy and Gassendus, about describing spirals by a thread unlapped from a cylinder, we do not recollect any thing of the kind among the writings of the mathematicians; and it is to Huyghens alone that we are indebted for this very beautiful and important branch of geometry. It well deserves both of these epithets. The theorems which constitute the doctrines of evolution are remarkable for their perspicuity and neatness. Nothing has so much contributed to give us clear notions of a very delicate subject of mathematical discussion, namely curvature, and the measure and variations of curvature. It had become the subject of very keen debate; and the notions entertained of it were by no means distinct. But nothing can give such a precise conception of the difference of curvature, in the different parts of a cycloid or other curve, as the beholding its description by a radius continually varying in length. This doctrine is peculiarly valuable to the speculator in the higher mechanics. The intensity of a deflecting force is estimated by the curvature which it induces on any rectilineal motion; and the variations of this intensity, which is the characteristic of the force, or what we call its nature, is inferred from the variations of this curvature. The evolution and involution of curve lines have therefore great claim to our attention. But a Work like ours can only propose to exhibit an outline of the subject; and we must refer our readers to those eminent authors who have treated it in detail. Varignon, in the Memoirs of the French Academy for 1706, has been at immense pains to present it in every form; James Bernoulli has also treated the subject in a very general and systematic manner. Some account is given of it in every treatise of fluxions. We recommend the original work of Mr Huyghens in particular; and do not hesitate to say, that it is the finest specimen (of its extent) of physico-mathematical discussion that ever has appeared. Huyghens was the most elegant of all modern geometers; and both in the geometrical and physical part of this work, *De Horologio Oscillatorio*, he has preserved the utmost rigour of demonstration, without taking one step in which Euclid or Apollonius would not have followed him.

—————— *juvat integros accedere fontes*
Atque haurire.

Such authors form the taste of the young mathematician, and help to preserve him from the almost mechanical procedure of the expert symbolical analyst, who arrives at his conclusion without knowing how he gets thither, or having any notions at all of the magnitudes of which he is treating.

There are two principal problems in this doctrine.

I. To ascertain the nature of the figure generated by the evolution of a given curve.

II. To determine the nature of the curve by whose evolution a given curve may be generated.—We shall consider each of these in order, and then take the opportunity which this subject gives of explaining a little the abstruse nature of curvature, and its measures and variations, and take notice of the opinions of mathematicians about the precise nature of the angle of contact.

Plate xxxi.

The curve line ABCDEF (fig. 1.) may be considered as the edge of a crooked ruler or mould; a thread may be supposed attached to it at F, and then lapped along it from F to A. If the thread be now led away from A, keeping it always tight, it is plain that the extremity A must describe a curve line A *b c d e f*, and that the detached parts of the thread will always be tangents to the curve ABCDEF. In like manner will the curve line F *d′ c′ b′* A′ be described by keeping the thread fast at A, and unlapping it from the other end of the mould.

This process was called by Mr Huyghens the Evolution of the curve ADF. ADF is called the Evolute. A *d f* was named by him the Curve by Evolution. It has been since more briefly termed the Evolutrix, or unlapper. It has also been called the Involute; because, by performing the process in the opposite direction *f d* A, the thread is lapped up on the mould, and the whole space ADF *f d* A is folded up like a fan. The detached parts C *c*, D *d*, or C *c′*, D *d′*, &c. of the thread, are called Radii of the Evolute; perhaps with some impropriety, because they rather resemble the momentary radii of the evolutrix. We may name them the evolved radii. The beginning A of evolution may be considered as the vertex of the curves, and the ends F and *f* may be called the terms.

There is another way in which this description of curve lines may be conceived. Instead of a thread F *f* gradually lapped up on the mould, we may conceive F *f* to be a straight edged ruler applied to the mould, and gradually rolled along it without sliding, so as to touch it in succession in all its points. It is evident, that by this process the point *f* will describe the curve *f d* A, while the point F describes the other curve F *d′ a′*. This way of conceiving it gives a great extension to the doctrine, and homologates it with that genesis of curve lines by which cycloids of all kinds are described, and which we may distinguish by the name of Provolution. For it is plain, that the relative motions of the points A and *b* are the same, whether the ruler *b* B *b′* roll on the mould ABF, or the mould roll on the ruler: but there will be a great difference in the form of the line traced by the describing point, if we suppose the plane

plane on which it is traced to be attached to the rolling figure. Thus, when a circle rolls on a ſtraight line, a point in its circumference traces a cycloid on the plane attached to the ſtraight line, while the point of the ſtraight line which quitted the circle deſcribes on the plane attached to the circle another line; namely, the involute of the circle. This mode of deſcription allows us to employ a curved ruler in place of the ſtraight one b B b'; and thus gives a vaſt extenſion to the theory. But at preſent we ſhall confine ourſelves to the employment of the ſtraight line b B b', only keeping in mind, that there is an intimate connection between the lines of evolution and of provolution.

By the deſcription now given of this proceſs of evolution and involution, it is plain,

1. That the evolution is always made from the convex ſide of the evolute.

2. That the evolved radii B b, C c, D d, &c. are reſpectively equal to the arches BA, CA, DA, &c. of the evolute which they have quitted; and that b B b', c C c', d D d, &c. are always equal to the whole arch ADF.

3. That any point B of the lapped up thread deſcribes during its evolution a curve line B $\gamma\,\delta\,\epsilon\,\varphi$ parallel to $b\,c\,d\,e\,f$; becauſe theſe curves are always equidiſtant from each other.

4. That if the thread extend beyond the mould as a tangent to it, the extremity α will deſcribe a parallel or equidiſtant curve $\alpha\,\beta\,\gamma\,\delta\,\epsilon\,\varphi$, lying without A $b\,c\,d\,e\,f$. From this it appears that B $\gamma\,\delta\,\epsilon\,\varphi$ is the complete evolutrix of FEDCB, while $bdeef$ is the evolutrix of that arch, and the added tangent B b. In like manner, the lapped up thread ADF, with the added part F φ', deſcribes the evolutrix $\varphi'\,\epsilon'\,\delta'\,\gamma'\,\beta'$ A'.

5. If from any point C of the evolute there be drawn lines C b, C c, C d, C e, &c. to the evolutrix, thoſe which are more remote from the vertex are greater than theſe which are nearer. Draw B b, c C, d D, e E, touching the evolute. C b is leſs than CB + B b; that is (2), than C c. Again, DC + C c is equal to D d, which is leſs than DC + C d. Therefore C c is leſs than C d. Now let C e cut D d in r. Then $e\,r$ + r DE is greater than e E. But e E is equal to $d\,r$ + r DE. Therefore $e\,r$ is greater than $d\,r$; and $e\,r$ + r C is greater than $d\,r$ + r C, which is greater than c C. Therefore e C is greater than c C.

6. Hence it follows, that a circle deſcribed round any point of the evolute, with a radius reaching to any point of the evolutrix, will cut the evolutrix in that point, and be wholly within it on the ſide remote from the vertex, and without it on the ſide next the vertex.

7. The evolved radius cuts every arch of the evolutrix perpendicularly, or a right line drawn through the interſection at right angles touches the evolutrix in that point. Through any point d draw the line $m\,d\,t$ at right angles to d D. The part of it $m\,d$ next to the vertex is wholly without the curve, becauſe it is without the circle deſcribed round the centre D; and this circle is without the evolutrix on that ſide of d which is next the vertex (6). Any point t on the other ſide of d is alſo without the curve. For let $t\,e$ E be another evolved radius, cutting D d in n: then $n\,d$ is leſs than $n\,t$, becauſe $n\,d\,t$ is a right angle by conſtruction; and therefore $n\,t\,d$ is acute. But becauſe E n + n D are greater than ED, E n + $n\,d$ are greater than ED + D d, that is, than E e, and $n\,d$ is greater than $n\,e$. Therefore, ſince it is leſs than $n\,t$, it follows that $n\,e$ is much leſs than $n\,t$, and t lies without the curve. Therefore the whole line $m\,d\,t$ is without the curve, except in the point d. It therefore touches the curve in d, and the radius D d cuts it at right angles in that point. By the ſame reaſoning, it is demonſtrated, that all the curves A $b\,d\,f$, $\alpha\,\beta\,\delta\,\varphi$, A' $b'\,d'\,f'$, $\alpha'\,\beta'\,\delta'\,\varphi'$, are cut perpendicularly by the tangents to the evolute. Alſo all theſe curves interſect the evolute at right angles in their vertexes.

It follows from this propoſition, that from every point, ſuch as s, or i, or o, &c. in the ſpace AOF comprehended by the evolute and its extreme tangents AO, FO, two perpendiculars may be drawn to the evolutrix A $d\,f$; and that from any point in the ſpace within the angle A $o\,f$ only one perpendicular can be drawn; and that no perpendicular can be drawn from any point on the other ſide of ADF. Apollonius had obſerved theſe circumſtances in the conic ſections, but had not thought of marking the boundary formed by the evolute ADE. Had he noticed this, he would certainly have diſcovered the whole theory of evolution, and its importance in ſpeculative geometry.

It alſo follows from this propoſition, that if a curve A $b\,c\,d\,e\,f$ is cut by the tangents of ABCDEF at right angles in every point, it will be deſcribed by the evolution of that curve: For if the evolutrix, whoſe vertex is A, be really deſcribed, it will coincide with A $b\,c\,d$ in A, and have the ſame tangent; it therefore does not deviate from it, otherwiſe their tangents would ſeparate, and would not both be at right angles with the lines touching the evolute. They muſt therefore coincide throughout.

8. The arches $b\,c\,d$ and $\beta\,\gamma\,\delta$, intercepted by the ſame radii B b and D d, may be called *concentric*; and the angles contained between the tangents drawn through their extremities are equal. Thus the angle $\lambda\,\tau\,\varepsilon$ is equal to $l\,p\,o$: but although equidiſtant, parallel, and containing the ſame angle between their tangents and between their radii, they are not ſimilar. Thus, the arch $\alpha\,\beta$ has a curvature at α that is the ſame with that of any circle whoſe radius is equal to A α; but the curvature at A is incomparable with it, and unmeaſurable. The ſame may be ſaid of the curvature δ at β and at B.

9. If a circle $u\,d\,z$ be deſcribed round the centre D with the radius D d, it both touches and cuts the evolutrix in the point d, and no circle can be deſcribed touching the curve in that point, and paſſing between it and the circle $u\,d\,z$; For ſince it touches the curve in d, its centre muſt be ſomewhere in the line d D perpendicular to $m\,d\,t$. It cannot be in any point n more remote from d than D is; for it would paſs without the arch $d\,u$, and be more remote than $d\,u$ from the arch $d\,c$ of the evolutrix. On the other ſide, it would indeed paſs without the arch $d\,z$, which lies within the arch $d\,e$ of the evolutrix: but it would alſo paſs without the curve. For it has been already demonſtrated (7) that $n\,d$ is greater than $n\,e$; and the curve would lie between it and the circle $d\,z$.

Thus it appears, that a circle deſcribed with the evolved radius approaches nearer to the curve, or touches it more cloſely, than any other circle; all other circles either interſect it in meaſurable angles, or are within or without the curve on both ſides of the point of contact. This circle $u\,d\,z$ has therefore the ſame curvature

ture with the curve in the point of contact and coalescence. It is the EQUICURVE CIRCLE, the circle of equal curvature, the OSCULATING CIRCLE (a name given it by Leibnitz). The evolved radius of the evolute is the RADIUS OF CURVATURE of the evolutrix, and the point of the evolute is the CENTRE OF CURVATURE at the point of contact with the evolutrix. The evolute is the geometrical locus of all the centres of curvature of the evolutrix.

This is the most important circumstance of the whole doctrine of the involution and evolution of curve lines. It is assumed as a self-evident truth by the precipitant writers of elements. It is indeed very like truth: For the extremity of the thread is a momentary radius during the process of evolution; and any minute arch of the evolute nearer the vertex must be conceived as more incurvated than the arch at the point of contact, because described with shorter radii: for the same reason, all beyond the contact must be less incurvated, by reason of the greater radii. The curvature at the contact must be neither greater nor less than that of the circle. But we thought it better to follow the example of Huyghens, and to establish this leading proposition on the strictest geometrical reasoning, acknowledging the singular obligation which mathematicians are under to him for giving them so palpable a method of fixing their notions on this subject. When the evolute of a curve is given, we have not only a clear view of the genesis of the curve, with a neat and accurate mechanical method of describing it, but also a distinct comprehension of the whole curvature, and a connected view of its gradual variations.

We speak of curvature that is greater and lesser; and every person has a general knowledge or conception of the difference, and will say, that an ellipsis is more curve at the extremities of the transverse axis than any where else. But before we can institute a comparison between them with a precision that leads to any thing, we must agree about a measure of curvature, and say what it is we mean by a double or a triple curvature.

Now there are two ways in which we may consider curvature, or a want of rectitude: We may call that a double curvature which, in a given space, carries us twice as far from the straight line; or we may call that a double curvature by which we deviate twice as much from the same direction. Both of these measures have been adopted; and if we would rigidly adhere to them, there would be no room for complaint: but mathematicians have not been steady in this respect, and by mixing and confounding these measures, have frequently puzzled their readers. All agree, however, in their first and simple measures of curvature, and say, that the curvature of an arch of a circle is as the arch directly, and as the radius inversely. This is plainly measuring curvature by the deflection from the first direction. In an arch of an inch long, there is twice as much deflection from the first direction when the radius of the circle is of half the length. If the radius is about $57\frac{1}{4}$th inches, an arch of one inch in length produces a final direction one degree different from the first. If the radius is $114\frac{1}{2}$ inches, the deviation is but half of a degree. The linear deflection from the straight path is also one-half. In the case of circles, therefore, both measures agree: but in by far the greatest number of cases they may differ exceedingly, and the change of direction may be greatest when the linear deviation is least. Flexure, or change of direction, is, in general, the most sensible and the most important character of curvature, and is understood to be its criterion in all cases. But our processes for discovering its quantity are generally by first discovering the linear deviation; and, in many cases, particularly in our philosophical inquiries, this linear deviation is our principal object. Hence it has happened, that the mathematician has frequently stopped short at this result, and has adapted his theorems chiefly to this determination. These differences of object have caused great confusion in the methods of considering curvature, and led to many disputes about its nature, and about the angle of contact; to which disputes there will be no end, till mathematicians have agreed in their manner of expressing the measures of curvature. At present we abide by the measure already given, and we mean to express by curvature or flexure the change of direction.

This being premised, we observe, that the curvature of all these curves of evolution where they separate from their evolutes, is incomparable with the curvature in any other place. In this point the radius has no magnitude; and therefore the curvature is said to be infinitely great. On the other hand, if the evolved curve has an assymptote, the curvature of the evolutrix of the adjacent branch is said to be infinitely small. These expressions becoming familiar, have occasioned some very intricate questions and erroneous notions. There can be little doubt of their impropriety: For when we say, that the curvature at A is infinitely greater than at α, we do not recollect that the flexure of the whole arch A l is equal to that of the whole arch $\alpha\,\beta$, and the flexure at A must either make a part of the whole flexure, or it must be something disparate.

The evolutrix A $b\,c\,d\,f$ (fig. 2.) of the common equilateral hyperbola exhibits every possible magnitude of curvature in a very small space. At the vertex A of the hyperbola it is perpendicular to the curve; and therefore has the transverse axis A φ A″ for its tangent. The curvature of the evolutrix at A is called infinitely great. As the thread unlaps from the branch ABC, its extremity describes A $b\,c$. It is plain, that the evolutrix must cut the assymptote φ H at right angles in some point G, where the curvature will be what is called infinitely small; because the centre of curvature has removed to an infinite distance along the branch AF of the hyperbola. This evolutrix may be continued to the vertex of the hyperbola on the other side of the assymptote, by causing the thread to lap upon it, in the same way that Mr Huyghens completed his cycloidal oscillation. Or we may form another evolutrix $\alpha\,\beta\,\gamma\,\delta\,\varphi\,\gamma'\,\delta'\,\beta'$ A″, by lengthening the thread from G to φ, the centre of the hyperbola, and supposing that, as soon as the curve A $\delta\,\varphi$ is completed, by unlapping the thread from the branch ABC, another thread laps upon the hyperbola A″ F″. This last is considered as a more geometrical evolution than the other: For the mathematicians, extending the doctrine of evolution beyond Mr Huyghens's restriction to curves which had their convexity turned one way, have agreed to consider as one continued evolution whatever will complete the curve expressed by one equation. Now the same equation expresses both the curves AF and A″F″, which occupy the same axis AA″. The cycloid employed by Huyghens

Involution. Huyghens is, in like manner, but one continuous curve, deſcribed by the continued provolution of the circle along the ſtraight line, although it appears as two branches of a *repeated* curve. We ſhall meet with many inſtances of this ſeemingly compounded evolution when treating of the ſecond queſtion.

Since the arch A b d G contains every magnitude of curvature, it appears that every kind of curvature may be produced by evolution. We can have no conception of a flexure that is greater than what we ſee at A, or leſs than what we ſee at G; yet there are caſes which ſeem to ſhew the contrary, and are familiarly ſaid, by the greateſt mathematicians, to exhibit curvatures infinitely ſmaller ſtill. Thus, let ABC (fig. 3.) be a conical parabola, whoſe parameter is AP. Let AEF be a cubical parabola, whoſe parameter is AQ. If we make AQ to AD as the cube of AP to the cube of AQ, the two parabolas will interſect each other in the ordinate DB. For, making AP $= p$, and AQ $= q$, and calling the ordinate of the conic parabola y, that of the cubic parabola z, and the indeterminate abſciſſa AD x, we have

$$p^3 : q^3 = q : x, = q^3 : z^3, \text{ and } p : q = q : z;$$

but $q : p = q : p$; therefore, by compoſition,

$$p^2 : q^2 = q^2 : px = q^2 : y^2, \text{ and } p : q = q : y;$$

therefore $z = y$, and the parabolas interſect in B.

Now, becauſe in all parabolas the ordinates drawn at the extremity of the parameters are equal to the parameters, the interſections q and p will be in a line A q p, which makes half a right angle with the axis AP. Therefore, when AQ is greater than AP, the point q is without the conical parabola, and the whole arch of the cubical parabola cut off by the ordinate DB is alſo without it: but when AQ is leſs than AP, q is within the conical parabola, as is alſo the arch q B. Therefore the remaining arch BEA is without it, and is therefore leſs incurvated at A. An endleſs number of conical parabolas of ſmaller curvature may be drawn by enlarging AP; yet there will ſtill be an arch AEB of the cubical parabola which is without it, and therefore leſs incurvated. Therefore the curvature of a cubical parabola is leſs than that of any conical parabola: It is ſaid to be infinitely leſs, becauſe an infinity of cubical parabolas of *ſmaller curvature* than AEB may be drawn by enlarging AQ.

It may be demonſtrated in the ſame manner, that a paraboloid, whoſe ordinates are in the ſubbiquadrate ratio of the abſciſſæ, has an infinitely ſmaller curvature at the vertex than the cubical parabola. And the curvature of the paraboloid of the next degree is infinitely leſs than this: and ſo on continually. Nay, Sir Iſaac Newton, who firſt took notice of this remarkable circumſtance, demonſtrates the ſame thing of an endleſs ſucceſſion of paraboloids interpoſed between any two degrees of this ſeries. *Neque novit* (ſays he) *natura limitem.*

If this be the caſe, all curves cannot be deſcribed by evolution; for we have no conception of a radius of curvature that is greater than a line without limit. The theory of curvilineal motions delivered in the article Dynamics muſt be imperfect, or there muſt be curve lines which bodies cannot deſcribe by any powers of nature. The theory there delivered profeſſes to teach how a body can be made to deſcribe the cubical parabola, and many other curves which have theſe infiniteſimal curvatures; and yet its demonſtrations employ the radius of curvature, and cannot proceed without it. We profeſs ourſelves obliged to an attentive reader (who has not favoured us with his name) for making this obſervation. It merits attention. Involution.

There muſt be ſome paralogiſm or miſconception in all this language of the mathematicians. It does not neceſſarily follow from the arch AEB lying without the arch AIB, that it is leſs incurvated at A; it may be more incurvated between A and B. Accordingly we ſee, that the tangent BT of the conical parabola is leſs inclined to the common tangent AV than the tangent B t of the cubical parabola is; and therefore the flexure of the whole arch AEB is greater than that of the whole arch AIB; and we ſhall ſee afterwards, that there is a part of AEB that is more incurvated than any part of AIB. There is nothing correſponding to this unmeaning and inconceivable ſucceſſion of ſerieſes of magnitudes of one kind, each of which contains an endleſs variety of individuals, and the greateſt of one ſeries infinitely leſs than the ſmalleſt of the next, &c.; there is nothing like this demonſtrated by all our arguments. In none of theſe do we ever treat of the curvature at A, But of a curvature which is *not* at A. At A we have none of the lines which are indiſpenſably neceſſary for the demonſtration. Beſides, in the very ſame manner that we can deſcribe a cubical parabola, and prove that it has an arch lying without the conical parabola, we can deſcribe a circle, and demonſtrate that it has alſo an arch lying without the parabola. Theſe infiniteſimal curvatures, therefore, are not warranted by our arguments, nor does it yet appear that there are curves which cannot be deſcribed by evolution. We are always puzzled when we ſpeak of infinites and infiniteſimals as of ſomething preciſe and determinate; whereas the very denomination precludes all determination. We take the diſtinguiſhing circumſtance of thoſe different orders for a thing clearly underſtood; for we build much on the diſtinction. We conceive the curvature of the cubical parabola as verging on that of the common parabola, and the one ſeries of curvatures as beginning where the other ends. But Newton has ſhewn, that between theſe two ſerieſes an endleſs number of ſimilar ſerieſes may be interpoſed. The very names given to the curvature at the extremities of the hyperbolic evolutrix have no conceptions annexed to them. At the vertex of the hyperbola there is no line, and at the interſection with the aſſymptote there is no curvature. Theſe unguarded expreſſions, therefore, ſhould not make us doubt whether all curves may be deſcribed by evolution. If a line be incurvated, it is not ſtraight. If ſo, two perpendiculars to it muſt diverge on one ſide, and muſt converge and meet on the other in ſome point. This point will lie between two other points, in which the two perpendiculars touch that curve by the evolution, of which the given arch of the curve may be deſcribed. Finally (which ſhould decide the queſtion), we ſhall ſee by and bye, that the cubic, and all higher orders of paraboloids, may be ſo deſcribed by evolution from curves having aſſymptotic branches of determinable forms.

Such are the general affections of lines generated by evolution. They are not, properly ſpeaking, peculiar properties; for the evolutrixes may be any curve lines whatever. They only ſerve to mark the mutual relations of the evolutes with their evolutrixes, and enable us to construct the one, and to discover its properties by means of our knowledge of the other. We proceed to shew how the properties of the evolutrix may be determined by our knowledge of the evolute.

This problem will not long occupy attention, being much limited by the conditions. One of the first is, that the length of the thread evolved must be known in every position: Therefore the length of the evolved arch must, in like manner, be known; and this, not only *in toto*, but every portion of it. Now this is not universally, or even generally the case. The length of a circular, parabolic, hyperbolic, arch has not yet been determined by any finite equation, or geometrical construction. Therefore their evolutrixes cannot be determined otherwise than by approximation, or by comparison with other magnitudes equally undetermined. Yet it sometimes happens, that a curve is discovered to evolve into another of known properties, although we have not previously discovered the length of the evolved arch. Such a discovery evidently brings along with it the rectification of the evolute. Of this we have an instance in the very evolution which gave occasion to the whole of this doctrine; namely, that of the cycloid; which we shall therefore take as our first example.

Let ABC (fig. 5.) be a cycloid, of which AD is the axis, and AHD the generating circle, and AG a tangent to the cycloid at A, and equal to DC. Let BKE touch the cycloid in B, and cut AG in K. It is required to find the situation of that point of the line BE which had unfolded from A?

Draw BH parallel to the base DC of the cycloid, cutting the generating circle in H, and join HA. Describe a circle KEM equal to the generating circle AHD, touching AG in K, and cutting BK in some point E. It is known, by the properties of the cycloid, that BK is equal and parallel to HA, and that BH is equal to the arch A *b* H. Because the circles AHD and KEM are equal, and the angles HAK and AKE are equal, the chords AH and KE cut off equal arches, and are themselves equal. Because BHAK is a parallelogram, AK is equal to HB; that is, to the arch A *b* H, that is, to the arch K *m* E. But if the circle KEM had been placed on A, and had rolled from A to K, the arch disengaged would have been equal to AK, and the point which was in contact with A would now be in E, in the circumference of a cycloid AEF, equal to CBA, having the line AG, equal and parallel to DC, for its base, and GF, equal and parallel to DA, for its axis. And if the diameter KM be drawn, and EM be joined, EM touches the cycloid AEF.

Cor. The arch BA of the cycloid is equal to twice the parallel chord HA of the generating circle: For this arch is equal to the evolved line BKE; and it has been shewn, that EK is equal to KB, and BE is therefore equal to twice BK, or to twice HA. This property had indeed been demonstrated before by Sir Christopher Wren, quite independent of the doctrine of evolution; but it is given here as a legitimate result of this doctrine, and an example of the use which may be made of it. Whenever a curve can be evolved into another which is susceptible of accurate determination, the arch of the evolved curve is determined in length; for it always makes a part of the thread whose extremity describes the evolutrix, and its length is found, by taking from the whole length of the thread that part which only touches the curve at its vertex.

This genesis of the cycloid AEF, by evolution of the cycloid ABC, also gives the most palpable and satisfactory determination of the area of the cycloid. For since BE is always parallel to AH, AH will sweep over the whole surface of the semicircle AHD, while BE sweeps over the whole space CBAEF; and since BE is always double of the simultaneous AH, the space CBAEF is quadruple of the semicircle AHD. But the space described in any moment by BK is also one fourth part of that described by BE. Therefore the area GAEF is three times the semicircle AHD; and the space DHABC is double of it; and the space CBAG is equal to it.

Sir Isaac Newton has extended this remarkable property of evolving into another curve of the same kind to the whole class of epicycloids, that is, cycloids formed by a point in the circumference of a circle, while the circle rolls on the circumference of another circle, either on the convex or concave side; and he has demonstrated, that they also may all be rectified, and a space assigned which is equal to their area (See *Principia*, B. I. prop. 48. &c.). He demonstrates, that the whole arch is to four times the diameter of the generating circle as the radius of the base is to the sum or difference of those of the base and the generating circle. We recommend these propositions to the attention of the young reader who wishes to form a good taste in mathematical researches; he will there see the geometrical principles of evolution elegantly exemplified.

We may just observe, before quitting this class of curves, that many writers, even of some eminence, in their compilations of elements, give a very faulty proof of the position of the tangent of a curve described by rolling. They say, for example, that the tangent of the cycloid at E is perpendicular to KE; because the line KE is, at the moment of description, turning round K as a momentary centre. This, to be sure, greatly shortens investigation; and the inference is a truth, not only when the rolling figure is a circle rolling on a straight line, but even when any one figure rolls on another. Every point of the rolling figure really *begins* to move perpendicularly to the line joining it with the point of contact. But this genesis of the arch E *e*, by the evolution of the arch B *b*, shews that K is by no means the centre of motion, nor HK the radius of curvature. Nor is it, in the case of epicycloids, trochoids, and many curves of this kind, a very easy matter to find the momentary centre. The circle KEM is both advancing and turning round its centre; and these two motions are equal, because the circle does not slide but roll, the detached arch being always equal to the portion of the base which it quits. Therefore, drawing the tangents E *g*, M *g*, and completing the parallelogram E *f* M *g*, E *f* will represent the progressive motion of the centre, and E *g* the motion of rotation. EM, the motion compounded of these, must be perpendicular to the chord EK.

The investigation that we have given of the evolutrix of the cycloid has been somewhat peculiar, being that which offered itself to Mr Huyghens at the time when he and many other eminent mathematicians were much occupied with the singular properties of this curve. It does not serve, however, so well for exemplifying the general

general process. For this purpose, it is proper to avail ourselves of all that we know of the cycloid, and particularly the equality of its arch BA to the double of the parallel chord HA. This being known, nothing can be more simple than the determination of the evolutrix, either by availing ourselves of every property of the cycloid, or by adhering to the general process of referring every point to an abscissa by means of perpendicular ordinates. In the first method, knowing that BE is double of BK, and therefore KE equal to HA, and KA = BH, = H *b* A, = K *m* E, we find E to be the describing point of the circle, which has rolled from A to K. In the other method, we must draw EN perpendicular to AG; then, because the point E moves, during evolution, at right angles to BE, EK is the normal to the curve described, and NK the subnormal, and is equal to the corresponding ordinate H′ I′ of the generating circle of the cycloid ABC. This being a characteristic property of a cycloid, E is a point in the circumference of a cycloid equal to the cycloid ABC.

Or, lastly, in accommodation to cases where we are supposed to know few of the properties of the evolute, or, at least, not to attend to them, we may make use of the fluxionary equation of the evolute to obtain the fluxionary equation of the evolutrix. For this purpose, take a point *e* very near to E, and draw the evolving radius *be*, cutting E*f* (drawn parallel to the base DC) in *o*; draw *en* parallel to the axis of the evolute, cutting E*o* in *v*; also draw *bbi* parallel to the base, and B*d* perpendicular to it. If both curves be now referred to the same axis CGF, it is plain that B*b*, B*d*, and *db* are ultimately as the fluxions of the arch, abscis, and ordinate of the evolute, and that E*e*, *ev*, and *v*E, are ultimately as the fluxions of the arch, abscissa, and ordinate of the evolutrix. Also the two fluxionary triangles are similar, the sides of the one being perpendicular, respectively, to those of the other. If both are referred to one axis, or to parallel axes, the fluxion of the abscissa of the evolute is to that of its ordinate, as the fluxion of the ordinate of the evolutrix is to that of its abscissa. Thus, from the fluxionary equation of the one, that of the other may be obtained. In the present case, they may be referred to AD and FG, making CG equal to the cycloidal arch CBA. Call this *a*; AI, *x*; IB, *y*; and AB, or EB, *z*. In like manner, let F*t* be $= u$, *t*E $= v$, and FE $= w$; then, because $DH^2 = DA^2 - AH^2$, and DA and AH are the halves of CF and BE, we have $DH^2 = \frac{a^2 - z^2}{4}$. Also $DI = \frac{DH^2}{DA} = \frac{a^2 - z^2}{4 \times \frac{1}{2}a}, = \frac{a^2 - z^2}{2a}$. But DI = F*t*. Therefore F*t*, or $u, = \frac{a^2 - z^2}{2a}$. Also $\dot{w} = \frac{\dot{u}z}{y}$, by what was said above, that is, $\dot{w} = \frac{a\dot{u}}{\sqrt{a^2 - z^2}}, = \frac{a\dot{u}}{\sqrt{2au}}$. Therefore we have $\dot{w} : \dot{u}\ (= a : \sqrt{2au}) = \sqrt{\tfrac{1}{2}a} : \sqrt{u} = \sqrt{GF} : \sqrt{Ft}$, which is the analogy competent to a cycloid whose axis is GF = DA.

It is not necessary to insist longer on this in this place; because all these things will come more naturally before us when we are employed in deducing the evolute from its evolutrix.

When the ordinates of a curve converge to a centre, in which case it is called a radiated curve, it is most convenient to consider its evolutrix in the same way, conceiving the ordinates of both as insisting on the circumference of a circle described round the same centre. Spirals evolve into other spirals, and exhibit several properties which afford agreeable occupation to the curious geometer. The equiangular, logarithmic, or loxodromic spiral, is a very remarkable example. Like the cycloid, it evolves into another equal and similar equiangular spiral, and is itself the evolutrix of a third. This is evident on the slightest inspection. Let C *r q p* (fig. 6.) be an equiangular spiral, of which S is the centre; if a radius SC be drawn to any point C, and another radius SP be drawn at right angles to it, the intercepted tangent CP is known to be equal to the whole length of the interior revolutions of the spiral, though infinite in number. If the thread CP be now unlapped from the arch C *r q*, it is plain that the first motion of the point P is in a direction PT, which is perpendicular to PC, and therefore cuts the radius PS in an angle SPT, equal to the angle SCP; and, since this is the case in every position of the point, it is manifest that its path must be a spiral PQR, cutting the radii in the same angle as the spiral C *r q p*. James Bernoulli first discovered this remarkable property. He also remarked, that if a line PH be drawn from every point of the spiral, making an angle with the tangent equal to that made by the radius (like an angle of reflection corresponding with the incident ray SP), those reflected rays would all be tangents to another similar and equal spiral I *v* H: so that PH = PS. S and H are conjugate foci of an infinitely slender pencil; and therefore the spiral I *v* H is the caustic by reflection of RQP for rays flowing from S. If another equal and similar spiral *x v y* roll on I *v* H, its centre *z* will describe the same spiral in another position *w u z*. All these things flow from the principles of evolution alone: and Mr Bernoulli traces, with great ingenuity, the connection and dependence of caustics, both by reflection and refraction, of cycloidal, and all curves of provolution, and their origin in evolution or involution. A variety of such repetitions of this curve (and many other singular properties), made him call it the SPIRA MIRABILIS. He desired that it should be engraved on his tombstone, with the inscription EADEM MUTATA RESURGO, as expressive of the resurrection of the dead. See his two excellent dissertations in *Act.* Erudit. 1692, March and May.

Another remarkable property of this spiral is, that if, instead of the thread evolving from the spiral, the spiral evolve from the straight line PC, the centre S will describe the straight line PS. Of this we have an example in the apparatus exhibited in courses of experimental philosophy, in which a double cone descends, by rolling along two rulers inclined in an angle to each other (see *Gravesande's* Nat. Phil. I. § 210). It is pretty remarkable, that a rolling motion, seemingly round C, as a momentary centre, should produce a motion in the straight line SP: and it shews the inconclusiveness of the reasoning, by which many compilers of elements of geometry profess to demonstrate, that the motion of the describing point S is perpendicular to the momentary radius. For here, although this seeming momentary radius may be shorter than any line that can be named, the real radius of curvature is longer than any line that can be named.

But it is not merely an object of speculative geometric curiosity to mark the intimate relation between the genesis of curves by evolution and provolution; it may be applied to important purposes both in science and in art. Mr M'Laurin has given a very inviting example of this in his account of the Newtonian philosophy; where he exhibits the moon's path in absolute space, and from this proposes to investigate the deflecting forces, and *vice versa*. We have examples of it in the arts, in the formation of the pallets of pendulums, the teeth of wheels, and a remarkable one in Messrs Watt and Boulton's ingenious contrivance for producing the rectilineal motion of a piston rod by the combination of circular motions. M. de la Hire, of the Academy of Sciences at Paris, has been at great pains to shew how all motions of evolution may be converted into motions of provolution, in a memoir in 1706. But he would have done a real service, if, instead of this ingenious whim, he had shewn how all motions of provolution may be traced up to the evolution which is equivalent to them. For there is no organic genesis of a curvilineal motion so simple as the evolution of a thread from a curve. It is the primitive genesis of a circle; and it is in evolution alone that any curvilineal motion is comparable with circular motion. A given curve line is an individual, and therefore its primitive organical genesis must also be individual. This is strictly true of evolution. A parabola has but one evolute. But there are infinite motions of provolution which will describe a parabola, or any curve line whatever; therefore these are not primitive organical modes of description. That this, however, is the case, may be very easily shewn. Thus let ABCD (fig. 7.) be a parabola, or any curve; and let *a b c d* be any other curve whatever. A figure E *m l k h i* may be found such, that while it rolls along the curve *a b c d*, a point in it shall describe the parabola. The process is as follows: Let B *b*, C *c*, D *d*, &c. be a number of perpendiculars to the parabola, cutting the curve *a b c d* in so many points. The perpendiculars may be so disposed that the points *a*, *b*, *c*, &c. shall be equidistant. Now we can construct a triangle E *c h* so, that the three sides E *e*, *eh*, and *h* E, shall be respectively equal to the three lines E *e*, *ef*, F *f*. In like manner may the whole figure be constructed, having the little bases of the triangles respectively equal to the successive portions of the base A *b c d*, and the radii equal to the perpendiculars B *b*, C *c*, D *d*, &c. Let this figure roll on this base *c*. While the little side *e k* moves from its present position, and applies itself to *e f*, the point E describes an arch E *ε* of a circle round the centre *e*, and, falling within the parabola, is somewhere between E and F. Then continuing the provolution, while the next side *h i* turns round *f* till *i* applies to *g*, the point E describes another arch *ε* F *o* round *f*, first rising up and reaching the parabola in F, when the line *h* E coincides with *f* F, and then falling within the parabola till the point *h* begin to rise again from *f* by the turning of the rolling figure round the point *g*. Reversing the motion, the sides *i h*, *h e*, *e k*, &c. apply themselves in succession to the portions *g f*, *f e*, *e d*, &c. of the base, and the point E describes an undulating line, consisting of arches of circles round the successive centres *g*, *f*, *e*, &c. These circular arches all touch the parabola in the points G, F, E, &c. and separate from it a little internally. By diminishing the portions of the base, and increasing the number of the triangular elements of the rolling figure without end, it is evident that the figure becomes ultimately curvilineal instead of polygonal, and the point E continues in the parabola, and accurately describes it. It is now a curvilineal figure, having its elementary arches equal to the portions of the base to which they apply in succession, and the radii converging to E equal to the perpendiculars intercepted between the curve ABCD and the base. It may therefore be accurately constructed.

It is clear, that practical mechanics may derive great advantage from a careful study of this subject. We now see motions executed by machinery which imitate almost every animal motion. But these have been the result of many random trials of *wipers*, *snail-pieces*, &c. of various kinds, repeatedly corrected, till the desired motion is at last accomplished. But it is, as we see, a scientific problem, to construct a figure which shall certainly produce the proposed motion; nor is the process by any means difficult. But how simple, in comparison, is the production of this motion by evolution. We have only to find the curve line which is touched by all the perpendiculars B *b*, C *c*, D *d*, &c. This naturally leads us to the second problem in this doctrine, namely, to determine the evolute by our knowledge of the involute: a problem of greater difficulty and of greater importance, as it implies, and indeed teaches, the curvature of lines, its measure, and the law of its variation in all particular cases. The evolute of a curve is the geometrical expression, and exhibition to the eye, of both these affections of curve lines.

Since the evolved thread is always at right angles to the evolutrix and its tangent, and is itself always a tangent of the evolute, it follows, that all lines drawn perpendicular to the arch of any curve, touch the curve line which will generate the given curve by evolution. Were this evolved curve previously known to us, we could tell the precise point where every perpendicular would touch it; but this being unknown, we must determine the points of contact by some other method, and by this determination we ascertain so many points of the evolute. The method pursued is this: When two perpendiculars to the proposed curve are not parallel (which we know from the known position of the tangents of our curve), they must intersect each other somewhere on that side of the tangents where they contain an angle less than 180°. But when they thus intersect, one of them has already touched the evolute, and the other has not yet reached it. Thus let *b s*, *e s* (fig. 1.) be the two perpendiculars: being tangents to the evolute, the point *s* of their intersection must be on its convex side, and the unknown points of contact B and E must be on different sides of *s*. These are elementary truths.

Let *e* E approach toward *b* B, and now cut it in *x*. The contact has shifted from E to D, and *x* is still between the contacts. When the shifting perpendicular comes to the position *c* C, the intersection is at *i*, between the contacts B and C. And thus we see, that as the perpendiculars to the involute gradually approach, their contacts with the evolute also approach, and their intersection is always between them. Hence it legitimately follows, that the ultimate position of the intersection fection (which alone is fufceptible of determination by the properties of the involute) is the pofition of the point of contact, and therefore determines a point of the evolute. The problem is therefore reduced to the inveftigation of this ultimate interfection of two perpendiculars to the propofed curve, when they coalefce after gradually approaching. This will be beft illuftrated by an example: Therefore let ABC (fig. 8.) be a parabola, of which A is the vertex, AH the axis, and AV one-half of the parameter; let BE and CK be two perpendiculars to the curve, cutting the axis in E and K, and interfecting each other in r; draw the ordinates BD, CV, and the tangent BT, and draw BF parallel to the axis, cutting CK in F, and CN in O.

Becaufe the perpendiculars interfect in r, we have $rE : EB = EK : BF$. If therefore we can difcover the ratio of EK to BF, we determine the interfection r. But the ratio of EK to BF is compounded of the ratio of EK to BO, and the ratio of BO to BF. The firft of thefe is the ratio of equality; for DE and VK are, each of them, equal to AV, or half the parameter. Take away the common part VE, and the remainders EK and DV are equal, and DV is equal to BO; therefore $EK : BF = BO : BF$; therefore $rE : rB = BO : BF$, and (by divifion) $BE : Er = FO : OB$. Now let the point C continually approach to B, and at laft unite with it. The interfection r will unite with a point of contact N on the evolute. The ultimate ratio of FO to OB, or of $fo : oB$, is evidently that of ED to DT, or ED to 2DA: therefore $BE : EN = ED : 2DA$, or as half the parameter to twice the abfciffa. Thus have we determined a point of the evolute; and we may, in like manner, determine as many as we pleafe.

But we wifh to give a general character of this evolute, by referring it to an axis by perpendicular ordinates. It is plain that V is one point of it, becaufe the point E is always diftant from its ordinate DB by a line equal to AV; and therefore, when B is in A, E will be in V, and r will coincide with it. Now draw VP and NQ perpendicular to AH, and NM perpendicular to VP; let EB cut PV in t: then, becaufe AV and DE are equal, AD is equal to VE, and VE is equal to one half of DT. Moreover, becaufe BD and NQ are parallel, $DE : EQ = BE : EN = DE : DT$; therefore $DT = EQ$, and $VE = \frac{1}{2}EQ$, and therefore $= \frac{1}{3}VQ$; therefore Vt is $\frac{1}{3}$ of Mt, and $\frac{1}{2}MV$. This is a characteriftic property of the evolute. The fubtangent is $\frac{3}{2}$ of the abfciffa; in like manner, as in the common parabola, it is double of the abfciffa. We know therefore that the evolute is a paraboloid, whofe equation is $ax^2 = y^3$; that is, the cube of any ordinate MN is equal to the parallelopiped whofe bafe is the fquare of the abfciffa VM, and altitude a certain line VP, called the parameter. To find VP, let CR be the perpendicular to the parabola in the point where it is cut by the ordinate at V; draw the ordinate RS of the paraboloid, and RG perpendicular to AH. Then it is evident, from what has been already demonftrated, that VK is $\frac{1}{2}$ of KG, and $\frac{1}{3}$ of VG: therefore $KG^2 = 4VK^2$, and (in the parabola) $VC^2 = 2VK^2$. Alfo, becaufe $KV : VC = KG : GR$, we have $GR^2 = 2KG^2 = 8VK^2$; therefore $VP \times RG^2 = 8VP \times VK^2$. But $VG^3 = 27VK^3, = 27VK \times VK^2$: therefore, becaufe in the paraboloid $VP \times VS^2, = SR^3$, or $VP \times RG^2 = VG^3$, we have $8VP \times VK^2 = 27VK \times VK^2$, and $8VP = 27VK$; or VK : VP; that is, $AV : VP = 8 : 27$; or $VP = \frac{27}{8}AV$, or $\frac{27}{16}$ of the parameter of the parabola ABC. The evolute of the conical parabola is the curve called the femicubical parabola, and its parameter is $\frac{27}{16}$ of the conical parabola.

This inveftigation is nearly the fame with that given by Huyghens, which we prefer at prefent to the method generally employed, becaufe it keeps the principle of inference more clofely in view.

Mr Huyghens has deduced a beautiful corollary from it. Since the parabola ABC is defcribed by the evolution of the paraboloid VNR, the line RC is equal to the whole evolved arch RNV, together with the redundant tangent line AV. If therefore we take from CR a part Cx equal to the redundant AV, the remainder xR is equal to the arch RNV of the paraboloid. We may do this for every pofition of the evolved radius, and thus obtain a feries of points V, β, x, δ, ι, of the evolutrix of the paraboloid. We have even an eafier method for obtaining the length of any part of the arch of the paraboloid, without the previous defcription of the parabola ABC. Suppofe Py the arch of the paraboloid, and yz the tangent; make $Pz = \frac{2}{27}$ of the parameter, and defcribe the arch Puu of a circle; then draw from every tangent yz a parallel line xv, cutting the circle in v. The length of the arch yP is equal to $yz + uv$. The celebrated author congratulates himfelf, with great juftice, on this neat exhibition of a right line equal to the arch of a curve, without the employment of any line higher than the circle. It is the fecond curve that has been fo rectified, the cycloid alone having been rectified by plain geometry a very few years before by Sir Chriftopher Wren. It is very true, and he candidly admits it, that this very curve had been rectified before by Mr William Neill, a young gentleman of Oxford, and favourite pupil of Dr Wallis; as alfo by Mr Van Heuraet, a Dutch gentleman of rank, and an eminent mathematician. But both of thefe gentlemen had done it by means of the quadrature of a curve, conftructed from the paraboloid after the manner of Dr Barrow, *Lect. Geom.* XI. Nor was this a folitary difcovery in the hands of Mr Huyghens, as the rectification of the cycloid had been in thofe of Sir Chriftopher Wren; for the method of inveftigation furnifhed Mr Huyghens with a general rule, by which he could evolve every fpecies of paraboloid and hyperboloid, two claffes of curves which come in the way in almoft every difcuffion in the higher geometry. He obferves, that the ratio of Bf to Ee, being always compounded of the ratios of Bf to Bo, and of Bo, or Dd, to Ee; and the ultimate ratio of Bf to Bo being that of TE to TD, which is given by the nature of the paraboloid, we can always find the ratio of BE to BN, if we know that of Dd to Ee. In all curves, the ratio of Dd to Ee (taken indefinitely near), is that of the fubtangent to the fum of the fubtangent and ordinate of a curve conftructed on the fame abfciffa, having its ordinates equal to the fubnormals DE, de, VK, &c. In the conic fections the ratio is conftant, becaufe the line fo conftructed is a ftraight line; and, in the parabola, it is parallel to the axis. See farther properties of it in Barrow's *Lect. Geom.* XI.

From this inveftigation, Mr Huyghens has deduced the following beautiful theorem:

Let

Let a be the parameter of the paraboloid, x its abſciſſa, and y its ordinate; and let the equation be $a^m x^n = y^{m+n}$; let the radius of the evolute meet the tangent through the vertex A in Z. We ſhall always have $BN = \frac{n}{m} BE + \frac{m+n}{m} BZ$. Thus,

$$\left.\begin{array}{l} \text{If } a\,x = y^2 \\ a^2 x = y^3 \\ a\,x^2 = y^3 \\ a\,x^3 = y^4 \\ a^3 x = y^4 \\ \text{\&c.} \end{array}\right\} \text{then } BN = \left\{\begin{array}{l} BE + 2\,BZ \\ \frac{1}{2} BE + \frac{3}{2} BZ \\ 2\,BE + 3\,BZ \\ 3\,BE + 4\,BZ \\ \frac{1}{3} BE + \frac{4}{3} BZ. \\ \text{\&c.} \end{array}\right.$$

This is an extremely ſimple and perſpicuous method of determining the radius of the evolute, or radius of curvature; and it, at the ſame time, gives us the rectification of many curves. It is plain that every geometrical curve may be thus examined, becauſe the ſubnormals DE, VK are determined; and therefore their differences are determined. Theſe differences are the ſame with the differences of D d and E e; and therefore the ratio of D d to E e is determined; that is, the ſubſidiary curve now mentioned can always be conſtructed.

There is a ſingular reſult from this rule, which would hardly have been noticed, if the common method for determining BN had alone been employed. The equation of the paraboloid is ſo ſimple, that the increaſe of the ordinates and diminution of curvature ſeem to keep pace together; yet we have ſeen that, in the vertex of the cubical parabola, the curvature is leſs than any circular curvature that can be named. In the legs, the curvature certainly diminiſhes as they extend farther; there muſt therefore be ſome intermediate point where the curvature is the greateſt poſſible. This is diſtinctly pointed out by Mr Huyghens's theorem. The evolute of this paraboloid (having $a^2 x = y^3$) is a curve ONRNQ (fig. 9.) conſiſting of two branches RO, and RQ, which have a common tangent in R; the branch RQ has the axis AE for its aſſymptote. The thread unfolding from OR, its extremity, deſcribes the arch BC, and then, unfolding from RQ, it deſcribes the ſmall arch CB′A. When B′ is extremely near A, the thread has a poſition B′N′E, in which B′N is very nearly $\frac{1}{2}$BE. At C, if CE be biſected in G, GR is $\frac{1}{2}$ of CZ. Here CR the radius of curvature is the ſhorteſt poſſible. The evolutes of all paraboloids conſiſt of two ſuch branches, if $m + n$ exceeds 2.

Such is the theory of evolution and involution as delivered by Mr Huyghens about the year 1672. It was cultivated by the geometers with ſucceſs. Newton prized it highly, and gave a beautiful ſpecimen of its application to the deſcription, rectification, and quadrature of epicycloids, trochoids, and epicycles of all kinds. But it was eclipſed by the fluxionary geometry of Newton, which included this whole theory in one propoſition, virtually the ſame with Mr Huyghens's, but more comprehenſive in its expreſſion, and much more ſimple in its application. Adopting the unqueſtionable principle of Mr Huyghens, that the evolved thread is the radius of a circle which has the ſame flexures with the curve, the point of the evolute will be obtained by finding the length of the radius of the equicurve circle. The formula for this purpoſe is given in the article FLUXIONS of the *Encyclopædia*; but is incorrectly ſtated $= \frac{\overline{a+4}|^{\frac{3}{2}}}{2\sqrt{a}}$, inſtead of $\frac{\overline{a+4x}|^{\frac{1}{2}}}{2\sqrt{a}}$. The theorem alſo from which it is deduced $\left(r = \frac{\dot{z}^2}{-\dot{x}\ddot{y}}\right)$ is incorectly printed, and is given without any demonſtration, thereby becoming of very little ſervice to the reader. For which reaſon, it is neceſſary to ſupply the defect in this place.

Therefore let A b c d E f (fig. 10.) be a circle, of which C is the centre, and ACE a diameter; let the points b, c, d, of the circumference be referred to this diameter by the equidiſtant perpendicular ordinates $b\,i$, $c\,g$, $d\,k$; draw the chords $b\,c$, $c\,d$, producing $d\,c$ till it meet the ordinate $b\,i$ in a, produce $c\,g$ to the circle in f, and join $b\,f$, $d\,f$; draw $b\,h$, $c\,m$, perpendicular to the ordinates; then $b\,h$, $c\,m$, $h\,c$, $m\,d$, $b\,c$, $c\,d$, are ultimately proportional to the firſt fluxions of the abſciſſa AE, the ordinate $c\,g$, and the arch A c; alſo $a\,b$, the difference between $d\,m$ and $c\,h$ is ultimately as the ſecond fluxion of the ordinate. The triangle $a\,b\,c$ is ſimilar to $b\,d\,f$; for the angle $a\,b\,c$ is equal to the alternate angle $b\,c\,f$, which is equal to $b\,d\,f$, ſtanding on the ſame ſegment. The angle $a\,c\,b$ is equal to $b\,f\,d$, ſtanding on the ſegment $b\,c\,d$; therefore the remaining angles $b\,a\,c$ and $d\,b\,f$ are equal; therefore $a\,b : b\,c = b\,d : d\,f = \frac{1}{2}\,b\,d : \frac{1}{2}\,d\,f$. Now let the ordinates $b\,i$ and $d\,k$ continually approach the ordinate $c\,g$, and at laſt unite with it; we ſhall then have $b\,c$ ultimately equal to $\frac{1}{2}\,b\,d$, and $c\,g$ ultimately equal to $\frac{1}{2}\,d\,f$. Therefore, ultimately, $a\,b : b\,c = b\,c : c\,g$, and $c\,g = \frac{b\,c^2}{a\,b}$.

Let u, v, w, repreſent the variable abſciſſa, ordinate, and arch. We have, for the fluxionary expreſſion of the ordinate of the equicurve circle, $v = \frac{\dot{w}^2}{-\ddot{v}}$ ($\ddot{v}$ muſt have the negative ſign, becauſe, as the arch increaſes, $\dot{v}$ diminiſhes). In the next place, it is evident that, ultimately, $b\,h : b\,c = c\,g : c\,C$, and $c\,C = \frac{c\,g \times b\,c}{b\,h}$. If r be the radius of the equicurve circle, we have $\dot{u} : \dot{w} = v : r$, and $r = \frac{v\,\dot{w}}{\dot{u}}$. But we had $v = \frac{\dot{w}^2}{-\ddot{v}}$. Subſtitute this in the preſent equation, and we obtain $r = \frac{\dot{w}^3}{-\dot{u}\,\ddot{v}}$. Laſtly, obſerve that $\dot{w}^2 = \dot{u}^2 + \dot{v}^2$, and $\dot{w} = \sqrt{\dot{u}^2 + \dot{v}^2} = \overline{\dot{u}^2 + \dot{v}^2}|^{\frac{1}{2}}$. Therefore $\dot{w}^3 = \overline{\dot{u}^2 + \dot{v}^2}|^{\frac{3}{2}}$ and we have $r = \frac{\overline{\dot{u}^2 + \dot{v}^2}|^{\frac{3}{2}}}{-\dot{u}\,\ddot{v}}$, as the moſt general fluxionary expreſſion of the radius of a circle, in terms of the ſine, coſine, and arch.

When a curve and a circle have the ſame curvature, it is not enough that the firſt fluxions of their abſciſſæ, ordinates, and arches, are the ſame. This would only indicate the poſition of their common tangent. They muſt have the ſame deflection from that tangent. This is always equal to half of the ſecond fluxion of the ordinate. Therefore the circle and curve muſt have the ſame

ſame ſecond fluxion of their ordinates. Therefore let D b c d F be any curve coinciding with, or oſculated by, the circle A b c d. Let its axis be DG, parallel to the diameter AE; and let $c\,n$ be its ordinate. Let D n be $= x$, $c\,n = y$, and $b\,c = z$. We have $\dot x, \dot y, \dot z$, reſpectively equal to $\dot u, \dot v, \dot w$. Therefore the radius of the oſculating circle is $r = \frac{\dot z^3}{-\dot x \ddot y}$ or $r = \frac{\overline{\dot x^2 + \dot y^2}|^{\frac{3}{2}}}{-\dot x \ddot y}$, for all curves whatever. (We recommend the careful peruſal of the celebrated 2d corollary of the 10th propoſition of the 2d book of Newton's Principia, where the firſt principles of this doctrine are laid down with great acuteneſs.)

Inſtead of ſuppoſing the ordinates equidiſtant, and conſequently $\dot x$ invariable, we might have ſuppoſed the ordinates to increaſe by equal ſteps. In this caſe y would have had no ſecond fluxion. The radius would then be $= \frac{\dot z^3}{\dot y \ddot x}$. Or, laſtly, we might ſuppoſe (and this is very uſual) the arch z to increaſe uniformly. In this caſe $r = \frac{\dot z \dot y}{\ddot x}$: For becauſe $\dot x^2 + \dot y^2 = \dot z^2$, by taking the fluxion of it, $2\dot x \ddot x + 2\dot y \ddot y = 0$, and $\ddot y = \frac{\dot x \ddot x}{\dot y}$; and therefore $r = \frac{\dot z^3}{\dot y \ddot x - \dot x \ddot y}, = \frac{\dot z^3}{\dot y \ddot x + \frac{\dot x^2 \ddot x}{\dot y}}$ $= \frac{\dot y \dot z^3}{\dot y^2 + \dot x^2 \times \ddot x}, = \frac{\dot y \dot z}{\ddot x}$.

Having thus obtained the radius of curvature, and conſequently a point of the evolute, we determine its form by reference to an abſciſs, without much farther trouble: It only requires the drawing C p perpendicular to the axis of the propoſed curve, and giving the values of Cp and Dp. If we ſuppoſe $\dot x$ conſtant, then, cC being $= \frac{\dot z^3}{-\dot x \ddot y}$, we have D p (= D n + $g\,c$, = D n + $\frac{\dot y}{\dot z} \times c$C) $= x + \frac{\dot y \dot z^2}{-\dot x \ddot y}$; and p C (= $c\,g$ — $c\,n$, = $\frac{\dot x}{\dot z} \times c$C — $c\,n$) $= \frac{\dot z^2}{-\ddot y} - y$. But if we ſuppoſe $\dot y$ conſtant; then, c C being $= \frac{\dot z^3}{\dot y \ddot x}$, we have D$p = x + \frac{\dot z^2}{\ddot x}$, and pC $= \frac{\dot z \dot x^2}{\dot y \ddot x} - y$. And if $\dot z$ be conſtant, then, c C being $= \frac{\dot y \dot z}{\ddot x}$, we ſhall have D$p$ $= x + \frac{\dot y^2}{\ddot x}$, and pC $= \frac{\dot x \dot y}{\ddot x} - y$.

Theſe formulæ are ſo many general expreſſions for determining both the curvature of the propoſed curve and the form of its evolute. They alſo give us the rectification of the evolute; becauſe c C is equal to the evolved arch, or to that arch, together with a conſtant part, which was a tangent to the evolute at its vertex, in thoſe caſes where the involute has a finite curvature at its vertex; as in the common parabola.

Let us take the example of the common parabola, that we may compare the two methods. The equation of this is $a\,x = y^2$, or $a^{\frac{1}{2}} x^{\frac{1}{2}} = y$. This gives $\dot y$ $= \frac{1}{2} a^{\frac{1}{2}} \dot x\, x^{-\frac{1}{2}}, = \frac{a^{\frac{1}{2}} \dot x}{2\,x^{\frac{1}{2}}}$, and (making $\dot x$ conſtant) $\ddot y = -\frac{1}{2} \times \frac{1}{2} a^{\frac{1}{2}} \dot x^2 x^{-\frac{3}{2}} = \frac{-a^{\frac{1}{2}} \dot x^2}{4\,x^{\frac{3}{2}}}$. Wherefore $\dot z\ (= \sqrt{\dot x^2 + \dot y^2}) = \frac{\dot x}{2} \sqrt{\frac{4x + a}{x}}$, and the radius of curvature $\left(= \frac{\dot z^3}{-\dot x \ddot y} \right) = \frac{\overline{a + 4x}|^{\frac{3}{2}}}{2\sqrt{a}}$. At the vertex, where $x = 0$, the formula becomes $= \frac{1}{2} a$. Again, D p $\left(= x + \frac{\dot y \dot z^2}{-\dot x \ddot y} \right)$ becomes $\frac{1}{2} a + 3x$; and therefore V$p = 3x$, = the abſciſſa of our evolute. Likewiſe $c\,p$, its ordinate, $\left(= \frac{\dot z^2}{-\ddot y} - y \right)$ $= \frac{4x^{\frac{3}{2}}}{\sqrt{a}}$; and C$p^2 = \frac{16x^3}{a}$; and C$p^2 \times a = 16x^3$. But V$p = 3x$, and V$p^3 = 27x^3$. Therefore C$p^2 \times$ $\frac{1}{16}$th $a = x^3$, = $\frac{1}{27}$th Vp^3, and $\frac{27}{16}$ths $a \times$ Cp^2 = Vp^3. Therefore the evolute VC is a ſemicubical parabola, whoſe parameter is $\frac{27}{16}$ a, as was ſhewn by Mr Huyghens. The arch VC is $= \frac{\overline{a + 4x}|^{\frac{3}{2}}}{2\sqrt{a}} - \frac{1}{2} a$.

We ſhall give one other example, which comprehends the whole claſs of paraboloids. Their general equation is $y = a\,x^n$. This gives us $\dot y = n\,a\,x^{n-1} \dot x$, and $\ddot y = n \times \overline{n-1} \times a\,x^{n-2} \dot x^2$; therefore $\dot z$ (= $\sqrt{\dot x^2 + \dot y^2}$) $= \dot x \sqrt{1 + n^2 a^2 x^{2n-2}}$; C$c$ $\left(= \frac{\dot z^3}{-\dot x \ddot y} \right)$ $= \frac{\overline{1 + n^2 a^2 x^{2n-2}}|^{\frac{3}{2}}}{-n \times \overline{n-1} \times a\,x^{n-2}}$; D$p$ $\left(= x + \frac{\dot y \dot z^2}{-\ddot y \dot x} \right)$ $= x - \frac{x + n^2 a^2 x^{2n-1}}{n-1}$; C$p$ $\left(= \frac{\dot z^2}{-\ddot y} - y \right) =$ $\frac{1 + \overline{2n-1} \times n^2 a^2 x^{2n-2}}{-\overline{n-1} \times n\,a\,x^{n-2}}$; and DV $= -\frac{n^2 a^2 0^{2n-1}}{n-1}$.

This laſt formula expreſſes the radius of curvature at the vertex D, or the redundant part of the thread, by which it exceeds the arch VC of the evolute. If $n = \frac{1}{2}$, the formula becomes $\frac{a^2}{2}$; but if n be greater than this, VC will be $= 0$; and if it be leſs, VC will be infinite. Hence it appears, that the radius of curvature at the vertex of a curve is a finite quantity only in the caſes where the firſt or naſcent ordinates are in the ſubduplicate ratio of their abſciſſæ. In all other caſes, the curvature is incomparable with that of any circle, being either what is called infinite (when n is greater than $\frac{1}{2}$) or nothing (when it is leſs).

We ſcruple not to ſay, that the method of Mr Huyghens is more luminous, more pleaſing to the imagination of a geometer, than this; and in all the caſes which occurred to us in our employment of it, it ſuggeſted

gested more ready constructions, with the additional satisfaction of exhibiting, in a continuous train, what the *symbolical* method, proceeding by the fluxionary calculus, only indicates by points. We must also observe, that the subsidiary curve employed by Huyghens, having its ordinates equal to the subnormals of the involute under examination, is the geometrical expression of that function of the involute which gives the second fluxions $\ddot{y}$ and $\ddot{x}$ of the ordinate and abscissa. The young mathematician will find no difficulty in constructing this curve *in every case;* whereas we imagine that he will not find it a light matter to construct the final equations of the symbolic method *almost in any case*. At the same time, the all comprehending extent of the latter method, and the numberless general theorems which it suggests to the expert analyst, give it a most deserved preference, and make it almost an indispensable instrument for all who would extend our physico-mathematical sciences.

In the employment of the geometry of curve lines, especially in the doctrine of centripetal forces, it is usual to consider the ordinates, not as insisting on a rectilineal abscissa, but as diverging from a centre. This is also the usual way of conceiving all spirals and evolutrixes of curves which include space: in short, all RADIAL curves. The process for finding their evolute, or their radius of curvature, is somewhat different from that hitherto exhibited; but it is more simple. Thus, let GPM (fig. 10.) be the elliptical path of a planet, of which S is the focus. We require PC, the radius of curvature in the point P. Let Pp be a very small arch. Draw the radii SP, Sp, the tangents PT, pt; and draw ST perpendicular to PT, cutting pt in t; and Po perpendicular to Sp. Let the arch GP be $=z$, the radius SP $=y$, and the perpendicular ST $=p$. Then, it is plain, that Pp, op, Tt, are ultimately proportional to $\dot{z}$, $\dot{y}$, $\dot{p}$. The triangles PCp, and Tpt or TPt are also ultimately similar; as also the triangles PST and poP. Therefore, ultimately,

$$Tt : Pp = PT : PC$$

also $$Pp : po = PS : PT$$

therefore $Tt : po = PS : PC$, or, $\dot{p} : \dot{y} = y : r$, and

$r = \dfrac{y\,\dot{y}}{\dot{p}}$; an expression of the radius of curvature, extremely simple, and of easy application.

The logarithmic or equiangular spiral PQR (fig. 6.) affords an easy example of the use of this formula. The angle SPT, which the ordinate makes with the curve, is everywhere the same. Therefore let a be our tabular radius, and b the sine of the angle SPT. We have

$\mathrm{ST} = \dfrac{b\,y}{a}$; and therefore PC $\left(=\dfrac{y\,\dot{y}}{\dot{p}}\right) = \dfrac{a\,y\,\dot{y}}{b\,\dot{y}} = \dfrac{a\,y}{b}$.

This is to SP or y in the constant ratio of a to b, or of SP to ST : that is, ST : SP = SP : PC, the triangles SPT and PCS are similar, the angles at P and C equal, and C is a point of an equiangular spiral pyr round the centre S.

It is not meant that the construction pointed out by this theory of involution, expressed in its most general and simple form, is always the best for finding the centre of the equicurve circle. Our knowledge of, or attention to, many other properties of the curve under consideration, besides those which simply mark its relation to an absciss and ordinate, must frequently give us better constructions. But evolution is the natural genesis of a line of varying curvature. Moreover, in the most important employment of mathematical knowledge, namely, mechanical philosophy, it is well known, that the most certain and comprehensive method of solving all intricate problems is by reference of all forces and motions to three co-ordinates perpendicular to each other. Thus, without any intentional search, we have already in our hands the very fluxionary quantities employed in this doctrine; and the expression which it gives of the radius of curvature requires only a change of terms to make it a mechanical theorem.

Thus have we considered the two chief questions of evolution and involution. We have done it with as close attention to geometry as possible, that the reader's mind may become familiar with the *ipsa corpora* while acquiring the elementary knowledge, which is to be employed more expeditiously afterwards by the help of the symbolical analysis. Without such ideas in the mind, the occupation is oftentimes as much divested of thought as that of an expert accountant engaged in complex calculations; the attention is wholly turned to the rules of his art.

It now remains to consider a little the nature of this curvature of which so much has been said, and about which so many obscure opinions have been entertained. We mentioned, in an early part of this article, the unwarranted use of the terms of infinite and infinitesimal magnitude as applicable to curvature, and shewed its impropriety by the inconsistences into which it leads mathematicians. Nothing threw so much light on this subject as Mr Huyghens's Geometry of Evolution; and we should have expected that all disputes would have been ended by it. But this has not been the case; and even the most eminent geometers and metaphysicians, such as the Bernoullis and Leibnitz, have given explanations of orders of curvature that can have no existence, and explanations of that coalescence which obtains between a curve line and its equicurve circle, which are not warranted by just principles.

These errors (for such we presume to think them) arose from the method employed by the geometers of last century for obtaining a knowledge of the magnitude and variation of curvature. The scrupulous geometers of antiquity despaired of ever being able to compare a curve with a right line. The moderns, although taught by Des Cartes to define the nature of a curve by its equation, allowed that this only enabled them to exhibit a series of points through which it passed, and to draw the polygon which connects these points, but gave no information concerning the continuous *incurvated* arches, of which the sides of the polygon are the chords. They could not generally draw a tangent to any point, or from any point; but they could draw a chord through any two points. Des Cartes was the first who could draw a tangent. He contrived it so, that the equation which expresses the intersections of the curve with a circle described round a given centre should have two equal roots. This indicates the coalescence of two intersections of the common chord of the circle and the curve. Therefore a perpendicular to the radius so determined must touch the curve in the point of their union. This was undoubtedly a great

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Had B been the vertex of the axis, every intersection on one side of B would have been similar to an intersection on the other, and there would always have been two pairs of roots that are equal; and therefore when three intersections coalesce, a fourth also coalesces, and the contact is said to be still closer.

What has now been shewn with respect to a conic section is true of every curve. When two intersections coalesce, there is a common tangent; when three coalesce, there is an equal curvature, and no other circle can pass between this circle and the curve. There cannot be a coalescence of four intersections, except when the diameter is perpendicular to the ordinates, and those are bisected by the diameter.

Mr Leibnitz, who valued himself for metaphysical refinement, and never fails to claim superiority in this particular, notices the important distinction between a simple contact and this closer union in a very well written dissertation, published in the *Acta Eruditorum*, July 1686. He calls the contact of equal curvatures an OSCULATION, and the circle of equal curvature the OSCULATING CIRCLE, and delivers several very judicious remarks with the tone of a master and instructor. He also speaks of different degrees or orders of osculation, each of which is infinitely closer than the other, as a thing not remarked by geometers. But Sir Isaac Newton had done all this before. The first twelve propositions of the *Principia* had been read to the Royal Society several years before, and were in the Registers. The *Principia* had received the imprimatur of the Society in July 1686; but was almost printed before that time. In the Scholium to the 11th Lemma, is contained the whole doctrine of contact and osculation; and in the lemma and its corollaries, is crowded a body of doctrine, which has afforded themes for volumes. The author glances with an eagle's eye over the whole prospect, and points out the prominent parts with the most compressed brevity; but with sufficient precision for marking out the more important objects, and particularly the different orders of curvature. This lemma and its corollaries are continually employed in the twelve propositions already mentioned. In 1671 he had written the first draught of his method of fluxions, where this doctrine is systematically treated; and Mr Collins had a copy of it ever since 1676. It is well known that Leibnitz, when in London, had the free perusal of the Society's records, and information at all times by his correspondence with the secretary Oldenburgh and Mr Collins. His conduct respecting the theorems concerning the elliptical motion of the planets, and the resistance of fluids, leave little room to doubt of his having availed himself in like manner of his opportunity of information on this subject. He gives a much better account of the Newtonian doctrine on this subject than in those other instances, it being more suited to his refining and paradoxical disposition.

In this and another dissertation, he considers more particularly the nature of evolution, and of that osculation which obtains between the evolutrix and the circle described by the evolved radius. He says, that it is equivalent to two simple contacts, each of which is equivalent to two intersections. An osculation produced in the evolution of a curve is therefore equivalent to four intersections. And he advises, with an air of authority, the mathematicians to attend to these remarks, as leading them into the recesses of science. He is mistaken, however; and the listening to him would prevent us from forming a just notion of osculation, and from conceiving with distinctness the singular fact of a circle both touching and cutting a curve in the same point. James Bernoulli lost his friendship, because he

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presumed to say that the presence of four intersections in an osculation is not warranted by the equation expressing those intersections.

Mr Leibnitz was misled by the way in which he had considered the osculation in the evolution of curves. It merits attention. From any point within the space ADFOA (fig. 1.), two perpendiculars may be drawn to the evolutrix *A b d f*; and therefore two circles may be described round that point, each touching the curve. Each contact is the union of two intersections. Therefore, as the centre approaches the evolute, the contacts approach each other, and they unite when the centre reaches the evolute. Therefore the osculation of evolution is equivalent to four intersections.

But when two such circles are described round a point *s*, so as that both may touch the evolutrix *A a f*, the point *s* is in the intersection of one evolved radius with the *prolongation* of another. The contact at the extremity *b* of the prolonged radius *b* B is an exterior contact, and the arch of the circle crosses the evolutrix, from without inwards, in some point more remote from A. The contact at the extremity *e* of the radius *é* E is an interior contact; and if *e s* be greater than the straight line EA, the arch of this circle crosses the curve, from within outwards, in some point nearer to A. Thus each contact is accompanied by an intersection on the side next the other contact, sometimes beyond it, and sometimes between the contacts. As the contacts approach, the intersections also approach, still retaining their characters as intersections, as the contacts still continue contacts. Also the circle next to A crosses from without inwards, and that next to *f* crosses from within outwards. They retain this character to the last; and when the contacts coalesce, the two circles coalesce over their whole circumference, still, however, crossing the curve in the same direction as before; that is, without the curve on the side of A, and within it on the side of *f*. The contacts unite as contacts, and the intersections as intersections. Thus it is that the osculating circle both touches and intersects the curve in the same point.

At *f* the osculation is indeed closer than anywhere else. The variation of curvature is less there than anywhere else, because the radius changes more slowly. It is this circumstance that determines the closeness of contact. If a circle osculates a curve, it has the same curvature. If this curvature does not change in the vicinity of the contact, the curve and circle must coincide; and the deviation of the circle (the curvature of which is everywhere the same) from the curve must proceed entirely from the variation of its curvature. This, therefore, is the important circumstance, and is indeed the characteristic of the figure as a curve line; and its other properties, by which the position of its different parts are determined, may be ascertained by means of the *variation* of its curvature, as well as by its relation to co-ordinates. Of this we have a remarkable instance at this very time. The orbit of the newly discovered planet has been ascertained with tolerable precision by means of observations made on its motions for three years. In this time it had not described the 20th part of its orbit; yet the figure of this orbit, the position of its transverse axis, the place and time of its perihelion, were all determined within 100dth part of the truth by the *observed variation* of its curvature. It therefore merits our attention in the close of this article. We know of no author who has treated the subject in so instructive a manner as Mr M'Laurin has done, by exhibiting the theorem which constitutes Newton's 11th lemma in a form which points this out even to the eye (see *M'Laurin's Fluxions*, Chap. xi. § 363, &c.). We earnestly recommend this work to the young geometer, as containing a fund of instruction and agreeable exercise to the mathematical genius, and as greatly superior in perspicuity and in ideas which can be treasured up and recollected, when required, to the greatest part of the elaborate performances of the eminent analysts of later times. By expressing every thing geometrically, the author furnishes us with a sort of picture, which the imagination readily reviews, and which exhibits in a train what mere symbols only give us a momentary glimpse of.

"As, of all right lines which can be drawn through a given point in the arch of a curve, that alone is the tangent which touches the arch so closely that no right line can pass between them; so, of all circles which touch a curve in a given point, that circle alone has the same curvature which touches it so closely that no circle can pass between them. It cannot coincide with the arch of the curve; and therefore the above condition is sufficient for making it equicurve. As the curve separates from the tangent by its flexure or curvature, it separates from the equicurve circle by its *change* of curvature; and as its curvature is greater or less according as it separates more or less from its tangent, so the variation of its curvature is greater or less according as it separates more or less from its equicurve circle. There can be but one equicurve circle at one point of a curve, otherwise any other circle described between them through that point will pass between the curve and the equicurve circle.

"When two curves touch each other in such a manner that no circle can pass between them, they must have the same curvature; because the arch which touches one of them so closely that no circle can pass between them, must touch the other in like manner. But circles may touch the curve in this manner, and yet there may be indefinite degrees of more or less intimate contact between the curve and its equicurve circle." This is shewn by the ingenious author in a series of propositions, of which a very short abridgment must suffice in this place.

Let any curve EMH (fig. 11.), and a circle ERB, touch a right line ET on the same side at E. Let any right line TK, parallel to the chord EB of the circle, meet the tangent in T, the curve in M, and a curve BKF (which passes through B) in K. Then, if $MT \times TK$ be everywhere equal to TE^2, the curvature of EMH in the point E is the same as that of the circle ERB; and the contact of EM and ER is so much the closer the smaller the angle is which is contained at B between the curve BKF and the equicurve circle BQE.

Let TK meet the circle in R and Q. Then, because $RT \times TQ = TE^2$, it must be $RT \times TQ = MT \times TK$; and $RT : MT = TK : TQ$. The line BKF may have any form. It may cross the circle BQR in B, as in the figure. It may touch it, or touch EB, &c. Let us first consider what situations of the point M correspond with the position of K, in that part of the curve BKF which lies without the circle BRE.

Let

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This corroborates the ſeveral remarks that we have made on the circumſtance of a circle touching and cutting a curve in the ſame point. No other circle can be made to paſs between it and the curve, and it therefore has the ſame curvature. This may therefore be taken as a ſufficient indication of the equicurve circle; the character peculiarly aſſured to it by the nature of evolution. It muſt be noted, however, that the curve is ſuppoſed to have its concavity in the vicinity of the contact turned all the ſame way. For if the contact be in a point of contrary fluxure, even a ſtraight line will both touch and cut it in that point.

The reader cannot but remark, that MK is always the chord of a circle touching TE in E, and paſſing through M.

Let E m be another curve, touching TE in E, ſuch, that the conjugate curve k B, which always gives $Tm \times Tk = TE^2$, alſo paſſes through B. Then, by what has now been demonſtrated, the two curves EM and E m have the ſame equicurve circle ERB, and conſequently the ſame curvature in E. Then, becauſe the rectangles $RT \times TQ$, $MT \times TK$, and $mT \times Tk$, are equal, we have $Tm : TM = TK : Tk$. Therefore if the arch B k paſs between BK and BQ, the curve E m muſt paſs between the curve EM and the circle ER. E m muſt therefore have a cloſer contact with ER than EM has with it; and the ſmaller the angle QBK is which is contained between the curve and its equicurve circle, the cloſer is the contact of the curve EM and its equicurve circle ER. Thus the length of the chord EB determines the *magnitude* or degree of curvature at E, when compared with another; and the angle contained between the equicurve circle and the conjugate curve BKF determines the cloſeneſs of the contact of the curve with its equicurve circle (the angle TEB being ſuppoſed the ſame in both).

It appears, from the proceſs of demonſtration, that the curve EMH falls without or within the equicurve circle according as its conjugate curve BKF does. Alſo, when BKF cuts BQR, HME alſo cuts it. But if FQB is on the ſame ſide of QB on both ſides of the interſection B, the curve HME is alſo on the ſame ſide of it on both ſides of the contact E. It is alſo very clear, that the contact or approach to coaleſcence between the curve and its circle of curvature, is ſo much the cloſer as the conjugate curve BKF comes nearer to the adjoining arch of this circle. It muſt be the cloſeſt of all when KB touches QB, and it muſt be the leaſt ſo when KB touches EB, or has EB for an aſſymptote. The ſpace QBK is a ſort of magnified picture of the ſpace MER; and we have a ſenſible proportion of TQ to TK as the repreſentation of the proportion of TM to TR, quantities which are frequently evaneſcent and inſenſible. When QBK is a finite angle, that is, when the tangents of BQ and BK do not coincide, the angle QBK can be meaſured. But no rectilineal angle can be contained as an unit in the curvilineal angle MER. They are incommenſurable, or incomparable. Let the curve KB touch the circle QB without cutting it. This angle is equally incomparable with the former QBK; yet it has a counterpart in MER. This muſt be incomparable with the former in the ſame manner; for there is the ſame proportion between the individuals of both pairs. Thus it appears plainly, that there are curvilineal angles incomparable with each other. Yet are they magnitudes of one kind; becauſe the ſmalleſt rectilineal angle muſt certainly contain them both; and one of them contains the other. But, further, there may be indefinite degrees of this coaleſcence or cloſeneſs of contact between a curve and a circle. The firſt degree is when the ſame right line touches both. This is a *ſimple contact*, and may obtain between any curve and any circle. The next is when EMH and ERB have the ſame curvature, and when the conjugate curve FKB interſects the circle QB in any aſſignable angle. This is an *oſculation*. The third degree of contact, and ſecond of oſculation, is when the curve KB touches the circle QB, but not ſo as to oſculate. The fourth degree of contact, and third of oſculation, is when KB and QB have the ſame curvature or oſculate in the firſt degree of oſculation. This gradation of more and more intimate contact, or (more properly ſpeaking) of approximation to coaleſcence, may be continued without end, "*neque novit natura limites*,"

the

Involution. the contact of EM and ER being always two degrees closer than that of BK and BQ. Moreover, in each of those classes of contact there may be indefinite degrees. Thus, when EM and ER have the same curvature, the angle QBK admits of indefinite varieties, each of which ascertains a different closeness of contact at E. Also, though the angle QBK should be the same, the contact at E will be so much the closer the greater the chord EB is.

For TR : TM = TK : TQ

Therefore RM : TR = KQ : KT

Or RM : KQ = TR : TK ; = TR × TQ : TK × TQ, = TE^2 : TK × TQ.

Therefore, when TE is given, RM (which is then the measure of the angle of contact) is proportional to KQ directly, and to the rectangle TK × TQ inversely; and when KQ is given, RM is less in proportion as KT × TQ is greater. In the very neighbourhood of E and B, it is plain that KT × TQ is very nearly equal to EB^2, and therefore ultimately RM : KQ = ET^2 : EB^2.

It will greatly assist our conception of this delicate subject, if we view the origin of these degrees of contact as they are generated by the evolution of lines. A thread evolving from a polygon EDCBA (fig. 13.) describes with its extremity *a* a line *e d b c a*, consisting of successive arches of circles united in simple contacts. If it evolve from any continuous curve CBA, after having evolved from the lines ED, BC, the arch *c b* will be united with the circular arch *d c* by osculation of the first degree. If any other curve FC touch this evolute in a simple contact, and if the two curves FCBA and DCBA are both evolved, they will touch each other in a simple osculation in that point where they have the same radius. If FC touches DC in a simple osculation, the evolved curves will touch in an osculation of the second degree; and, in general, the osculation of the two generated curves is a degree closer than that of their evolutes; and in each state of one of the osculations, there is an indefinite variety of the other, according to the length of its radius of curvature. All this is very clear; and shews, that these degrees of contact do not indicate degrees of curvature, one of which infinitely exceeds another; for they are all finite.

The reader will do well to remark, that the magnitude, which is the subject of the above proportions, which is really of the same kind in them all, and considered as susceptible of various degrees and orders of infinitesimals, is not curvature, but lineal extension. It is RM, the subtense of the angle of contact MER. It is the linear separation from the tangent, or from the equicurve circle. It is, however, usually considered as the measure of curvature, or the proportions of this line are given as the proportions of the curvature. This is inaccurate; for curvature is unquestionably a change of direction only. As this line has generally been the interesting object in the refined study of curve lines, especially in the employment of it in the discussions of mechanical philosophy, it has attracted the whole attention, and the language is now appropriated to this consideration. What is called, by the most eminent mathematicians, variation of curvature, is, in fact, variation of the subtense of the angle of contact. But it is necessary always to distinguish them carefully.

Variation of curvature is the remaining object of our attention. Involution.

Curvature is uniform in the circle alone. When the curvature of the arch EMH (fig. 11.) decreases as we recede from E, the arch, being less deflected from its primitive direction ET than the arch ER, must separate less from the line ET, or must fall without the arch ER. The more rapidly its curvature decreases, the describing point must be left more without the circle. It must be the contrary, if its curvature had increased from E toward M. It may change its curve equably or unequably. If equably, there must be a certain uniform rate, which would have produced the same final change of direction in a line of the same length, bending it into the uniformly incurvated arch of a circle. It is not so obvious how to estimate a rate of variation of curvature; and authors of eminence have differed in this estimation. Sir Isaac Newton, who was much interested in this discussion, in his studies on universal gravitation, seems to have adopted a measure which best suited his own views; and has been followed by the greater number. He gives a very clear conception of what he means, by stating what he thinks a case of an invariable rate of variation. This is the equiangular spiral, all the arches of which, comprehended in equal angles from the centre, are perfectly similar, although continually varying in curvature. He calls this a curve EQUABLY VARIABLE, and makes its rate of variation (estimated in that sense in which it is uniform) the measure of the rate of variation in all other curves. Let us see in what respect its variation of curvature is constant. It may be described by the evolution of the same spiral in another position (see fig. 6.), and the ratio between the radius of the evolute and that of the evolutrix is always the same; or (which amounts to the same thing) the arch of the evolutrix bears to the evolved arch of the evolute a constant ratio. The curvature of the spiral changes more rapidly in the same proportion as the ratio of the evolved arch to the arch of the evolutrix generated by it is greater, or as it cuts the radii in a more acute angle. These arches may be infinitesimal; therefore the fraction $\frac{\text{fluxion of evolute}}{\text{fluxion of evolutrix}}$ expresses the rate of the variation of curvature in this spiral, Now let *a b c d* (fig. 13.) be any other curve, and ABCD its evolute; let *p* be the centre of curvature at the point B of the evolute, and B *o* the evolved arch; draw the radii *p* B, *p o*, B *m*, *o n*; join *p m*, and draw B *q* perpendicular to *p m*. It is evident that *m n* and B *o* have the same ratio with B *m* and B *p*; and that these two small arches may be conceived as being portions of the same equiangular spiral (perhaps in another position), of which *q* is the centre; and that *p* is in the curve of another of the same. For *q p* : *q* B = *q* B : *q* M, = *p* B : B *m*; therefore the ratio of these infinitesimal arches *m n* and B *o* will express the rate of variation in any curve. This is evidently equivalent to saying, that the variation of curvature is proportional to the fluxion of the radius of curvature directly, and the fluxion of the curve inversely. For *m n* and B *o* are ultimately as those fluxions, and $\frac{B o}{m n}$ is equivalent to $\frac{\dot{r}}{\dot{z}}$, where *z* is the arch of the spiral, and *r* the evolved radius of the other. Accordingly,

ingly, this is the enunciation of the INDEX OF VARIATION given by Newton (See Newton's Fluxions, Prob. VI. § 3.). Therefore, what Newton calls a uniform variation of curvature, is not an increase or diminution by equal arithmetical differences, but by equal proportions of the curvature in every point. The variation of curvature in similar points of similar arches is supposed to be the same.

It is evident that this ratio is the same with that of radius to the tangent of the angle $p\,m$ B, or of 1 to its tabular tangent. The tangent therefore of this angle corresponding to any point of a curve is the measure of the variation of curvature in that point. Now it may be shewn (and it will appear by and bye), that the fluxion of TK in fig. 11. or the ultimate value of KQ, is always $\frac{2}{3}$ds of the fluxion of the radius of curvature. Therefore the tangent of the angle QBK is always $\frac{2}{3}$ds of that of $p\,m$ B; and therefore the angle QBK, which we have seen to be an index of the closeness of contact, is also the index of the variation of curvature (See *M'Laurin*, § 386.).

Sir Isaac Newton has given specimens of the use of this measure in a variety of geometrical curves, by means of a general expression of $\frac{\dot{r}}{\dot{z}}$. Thus, in the curve ABC (fig. 8.), let AB be $= z$, AD $= x$, DB $= y$, BN $= r$, and BE $= p$; we have $\frac{\text{N}n}{\text{B}b} = \frac{\dot{r}}{\dot{z}}$. Now DB : BE $= y : p, =$ D d : B $b, = \dot{x} : \dot{z}$. Therefore $\dot{z} = \frac{p\dot{x}}{y}$, and $\frac{\dot{r}}{\dot{z}} = \frac{y\dot{r}}{p\dot{x}}$. Now, in every curve which we can express by an equation, we can obtain all these quantities p, y, $\dot{r}$, and $\dot{z}$, and can therefore obtain the measure of the variation of curvature. It also deserves particular notice, that this investigation of $\frac{\dot{r}}{\dot{z}}$ is equivalent with finding the centre and radius of curvature of the evolute, by which the curve under consideration is generated; or with finding the centre q (fig. 13.) of an equiangular spiral, which will touch our curve in m, its evolute in B, and the evolute of the evolute in p, if put into different positions when necessary. This leads to very curious speculations, for which, however, we have no room. It has been said, for instance, that the curvature at the intersection of a cycloid with its base is infinitely greater than that of any circle. If the evolution of the cycloid begin from this point, the curvature of its evolutrix will be infinitely greater still upon the same principles; and we shall have one infinitely greater than this by evolving it. Yet all these infinities, multiplied to infinity, are contained in the central point of every equiangular spiral! In like manner, there are evolutrixes which coincide with a straight line, and others of infinitely greater rectitude, and still they are curves. Can this have any meaning? And can it be reconciled with the legitimate reasoning from the same principles, that all these curvatures and angles of contact are producible by evolution; and that they may be, and certainly are every day described, by bodies moving in free space, and acted on by accelerating forces directed to different bodies?

The parabola (conical) is the most simple of all the lines of unequably varying curvature, and becomes a very good standard of comparison. In the parabola ABC (fig. 8.) let the parameter be $2\,a$. The equation is then $2\,a\,x = y^2$; DE $= a$; p, or BE $= \sqrt{a^2 + y^2}$ DQ $= a + 2\,x$ (by what was formerly demonstrated). Moreover, DB : BE = DQ : BN; and BN $= \frac{pa + 2px}{a}$, $= r$. These equations give $2\,a\,\dot{x} = 2\,y\,\dot{y}, = 2\,p\,\dot{p}$; and $\frac{a\dot{p} + 2\,x\,\dot{p} + 2\,p\dot{x}}{a} = \dot{r}$. Now making $\dot{x} = 1$, and reducing the equations, we obtain $\dot{y} = \frac{a}{y}$; $\dot{p} = \frac{y\dot{y}}{p} = \frac{a}{p}$; and $\dot{r} = \frac{a\dot{p} + 2\,x\,\dot{p} + 2\,p}{a}$.

With these values of $\dot{y}, \dot{p}, \dot{r}$, we obtain a numeric value of $\frac{y\,\dot{r}}{p}$ most readily. Thus, in order to obtain the index of variation of curvature in the point where the ordinate at the focus cuts the parabola, make $a = 1$. Then $2\,x = y^2$; $x = \frac{1}{2}$, $y\ (= \sqrt{2\,x}) = 1$; $\dot{y}\left(= \frac{a}{y}\right) = 1$; $p\ (= \sqrt{a^2 + y^2}) = \sqrt{2}$; $\dot{p}\left(= \frac{a}{p}\right) = \sqrt{\tfrac{1}{2}}$, and $\dot{r}\left(= \frac{a\dot{p} + 2\,x\,\dot{p} + 2\,p}{a}\right) = \sqrt{2} \times 3$. Therefore $\frac{y\,\dot{r}}{p} = 3$, = the index of variation in the point B when D is the focus of the parabola; that is to say, the fluxion of the radius of curvature is three times the fluxion of the curve.

The index of variation, where the ordinate is equal to the parameter, is had by making $x = 2$. This gives $y = 2$; $\dot{y} = \frac{1}{2}$; $p = \sqrt{5}$; $\dot{p} = \sqrt{\tfrac{1}{5}}$, and $\dot{r} = 3\sqrt{5}$. Wherefore $\frac{y\,\dot{r}}{p} = 6$, which is the index of variation. Moreover, since p and $\dot{r}$ are in a constant ratio, it appears that the index of variation of curvature in the parabola is proportional to the ordinate y. It is always $= 6\,\frac{\text{ordinate}}{\text{parameter}}$; and thus, with very little trouble, we can describe the evolute of its evolute, *i. e.* of the semicubical parabola.

In like manner, it may be shewn, that in all the conic sections $\frac{\dot{r}}{\dot{z}}$ is always proportional to the rectangle of the ordinate DB and the subnormal DE, or to DB × DE. In the parabola, whose equation is $2\,a\,x = y^2$, we have $\frac{\dot{r}}{\dot{z}} = \frac{3\,y}{a}$. In an ellipse, whose equation is $2\,a\,x - b\,x^2 = y^2$, we have $\frac{\dot{r}}{\dot{z}} = \frac{3 - 3\,b}{a} \times$ DB × DE, and in the hyperbola, whose equation is $2\,a\,x + b\,x^2$, $\frac{\dot{r}}{\dot{z}}$ is $= \frac{2 + 3\,b}{a} \times$ DB × DE. This ratio, in all the three sections, is always as the tangent of the angle contained between the diameter and the normal at the point of contact. By this we may compare them with a parabola. In the cycloid at the point E

Involution, ‖ Joan.

(fig. 5.) $\frac{\dot{y}}{\dot{z}}$ is = tan. ∠ EKM, &c. &c.

All these things may be traced in the observations made on fig. 11. and 12. When the angle BET is a right angle, the angle KBQ indicates it directly, its tangent being always $= \frac{2r}{3z}$. It is easy also to see, that when the curve EMH is a parabola, the line BKF is a straight line parallel to ET. It is also plain, that by the same steps that we proved that no circle can pass between this parabola and its equicurve circle ERB, so no other parabola can pass between them. Indeed the same reasoning will prove that no curve of the same kind can pass between any curve and its osculating circle. In many cases, it is more easy to reason from the curvature of a curve, by comparing it with an equicurve parabola than with an equicurve circle; particularly in treating of the curvilineal motions of bodies in free space, actuated by deflecting forces.

If EMH be an ellipse or hyperbola, BKF is another ellipse or Hyperbola (*M'Laurin*, § 373.)

We have thus endeavoured to introduce our readers into this curious branch of speculative geometry. An introduction is all that can be expected from a work of this kind. We have enlarged on particular points, in proportion as we thought that the notions entertained on the subject were inadequate, or even vague and indistinct; and we hope that some may be incited to acquire clearer conceptions by going to the fountain head. We conclude, by recommending to the young geometer the perusal of the Fluxions of Sir Isaac Newton, after he has read M'Laurin's Chapter with care. He will probably be surprised and delighted with seeing the whole compressed by a master's hand into such narrow compass with such beautiful perspicuity.

JOAN D'ARC, the maid of Orleans, has been variously characterised; but all now agree, that she was worthy of a better fate than the horrid death she was doomed to die. (See JOAN *d'Arc*, *Encycl.*). But did she actually die that death? An ingenious writer in the *Monthly Magazine* has proved, we think, that she did not.

The bishop of Beauvais (says he) is accused by all parties of treachery and trick in the conduct of the trial: it was his known propensity to gain his ends by stratagem, craft, manœuvre, fraud, dexterity. He seeks out, and brings forward, such testimony only as relates to ecclesiastical offences, and then hands over the decision to the secular judges, whose clemency he invokes. Joan says to him publicly, "You * *promised* to restore me to the church, and you deliver me to my enemies." The intention of the bishop, then, must have been, that the secular judges, for want of evidence, should see no offence against the state; as the clerical judges, notwithstanding the evidence, had declined to see any against the church. A fatal sentence was, however, pronounced; and the fulfilment of it entrusted to the ecclesiastical authorities. Immediately after the *auto da fé*, one of the executioners ran to two friars, and said, "that he had never been so shocked at any execution, and that the English had built up † a scaffolding of plaster (*un echafaud de platre*) so lofty, that he could not approach the culprit, which must have caused her sufferings to be long and horrid." She was, therefore, by some *unusual* contrivance, kept out of the reach and observation even of the executioners.

* *Villaret Histoire de France*, tom. xv. p. 72.

† *Pasquier Histoire d'Orleans*, liv. vi.

Joan, ‖ John.

Some time after, when public commiseration had succeeded to a vindictive bigotry, a woman appeared at Metz‡, who declared herself to be Joan of Arc. She was everywhere welcomed with zeal. At Orleans, especially, where Joan was well known, she was received with the honours due to the liberatress of the town. She was acknowledged by both her brothers, Jean and Pierre d'Arc. On their testimony she was married by a gentleman of the house of Amboise, in 1436. At their solicitation her sentence was annulled in 1456. The Parisians, indeed, long remained incredulous: they must else have punished those ecclesiastics, whose humanity, perhaps, conspired with the bishop of Beauvais to withdraw her from real execution down a central chimney of brick and mortar; or, as the executioner called it, a scaffolding of plaster. The king, for the woman seems to have shunned no confrontation, is stated to have received her with these words: "*Pucelle, m'amie, soyez la tres bien revenue, au nom de Dieu.*" She is then said to have communicated to him, kneeling, the artifice practised. Can this woman be an impostor? Our author thinks not, and appeals to Voltaire, who, in his prose works, seems willing to allow that she was not, as is too commonly imagined, one of those half-insane enthusiasts, employed as tools to work upon the vulgar; whom the one party endeavoured to cry up as a prophetess, and the other to cry down as a witch; but that she was a real heroine, superior to vulgar prejudice, and no less remarkable by force of mind than for a courage and strength unusual in her sex. This opinion is certainly countenanced by her behaviour in adversity, and during her trial, which was firm without insolence, and exalted without affectation.

‡ *Histoire de la Pucelle par l'Abbé Lenglet.* See also *Melanges Curieux Monstrelet;* and the manuscript authorities cited by the continuator of Velly.

JOHN, BAYOUK OF ST, a little creek which furnishes a very easy communication from New-Orleans to West-Florida. It is navigable for vessels drawing about 4 feet water 6 miles up from the lake Ponchartrain, where there is a landing place, at which vessels load and unload: this is about 2 miles from the town. The entrance of the Bayouk of St John is defended by a battery of 5 or 6 cannon. There are some plantations on the Bayouk, and on the road from thence to New-Orleans.—*Morse.*

JOHN DE FRONTIERA, ST, is the chief town of the province of Cuyo in Peru.—*ib.*

JOHN'S COLLEGE, ST, in Maryland, is situated in the city of Annapolis, was instituted in 1784, to have 24 trustees, with power to keep up the succession by supplying vacancies, and to receive an annual income of £9,000. It has a permanent fund of £1,750 a year, out of the monies arising from marriage licenses, fines and forfeitures on the Western Shore. This college, with Washington college at Chestertown, constitute one university, named "The University of Maryland." The convocation of the University of Maryland, who are to frame the laws, preserve uniformity of manners and literature in the colleges, confer the higher degrees, determine appeals, &c.—*ib.*

JOHN'S ISLAND, in South-Carolina, lies S. W. of Charleston harbour, divided from James's Island by Stono river, which forms a convenient and safe harbour. —*ib.*

JOHN'S

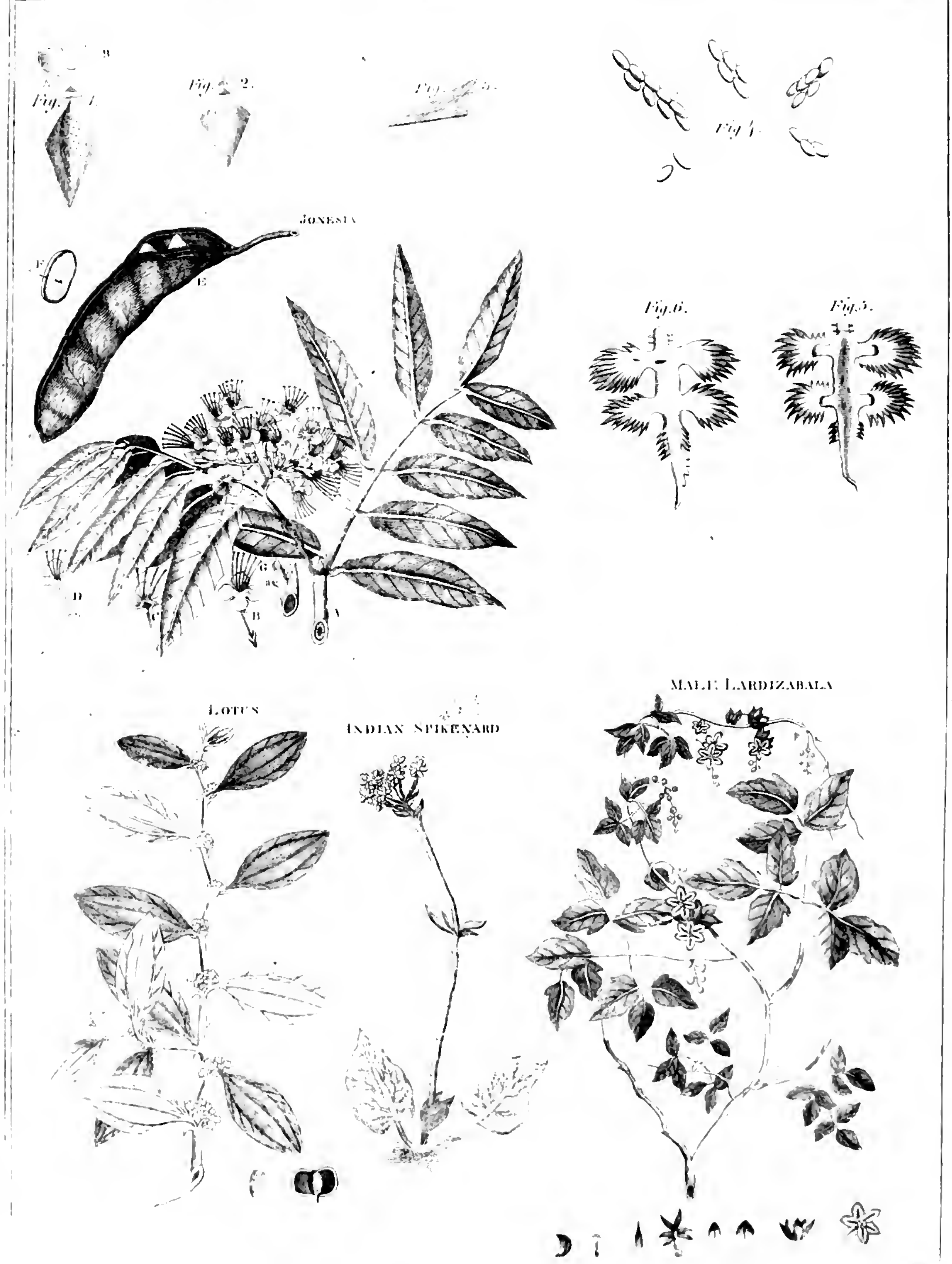
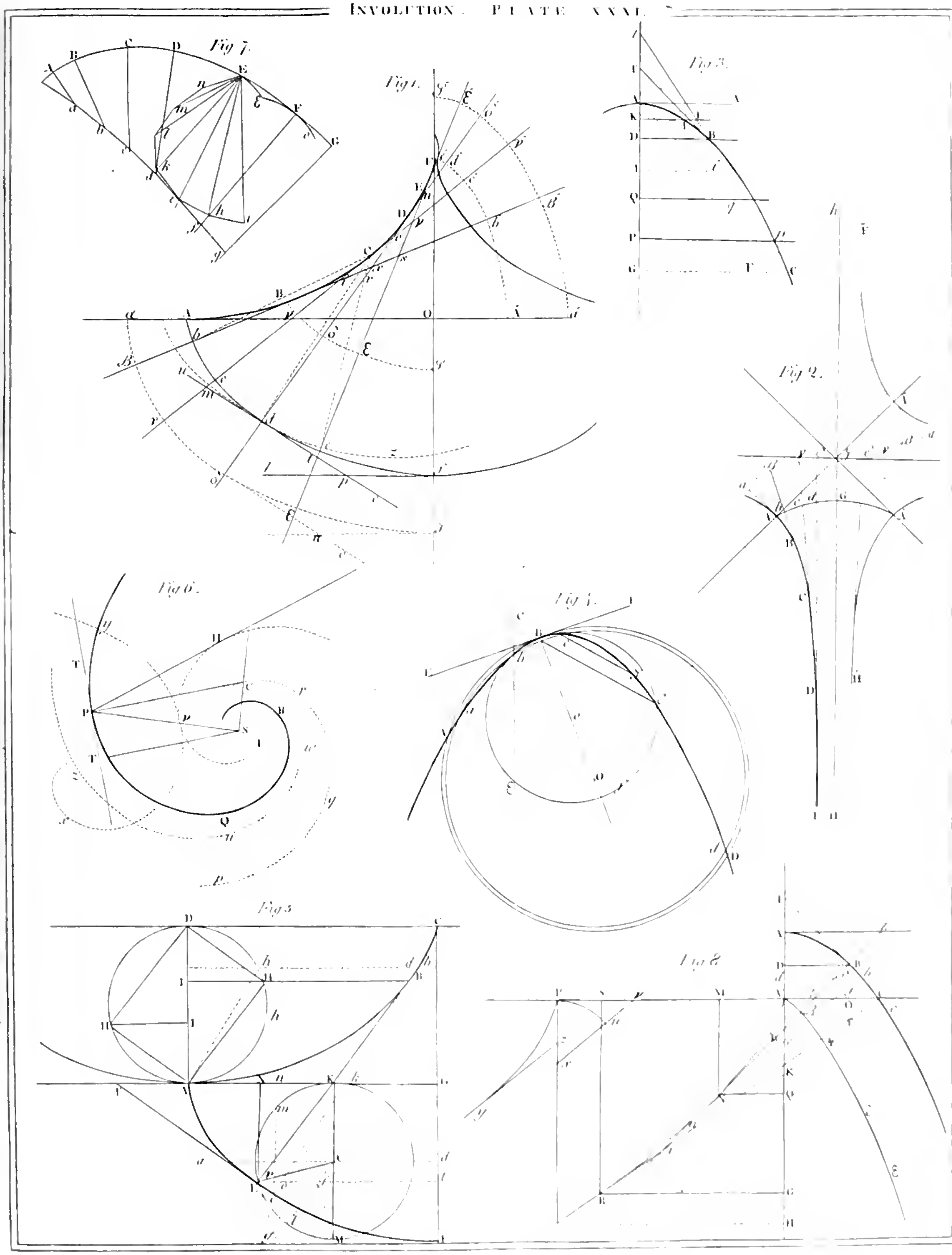


Fig. 1
Fig. 2
Fig. 3
Fig. 4
JONESIA
Fig. 6.
Fig. 5.
LOTUS
INDIAN SPIKENARD
MALE LARDIZABALA



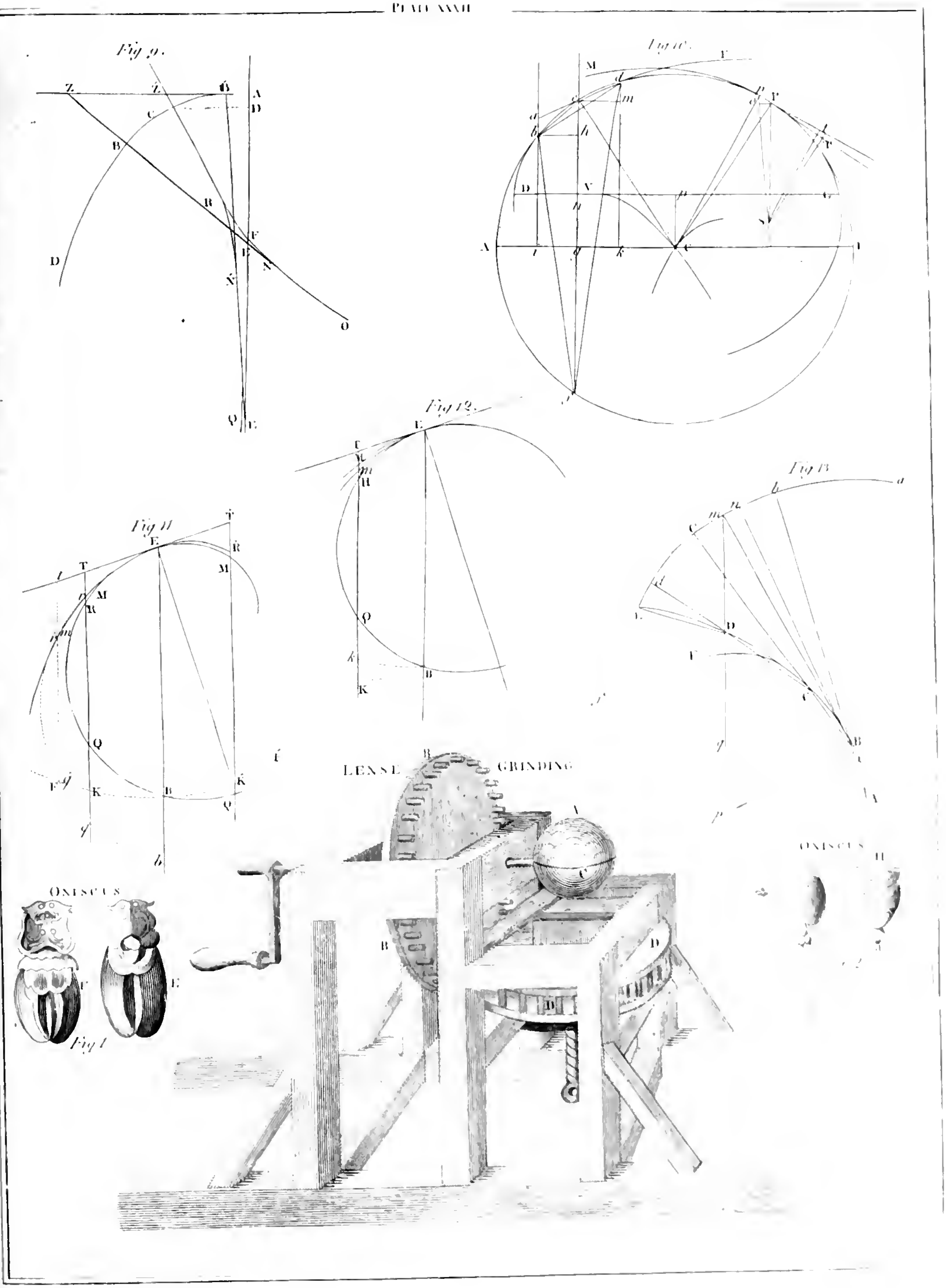


Fig 9.
Fig 10.
Fig 12.
Fig 11
Fig 13
LENSE GRINDING
ONISCUS
ONISCUS
Fig 1

John's. JOHN'S, ST, one of the chief towns of Newfoundland island, situated on the east coast, 6 miles north-west of Cape Spear, and 18 south-east of Cape St Francis. N. lat. 47° 32', W. long. 52° 21'. It lies on the bay of the same name. Its harbour is one of the best in the island, and has from 10 to 17 fathoms water up to King's wharf, which is a little to the north-west of the Old Fort, at the bottom of the town, and is a mile from the mouth of the harbour. A mile further is the mouth of Castor river, in which distance there is from 14 to 4 fathoms of water. On the south side of this river is King's wharf, an hospital, and a watering place. Near these are the hills called the High Lands of St John's. N. lat. 47° 32', W. long. 52° 29'.—*ib.*

JOHN'S, ST, a bay and island on the west coast of Newfoundland island, in the gulf of St Lawrence, at the south-west end of the straits of Bellisle.—*ib.*

JOHN'S RIVER, ST, in East-Florida rises in or near a large swamp in the heart of East-Florida, and pursues a northern course, in a broad navigable stream, which in several places spreads into broad bays or lakes; of which Lake George is the chief. Vessels that draw 9 or 10 feet water, may navigate safely through the west channel into St John's river as far as Lake George. The bar at the mouth is liable to shift. It is 10½ leagues north of St Augustine.—*ib.*

JOHN'S RIVER, *Little St*, in West Florida, falls into Apalache Bay, about 10 miles eastward of Apalache river. It is said to be the clearest and purest of any in America, is about 200 yards broad, and about 15 or 20 feet deep at the town of Talahasochete. The swamp called Ouaquaphenogaw is said to be its source, which is 100 miles by land from Talahasochete, and, following its windings, from the sea 200 miles. The Indians and traders say it has no branches, or tributaries, which fall into it; but that it is fed by great springs which break out through the banks.—*ib.*

JOHN'S, ST, is the largest river in the British province of New-Brunswick. From its mouth on the north side of the bay of Fundy, to its main source is computed to be 350 miles. The tide flows 80 or 90 miles up this river. It is navigable for sloops of 50 tons 60 miles, and for boats 200. Its general course from its source is E. S. E. It furnishes the greatest plenty of salmon, bass, and sturgeon; and is the common route to Quebec. About a mile above the city of St John's is the only entrance into this river. It is about 80 or 100 yards wide, and about 400 yards in length; called the falls of the river. It being narrow, and a ridge of rocks running across the bottom of the channel, on which are not above 17 feet of water, it is not sufficiently spacious to discharge the fresh waters of the river above. The common tides flowing here about 20 feet, the waters of the river, at low water, are about 12 feet higher than the waters of the sea; at high water, the waters of the sea are about five feet higher than those of the river; so that in every tide there are two falls, one outwards and one inwards. The only time of passing with safety is at the time when the waters of the river are level with the waters of the sea, which is twice in a tide, and continues not more than 20 minutes each time. At other times it is either impassable or extremely dangerous; resembling the passage of Hell Gate near New-York. The banks of this river, enriched by the annual freshets, are excellent land. About 30 miles from its mouth commences a fine level country of rich intervale and meadow lands, well cloathed with timber and wood, such as pine, beech, elm, maple, and walnut. It has many tributary streams, which fall into it on each side, among which are the Oromocto river, by which the Indians have a communication with Passamaquoddy, the Nashwach and Madamkiswick, on which are rich intervales that produce all kinds of grain in the highest perfection. This noble river, in its numerous and extensive branches, waters and enriches a large tract of excellent country, a great part of which is settled and under improvement. The up-lands, in general, are covered with a fine growth of timber, such as pine and spruce, hemlock and hardwood, principally beech, birch, maple, and some ash. The pines on this river are the largest to be met with in British America, and afford a considerable supply of masts, some from 20 to 30 inches in diameter, for the British navy.—*ib.* John's.

JOHN'S, ST, one of the Virgin Islands, about 12 leagues east of Porto Rico. It is about 5 miles long and 1 broad; and 2 leagues south of St Thomas. It is the best watered of all the Virgin Isles; and its harbour, called Crawl Bay, is reckoned better than that of St Thomas, and passes for the best to the leeward of Antigua. There is, however, little good land in the island and its exportations are trifling.—*ib*

JOHN'S, ST, an island in the gulf of St Lawrence, near the northern coast of Nova-Scotia, to which government it is annexed. It is 117 miles in length from N. E. to S. W. The medium breadth is 20 miles; but between Richmond Bay on the north, and Halifax Bay on the south, it is not above 3 miles broad. The other bays on the north side are London Harbour, Grand Rastied, and St Peters; those on the south side, Egmont, Halifax, and Hillsborough. On the east side, Three River Harbour, and Murry Harbour. It has several fine rivers, a rich soil, and is pleasantly situated. Its capital is Charlotte-Town, the residence of the lieutenant-governor, who is the chief officer on the island. The number of inhabitants are estimated at about 5,000. Upon the reduction of Cape Breton in 1745, the inhabitants quietly submitted to the British arms. While the French possessed this island, they improved it to so much advantage, as that it was called the granary of Canada, which it furnished with great plenty of corn, as well as beef and pork. When taken it had 10,000 head of black cattle upon it, and several of the farmers raised 12,000 bushels of corn annually. Its rivers abound with salmon, trout, and eels, and the surrounding sea affords plenty of sturgeon, plaice, and most kinds of shell-fish. The island is divided into 3 counties, viz. King's, Queen's, and Prince's counties; which are subdivided into 14 parishes, consisting of 27 townships, which in all make 1,363,400 acres, the contents of the island. The chief towns, besides the capital, are Georgetown, Prince's-Town; besides which are Hillsborough-Town, Pownal-Town, Maryborough-Town, &c. It lies between 45° 46', and 47° 10 N. lat. and between 44° 22', and 46° 32 W. long.—*ib.*

JOHN'S, ST, the north-westernmost town in Sussex county, Delaware, is situated at the head of the middle branch of Nanticoke river, about 27 miles N. E. of Vienna in Maryland, and 22 S. by W. of Dover.—*ib.*

JOHN'S, ST, a town and fort in Lower Canada, situated

ated on the west bank of Sorel river, at the north end of lake Champlain, a few miles southward of Chamblee, 28 miles southward of Montreal. It has been established as the sole port of entry and clearance for all goods imported from the interior of the United States into Canada, by an ordinance published by the executive council of Lower Canada, the 7th of July, 1796. It is 115 miles northward of Ticonderoga, and was taken by General Montgomery in Nov. 1775. N. lat. 45° 9′, W. long. 72° 18′.—*ib.*

JOHN, ST, a lake in Lower-Canada, which receives rivers from every direction, and sends its waters through Saguenai river into the St Lawrence, at Tadousac. It is about 25 miles each way.—*ib.*

JOHN'S BERKLEY, ST, a parish of S. Carolina, in Charleston district, containing 5,922 inhabitants; of whom 692 are whites, and 5,170 are slaves.—*ib.*

JOHN'S, ST, a small island in the West-Indies belonging to Denmark, north of St Croix, and south of Tortola, to which last it is very near. It is noted only for its fine harbour, which is said to be sufficient to contain in safety the whole British navy. It has a number of salt ponds, which, however, are no evidence of its fertility.—*ib.*

JOHN'S COLLETON, ST, a parish of S. Carolina, in Charleston district, containing 5,312 inhabitants; of whom 585 are whites, and 4,705 slaves.—*ib.*

JOHN'S, ST, the capital of the island of Antigua in the West-Indies. It is a regularly built town, with a harbour of the same name, situated on the west shore, and on the north-east side of Loblollo Bay. The entrance of the harbour is defended by Fort James. this town is the residence of the governor general of the leeward Charaibe Islands, and where the assembly is held, and the port where the greatest trade is carried on. It was so flourishing as to receive a loss by a storm, to the value of £400,000 sterling. N. lat. 17° 4′, W. long. 62° 4′.—*ib.*

JOHN, ST, or *Juan de Porto Rico*, the capital of the island of Porto Rico, in the West-Indies.—*ib.*

JOHNSBURY, ST, a township in Caledonia county, in Vermont, bounded S. W. by Danville, and has 143 inhabitants.—*ib.*

JOHNSON FORT, in S. Carolina, lies on the N. E. side of James's Island, and south of the city of Charleston. It stands at the entrance of the harbour, and by which no vessel can pass unless the master or mate make oath that no malignant distemper is on board. It is guarded by 10 men.—*ib.*

JOHNSTON FORT, or *Johnson Fort*, in N. Carolina, stands on the western bank of Cape Fear river, opposite to the island on the sea-coast whose southern point is Cape Fear.—*ib.*

JOHNSONSBOROUGH, a post-town of New-Jersey, 10 miles from Sussex court-house.—*ib.*

JOHNSON'S LANDING-PLACE, is on O-yongwongyeh Creek, about 4 miles eastward of Fort Niagara.—*ib.*

JOHNSON, a county of N. Carolina, in Newbern district, bounded S. E. by Glasgow, N. by Franklin and Wayne counties, and S. by Sampson. It contains 5634 inhabitants, of whom 1329 are slaves.—*ib.*

JOHNSTOWN, a post-town and the capital of Montgomery county, New-York, situated on the N. bank of Mohawk river, 24 miles W. of Schenectady. The compact part of the town is a little back from the river, and contains about 70 houses, a Presbyterian and an Episcopal church, a court-house and gaol. In the township 593 of the inhabitants are electors. Caghnawaga is a parish or district of Johnstown 26 miles above Schenectady on the river. Settlements have been made here for about 80 years. Here stand the dwelling house, barn, and out-houses (all of stone) formerly occupied by Sir William Johnson. This settlement was mostly destroyed by the British in the year 1780, who were joined by a party of Indians and others, under the command of Sir William Johnson. In this action it is asserted, that Sir William evinced a want of feeling which would have disgraced a savage. The people destroyed in this expedition were his old neighbours, with whom he had formerly lived in the habits of friendship. His estate was among them; and the inhabitants had always considered him as their friend. These unfortunate people, after seeing their houses and property consumed, were hurried, such as could walk, into cruel captivity; those who could not, fell victims to the tomahawk and scalping knife.—*ib.*

JOHNSTON, a township in Providence county, Rhode-Island, westerly of the town of Providence, having 1320 inhabitants.—*ib.*

JOHNSTON, a township in Franklin county, in Vermont; it contains 93 inhabitants.—*ib.*

JONAS'S SOUND, the most northern inlet on the western coast of Sir Thomas Smith's Bay, lying near the arctic circle, in latitude 76°.—*ib.*

JONES (Sir William), who was styled by Johnson the most enlightened of men, was the son of William Jones, Esq; one of the last of those genuine mathematicians, admirers, and contemporaries of Newton, who cultivated and improved the sciences in the last century. Our author was born on the 28th of September 1746, and received his education at Harrow school, under the care of Dr Robert Sumner, whom he has celebrated in an eulogium which will out-last brass or marble. We are told that he was a class fellow with Dr Parr, and at a very early age displayed talents which gave his tutor the most promising expectations, and which have since been amply justified. From Harrow he was sent to University college, Oxford, where the rapidity and elegance of his literary acquisitions excited general admiration; while a temper, ardently generous, and morals perfectly irreproachable, procured him testimonies of the most valuable esteem. The grateful affection which he always cherished for that venerable seat of learning, did as much honour to his sensibility, as Oxford herself has received by enrolling him among the number of her sons.

In the twenty-third year of his age he travelled through France, and resided some time at Nice, where he employed himself very differently from most other young men who make what is called the tour of Europe. *Man*, and the influence of various forms of *government*, were the principal objects of his investigation; and in applying the result of his inquiries to the state of his own country, he mingled the solicitudes of the Patriot with the honest partialities of an Englishman.

Mr Jones's first literary work was a translation into French of a Persian manuscript, entitled "*Histoire de Nadir Shah, connu sous le nom de Thahmas Kuli Khan, Empereur de Perse*," in two vols. 4to; the history of which performance we shall give in his own words;

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words: "A great northern monarch, who visited this country a few years ago, under the name of the Prince of Travendal, brought with him an eastern manuscript, containing the life of Nadir Shah, the late sovereign of Persia, which he was desirous of having translated in England. The secretary of state, with whom the Danish minister had conversed upon the subject, sent the volume to me, requesting me to give a literal translation of it in the French language; but I wholly declined the task, alledging for my excuse the length of the book, the dryness of the subject, the difficulty of the style, and chiefly my want both of leisure and ability to enter upon an undertaking so fruitless and so laborious. I mentioned, however, a gentleman, with whom I had not then the pleasure of being acquainted, but who had distinguished himself by a translation of a Persian history, and was far abler than myself to satisfy the king of Denmark's expectations. The learned writer, who had other works upon his hands, excused himself on the account of his many engagements; and the application to me was renewed. It was hinted, that my compliance would be of no small advantage to me at my entrance into life; that it would procure me some mark of distinction which might be pleasing to me; and, above all, that it would be a reflection upon this country, if the king should be obliged to carry the manuscript into France. Incited by these motives, and principally by the last of them, unwilling to be thought churlish or morose, and eager for the bubble reputation, I undertook the work, and sent a specimen of it to his Danish Majesty; who returned his approbation of the style and method, but desired that the whole translation might be perfectly literal, and the oriental images accurately preserved. The task would have been far easier to me, had I been directed to finish it in Latin; for the acquisition of a French style was infinitely more tedious; and it was necessary to have every chapter corrected by a native of France, before it could be offered to the discerning eye of the public, since in every language there are certain peculiarities of idiom, and nice shades of meaning, which a foreigner can never learn to perfection. But the work, how arduous and unpleasing soever, was completed in a year, not without repeated hints from the secretary's office that it was expected with great impatience by the Court of Denmark." The translation of the History of Nadir Shah was published in the summer of the year 1770, at the expence of the translator; and forty copies upon large paper were sent to Copenhagen; one of them bound with uncommon elegance for the king himself, and the others as presents to his courtiers.*

* Preface to the History of Nadir Shah, 1770.

What marks of distinction our author received, or what fruits he reaped for his labour, he has not thought proper to disclose; but if any dependence is to be placed on common fame, the reward bestowed upon him for this laborious task consisted only in the thanks of his Danish Majesty, and the honour of being enrolled in the Royal Society of Copenhagen. That distinction was indeed accompanied with a letter, recommending the learned translator to the patronage of his own sovereign; but, in the interim, his friend Lord Dartmouth, who was to have delivered it, had resigned his office of secretary of state, and the letter, we are told, was never presented.

There is reason to think, that this early and severe disappointment made a deep impression on his mind, and induced him to renounce the muses for a time, and to apply himself with assiduity to the study of jurisprudence. This we think apparent, from the style in which he writes of his return from the continent, and of the death of his beloved preceptor Dr Sumner.

"When I left Nice, (says he) where I had resided near seven months, and after traversing almost all France, returned to England, I most ardently desired to pass several years more in the study of polite literature; as then, I thought, I might enter into public life, to which my ambition had always prompted me, more mature and prepared: but with this fruit of my leisure, either fortune, or rather Providence, the disposer of all human events, would not indulge my sloth; for on a sudden, I was obliged to quit that very literature to which, from my childhood, I had applied myself; and he who had been the encourager and assistant of my studies, who had instructed, taught, formed me such as I was, or if I am any thing at all, ROBERT SUMNER, within a year after my return, was snatched away by an untimely death (A)."

In

(A) As a specimen of our author's latinity, we subjoin the epitaph on Dr Sumner, which is affixed to the wall of the south transept of Harrow church.

H. S. E.
ROBERTUS SUMNER, S. T. P.
Collegii Regalis apud Cantab. olim Socius,
Scholæ Harroviensis haud ita pridem Archididascalus.
Fuit hoc præstantissimo Viro
Ingenium naturâ peracre, optimarum disciplinis artium sedulo
Excultum, usu diuturno confirmatum, & quodammodo subactum.
Nemo enim aut in reconditis sapientiæ studiis illo subtilior extitit,
Aut humanioribus literis limatior: nemini fere vel felicius
Contigit judicii acumen, vel uberior eruditionis copia.
Egregiis hisce cum dotibus naturæ, tum doctrinæ subsidiis,
Insuper accedebat in scriptis mira ac prope perfecta eloquentia.
In sermone facetiarum lepor plane Atticus, & gravitate suaviter
Aspera urbanitas; in moribus singularis quædam integritas & fides;
Vitæ denique ratio constan sibi, & ad virtutis normam diligenter severeque,
Exculta. Omnibus qui vel amico essent eo, vel magistro usi, doctrinæ,
Ingenii, virtutis triste reliquit desiderium, subitâ, eheu! atque immaturâ
Morte correptus prid. Id. Sept. A. D.
1771, Æt. 41.

Jones.

In 1771 Mr Jones published *Dissertation sur la Literature Orientale*, 8vo, and this was followed by *Lettre à Monsieur A** Du P***, dans laquelle est compris l' Examen de sa Traduction des Livres attribues à Zoroastre*, 8vo. The dissertation offered a favourable specimen of the author's abilities as a linguist and as a critic; and the letter contained a spirited vindication of the university of Oxford, from the very scurrilous reproaches, in which its incompetency in Oriental literature was asserted by the illiberal translator of the supposed works of the Persian philosopher.

In the same year he gave to the public, "A Grammar of the Persian language," 4to, and at the same time proposed to republish Meninski's Dictionary, with improvements from *De Labrosse's Gazophylacium Linguæ Persarum*, and to add in their proper place an Appendix subjoined to Gehanaguire's Persic Dictionary. The Grammar has been found extremely useful, and has been reprinted several times; but the design of the Dictionary, though an object of even national importance, for want of due encouragement was obliged to be laid aside.

In 1772 he published "Poems; consisting chiefly of Translations from the Asiatic Languages. To which are added two Essays; 1. On the Poetry of the Eastern Nations. 2. On the Arts commonly called Imitative," 8vo, which in 1777 he republished with the addition of some Latin Poems, every way worthy of their author. On the 18th June 1773, he took the degree of Master of Arts, and the same year published "The History of the Life of Nadir Shah, King of Persia. Extracted from an Eastern Manuscript, which was translated into French by order of his Majesty the King of Denmark. With an Introduction, containing, 1. A Description of Asia according to the Oriental Geographers. 2. A short History of Persia from the earliest Times to the present Century: And an Appendix, consisting of an Essay on Asiatic Poetry, and the History of the Persian Language. To which are added Pieces relative to the French Translation," 8vo. Our author having at this period determined to study the law as a profession, and to relinquish every other pursuit, our readers will not be displeased with the following extract, relating to this resolution, which concludes the preface to the history now under consideration:

"To conclude; if any essential mistakes be detected in this whole performance, the reader will excuse them, when he reflects upon the great variety of dark and intricate points which are discussed in it; and if the obscurity of the subject be not a sufficient plea for the errors which may be discovered in the work, let it be considered, to use the words of Pope in the preface to his juvenile poems, that there are very few things in this collection which were not written under the age of five-and-twenty: most of them indeed were composed in the intervals of my leisure in the South of France, before I had applied myself to a study of a very different nature, which it is now my resolution to make the sole object of my life. Whatever then be the fate of this production, I shall never be tempted to vindicate any part of it which may be thought exceptionable; but shall gladly resign my own opinions, for the sake of embracing others, which may seem more probable; being persuaded, that nothing is more laudable than the love of truth, nothing more odious than the obstinacy of persisting in error. Nor shall I easily be induced, when I have disburdened myself of two other pieces which are now in the press, to begin any other work of the literary kind; but shall confine myself wholly to that branch of knowledge in which it is my chief ambition to excel. It is a painful consideration, that the profession of literature, by far the most laborious of any, leads to no real benefit or true glory whatsoever. Poetry, science, letters, when they are not made the sole business of life, may become its ornaments in prosperity, and its most pleasing consolation in a change of fortune; but if a man addicts himself entirely to learning, and hopes by that, either to raise a family, or to acquire, what so many wish for, and so few ever attain, an honourable retirement in his declining age, he will find, when it is too late, that he has mistaken his path; that other labours, other studies, are necessary; and that unless he can assert his own independence in active life, it will avail him little to be favoured by the learned, esteemed by the eminent, or recommended even by kings. It is true, on the other hand, that no external advantages can make amends for the loss of virtue and integrity, which alone give a perfect comfort to him who possesses them. Let a man, therefore, who wishes to enjoy, what no fortune or honour can bestow, the blessing of self-approbation, aspire to the glory given to Pericles by a celebrated historian, of being acquainted with all useful knowledge, of expressing what he knows with copiousness and freedom, of loving his friends and country, and of disdaining the mean pursuits of lucre and interest: this is the only career on which an honest man ought to enter, or from which he can hope to gain any solid happiness."

The next year he published *Poeseos Asiaticæ Commentariorum Libri Sex, cum Appendice: subjicitur Limon, seu Miscellaneorum Liber*, 8vo; and pursuing his purpose of applying to the study of the law, we hear no more of him from the press (except the new edition of his Poems), until the year 1779. In this interval he was called to the bar, and attended Westminster hall and the Oxford circuit, where he obtained but little business. He was however appointed a commissioner of bankrupts by Lord Bathurst, who is supposed to have intended to exert his interest to procure his nomination to the bench in the East Indies.

He published in this year, "The speeches of Iseus, in causes concerning the law of succession to property at Athens; with a preparatory discourse, notes critical and historical, and a Commentary, 4to." In this valuable work, the talents of the scholar, the critic, and the lawyer, combine to elucidate a very important part of jurisprudence; for, "though deep researches into the legal antiquities of *Greece* and *Rome* (as he observes in his Commentary) are of greater use to scholars and contemplative persons, than to lawyers and men of business; though Bracton and Lyttleton, Coke and Rolle, are the proper objects of our study; yet the ablest advocates, and wisest judges, have frequently embellished their arguments with learned allusions to ancient cases; and such allusions, it must be allowed, are often useful, always ornamental; and,

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and, when they are introduced without pedantry, never fail to pleaſe." The work was dedicated in a ſtyle of reſpectful gratitude to his patron Lord Bathurſt.

In the year 1780, we find our author a candidate to repreſent in parliament the univerſity of Oxford. He had for ſome time reſided but little in the univerſity, and therefore laboured under ſome diſadvantages; but he did not meanly court the ſupport of any man. In a paper, which was circulated on that occaſion, his friends, who were numerous, declare, that they have "neither openly ſolicited, nor intend openly to ſolicit, votes for Mr Jones within the Univerſity itſelf, becauſe he will never become the inſtrument of diſturbing the calm ſeat of the Muſes, by conſenting to any ſuch ſolicitation for himſelf or for any man whatever. His own applications have been, are, and will be, confined to thoſe only who have profeſſed a regard for him, *and who have no votes themſelves:* the Maſters of Arts in a great univerſity, whoſe prerogative is cool reaſon and impartial judgment, muſt never be placed on a level with the voters of a borough, or the freeholders of a county. Even in proceeding thus far, he does not ſet the example, but follows it; and his friends would never have printed any paper, if they had not thought themſelves juſtified by the conduct of others.

"For the firſt and the laſt time, they beg leave to ſuggeſt, that no exertions muſt be ſpared by theſe who, either perſonally or by reputation, approve the character of Mr Jones; into which, both literary and political, as well as moral, his friends deſire and demand the ſtricteſt ſcrutiny. For his univerſity he began early to provoke, and poſſibly to incur, the diſpleaſure of great and powerful men: For his univerſity he entered the liſts with a foul-mouthed and arrogant Frenchman, who had attacked Oxford in three large volumes of miſrepreſentation and ſcurrility: For his univerſity he reſigned, for a whole year, his favourite ſtudies and purſuits, to ſave Oxford the diſcredit of not having one of her ſons ready to tranſlate a tedious Perſian manuſcript. To Oxford, in ſhort, he is known to be attached by the ſtrongeſt poſſible ties; and only regrets the neceſſity of abſenting himſelf from the place in which of all others he moſt delights, until the event of the preſent competition ſhall either convince him that he has toiled in vain as a man of letters, or ſhall confer on him the greateſt reward to which he can aſpire. The unavoidable diſadvantage of being ſo late propoſed, and the reſpectable ſupport with which he is now honoured, will ſecure him in all events from the leaſt diſgrace." The application was unſucceſsful, chiefly becauſe his own college had fixed upon another candidate, from a perſuaſion that the immediate appointment of Mr Jones to a ſeat, then vacant on the bench of judges in India, was morally certain.

The riots of that year gave occaſion to another publication of our author, entitled, "An Inquiry into the legal Mode of ſuppreſſing Riots; with a conſtitutional Plan of future Defence," 8vo; and in 1781 he publiſhed "An Eſſay on the Law of Bailments," 8vo, a very maſterly treatiſe, which did great honour to his legal abilities. In this laſt work he inculcates the neceſſity of deeply exploring the grounds of the common law; and ſpeaking of Blackſtone, (he ſays) "his commentaries are the moſt correct and beautiful outline that ever was exhibited of any human ſcience; but they alone will no more form a lawyer, than a general map of the world, how accurately and elegantly ſoever it may be delineated, will make a geographer."

Jones.

In this year he likewiſe recalled his muſe in an Ode on the nuptials of Lord Viſcount Althorpe, who had been his pupil, to Miſs Lavinia Bingham. This beautiful little poem is preſerved in the European Magazine for January 1785, and we think in other periodical publications.

From many circumſtances which might be collected together, it would appear that our author at this juncture did not coincide in opinion with thoſe who had the direction of government, nor did he approve the meaſures at that period adopted.—With theſe ſentiments he ſeems to have been ſelected as a proper perſon to be introduced as a member of the Conſtitutional Society. Could he have foreſeen the degeneracy of ſuch aſſociations, there is reaſon to believe that he would have declined what he condeſcended to accept as an honour; for though an ardent friend to liberty, he was an enemy to theoretical innovation, and declares, in a letter to the ſecretary, that by the term conſtitution, he underſtands "the great ſyſtem of public, in contradiction to private and criminal law, which compriſes all thoſe articles which Blackſtone arranges, in his firſt volume, under the rights of perſons, and of which he gives a perſpicuous analyſis. Whatever then relates to the rights of perſons, either abſolute rights, as the enjoyment of liberty, ſecurity, and property, or relative, that is, in the public relations of magiſtrates and people, makes a part of that majeſtic whole, which we properly call the conſtitution. This conſtitutional or public law is partly unwritten, and grounded upon immemorial uſage, and partly written or enacted by the legiſlative power; but the unwritten, or common law, contains the true ſpirit of our conſtitution: the written has often moſt unjuſtifiably altered the form of it; the common law is the collected wiſdom of many centuries, having been uſed and approved by ſucceſſive generations; but the ſtatutes frequently contain the whims of a few leading men, and ſometimes of the mere individuals employed to draw them."

In 1782 he publiſhed "The Mahomedan Law of Succeſſion to the Property of Inteſtates, in Arabic, with a verbal Tranſlation and explanatory Notes." 4to.

At length the poſt of one of the judges in the Eaſt Indies, which had been kept vacant five years, was determined upon being filled up; and our author, on the 4th March 1783, was appointed to that ſtation, and on the 20th received the honour of knighthood. On the 8th of April he married Miſs Shipley, eldeſt daughter of the Biſhop of St Aſaph, and almoſt immediately embarked for the Indies. He had previouſly publiſhed "The Moallakat; or, Seven Arabian Poems, which were ſuſpended on the Temple at Mecca, with a Tranſlation and Arguments." 4to. To this it was intended to add a preliminary diſcourſe and notes.—The former to compriſe obſervations on the antiquity of the Arabian language and letters; on the dialects and characters of Himyar and Koraiſh, with accounts of ſome Himyarick poets; on the manners of the Arabs in the age immediately preceding that of Mahomed; on the temple at Mecca, and the Moallakat, or pieces of poetry suspended on its walls or gate; lastly, on the lives of the Seven Poets, with a critical history of their works, and the various copies or editions of them preserved in Europe, Asia, and Africa. The latter to contain authorities and reasons for the translation of controverted passages; to elucidate all the obscure couplets, and exhibit or propose amendments of the text; to direct the reader's attention to particular beauties, or point out remarkable defects; and to throw light on the images, figures, and allusions of the Arabian poets, by citations either from writers of their own country, or from such of our European travellers as best illustrate the ideas and customs of Eastern nations. This discourse and the notes have not yet appeared. At his departure for the eastern world, he left, in manuscript, with his brother-in-law the Dean of St Asaph, a little tract, entitled "The Principles of Government, in a Dialogue between a Scholar and a Peasant." This celebrated dialogue being afterwards published by the Dean, and widely circulated by the society for constitutional information, the Dean was prosecuted for publishing a libel, and, if our memory deceives us not, was found guilty.

Sir William Jones now dropt for ever all concern in party politics, and applied himself to pursuits more worthy of his talents. During his voyage to India, he conceived the idea of the Asiatic Society, of which an account has been given under the title SOCIETIES (*Encycl.*), and of whose researches five volumes, replete with much curious information, are now before the public. But ardently as his mind was attached to general literature and science, he was by no means inattentive to the professional duties of his high station. He had indeed, to use his own expression, an "undissembled fondness for the study of jurisprudence *;" and in the character of a judge, displayed the profound knowledge and irreproachable integrity, which, before his promotion, pervaded his reasonings as a lawyer, and governed his conduct as a man. Unfortunately the intense ardour of application, which produced his frequent contributions to the stock of human knowledge, added to the unfavourable influence of the climate, greatly impaired his health. On this account, after a residence of about fifteen years in India, he made preparations for returning to England; but death interposed; and this illustrious ornament of science and virtue was taken from the world on the 27th of April 1794, in the 48th year of his age. "It is to the shame of scepticism (as one of his biographers well observes), to the encouragement of hope, and to the honour of genius, that this great man was a sincere believer in the doctrines of Christianity, and that he was found in his closet in the attitude of addressing his prayer to God." We shall give his character as it was drawn by Sir John Shore, Baronet, (now Lord Teignmouth) in a discourse delivered at a meeting of the Asiatic Society, held on the 22d of May 1794.

* *Law of Bailments.*

"His capacity for the acquisition of languages has never been excelled. In Greek and Roman literature, his early proficiency was the subject of admiration and applause; and knowledge of whatever nature, once obtained by him, was ever afterwards progressive. The more elegant dialects of modern Europe, the French, the Spanish, and Italian, he spoke and wrote with the greatest fluency and precision; and the German and Portuguese were familiar to him. At an early period of life his application to Oriental literature commenced; he studied the Hebrew with ease and success; and many of the most learned Asiatics have the candour to avow, that his knowledge of Arabic and Persian was as accurate and extensive as their own; he was also conversant in the Turkish idiom, and the Chinese had even attracted his notice so far as to induce him to learn the radical characters of that language, with a view perhaps to farther improvements. It was to be expected, after his arrival in India, that he would eagerly embrace the opportunity of making himself master of the Sanscrit; and the most enlightened professors of the doctrines of Brahma confess with pride, delight, and surprise, that his knowledge of their sacred dialect was most critically correct and profound. The Pandits, who were in the habit of attending him, could not, after his death, suppress their tears for his loss, nor find terms to express their admiration at the wonderful progress he had made in their sciences.

"Before the expiration of his twenty-second year, he had completed his Commentaries on the Poetry of the Asiatics, although a considerable time afterwards elapsed before their publication; and this work, if no other monument of his labours existed, would at once furnish proofs of his consummate skill in the Oriental dialects, of his proficiency in those of Rome and Greece, of taste and erudition far beyond his years, and of talents and application without example.

"But the judgment of Sir William Jones was too discerning to consider language in any other light than as the key of science, and he would have despised the reputation of a mere linguist. Knowledge and truth were the objects of all his studies, and his ambition was to be useful to mankind; with these views he extended his researches to all languages, nations, and times.

"Such were the motives that induced him to propose to the government of India, what he justly denominated a work of national utility and importance, the compilation of a copious Digest of Hindu and Mahomedan Law, from Sanscrit and Arabic originals, with an offer of his services to superintend the compilation, and with a promise to translate it. He had foreseen, previous to his departure from Europe, that without the aid of such a work, the wise and benevolent intentions of the legislature of Great Britain, in leaving to a certain extent the natives of these provinces in possession of their own laws, could not be completely fulfilled; and his experience, after a short residence in India, confirmed what his sagacity had anticipated, that without principles to refer to, in a language familiar to the judges of the courts, adjudications amongst the natives must too often be subject to an uncertain and erroneous exposition, or wilful misinterpretation of their laws.

"To the superintendance of this work, which was immediately undertaken at his suggestion, he assiduously devoted those hours which he could spare from his professional duties. After tracing the plan of the Digest, he prescribed its arrangement and mode of execution, and selected from the most learned Hindus and Mahomedans fit persons for the task of compiling it: flattered by his attention, and encouraged by his applause, the

the Pandits prosecuted their labours with cheerful zeal to a satisfactory conclusion. The Molavees have also nearly finished their portion of the work; but we must ever regret, that the promised translation, as well as the meditated preliminary dissertation, have been frustrated by that decree, which so often intercepts the performance of human purposes.

"During the course of this compilation, and as auxiliary to it, he was led to study the works of Menu, reputed by the Hindus to be the oldest and holiest of legislators; and finding them to comprise a system of religious and civil duties, and of law in all its branches, so comprehensive and minutely exact, that it might be considered as the institutes of Hindu Law, he presented a translation of them to the government of Bengal. During the same perind, deeming no labour excessive or superfluous that tended in any respect to promote the welfare or happiness of mankind, he gave the public an English version of the Arabic Text of the Sirajiyah or Mahomedan Law of Inheritance, with a Commentary. He had already (as has been observed) published in England a translation of a tract on the same subject by another Mahomedan lawyer, containing, as his own words express, 'a lively and elegant Epitome of the Law of Inheritance of Zaid.'

"To these learned and important works, so far out of the road of amusement, nothing could have engaged his application but that desire which he ever professed, of rendering his knowledge useful to his nation, and beneficial to the inhabitants of these provinces.

"I should scarcely (continues Lord Teignmouth) think it of importance to mention, that he did not disdain the office of editor of a Sanscrit and Persian work, if it did not afford me an opportunity of adding, that the latter was published at his own expence, and was sold for the benefit of insolvent debtors. A similar application was made of the produce of Sirajiyah."

But nothing exhibits the large grasp of Sir William Jones's mind in so striking a point of view as a paper in his own hand writing, which came into Lord Teignmouth's possession after his death. It was intitled DESIDERATA, and proposed for investigation the following subjects relating to the eastern world.

India.—1. The ancient geography of India, &c. from the Puranas. 2. A botanical description of Indian plants, from the Cosha, &c. 3. A grammar of the Sanscrit language, from Panini, &c. 4. A dictionary of the Sanscrit language, from the 32 original vocabularies and Nirusti. 5. On the ancient music of the Indians. 6. On the medical substances of India, and the Indian art of medicine. 7. On the philosophy of the ancient Indians. 8. A translation of the Veda. 9. On ancient Indian geometry, astronomy, and algebra. 10. A translation of the Puranas. 11. A translation of the Mahabbara and Ramayan. 12. On the Indian theatre, &c. &c. 13. On the Indian constellations, with their mythology, from the Puranas. 14. The history of India before the Mahomedan conquest, from the Sanscrit Cashmir Histories.

Arabia.—15. The history of Arabia before Mahomed. 16. A translation of the Hamasa. 17. A translation of Hariri. 18. A translation of the Facahatul Khulafa. Of the Cafiah.

Persia.—19. The history of Persia, from authorities in Sanscrit, Arabic, Greek, Turkish, Persian ancient and modern, Firdausi's Khrosrau nama. 20. The five poems of Nizami, translated in prose. 21. A dictionary of pure Persian Je-changire.

China.—22. A translation of Shi-cing. 23. The text of Can-fu-tsu, verbally translated.

Tartary.—24. A history of the Tartar nations, chiefly of the Moguls and Othmans, from the Turkish and Persian.

"We are not authorised (says his Lordship) to conclude, that he had himself formed a determination to complete the works which his genius and knowledge had thus sketched; the task seems to require a period beyond the probable duration of any human life; but we, who had the happiness to know Sir William Jones; who were witnesses of his indefatigable perseverance in the pursuit of knowledge, and of his ardour to accomplish whatever he deemed important; who saw the extent of his intellectual powers, his wonderful attainments in literature and science, and the facility with which all his compositions were made—cannot doubt, if it had pleased Providence to protract the date of his existence, that he would have ably executed much of what he had so extensively planned."

We have already enumerated attainments and works which, from their diversity and extent, seem far beyond the capacity of the most enlarged minds; but the catalogue may yet be augmented. To a proficiency in the languages of Greece, Rome, and Asia, he added the knowledge of the philosophy of those countries, and of every thing curious and valuable that had been taught in them. The doctrines of the Academy, the Lyceum, or the Portico, were not more familiar to him than the tenets of the Vedas, the mysticism of the Sufis, or the religion of the ancient Persians; and whilst, with a kindred genius, he perused with rapture the heroic, lyric, or moral compositions of the most renowned poets of Greece, Rome, and Asia, he could turn with equal delight and knowledge to the sublime speculations or mathematical calculations of Barrow and Newton. With them also he professed his conviction of the truth of the Christian religion; and he justly deemed it no inconsiderable advantage, that his researches had corroborated the multiplied evidence of Revelation, by confirming the Mosaic account of the primitive world.

In his eighth anniversary discourse to the Asiatic Society, he thus expresses himself: "Theological inquiries are no part of my present subject; but I cannot refrain from adding, that the collection of tracts which we call, from their excellence, the Scriptures, contain, independently of a divine origin, more true sublimity, more exquisite beauty, purer morality, more important history, and finer strains both of poetry and eloquence, than could be collected within the same compass from all other books that were ever composed in any age, or any idiom. The two parts, of which the Scriptures consist, are connected by a chain of compositions, which bear no resemblance in form or style to any that can be produced from the stores of Grecian, Indian, Persian, or even Arabian learning; the antiquity of these compositions no man doubts, and the unstrained application of them to events long subsequent to their publication, is a solid ground of belief that they were genuine predictions; and consequently inspired."

There were, in truth, few sciences in which he had not acquired considerable proficiency; in most, his knowledge

knowledge was profound. The theory of music was familiar to him; nor had he neglected to make himself acquainted with the interesting discoveries lately made in chemistry; "and I have heard him (says Lord Teignmouth) assert, that his admiration of the structure of the human frame had induced him to attend for a season to a course of anatomical lectures, delivered by his friend the celebrated Hunter."

His last and favourite pursuit was the study of botany, which he originally began under the confinement of a severe and lingering disorder, which with most minds would have proved a disqualification from any application. It constituted the principal amusement of his leisure hours. In the arrangements of Linnæus, he discovered system, truth, and science, which never failed to captivate and engage his attention; and from the proofs which he has exhibited of his progress in botany, we may conclude that he would have extended the discoveries in that science.

It cannot be deemed useless or superfluous to inquire by what arts or method he was enabled to attain to a degree of knowledge almost universal, and apparently beyond the powers of man, during a life little exceeding 47 years.

The faculties of his mind, by nature vigorous, were improved by constant exercise; and his memory, by habitual practice, had acquired a capacity of retaining whatever had once been impressed upon it. To an unextinguished ardour for universal knowledge, he joined a perseverance in the pursuit of it which subdued all obstacles; his studies began with the dawn, and, during the intermissions of professional duties, were continued throughout the day; reflection and meditation strengthened and confirmed what industry and investigation had accumulated. It was a fixed principle with him, from which he never voluntarily deviated, not to be deterred by any difficulties that were surmountable from prosecuting to a successful termination what he had once deliberately undertaken.

But what appeared more particularly to have enabled him to employ his talents so much to his own and the public advantage, was the regular allotment of his time, and a scrupulous adherence to the distribution which he had fixed; hence all his studies were pursued without interruption or confusion. He collected information, too, from every quarter; justly concluding, that something might be learned from the illiterate, to whom he listened with the utmost candour and complacency.

Lord Teignmouth, addressing himself to the Asiatic Society, says, "Of the private and social virtues of our lamented President, our hearts are the best records. To you who knew him, it cannot be necessary for me to expatiate on the independence of his integrity, his humanity, probity, or benevolence, which every living creature participated; on the affability of his conversation and manners, or his modest, unassuming deportment: nor need I remark, that he was totally free from pedantry, as well as from arrogance and self-sufficiency, which sometimes accompany and disgrace the greatest abilities. His presence was the delight of every society, which his conversation exhilarated and improved; and the public have not only to lament the loss of his talents and abilities, but that of his example.

"To him, as the founder of our institution, and whilst he lived its firmest support, our reverence is more particularly due. Instructed, animated, and encouraged by him, genius was called forth into exertion, and modest merit was excited to distinguish itself. Anxious for the reputation of the Society, he was indefatigable in his own endeavours to promote it, whilst he cheerfully assisted those of others. In losing him, we have not only been deprived of our brightest ornament, but of the guide and patron, on whose instructions, judgment, and candour, we could implicitly rely." Though these are the sentiments, not only of Lord Teignmouth, but, we believe, of every man of letters, we trust there is still left in Bengal a sufficient love of letters and of science to carry on the plan which was formed by the genius of Sir William Jones.

JONES, a county of N. Carolina, in Newbern district, bounded N. by Craven. It contains 3141 free inhabitants, and 1681 slaves. It is well watered by Trent river, and its tributary streams. Chief town Trenton.—*Morse.*

JONESBOROUGH, a post-town, and chief town of Washington district in Tennessee, is the seat of the district and county courts. It has but few houses, having been but lately established. It is 26 miles from Greenville, 101 from Knoxville, 40 from Abingdon in Virginia, and 627 from Philadelphia.—*ib.*

Jonesborough, the chief town of Camden county in Edenton district, N. Carolina. It contains a court-house and a few dwelling-houses.—*ib.*

JONES's PLANTATION, in Lincoln county, Maine, was incorporated by the name of Harlem, in February, 1796. It is 19 miles N. E. of Hallowell, 47 from Pownalborough, and 213 N. E. by N. of Boston. It contains 262 inhabitants.—*ib.*

Jones's Ford, on Brandywine creek, is 5 or 6 miles above Chad's Ford, in Pennsylvania.—*ib.*

JONESIA, is a very handsome middling-sized ramous tree, found in gardens about Calcutta. In the Sanscrit it is called *As'óca*, and in the Bengalese *Ruffuck*; but the name Jonesia was given to it by the Asiatic Society, who consecrated it to the memory of their first president Sir William Jones. It is thus described by Dr Roxburgh, a member of that society:

"*Calyx*, two leaved, corol, one petaled, pistil bearing; base of the tube impervious; stamens long, ascending, inserted into the margin of a glandulous nectarial ring, which crowns the mouth of the tube, the uppermost two of which more distant; style declining. *Legume* turgid. *Trunk* erect, though not very straight. *Bark* dark brown, pretty smooth. *Branches* numerous, spreading in every direction, so as to form a most elegant shady head. *Leaves* alternate, abruptly feathered, sessile, generally more than a foot long; when young pendulous and coloured. *Leaflets* opposite, from four to six pair, the lowermost broad lanced, the upper lanced; smooth, shining, firm, a little waved, from four to eight inches long. *Petiole* common, round, and smooth. *Stipule* axillary, solitary; in fact a process from the base of the common petiole, as in many of the grasses and monandrists, &c. *Umbels* terminal and axillary; between the stipule and branchlet, globular, crowded, subsessile, erect. *Bracts*, a small hearted one under each division of the umbel. *Peduncle* and pedicels smooth, coloured. *Flowers* very numerous, pretty large; when they first expand they are of a beautiful orange colour, gradually changing to red, forming a variety of lovely shades;

shades; fragrant during the night. *Calyx* perianth, below two-leaved, leaflets small, nearly opposite, coloured, hearted, bracte-like, marking the termination of the pedicel, or beginning of the tube of the corol. *Corol* one-petalled, funnel form; tube slightly incurved, firm, and fleshy, tapering towards the base (club funnel-shaped) and there impervious; border four-parted; division spreading, suborbicular; margins most slightly woolly: one-third the length of the tube. *Nectary*, a stameniferous and pistiliferous ring crowns the mouth of the tube. *Stamens*, filaments generally seven; and seven must, I think, be the natural number; viz. three on each side, and one below, above a vacancy, as if the place of an eighth filament, and is occupied on its inside by the pistil; they are equal, distinct, ascending, from three to four times longer than the border of the corol. *Anthers* uniform, small, incumbent. *Pistil*, germ oblong, pediceled; pedicel inserted into the inside of the nectary, immediately below the vacant space already mentioned; style nearly as long as the stamens, declining; stigma simple. *Pericarp*, legume scimeter-formed, turgid, outside reticulated, otherwise pretty smooth; from six to ten inches long, and about two broad. *Seeds* generally from four to eight, smooth; grey, size of a large chesnut."

The Jonesia flowers at the beginning of the hot season, and its seeds ripen during the rains. The plants and seeds were originally brought to Calcutta from the interior parts of the country, where it is indigenous. *N. B.* Many of the flowers have only the rudiment of a pistil. In Plate XXX. A is a branchlet of the natural size. B, A single flower a little magnified; *a a* the calyx. C, A section of the same, exhibiting four of the stamens, 1 1 1 1 the pistil 2, and how far the tube is perforated. D, A similar section of one of the abortive flowers; 3 is the abortive pistil. E, The ripe legume opening near the base, natural size. *Note*, The space between the *b* and *c* marks the original tube of the corol. F, One of the seeds, natural size. G, The base of the common petiole, with its stipule; *a a*, the petioles of the lower pair of leaflets.

JOOTSI-SIMA, a small flat island, which is separated from Cape Nota in Japan by a channel about five leagues wide. Its circumference does not exceed two leagues; it is well wooded, of an agreeable aspect, and well inhabited. Perouse, who sailed round it, remarked from the quarter deck of his ship some considerable edifices between the houses of the inhabitants; and hard by a fort of castle, at the south-west point of the island, he distinguished some gibbets. He does not, however, affirm that those gibbets were for the execution of criminals; for, as he observes, it would be singular enough if the Japanese, whose customs are so different from ours, were in this point to resemble us so nearly. He represents the island as surrounded with dreadful breakers; at the distance of a league and a half from which, he had constantly 60 fathoms, with rocky bottom. He places the island (differently, according to the editor of his voyage, from all other geographers) in latitude 37° 51′ north, and in Long. 135° 20′ east from Paris.

JOPPA, a small town in Harford county, Maryland, 20 miles E. by N. of Baltimore, and 82 S. W. of Philadelphia.—*Morse.*

JORDAN's *River* passes through Trenton, in the District of Maine, 8 miles from Union river.—*ib.*

JORE, a village and mountain in the Cherokee country. The mountain is said to be the highest in the Cherokee country, and through which the Tennessee river forces its waters. The Indian village, called Jore, is situated in a beautiful lawn, many thousand feet higher than the adjacent country. Here is a little grove of the Casine Yapon, called by the Indians the beloved tree. They are very careful to keep this tree pruned and cultivated, and drink very strong infusion of the leaves, buds, and tender branches of this plant. It is venerated by the Creeks, and all the southern maritime nations of Indians.—*ib.*

JOSEPH, LAKE ST, in N. America, lies E. of Lake Sal, and sends its waters by Cat Lake river into Cat Lake, and afterwards forms the S. E. branch of Severn river. The lake is 55 miles long and 15 broad. Osnaburg House is on the N. E. part of the lake.—*ib.*

JOSEPH, *Ilet à Pierre*, a village on the westernmost coast of the island of St Domingo; about 3 leagues N. W. of the village of Tiburon.—*ib.*

JOSEPH's, ST, in the province of California, in Mexico, N. America. N. lat. 23° 3′.—*ib.*

JOSEPH's BAY, ST, on the coast of West-Florida, is of the figure of a horse-shoe, being about 12 miles in length, and 7 across where broadest. The bar is narrow, and immediately within it there is from 4 to 6½ fathoms soft ground. The best place to anchor, is just within the peninsula, opposite to some ruins that still remain of the village of St Joseph. The peninsula between St Joseph's and Cape Blaze is a narrow slip of land, in some places not above a quarter of a mile broad. A very good establishment might be made here for a fishery, as the settlers might make salt on the spot to cure the bass, rock, cod, grouper, red mullet, &c. which are here in abundance.—*ib.*

JOSEPH, ST, a water which runs N. W. into the S. E. part of Lake Michigan. It springs from a number of small lakes, a little to the N. W. of the Miami village. The Pawtewatamie Indians reside on this river, opposite Fort St Joseph. They can raise 200 warriors. At or near the confluence of the rivers St Mary's and St Joseph's where Fort Wayne now stands, the Indians have ceded to the United States a tract of 6 miles square.—*ib.*

JOSEPH, *Fort St*, is situated on the eastern side of the above river in N. lat. 42° 14′, W. long. 86° 10′. It is about 175 miles S. W. by W. of Detroit, to which place there is a straight road.—*ib.*

JOSEPH, ST, a port on the W. side of the island of Trinidad, near the coast of Terra Firma.—*ib.*

JOURNALS, the title of periodical publications. See *Encyclopædia*. The principal British Journals are: *The History of the Works of the Learned*, begun at London in 1699. *Censura Temporum*, in 1708. About the same time there appeared two new ones; the one under the title of *Memoirs of Literature*, containing little more than an English translation of some articles in the foreign Journals, by M. de la Roche; the other, a collection of loose tracts, intitled, *Bibliotheca Curiosa*, or a Miscellany. These, however, with some others, are now no more, but are succeeded by the *Annual Register*, which began in 1758; the *New Annual Register*, Journals, Ipswich. Ipswich, Iron.

A r, begun in 1780; the *Monthly Review*, which began in the year 1749, and gives a character of all English literary publications, with the most considerable of the foreign ones: the *Critical Review*, which began in 1756, and is nearly on the same plan: as also the *London Review*, by Dr Kenrick, from 1775 to 1780; *Maty's Review*, from Feb. 1782 to Aug. 1786; the *English Review*, begun in Jan. 1783; and the *Analytical Review*, begun in May 1788, dropt in 1798, and revived in 1799, under the title of the *New Analytical Review*: but again dropt after two or three months trial: the *British Critic*, begun in 1792, and still carried on with much spirit and ability: the *Anti-Jacobin Review and Magazine*, commenced in 1798, for the meritorious purpose of counteracting the pernicious tendency of French Principles in politics and religion: the *New London Review*, January 1799: *A Journal of Natural Philosophy, Chemistry, and the Arts*, which was begun in 1797 by Mr Nicholson, and has been conducted in such a manner, that it is one of the most valuable works of the kind to be found in any language: the *Philosophical Magazine*, begun in 1798 by Mr Tilloch, and carried on upon much the same plan, and with much the same spirit, as Nicholson's Journal.

Besides these, we have several monthly pamphlets, called *Magazines*, which, together with a chronological series of occurrences, contain letters from correspondents, communicating extraordinary discoveries in nature and art, with controversial pieces on all subjects. Of these, the principal are those called the *Gentleman's Magazine*, which began with the year 1731; the *London Magazine*, which began a few months after, and has lately been discontinued; the *Universal Magazine*, which is nearly of as old a date; the *Scotch Magazine*, which began in 1739, and is still continued; the *European Magazine*; and the *Monthly Magazine*, a miscellany of much information, which began in January 1796.

IOWA, a river of Louisianna, which runs southeastward into the Mississippi, in N. lat. 41° 5′, 61 miles above the *Iowa Rapids*, where on the E. side of the river is the *Lower Iowa Town*, which 20 years ago could furnish 300 warriors. The *Upper Iowa Town* is about 15 miles below the mouth of the river, also on the E. side of the Mississippi, and could formerly furnish 400 warriors.—*Morse*.

JOYST or Jeyst, the second month of the Bengal year.

IPSWICH, the *Agawam* of the Indians, is a post-town and port of entry on both sides of Ipswich river, in Essex county, Massachusetts, 12 miles south of Newburyport, 10 north-east of Beverly, 32 N. E. by N. of Boston, and about a mile from the sea. The township of Ipswich is divided into 5 parishes, and contains 601 houses, and 4502 inhabitants. There is an excellent stone bridge across Ipswich river, composed of two arches, with one solid pier in the bed of the river, which connects the two parts of the town, executed under the direction of the late Hon. Judge Choate. This was heretofore a place of much more consideration than at present. Its decline is attributed to a barred harbour and shoals in the river. Its natural situation is pleasant, and on all accounts excellently well calculated to be a large manufacturing town. The supreme judicial court, the courts of common pleas and sessions are held here once a year, on the 1st Tuesday of April; and from its central situation, it appears to be the most convenient place for all the courts and public offices of the county. The inhabitants are chiefly farmers, except those in the compact part of the township. A few vessels are employed in the fishery and a few trade to the West Indies. Silk and thread lace, of an elegant texture, are manufactured here by women and children, in large quantities, and sold for use and exportation in Boston, and other mercantile towns. In 1790, no less than 41,979 yards were made here, and the manufacture is rather increasing. Ipswich township was incorporated in 1634, and is 378 miles N. E. of Philadelphia. N. lat. 42° 43′, W. long. 70° 50′.—*Morse*.

Ipswich, New, a township in Hillsborough county, New-Hampshire, containing 1241 inhabitants, situated on the west side of Souheagan river, and separated from Whatohook Mountain by the north line of Massachusetts; 56 miles N. W. of Boston, and about 77 west of Portsmouth. It was incorporated in 1762, and has in it a flourishing academy.—*ib.*

IRASBURG, a township in Orleans county, in Vermont, situated on Black river, 17 miles N. of Hazen Block-house, and 12 S. of the Canada line.—*ib.*

IREDELL COUNTY, in Salisbury district, N. Carolina, is surrounded by Surry, Rowan, and Burke. The climate is agreeable and healthy; the lands beautifully variegated with hills, and the soil is rich. It contains 5435 inhabitants of whom 858 are slaves. At *Iredell* court-house is a post-office. It is 25 miles from Salisbury, and 25 from Charlotte court-house.—*ib.*

IRELAND, NEW, a long narrow island in the Pacific ocean, N. of New Britain, extending from the N. W. to the S. E. about 270 miles, and in general very narrow; between 3° and 5° S. lat. and 146° 30′, and 151° E. long. from Paris. The inhabitants are negroes. The island is covered with wood, and abounds with pigeons, parrots, and other birds. West and N. W. of New Ireland, lie Sandwich, Portland, New Hanover, and Admiralty Islands, discovered and named by Captain Carteret, in 1767. The tracks of Le Maire and Schouten in 1616, of Roggewin in 1722, and of Bouganville in 1768, pass these islands.—*ib.*

IROIS, POINTE DE, or *Irish Point*, a village on the W. end of the island of St Domingo.—*ib.*

IRON, is by much the most useful of all the metals, as has been sufficiently proved under the article Iron, *Encycl.* and under Chemistry in this *Supplement*. The word is again introduced here, because it affords us an opportunity of laying before our readers some valuable observations by Chaptal on the use of the *oxyds* of iron in dyeing cotton.

"The oxyd of iron has such an affinity for cotton thread, that if the latter be plunged in a saturated solution of iron in any acid whatever, it immediately assumes a chamoy yellow colour, more or less dark, according to the strength of the liquors. It is both a curious and easy experiment, that when cotton is made to pass through a solution of the sulphat of iron, rendered turbid by the oxyd which remains suspended in the liquor, it will be sufficient to dip the cotton in the bath to catch

Iron.

catch the last particle of the oxyd, and to restore to the liquor the transparency it has lost. The solution, then, which before had a yellowish appearance, becomes more or less green, according as it is more or less charged.

"The colour given to cotton by the oxyd of iron becomes darker, merely by exposure to the air; and this colour, soft and agreeable when taken from the bath, becomes harsh and ochry by the progressive oxydation of the metal. The colour of the oxyd of iron is very fast: it resists not only the air and water, but also alkaline leys, and soap gives it splendour without sensibly diminishing its intensity. It is on account of these properties that the oxyd of iron has been introduced into the art of dyeing, and been made a colouring principle of the utmost value.

"In order that the oxyd of iron may be conveniently applied to the cotton thread, it is necessary to begin by effecting its solution; and, in this case, acids are employed as the most useful solvents. Dyers almost everywhere make a mystery of the acid which they employ; but it is always the acetous, the sulphuric, the nitric, or the muriatic. Some of them ascribe great differences to the solution of iron by the one or the other acid; but, in general, they give the preference to the acetous. This predilection appears to be founded much less on the difference of the colours that may be communicated by the one or the other salt, than on the different degrees of corrosive power which each exercises on the stuff. That of the sulphat and muriat is so great, that if the stuff be not washed when it comes from the bath, it will certainly be burnt; whereas solutions by the acetous, or any other vegetable acid, are not attended with the like inconvenience.

"Iron appears to be at the same degree of oxydation in the different acids, since it produces the same shade of colour when precipitated; and any acid solvent may be employed indiscriminately, provided the nature of the salt, and the degree of the saturation of the acid, be sufficiently known; for the subsequent operations may be then directed according to this knowledge, and the inconveniences which attend the use of some of these salts may be prevented. This, without doubt, is a great advantage which the man of science enjoys over the mere workman, who is incapable of varying his process according to the nature and state of the salts which he employs.

"1. If the sulphat of iron, or any other martial salt, be dissolved in water, and cotton be dipped in the liquid, the cotton will assume a chamoy colour, more or less dark according as the solution is more or less charged. The affinity of the cotton to the iron is so great, that it attracts the metal, and takes it in a great measure from the acid by which it was dissolved.

"2. If the iron of a pretty strong solution be precipitated by an alkaline liquor that shews five or six degrees (by the areometer of Baumé), the result will be a greenish blue magma. The cotton macerated in this precipitate assumes at first an unequal tint of dirty green; but mere exposure to the air makes it in a little time turn yellow, and the shade is very dark.

"It is by such, or almost similar processes, that dyers communicate what is called among workmen an *okre* or *rust colour*. But these colours are attended with several inconveniences to the artist: 1. Strong shades burn or injure the cloth: 2. This colour is harsh, disagreeable to the eye, and cannot be easily united with the mild colours furnished by vegetables."

To avoid these inconveniences, our author made several attempts, which led him to the following practice: He treads the cotton cold in a solution of the sulphat of iron, marking three degrees: he wrings it carefully, and immediately plunges it in a ley of potash at two degrees, upon which he has previously poured to saturation a solution of the sulphat of alumine: the colour is then brightened, and becomes infinitely more delicate, soft, and agreeable. The sulphat no longer attacks the tissue of the stuff; and after the cotton has been left in the bath for four or five hours, it is taken out to be wrung, washed, and dried. In this manner we may obtain every shade that can be wished, by graduating the strength of the solutions. This simple process, the theory of which presents itself to the mind of every chemist, has the advantage of furnishing a colour very agreeable, exceedingly fixed, and, above all, extremely economical. He employs it with great advantage in dyeing nankeens, as it has the property of resisting leys. It becomes brown, however, by the action of astringents.

M. Chaptal made several attempts to combine this yellow with the blue of indigo, in order to obtain a durable green; but as they were all unsuccessful, he infers that there is not a sufficient affinity between the blue of indigo and the oxyds of iron. He found that these oxyds, on the other hand, combine very easily with the red of madder, and produce a bright violet or plum colour, the use of which is as extensive as beneficial in the cotton manufactory. But if we should confine ourselves to apply these two colours to cotton, without having employed a mordant capable of fixing the latter, the colour would not only remain dull and disagreeable by the impossibility of brightening it, but it would still be attended with the great inconvenience of not resisting leys. We must begin, then, by preparing the cotton as if to dispose it for receiving the Adrianople red; and when it has been brought to the operation of galling, it is to be passed through a solution of iron, more or less charged, according to the nature of the violet required: it is then to be carefully washed, twice maddered, and brightened in a bath of soap.

When a real velvety rich violet is required, it is not to be passed through the solution of iron till it has been previously galled; the iron is then precipitated in a bluish oxyd, which, combined with the red of madder, gives a most brilliant purple, more or less dark according to the strength of the galling and of the ferruginous solution. It is very difficult to obtain an equal colour by this process; and in manufactories, an equal violet is considered as a master-piece of art. It is generally believed, that it is only by well directed manipulations that it is possible to resolve this problem, of so much importance in dyeing. But I am convinced (says our author), that the great cause of the inequality in this dye is, that the iron deposited on the cotton receives an oxydation merely by exposure to the air, which varies in different parts of it. The threads which are on the outside of the hank are strongly oxydated, while those in the inside, removed from the action of the air, experience no change. It thence follows, that the inside of the hank presents a weak shade, while the exterior part exhibits a violet almost black. The means to remedy this inconvenience is, to wash the cotton when it is taken from the solution of iron, and to expose it to the madder moist. The colour will become more equal and velvety. The solvents of iron are almost the same for this colour as for the yellow colour already mentioned.

The following observation may serve to guide the artist in brightening the violet on his cotton. The red of madder and the oxyd of iron deposited on the stuff determine the violet colour. This colour becomes red or blue, according as either of the principles predominates. The dyer knows by experience how difficult it is to obtain a combination which produces the tone of colour desired, especially when it is required to be very full, lively, and durable. This object, however, may be obtained, not only by varying the proportions of the two colouring principles, but also by varying the process of brightening. The only point is to be acquainted with the two following facts; that the soda destroys the iron, while the soap, by strong ebullition, seizes in preference the red of the madder. Hence it is, that the colour may be inclined to red or blue, according as you brighten with one or the other of these mordants. Thus, cotton taken from the madder dye, when washed and boiled in the brightening liquor with $\frac{1}{10}$ths of soap, will give a superb violet; whereas you will obtain only a plum colour in treating it with soda.

The oxyd of iron precipitated on any stuff unites also very advantageously with the fawn colour furnished by astringents; and by varying the strength of mordants, an infinity of shades may be produced. In this case, it is less a combination or solution of principles than the simple mixture or juxta-position of the colouring bodies on the stuff. By means of a boiling heat, we may combine, in a more intimate manner, the oxyd of iron with the astringent principle: and then it is brought to the state of black oxyd, as has been observed by Berthollet. It is possible also to embrown these colours, and to give them a variety of tints, from the bright grey to the deep black, by merely passing the cottons impregnated with the astringent principle thro' a solution of iron. The oxyd is then precipitated itself by the principle which is fixed on the stuff.

An observation, which may become of the utmost value for the art of dyeing, is, that the most usual astringent vegetables all furnish a yellow colour, which has not much brilliancy, but which has sufficient fixity to be employed with advantage. This yellow colour is brightened in the series of vegetables, in proportion as the astringent principle is diminished, and the vivacity of the colour is augmented in the same proportion. It is difficult, then, to obtain yellow colours which are at the same time durable and brilliant. These two valuable qualities are to each other in an inverse ratio: but it is possible to unite the colouring principles in such a manner as to combine splendour with fixity. Green oak bark unites perfectly with yellow weed, and sumach with green citron. It is by this mixture that we may be able to combine with the oxyd of iron vegetable colours, the splendour of which is equal to their durability.

Our author concludes his observations with cautioning the dyer against substituting sumach and the bark of the alder tree or oak for gall when dyeing cotton red. "I can safely assert (says he), that it is impossible to employ these as substitutes, in whatever doses they may be used. The colour is always much paler, poorer, and less fixed. I know that the case is not the same in regard to dyeing wool and silk, in which it may be employed with success; and in giving an account of this difference, I think the cause of it may be found in the nature of the gall-nuts. 1. The acid which they exclusively contain, as Berthollet has proved, facilitates the decomposition of the soap with which the cottons have been impregnated, and the oil then remains fixed in their tissue, and in a greater quantity, as well as in a more intimate combination. 2. The gall-nuts, which owe their development to animal bodies, retain a character of animalisation, which they transmit to the vegetable stuff, and by these means augment its affinities with the colouring principle of the madder; for it is well known of what utility animal substances are to facilitate this combination. This animalisation becomes useless in operating upon woollen or silk."

IRON BANKS, a tract of land on the E. side of the Mississippi, below the mouth of the Ohio.—*Morse.*

IRON-CASTLE, one of the forts of Porto Bello, in S. America, which admiral Vernon took and destroyed in 1739. The Spaniards call it St Philip de todo Fierra.—*ib.*

IRONDEQUAT, called in some maps *Ge Rundegut*, a gulf or bay on the S. side of the Lake Ontario, 4 miles E. of Walker's at the mouth of Genessee river. —*ib.*

IRON MOUNTAINS, GREAT, in the State of Tennessee, extend from the river Tennessee to that of French Broad from S. W. to N. E. farther to the N. E. the range has the name of Bald Mountain, and beyond the Nolachucky, that of Iron Mountains. The Iron Mountains, seems to be the name generally applied to the whole range. It constitutes the boundary between the State of Tennessee, and that of North-Carolina, and extends from near the lead mines, on the Kanhaway, through the Cherokee country, to the south of Chota, and terminates near the sources of the Mobile. The caverns and cascades in these mountains are innumerable.—*ib.*

IRRATIONAL NUMBERS or *Quantities*, are the same as *surds*, for which see ALGEBRA, *Encycl.*

IRREDUCIBLE CASE, in algebra, is used for that case of cubic equations where the root, according to Cardan's rule, appears under an impossible or imaginary form, and yet is real.

It is remarkable that this case always happens, *viz.* one root, by Cardan's rule, in an impossible form, whenever the equation has three real roots, and no impossible ones, but at no time else.

If we were possessed of a general rule for accurately extracting the cube root of a binomial radical quantity, it is evident we might resolve the irreducible case generally, which consists of two of such cubic binomial roots. But the labours of the algebraists, from Cardan down to the present time, have not been able to remove this difficulty. Dr Wallis thought that he had discovered such a rule; but, like most others, it is merely tentative, and can only succeed in certain particular circumstances.

IRVIN *River* is a western head water of the Neus, in N. Carolina.—*Morse.*

ISABEL, ST, one of the islands of Solomon, 200 miles

miles in circumference in the Pacific Ocean, 7° 30′ S. lat. about 160 leagues W. of Lima, discovered by Mendana, 1567, whose inhabitants are cannibals, and worship serpents, toads, and other animals. Their complexion is bronze, their hair woolly, and they wear no covering but round the waist. The people are divided into tribes, and are constantly at war with each other. Bats were seen here, which from one extremity of their wings to the other, measured 5 feet. Dampier, who has the reputation of exactness, says that he saw, in the small island of Sabuda, on the W. coast of Papua, bats as large as young rabbits, having wings 4 feet in extent from one tip to the other.—*ib.*

ISABELLA *Point*, lies on the N. side of the island of St Domingo, and forms the N. E. side of the bay of its name. N. lat. 19° 59′ 10″. This is the port where Columbus formed the first Spanish settlement on the island, and named both it and the point after his patroness Queen Isabella. He entered it in the night, driven by a tempest. It is over-looked by a very high mountain flat at the top, and surrounded with rocks, but is a little exposed to the N. W. wind. The river Isabella which falls into it, is considerable. There are 14 fathoms of water to anchor in. The settlement was begun in 1493, was given up in 1496, when its inhabitants were carried to the city of St Domingo, which originally was called New Isabella. The bay is said to have good anchorage for ships of war. It is about 29 leagues east by north of Cape Francois, measuring in a straight line.—*ib.*

ISCA, or rather *Ica*, with Pisco and Nasca, three towns from which a jurisdiction of Lima in Peru, S. America, has its name. Great quantities of wine are made here and exported to Calao. It also produces excellent olives, either for eating or for oil. The fields which are watered by trenches, yield an uncommon plenty of wheat, maize, and fruits. This jurisdiction is remarkable for spacious woods of carob trees, with the fruit of which the inhabitants feed numbers of asses, for the uses of agriculture, to this and the neighbouring jurisdictions. The Indians who live near the sea apply themselves to fishing, and after salting the fish carry them to a good market in the towns among the mountains.—*ib.*

ISLE OF WIGHT, a county of Virginia, on the south side of James's river, west of Norfolk county, being about 40 miles long and 15 broad, and contains 9,028 inhabitants, including 3,867 slaves. A mineral spring has been discovered near the head of the west branch of Nansemond river, about 10 miles from Smithfield, and 12 from Suffolk. It is much resorted to, and famed for its medicinal qualities.—*ib.*

ISLE ROYAL, on the north-west side of Lake Superior, lies within the territory of the United States north-west of the Ohio, is about 100 miles long, and in many places about 40 broad. The natives suppose that this and the other islands in the lake are the residence of the Great Spirit.—*ib.*

ISLESBOROUGH, a township in Hancock county, Maine, formed by Long-Island, in the centre of Penobscot Bay, 15 miles in length, and from 2 to 3 in breadth. It was incorporated in 1789, contains 382 inhabitants, and is 260 miles N. E. by N. of Boston. —*ib.*

ISLES DE MADAME lie at the south end of Sydney, or Cape Breton Island, on which they are dependant. The largest of these, with Cape Canso, the east point of Nova-Scotia, form the entrance of the Gut of Canso from the Atlantic ocean.—*ib.*

ISLIP, a township of New-York, situated in Suffolk county, Long-Island, east of Huntington, and contains 609 inhabitants; of these 93 are electors, and 35 slaves.—*ib.*

JUAN DE FUCA, a celebrated strait on the north-west coast of America, was surveyed by Captain Vancouver in the Discovery sloop of war, with a view to ascertain whether it leads to any communication between the North Pacific and the North Atlantic Oceans. As they advanced within the opening of the strait, their progress was greatly retarded by the number of inlets into which the entrance branched in every direction; and most of these were examined by the boats, which were frequently absent from the ships on this service for several days together. In the midst of their labours, they were surprised by the sight of two Spanish vessels of war, employed, like themselves, in surveying this inlet, the examination of which had been begun by them in the preceding year. Measures of mutual assistance were concerted between the captains of the two nations for the prosecution of the survey, in which each agreed to communicate to the other their discoveries. Not one of the many arms of the inlet, nor of the channels which they explored in this broken part of the coast, was found to extend more than 100 miles to the eastward of the entrance into the strait. After having surveyed the southern coast, on which side a termination was discovered to every opening, by following the continued line of the shore, they were led to the northward, and afterward towards the north-west, till they came into the open sea through a different channel from the strait of Juan de Fuca, by which they had commenced this inland navigation.

Thus it appeared, that the land forming the north side of that strait is part of an island, or of an archipelago, extending nearly 100 leagues in length from S. E. to N. W.; and on the side of this land most distant from the continent is situated Nootka Sound. The most peculiar circumstance of this navigation is the extreme depth of water, when contrasted with the narrowness of the channels. The vessels were sometimes drifted about by the currents during the whole of a night, close to the rocks, without knowing how to help themselves, on account of the darkness, and the depth being much too great to afford them anchorage.

In the course of this survey, the voyagers had frequent communications with the natives, whom they met sometimes in canoes and sometimes at their villages. In their transactions with Europeans, they are described as "well versed in the principles of trade, which they carried on in a very fair and honourable manner." In other respects they were less honest. At one village 200 sea otter skins were purchased of them by the crews of the vessels in the course of a day; and they had many more to sell in the same place, as also skins of bears, deer, and other animals. One party of Indians whom they met had the skin of a young lioness; and these spoke a language different from that used in Nootka Sound. Venison was sometimes brought for sale; and a piece of copper, not more than a foot square, purchased one whole deer and part of another. Among other articles of traffic, two children, six or seven years of age, were offered for sale. The commodities most prized by the natives were fire-arms, copper, and great coats. Beads and trinkets they would only receive as presents, and not as articles of exchange. Many of them were possessed of fire-arms. In one part it is related, that after a chief had received some presents, "he, with most of his companions, returned to the shore; and, on landing, fired several muskets, to shew, in all probability, with what dexterity they could use these weapons, to which they seemed as familiarized as if they had been accustomed to fire-arms from their earliest infancy."

The dresses of these people, besides skins, are a kind of woollen garments; the materials composing which are explained in the following extract:

"The dogs belonging to this tribe of Indians were numerous, and much resembled those of Pomerania, though, in general, somewhat larger. They were all shorn as close to the skin as sheep are in England; and so compact were their fleeces, that large portions could be lifted up by a corner without causing any separation. They were composed of a mixture of a coarse kind of wool, with very fine long hair, capable of being spun into yarn. This gave Captain Vancouver reason to believe, that their woollen cloathing might in part be composed of this material mixed with a finer kind of wool from some other animal, as their garments were all too fine to be manufactured from the coarse coating of the dog alone."

Of other animals alive, deer only were seen in any abundance by our people.

The number of inhabitants computed to be in the largest of the villages or towns that were discovered, did not exceed 600. Captain Vancouver conjectured the small-pox to be a disease common and very fatal among them. Many were much marked; and most of these had lost their right eye. Their method of disposing of their dead is very singular.

"Baskets were found suspended on high trees, each containing the skeleton of a young child; in some of which were also small square boxes filled with a kind of white paste, resembling (says our author) such as I had seen the natives eat, supposed to be made of the saranne root; some of these boxes were quite full, others were nearly empty, eaten probably by the mice, squirrels, or birds. On the next low point south of our encampment, where the gunners were airing the powder, they met with several holes in which human bodies were interred, slightly covered over, and in different states of decay, some appearing to have been very recently deposited. About half a mile to the northward of our tents, where the land is nearly level with high water mark, a few paces within the skirting of the wood, a canoe was found suspended between two trees, in which were three human skeletons.

"On each point of the harbour, which, in honour of a particular friend, I called *Penn's Cove*, was a deserted village; in one of which were found several sepulchres, formed exactly like a centry box. Some of them were open, and contained the skeletons of many young children tied up in baskets: the smaller bones of adults were likewise noticed, but not one of the limb bones could here be found; which gave rise to an opinion, that these, by the living inhabitants of the neighbourhood, were appropriated to useful purposes; such as pointing their arrows, spears or other weapons."

However honourably these people have been represented in their conduct as traders, it appeared on several occasions that it was unsafe to depend on their good-will alone: and some instances occurred, of their making every preparation for an attack, from which they desisted only on being doubtful of the event; yet immediately on relinquishing their purpose, they would come with the greatest confidence to trade, appearing perfectly regardless of what had before been in agitation. The boats, as already noticed, were frequently at a great distance from the ships; and on such occasions, when large parties of Indians have first seen them, they generally held long conferences among themselves before they approached the boats; probably for the purpose of determining the mode of conduct which they judged it most prudent to observe. Captain Vancouver places the entrance of the strait of Juan de Fuca in 48° 20′ N. Lat. and 124° W. Long.

JUAN. St, the capital of California in N. America. N. lat 26° 25′, W. long. 114° 9′.—*Morse.*

Juan, *Fort St*, stands in the province of New Leon, in N. America, on the S. W. side of the Rio Bravo, in the 29th degree of N. latitude and 101st of W. longitude.—*ib.*

JUDITH, POINT, the south-easternmost point of Rhode-Island State, situated on the sea-coast of Washington county, in South-Kingston township.—*ib.*

JUDOSA BAY, in Louisianna, lies in the N. W. corner of the gulf of Mexico. A chain of islands form a communication between it south westward to St Bernard's Bay.—*ib.*

JUGGLERS are a kind of people whose profession has not been often deemed either respectable or useful. Professor Beckmann, however, has undertaken their defence; and in a long and learned chapter in the third volume of his *History of Inventions*, pleads the cause of the practisers of legerdemain; rope-dancers; persons who place their bodies in positions apparently dangerous; and of those who exhibit feats of uncommon strength. All these men he classes under the general denomination of *Jugglers;* and taking it for granted (surely upon no good grounds) that every useful employment is full, he contends, that there would not be room on the earth for all its present inhabitants did not some of them practise the arts of *Juggling*.

"These arts (says he) are indeed not unprofitable, for they afford a comfortable subsistence to those who practise them; but their gain is acquired by too little labour to be hoarded up; and in general, these roving people spend on the spot the fruits of their ingenuity; which is an additional reason why their stay in a place should be encouraged. But farther, it often happens, that what ignorant persons first employ, merely as a show, for amusement or deception, is afterwards ennobled by being applied to a more important purpose. The machine with which a Savoyard, by means of shadows, amused children and the populace, was by Lieberkühn converted into a solar microscope; and, to give one example more, the art of making ice in summer, or in a heated oven, enables guests, much to the credit of their hostess, to cool the most expensive dishes. The Indian discovers precious stones, and the European, by polishing, gives them a lustre.

"But, if the arts of juggling ferved no other end than to amufe the moft ignorant of our citizens, it is proper that they fhould be encouraged for the fake of thofe who cannot enjoy the more expenfive deceptions of an opera. They anfwer other purpofes, however, than that of merely amufing: they convey inftruction in the moft acceptable manner, and ferve as an agreeable antidote to fuperftition, and to that popular belief in miracles, exorcifm, conjuration, forcery, and witchcraft, from which our anceftors fuffered fo feverely."

Surely this reafoning, as well as the caufe in which it is brought forward, is unworthy of the learning of Beckmann. It is indeed true, that jugglers fpend their money freely, and that their arts afford them the means of fubfiftence; but it is very feldom, as our author muft know, that they fubfift either comfortably or innocently. Is it innocent to entice the ignorant and labouring poor, by ufelefs deceptions, to part with their hard earned pittance to idle vagabonds? or is the life of thofe vagabonds comfortable, when it is paffed amid fcenes of the moft grovelling diffipation? Jugglers fpend indeed their money, for the moft part, on the fpot where it is gained; but they fpend it in drunkennefs, and other feducing vices, which corrupt their own morals and the morals of all with whom they affociate; and therefore their ftay in a place fhould certainly *not* be encouraged. Could it be proved that the folar microfcope would never have been invented, had not a Savoyard juggler contrived a fimilar machine to amufe children and the rabble, fome ftrefs might be laid on the fervice which fuch wretches have rendered to fcience: but where is the man that will fuppofe the philofophy of Bacon and Newton to reft upon the arts of juggling? or who confiders the refinements of fcience as of equal value with the morals of the people? There is, at the moment in which this article is drawing up, a fellow exhibiting, before the windows of the writer's chamber, the moft indecent fcenes by means of puppets, and keeping the mob in a conftant roar. Is he innocently employed? or will any good man fay that there is not room for him in the armies which on the Continent are fighting in the caufe of God and humanity?

Our author endeavours to ftrengthen his reafoning by proving, which he does very completely, the antiquity of juggling. "The deception (fays he) of breathing out flames, which at prefent excites, in a particular manner, the aftonifhment of the ignorant, is very ancient. When the flaves in Sicily, about a century and a half before our æra, made a formidable infurrection, and avenged themfelves in a cruel manner for the feverities which they had fuffered, there was amongft them a Syrian named Eunus, a man of great craft and courage, who, having paffed through many fcenes of life, had become acquainted with a variety of arts. He pretended to have immediate communication with the gods; was the oracle and leader of his fellow flaves; and, as is ufual on fuch occafions, confirmed his divine miffion by miracles. When, heated by enthufiafm, he was defirous of infpiring his followers with courage, he breathed flames or fparks among them from his mouth while he was addreffing them. We are told by hiftorians, that for this purpofe he pierced a nut-fhell at both ends, and having filled it with fome burning fubftance, put it into his mouth and breathed through it.

"This deception, at prefent, is performed much better. The juggler rolls together fome flax or hemp, fo as to form a ball about the fize of a walnut; fets it on fire; and fuffers it to burn till it is nearly confumed; he then rolls round it, while burning, fome more flax; and by thefe means the fire may be retained in it for a long time. When he wifhes to exhibit, he flips the ball unperceived into his mouth and breathes through it; which again revives the fire, fo that a number of weak fparks proceed from it; and the performer fuftains no hurt, provided he infpire the air not through the mouth but the noftrils.

"For deceptions with fire the ancients employed alfo naphtha, a liquid mineral oil, which kindles when it only approaches a flame. (See Naphtha, *Encycl.*) Galen informs us, that a perfon excited great aftonifhment by extinguifhing a candle and again lighting it, without any other procefs than holding it immediately againft a wall or a ftone. The whole fecret of this confifted in having previoufly rubbed over the wall or ftone with fulphur. But as the author, a few lines before, fpeaks of a mixture of fulphur and naphtha, we have reafon to think that he alludes to the fame here. Plutarch relates how Alexander the Great was aftonifhed and delighted with the fecret effects of naphtha, which were exhibited to him at Ecbatana. The fame author, as well as Pliny, Galen, and others, has already remarked that the fubftance with which Medea deftroyed Creufa, the daughter of Creon, was nothing elfe than this fine oil. She fent to the unfortunate princefs a drefs befmeared with it, which burft into flames as foon as fhe approached the fire of the altar. The blood of Neffus, in which the drefs of Hercules, which took fire likewife, had been dipped, was undoubtedly naphtha alfo; and this oil muft have been always employed when offerings caught fire in an imperceptible manner.

"In modern times, perfons who could walk over burning coals or red-hot iron, or who could hold red-hot iron in their hands, have often excited wonder. But laying afide the deception fometimes practifed on the fpectators, the whole of this fecret confifts in rendering the fkin of the foles of the feet and hands fo callous and infenfible, that the nerves under them are fecured from all hurt, in the fame manner as by fhoes and gloves. Such callofity will be produced if the fkin is continually compreffed, finged, pricked, or injured in any other manner. Thus do the fingers of the induftrious fempftrefs become horny by being frequently pricked; and the cafe is the fame with the hands of fire workers, and the feet of thofe who walk bare footed over fcorching fand.

"In the month of September 1765, when I vifited (fays our author) the copper-works at Awedal, one of the workmen, for a little drink money, took fome of the melted copper in his hand, and after fhewing it to us, threw it againft a wall. He then fqueezed the fingers of his horny hand clofe to each other; put it a few minutes under his arm-pit, to make it fweat, as he faid; and, taking it again out, drew it over a ladle filled with melted copper, fome of which he fkimmed off, and moved his hand backwards and forwards, very quickly, by way of oftentation. While I was viewing this performance, I remarked a fmell like that of finged horn or leather, though his hand was not burnt. It is highly probable, that people who hold in their hands red hot iron, or who walk upon it, as I faw done at Amfterdam, but

at

Jugglers. at a distance, make their skin callous before, in the like manner. This may be accomplished by frequently moistening it with spirit of vitriol; according to some the juice of certain plants will produce the same effect; and we are assured by others, that the skin must be very frequently rubbed, for a long time, with oil, by which means, indeed, leather also will become horny*."

Our author then proves, in a very learned manner, that all these tricks were of high antiquity; that the Hirpi, who lived near Rome, jumped through burning coals; that women were accustomed to walk over burning coals at Castabala in Cappadocia, near the temple dedicated to Diana; that the exhibition of balls and cups (see LEGERDEMAIN, *Encycl.*) is often mentioned in the works of the ancients; that in the third century, one Firmus or Firmius, who endeavoured to make himself emperor in Egypt, suffered a smith to forge iron on an anvil placed on his breast; that rope-dancers with balancing poles are mentioned by Petronius and others; and that the various feats of horsemanship exhibited in our circuses passed, in the thirteenth century, from Egypt to the Byzantine court, and thence over all Europe.

* *Haller, Elementa Physiolog.*

Julian, ‖ Iwanee.

JULIAN, ST, a harbour on the coast of Patagonia, in South-America, where ships bound to the Pacific ocean usually touch for refreshment. S. lat. 48° 51', W. long. 65° 10'.—*Morse.*

JULIET, MOUNT, in North-America, lies on the north side of Illinois river, opposite the place where that river is formed by the junction of Theakiki and Plein rivers. The middle of Mount Juliet is in N. lat. 42° 5', W. long. 88° 44'.—*ib.*

JUNGLE, in Bengal, waste land, or land covered with wood and brambles.

JUNIUS, a military township in New-York State, bounded north by Galen, and south by Romulus.—*Morse.*

JUNIUS CREEK, a northern branch of the Little Kanhaway, which interlocks with the western waters of Monongahela river; and which may one day admit a shorter passage from the latter into the Ohio.—*ib.*

IWANEE, a little town near St Jago de Cuba, where a small remnant of the ancient Indians live, who have adopted the manners and language of the Spaniards.—*ib.*

K.

Kaarta.

KAARTA, a kingdom in Africa, through which Mr Park passed in his route from the Gambia to the Niger. He describes the country as consisting either of sandy plains or rocky hills; but, from his account, the level part seems to be the most extensive. The natives are negroes, of whom many, though converted to the Mahomedan faith, or rather to the ceremonial part of the Mahomedan religion, retain all their ancient superstitions, and even drink strong liquors. They are called Johers or Jowers, and in Kaarta form a very numerous and powerful tribe. One of these men undertook to conduct our author to Kemmoo, the capital of the kingdom, and alarmed him not a little by his superstitious ceremonies.

We had no sooner (says Mr Park) got into a dark and lonely part of the first wood, than he made a sign for us to stop, and taking hold of a hollow piece of bamboo, that hung as an amulet round his neck, whistled very loud, three times. I confess I was somewhat startled, thinking it was a signal for some of his companions to come and attack us; but he assured me that it was done merely with a view to ascertain what success we were likely to meet with on our present journey. He then dismounted, laid his spear across the road, and having said a number of short prayers, concluded with three loud whistles; after which he listened for some time, as if in expectation of an answer, and receiving none, told us we might proceed without fear, for there was no danger."

White men were strangers in the kingdom of Kaarta; and the appearance of our author had on some of the natives the effect which ignorant people, in this country, attribute to ghosts. "I had wandered (says he) a little from my people, and being uncertain whether they were before or behind me, I hastened to a rising ground to look about me. As I was proceeding towards this eminence, two negro horsemen, armed with muskets, came galloping from among the bushes: on seeing them I made a full stop; the horsemen did the same, and all three of us seemed equally surprised and confounded at this interview. As I approached them their fears increased, and one of them, after casting upon me a look of horror, rode off at full speed; the other, in a panic of fear, put his hand over his eyes, and continued muttering prayers until his horse, seemingly without the rider's knowledge, conveyed him slowly after his companion. About a mile to the westward, they fell in with my attendants, to whom they related a frightful story: it seems their fears had dressed me in the flowing robes of a tremendous spirit; and one of them affirmed, that when I made my appearance, a cold blast of wind came pouring down upon him from the sky like so much cold water."

Kaarta, ‖ Kaats.

At Kemmoo our traveller was graciously received by the king; who honestly told him, however, that he could not protect him, being then engaged in war with the king of BAMBARRA (See SEGO in this *Supplement*); but he gave him a guard to JARRA, the frontier town of the neighbouring kingdom of Ludamar. The origin and issue of this war between Kaarta and Bambarra, of which Mr Park gives a full account, shews the folly of attempting to liberate the negroes from slavery till civilization and Christianity be introduced into Africa. Major Rennel places Kemmoo, the capital of Kaarta, in 14° 15' N. Lat. and 7° 20' W. Lon.

KAATS' BAAN, in New-York State, lies on the west bank of Hudson's river, 7 miles southerly from Kaats' Kill, and 11 N. E. by N. from Esopus.—*Morse.*

Kaats' Kill, or *Catskill*, a small village of 30 or 40 houses and stores, in the State of New-York, situated on the west side of Hudson's river, about 100 rods from its bank; 5 miles south of Hudson city, and 125 north of New York. It has the appearance of a thriving place. and it is in contemplation to erect buildings on a marshy point, on the margin of the river, for the advantage of deeper water. The creek on which the stores now stand being too shallow. The township of this name contains 1,980 inhabitants, of whom 343 are electors, and 305 slaves.—*ib.*

Kaats' Kill *Mountains*, in the vicinity of the above town on the west bank of Hudson's river, which make a majestic appearance. These are the first part of the chain of mountains called the Allegany, or Appalachian mountains.—*ib.*

KABOBIQUAS, a nation in south Africa, who had never seen a white man till 1785, that they were visited by M. Vaillant. Intimation had been given of his approach by some of the tribes through whose country he had previously passed; and every thing that had been said of his colour, his fusees, and his equipage, bore the character of the most enthusiastic exaggeration. The curiosity of the people was wound up to the highest pitch; and as soon as they saw his company at a distance, the whole horde quitted the kraal, and ran with eagerness to meet him. Not being able to believe their eyes in regard to what they saw, they endeavoured to obtain more satisfaction by touching him. They felt his hair, hands, and almost every part of his body. His beard, above all, astonished them to an inconceivable degree. More than thirty persons came in succession, and half unbuttoned his clothes. They all imagined him to be a hairy animal; and supposed, without doubt, that his body was covered with hair as long as that on his chin; but finding this not to be the case, they were astonished, and confessed, with the openness of savages, that they had never seen the like in any man of their country. The little children, terrified at his appearance, hid themselves behind their mothers. When he attempted to lay hold of any of them, in order to caress them, they sent forth loud cries, as a child would do in Europe who should see a negro for the first time.

The grown up people, however, were soon reconciled to his appearance, and even the children were bribed by small bits of sugar candy. The chief of the horde showed him every mark of attachment. He was a man advanced in life, and of a majestic figure. He wore a long mantle, which hung from his shoulders to the ground, and which, formed of four jackal skins joined together, was bordered at the sides with that of a hyæna. His left hand wanted two joints of the little finger, which he said, were amputated in his infancy to cure him of a severe illness.

This custom of savages, who, to relieve a man from pain, add new sufferings to his evils, affords a vast field for reflection. Mr Paterson, another African traveller, tells us, that he observed instances of the same practice among a horde at the mouth of Orange-river; which is not improbable. However absurd a custom may be, savage tribes when they are neighbours, may borrow it from each other; but that it should be common among the islanders of the South Sea, who, since their country was first inhabited, had never seen strangers before Cook and Bougainville, is truly astonishing. Our author was very desirous of interrogating minutely the people of the horde on this subject. He wished also to propose some questions to them respecting other customs which appeared singular; but difficulties increased the more he advanced into the country. The Kabobiquas spoke a particular language; and this dialect, though accompanied with the clapping noise of the Hottentots, was understood only by the Koraquas, who, on account of their vicinity, kept up some intercourse with them. The case was the same with the language of the Koraquas, in regard to their neighbours the Nimiquas; and nothing reached our author's ear till it had passed through four different months. The consequence was, that when he asked any thing, the answer had frequently no relation to the question; and for this inconveniency no remedy could be found.

The same desire for trinkets to ornament their dress prevailed among the Kabobiquas as among the other hordes which Vaillant had visited; and in one day he purchased twenty oxen for things of that kind of no value. The chief, however, had set his affections on a razor; and just when our author and he were treating about it, a shot was fired near them, which was instantly followed by the most frightful cries. "Rushing instantly from my tent (says M. Vaillant) to enquire what was the cause of this noise, I saw a Kabobiqua flying as fast as he could from one of my hunters, while, at the distance of a hundred paces farther, three men were making the most lamentable clamour, and near them was a young girl lying on the ground. I made a signal to my hunter to approach me; but the report of the shot, and the howling of the three men, had already spread alarm throughout the horde. Some cried out treachery; others ran to their arms; and I now imagined that I was about to be massacred, with my whole company, and that I should be obliged to arm them in my defence. My situation was the more critical, as neither I, nor any person in the kraal, knew what was the cause of this confusion; and if I had known, how could I have explained it?

"Under this embarrassment, I took the chief by the hand, and advanced with him towards the horde. Fear was painted in his countenance; tears began to drop from his eyes; and he spoke to me with great vivacity. He imagined, no doubt, that he was betrayed. He complained to me. and accused my people of perfidy; yet he readily followed me.

"As I was without arms, and presented myself with the chief, I was received with confidence, and my appearance seemed, in some measure, to calm their perturbation. My people, who had seen me direct my course towards the kraal, hastened thither after me, to protect me; and their number overawed the multitude. At length the whole mystery was cleared up, and we learned what had occasioned the tumult.

"A Kabobiqua having met one of my hunters, who was returning with his fusee, wished to examine it, and begged him to shew it to him. In handling it, however, he accidentally touched the trigger; it instantly went off; and the savage, frightened by the unexpected explosion, threw down the fusee, and ran away as fast as he could.

"At that time, three men of the horde and a young girl happened unluckily to be standing, at the distance of a hundred paces, in the direction of the piece. The

Kabobiquas. latter received a single grain of shot in the cheek; and the others a few grains in the legs and thighs. The author of the misfortune confirmed this explanation; tranquillity was soon restored; the savages deposited their arms; and I was surrounded only by friends as before.

"Nothing remained but to enquire into the state of the wounded, and to give them every assistance in my power. Without loss of time, therefore, I repaired, still accompanied by the chief, to the place where they were. By the way we met the young girl, who was returning from the kraal, bathed in tears. The cause of her uneasiness was a grain of lead, which had, however, penetrated so little, that I forced it out by only pressing the part with my fingers. With regard to the three men, they lay rolling on the ground, howling in a most frightful manner, and exhibiting every symptom of despair.

"I was astonished at their consternation, and could not conceive how men inured to sufferings should be so much affected by a few small punctures, the pain of which could have scarcely drawn tears from an infant. They at length told me the cause of their wailings. These savages, accustomed to poison their arrows, imagined that I had in like manner poisoned the lead with which they were wounded. They had, therefore, given themselves up as lost, and expected in a few moments to expire."

It was with great difficulty that our author could convince them that they had nothing to fear. He shewed them in the flesh of his own leg a dozen of shots of lead; but they were not satisfied till one of the most intelligent of his Hottentots, taking from his shot bag a few grains of lead, and shewing them to the three men, immediately swallowed them. This conclusive argument produced the desired effect. The cries of the wounded men instantly ceased; serenity again appeared in their faces; and their wounds were no more mentioned.

The Kabobiquas have neither the flat nose nor plump cheeks of the Hottentots. Their skin also has not that bastard colour, which, being neither black nor white, renders them odious to both races; nor do they besmear their bodies with those disgusting fat substances, on account of which one cannot approach them without being bedaubed with their filth, or acquiring an offensive smell. In stature they are as tall as the Caffres, and their colour is equally black. Their hair, which is exceedingly short, and much curled, is ornamented with small copper buttons, arranged with great art and symmetry. Instead of that apron made of a jackal's skin, employed by the Hottentot to cover what modesty bids him conceal, the Kabobiquas use a round piece of leather, the edge of which is ornamented with a small indented circle of copper, and which is divided into different compartments by rows of glass beads of various colours, all proceeding from the centre, and diverging towards the circumference, like the rays in our images of the sun.

This kind of veil is made fast to the groin by means of a girdle; but as it is only four inches in diameter, as it is deranged by the smallest movement, and as they give themselves little uneasiness respecting such accidents, it is very ill suited to the purpose for which it is applied. During the great heats, this small and almost useless apron is the only covering on their bodies. Its being so readily displaced, enabled our author to ascertain that they do not practise circumcision; but it seemed to show also, that, in regard to modesty, their ideas are very different from ours.

Kabobiquas. Though they go thus almost entirely naked, their manners, instead of being licentious, are remarkably chaste. No females can be more prudent or more reserved than their women; and whether from refinement of coquetry, or the effect of prudence, they do not tattoo their faces like their husbands and fathers. They do not even follow their example in ornamenting their hair with copper buttons; and they always go barelegged, though most of them wear sandals.

Their dress consists of an apron that reaches only half down the thigh; a kross which, passing under the arm-pits, is tied on the breast; and a long mantle like that of the men. The mantle is made of skins not deprived of the hair; and the kross of tanned leather, prepared like that used for gloves in Europe.

With regard to glass beads, they wear them as bracelets. They form them also into necklaces, which descend in different rows to the pit of the stomach; and they suspend from their girdles several strings of them, which fall down their thighs below the apron.

These ornaments being very durable, the habit of seeing them renders the women almost indifferent to the pleasure of possessing them. Those they procured from our author afforded at first great satisfaction, on account of their novelty. But when he shewed them scissars and needles, they gave the preference to these articles; and this choice does honour to the good sense of the Kabobiqua ladies. Like their chief, they set a higher value on utility than ornament.

Before our author's arrival among them, the Kabobiquas were acquainted with the use of tobacco through the means of some of the tribes more contiguous to the Cape. It was, however, a luxury which they could seldom enjoy; and so indifferent were they about it, that if it were not brought to them, they would not go a step to procure it. This indifference, about an article which is eagerly sought for by all the tribes of Hottentots, seemed to shew that there are traits in the character of the Kabobiquas which distinguish them from their southern neighbours. The case was the same as to strong liquors, on which they set no great value; and though there were among them some few individuals disposed to relish them, the greater number absolutely refused them.

"If the contents of my flasks (says Vaillant) gave them little satisfaction, they were, however, much captivated with the flasks themselves. These transparent bottles excited their admiration in the highest degree. They called them *solid water;* for, notwithstanding the heat of the climate, these savages had seen ice on the summits of the mountains by which they are surrounded; and they entertained no doubt that the glass of my flasks was water, which I had rendered solid by magic, and which I prevented their fires from melting. As it was impossible for me to explain this matter, I did not attempt to undeceive them: and besides, with what advantage would it have been attended? I suffered them, therefore, to continue in their error, and contented myself with conferring on them an obligation, by giving them all the empty bottles for which I had no use.

"On their part, they vied with each other in shewing

Kabobiquas.

ing their generosity towards me; and I must indeed allow, that I never saw a nation so disinterested. Every night they brought to my camp a considerable quantity of milk; and they never came to spend the evening with my people, without bringing some sheep to regale them. I have seen many of them give away gratuitously, and without receiving any thing in return, part of their herds and their flocks; and, when I departed, there were many persons in my caravan who possessed both sheep and oxen, which they had received as a pure gift."

With this benevolent disposition, the Kabobiquas have also a martial character. Their weapons are poisoned arrows, and a lance with a long iron point, but different from the assagay of the Hottentots. In battle, their defensive armour consists of two bucklers; the one of a size sufficient to cover the whole body of the combatant; the other much smaller. They are both made of skins exceedingly thick, and proof against arrows.

The courage which the Kabobiquas display in combat is particularly exercised in their hunting excursions, and, above all, against carnivorous animals. Intrepid, however, as it may be to attack the elephant and the rhinoceros, these species of animals are not objects of their vengeance; because, living upon grass and herbs, they have nothing to apprehend from them, either for themselves or their cattle. But the tiger, lion, hyæna, and panther, being enemies of a different kind, they declare against them implacable war, and pursue them without remission.

Of the spoils of these destructive animals they form their bucklers, girdles, sandals, krosses, mantles, &c. They consider it as a mark of honour to wear them; and they set a much higher value upon them than upon the skin of the rhinoceros or of the elephant. If they sometimes hunt the latter, it is only as objects of food; and they employ to catch them those concealed pits, which are the usual snares of the Hottentots: but this method, which requires both patience and labour, is very little suited to a people so brave and enterprising as the Kabobiquas.

As they possess so bold and resolute a character, one might be induced to believe that they are ferocious and intractable. Among all the African nations, however, which our author visited, he never knew one that so much practised obedience and subordination.

The chief here is not, as in other tribes, a principal among his equals; he is a sovereign in the midst of his subjects, a master surrounded by his slaves. A word, a gesture, or a look, is sufficient to procure him obedience. Whatever be his orders, they are never contradicted; and the case is the same in every particular family. What the chief is to the horde, the father is to his children. His commands are absolute; and he exercises regal power at home, while he obeys elsewhere.

Though the tribe was very numerous, the wisdom with which it was ruled, and the good order that prevailed, announced, in the man by whom it was governed, an intelligence superior to that of all the savages our author had before seen; for he had not then visited the Houzouanas. The habitation of this chief was suited to his supreme dignity. It was, indeed, a hut only, like those of his subjects, and, like them covered with the skins of animals; but it was much larger, as well as more elevated; and around it were six others, occupied by his family, and destined for them alone.

Kabobiquas, Kajaaga.

The natural dryness of the country inhabited by the Kabobiquas obliges them to dig wells, for their own use as well as for their cattle; but as the same cause often dries up these wells, they are then forced to remove, and to seek elsewhere a soil more abundant in springs; for Fish-River, though considerable in the rainy season, is often, during the great heats, entirely destitute of water.

The long journeys which these too frequent emigrations compel them to undertake, and the intercourse which they thence have with other nations, must necessarily inspire them with ideas unknown to the settled tribes; and it would not be unnatural to suppose, that to this extension of ideas are they indebted for that superiority of intelligence which elevates them above their neighbours.

Of the religion of the Kabobiquas, our author talks very inconsistently, and like a true philosopher of the French school. "Of all the African nations (says he), they are the only people among whom I found any idea, however confused a one, of the existence of a Deity. I do not know whether it be from their own reflection, or the communications of other tribes, that they have acquired this sublime knowledge, which would alone bring them near to a level with polished nations; but they believe, as far as I have been able to learn from my people, that beyond the stars there exists a Supreme Being, who made and who governs all things. I must however observe, that on this subject their ideas are vague, barren, and unproductive. They have no conception of the future existence of the soul, or of rewards and punishments in another life; in short, they have neither worship, sacrifices, ceremonies, nor priests, and are total strangers to what we call religion."

This is impossible. A people believing in a Supreme Being, who made and who governs all things, *may* indeed be without *sacrifices*, *ceremonies*, and *priests*; but such a people cannot avoid *wishing*, that the Being who governs all things may protect them. Such a wish is a prayer; and surely he who prays is no stranger to religion. M. Vaillant places the country of the Kabobiquas between 23° and 25° S. Lat. and 16° 25′ and 19° 25′ Long. east from Paris.

KAHNONWOLOHALE, the principal village of the Oneida Indians, in which is Oneida Castle, about 20 miles south of west from Whitetown, and 12 west of Paris. There is but one framed house in this village. Their habitations are but a small improvement upon the ancient *wigwams*; and are scattered sparsely throughout an enclosure of several miles in circumference, within which they keep their cattle, horses, and swine, and without, plant their corn and sow their grain.—*Morse.*

KAJAAGA, an African kingdom, called by the French *Gallam*, is bounded on the south-east and south by Bambouk; on the west, by Bondou and Foota Torra; and on the north, by the river Senegal. The air and climate (says Mr Park) are more pure and salubrious than at any of the settlements towards the coast; the face of the country is every where interspersed with a pleasing variety of hills and valleys; and the windings of the Senegal river, which descends from the rocky

hills

hills of the interior, make the ſcenery on its banks very picturefque and beautiful.

The inhabitants are called Serawoollies, or (as the French write it) *Seracolets*. Their complexion is a jet black: they are not to be diſtinguiſhed in this reſpect from the Jaloffs.

The government is monarchical; and the regal authority, from what I experienced of it, ſeems to be ſufficiently formidable. The people themſelves, however, complain of no oppreſſion; and ſeemed all very anxious to ſupport the king in a conteſt he was going to enter into with the ſovereign of Kaſſon. The Serawoollies are habitually a trading people; they formerly carried on a great commerce with the French in gold and ſlaves, and ſtill maintain ſome traffic in ſlaves with the Britiſh factories on the Gambia. They are reckoned tolerably fair and juſt in their dealings, but are indefatigable in their exertions to acquire wealth, and they derive conſiderable profits by the ſale of ſalt and cotton cloth in diſtant countries. When a Serawoolli merchant returns home from a trading expedition, the neighbours immediately aſſemble to congratulate him upon his arrival. On theſe occaſions the traveller diſplays his wealth and liberality, by making a few preſents to his friends; but if he has been unſucceſsful, his levee is ſoon over; and every one looks upon him as a man of no underſtanding, who could perform a long journey, and (as they expreſs it) *bring back nothing but the hair upon his head.*

Their language abounds much in gutturals, and is not ſo harmonious as that ſpoken by the Foulahs: it is, however, well worth acquiring by thoſe who travel through this part of the African continent; it being very generally underſtood in the kingdoms of Kaſſon, Kaarta, Ludamar, and the northern parts of Bambara. In all theſe countries the Serawoollies are the chief traders.

Joag, the frontier town of this kingdom as you enter it from Pi?ania, may be ſuppoſed, on a groſs computation, to contain two thouſand inhabitants. It is ſurrounded by a high wall, in which are a number of port holes, for muſquetry to fire through in caſe of an attack. Every man's poſſeſſion is likewiſe ſurrounded by a wall; the whole forming ſo many diſtinct citadels; and amongſt a people unacquainted with the uſe of artillery, theſe walls anſwer all the purpoſes of ſtronger fortifications. To the weſtward of the town is a ſmall river, on the banks of which the natives raiſe great plenty of tobacco and onions. Mr Park was in this town plundered of half his effects by order of the king, becauſe forſooth he had neglected to pay the accuſtomed duties before he entered the kingdom; and it required a good deal of addreſs to prevent himſelf and his attendants from being made ſlaves; a ſtate to which the law, it was ſaid, condemned them for the commiſſion of this unintended crime. He was at laſt reſcued from Joag by a nephew of the king of Kaſſon. Joag is placed by Major Rennel in 14° 25′ N. Lat. and 9° 46′ W. Long.

KAINSI is the name given by the Hottentots to a particular ſpecies of antelope, of which, according to Vaillant, no author has yet given a perfect deſcription. It is called by the Dutch *klip-ſpringer*, on account of the eaſe with which it leaps from rock to rock; and indeed of all the antelopes there is no one equal to it in agility. It is about the ſize of a kid of a year old, and of a yellowiſh grey colour; but its hair has this peculiarity, that, inſtead of being round, pliable, and firm, like that of moſt other quadrupeds, it is flat, harſh, and ſo little adherent to the ſkin, that the ſlighteſt friction makes it fall off. Nothing is more eaſy, therefore, than to deprive this animal of its hair: dead or alive it is the ſame; to rub, or even to touch the animal, is ſufficient. Another peculiarity of this ſingular hair is its being extremely fragile; ſo that if you take a tuft of it between your fingers, and twiſt it with the other hand, it will break like the barbs of a feather. This property, however, belongs not excluſively to the hair of the kainſi; for our author ſays he has obſerved it in the hair of other quadrupeds, which in the ſame manner live among the rocks.

This antelope differs from the other ſpecies alſo in the ſhape of the foot, which, inſtead of being pointed like theirs, is rounded at the end; and as it is always accuſtomed, both in leaping and walking, to tread with the point of the hoof, without reſting at all on the heel, it leaves a print diſtinguiſhable from that of any other antelope in Africa. Its fleſh is exquiſitely flavoured, and much ſought after, particularly by the hunters.

The chace of the kainſi is very amuſing. It is true, it is ſcarcely poſſible to hunt it down with dogs, as it ſoon eſcapes them by means of its inconceivable agility, and gets out of their reach on the point of ſome detached rock, where it will remain whole hours ſafe from all purſuit, and ſuſpended, as it were, above the abyſs. But in this ſituation it is excellently placed for the arrow or the ball of the huntſman; who is commonly certain of ſhooting it at pleaſure, though he is not always able to come at it when killed. We ſhall give our author's account of a chace of the kainſi in his own words.

"I was hunting (ſays he) one of theſe animals, when, from the nature of the place, it found itſelf ſo preſſed by my dogs, as to be on the point of being run down and taken. There were apparently no means of eſcape; ſince before it was a vaſt perpendicular rock, by which its courſe was neceſſarily ſtopped. In this wall, however, which appeared to me perfectly ſmooth, was a little ridge, projecting at moſt not above *two inches*, which the kainſi quickly perceived, and, leaping upon it, to my great aſtoniſhment kept itſelf *firm* (A). I imagined, that at any rate it muſt ſoon tumble down; and my dogs, too, ſo fully expected it, that they ran to the bottom of the rock, to be ready to catch it when it fell. To haſten its fall, I endeavoured to haraſs it, and make it loſe its equilibrium; and for this purpoſe I pelted it with ſtones. All at once, as if gueſſing my deſign, it collected its whole ſtrength, bounded over my head, and, falling a few paces from me, darted away with the utmoſt ſpeed. Notwithſtanding the rapidity of its flight, it would have been eaſy for me to have ſhot it; but its leap had ſo ſurpriſed and amuſed me, that I gave it its life." This was generous, if the ſtory be true.

KAMTSCHATKA is inhabited by a people, who are repreſented in the *Encyclopædia* as poſſeſſing almoſt every quality that can diſgrace human nature. We think

(A) This we think incredible.

Kamtschatka.

think it incumbent upon us to acknowledge, in this place, that a much more favourable picture of them is drawn by La Perouse who visited Kamtschatka in September 1787. The Russian governor made the commodore and his officers remark the promising appearance of several small fields of potatoes, of which the seed had been brought from Irkoutsk a few years before; and purposed to adopt mild, though infallible means, of making farmers of the Russians, Cossacks, and Kamtschadales. The small-pox in 1769 swept away three-fourths of the individuals of the latter nation, which is now reduced to less than four thousand persons, scattered over the whole of the peninsula; and which will speedily disappear altogether, by means of the continual mixture of the Russians and Kamtschadales, who frequently intermarry. A mongrel race, more laborious than the Russians, who are only fit for soldiers, and much stronger, and of a form less disgraceful to the hand of nature, than the Kamtschadales, will spring from these marriages, and succeed the ancient inhabitants. The natives have already abandoned the *yourts*, in which they used to burrow like badgers during the whole of the winter, and where they breathed an air so foul as to occasion a number of disorders. The most opulent among them now build *isbas*, or wooden houses, in the manner of the Russians. They are precisely of the same form as the cottages of our peasants; are divided into three little rooms; and are warmed by a brick stove, that keeps up a degree of heat (A) insupportable to persons unaccustomed to it. The rest pass the winter, as well as the summer, in *balagans*, which are a kind of wooden pigeon-houses, covered with thatch, and placed upon the top of posts twelve or thirteen feet high, to which the women as well as the men climb by means of ladders that afford a footing very insecure. But these latter buildings will soon disappear; for the Kamtschadales are of an imitative genius, and adopt almost all the customs of their conquerors. Already the women wear their hair, and are almost entirely dressed, in the manner of the Russians, whose language prevails in all the *ostrogs;* a fortunate circumstance, since each Kamtschadalian village spoke a different jargon, the inhabitants of one hamlet not understanding that of the next. It may be said in praise of the Russians, that though they have established a despotic government in this rude climate, it is tempered by a mildness and equity that render its inconveniences unfelt. They have no reproaches of atrocity to make themselves, like the Spaniards in Mexico and Peru. The taxes they levy on the Kamtschadales are so light, that they can only be considered as a mark of gratitude towards the sovereign, the produce of half a day's hunting acquitting the imposts of a year. It is surprising to see in cottages, to all appearance more miserable than those of the most wretched hamlets in our mountainous provinces, a quantity of specie in circulation, which appears the more considerable, because it exists among so small a number of inhabitants. They consume so few commodities of Russia and China, that the balance of trade is entirely in their favour, and that it is absolutely necessary to pay them the difference in rubles. Furs at Kamtschatka are at a much higher price than at Canton; which proves, that as yet the market of Kiatcha has not felt the advantageous effect of the new channel opened in China.

Our author compares Kamtschatka, with respect to climate and soil, to the coast of Labrador in the vicinity of the Straits of Belle-Isle; but the men, like the animals, are there very different. The Kamtschadales appeared to him the same people as those of the bay of Castries, upon the coast of Tartary. Their mildness and their probity are the same, and their persons are very little different. They ought then no more to be compared to the Esquimaux Indians, than the sables of Kamtschatka to the martins of Canada.

The Greek religion has been established among the Kamtschadales without persecution or violence, and with extraordinary facility. The vicar of Paratounka is the son of a Kamtschadale and of a Russian woman. He delivers his prayers and catechism with a tone of feeling very much to the taste of the aborigines, who reward his cares with offerings and alms, but pay no tythes. The canons of the Greek church permitting priests to marry, we may conclude that the morals of the country clergymen are so much the better. "I believe them, however (says Perouse), to be very ignorant; and do not suppose, that for a long time to come they will stand in need of greater knowledge. The daughter, the wife, and the sister of the vicar, were the best dancers of all the women, and appeared to enjoy the best state of health. The worthy priest knew that we were good Catholics, which procured us an ample aspersion of holy water; and he also made us kiss the cross that was carried by his clerk; these ceremonies were performed in the midst of the village. His parsonage-house was a tent, and his altar in the open air; but his usual abode is Paratounka, and he only came to St Peter and St Paul's to pay us a visit."

The people of Kamtschatka have inured themselves to the extremes of heat and cold. It is well known, that their custom in Europe, as well as in Asia, is to go into vapour baths, come out covered with perspiration, and immediately roll themselves in the snow. The *ostrog* of St Peter had two of these public baths, into which our author went before the fires were lighted. They consist of a very low room, in the middle of which is an oven constructed of stones, without cement, and heated like those intended to bake bread. Its arched roof is surrounded by seats one above another, like an amphitheatre, for those who wish to bathe, so that the heat is greater or less according as the person is placed upon a higher or lower bench. Water thrown upon the top of the roof, when heated red hot by the fire underneath, is converted instantly into vapour, and excites the most profuse perspiration. The Kamtschadales have borrowed this custom, as well as many others, from their conquerors; and ere long the primitive character that distinguished them so strongly from the Russians will be entirely effaced.

Our author describes the bay of Avatscha as the finest, the most convenient, and the safest, that is to be met with in any part of the world. The entrance is narrow, and ships would be forced to pass under the guns of the forts that might be easily erected. The

 bottom

(A) Not less than thirty degrees of Reaumur's thermometer.

bottom is mud, and excellent holding ground. Two vast harbours, one on the eastern side, the other on the western, are capable of containing all the ships of the French and English navy. The rivers of Avatscha and Paratounka fall into this bay, but they are choaked up with sand-banks, and can only be entered at the time of high water. The village of St Peter and St Paul is situated upon a tongue of land, which, like a jetty made by human art, forms behind the village a little port, shut in like an amphitheatre, in which three or four vessels might lie up for the winter. The entrance of this sort of bason is more than twenty-five toises wide; and nature can afford nothing more safe or commodious. On its shore the governor proposed to lay down the plan of a city, which some time or other will be the capital of Kamtschatka, and perhaps the centre of an extensive trade with China, Japan, the Phillippines, and America. A vast pond of fresh water is situated northward of the site of this projected city; and at only three hundred toises distance run a number of streamlets, the easy union of which would give the ground all the advantages necessary to a great establishment. Of these advantages Mr Kasloff understood the value; "but first (said he a thousand times over) we must have bread and hands, and our stock of both of them is very small." He had, however, given orders, which announced a speedy union of the other *ostrogs* to that of St Peter and St Paul, where it was his intention immediately to build a church. By observation, St Peter and St Paul was found to be in 53° 1′ N. Lat. and 156° 30′ E. Long. from Paris.

KANAWA, or *Kanhawa*, a large mountainous county on the western line of Virginia, having the Ohio river on the north-west, and Kentucky west. The population of this county is included in Green Briar, being 6,015 inhabitants, including 319 slaves. About 7 miles from the mouth of Elk river in this county, is a burning spring, capacious enough to hold 40 gallons. A bituminous vapour constantly issues from it, which agitating the sand around it, gives it the appearance of a boiling spring. On presenting a torch within 18 or 20 inches of the mouth, it flames up in a column, 4 or 5 feet in height, and about 18 inches diameter, and which sometimes burns 20 minutes, and at other times has continued 3 days. General Clarke kindled the vapour, staid about an hour, and left it burning.—*Morse.*

KANAWAGERES, an Indian village on the west side of Genessee river, 4 miles west-south-west of Hartford in the Genessee country in New-York.—*ib.*

KANEM, is the name given by Edrisi to the kingdom of Bornou in Africa, of which the reader will find some account in the *Encyclopædia*. In some particulars, however, that account is incorrect. The kingdom of Bornou or Kanem must extend farther east and farther north than it is there said to do; for according to the latest and best accounts, its capital stands in Lat. 24° 32′ Long. 22° 57′. The empire is said to be very extensive; and if it be true, as we learn from the proceedings of the African Association, that its sovereign is more powerful than the Emperor of Morocco, the people cannot be such absolute brutes, as we have represented them in the article referred to; for the sovereign of brutes would have no power. The truth, however is, that very little is yet known in Europe of Bornou or its inhabitants.

KANHAWAY, GREAT, a river of Virginia of considerable note for the fertility of its lands, and still more as leading towards the head waters of James's river. But it is doubtful whether its great and numerous rapids will admit a navigation, but at an expense to which it will require ages to render its inhabitants equal. The great obstacles begin at what are called the Great Falls, 90 miles above the mouth, below which are only 5 or 6 rapids, and these passable with some difficulty even at low water. From the falls to the mouth of Green Briar is 100 miles. It is 280 yards wide at its mouth. The head waters of this river are in the western part of North Carolina, in the most easterly ridge of the Alleghany or Appalachian mountains, and south of the 36th degree of latitude. Its head branches encircle those of the Holston, from which they are separated by the Iron Mountain, through which it passes 10 miles above the lead mines. About 60 miles from Little river it receives Green Briar river from the east, which is the only considerable tributary stream in all that distance. About 40 miles below the mouth of Green Briar river, in Virginia, in the Kanhaway, is a remarkable cataract. A large rock, a little elevated in the middle, crosses the bed of the river, over which the water shoots, and falls about 50 feet perpendicularly, except at one side where the descent is more gradual. The great Kanhaway is 196 miles below Pittsburg, and is navigable most of the year; and a waggon road may be made through the mountain, which occasions the falls, and by a portage of a few miles only, a communication may be had between the waters of Great Kanhaway and Ohio, and those of James's river in Virginia. Down this river great quantities of goods are conveyed up the Kentucky river, others on horseback or in waggons to the settled part, and sold on an average, at 100 per cent. advance.—*Morse.*

KANHAWAY, LITTLE, a small navigable river of Virginia, which is 150 yards wide at its mouth, and is navigable 10 miles only. Perhaps its northerly branch, called Junius Creek, which interlocks with the western waters of Monongahela, may one day admit a shorter passage from the latter into the Ohio.—*ib.*

KANT (Immanuel), Royal Professor of Morals and Metaphysics in the University of Königsberg, is considered by his admirers as the greatest philosopher that Germany ever produced. Were we to form an estimate of his merits from the different views that have been given in English of his celebrated system, we certainly should not consider him as entitled to that character; for those views are obscured by new and uncouth terms, and are altogether wrapt up in a style which approaches nearer to jargon than to the luminous composition of a man who thinks with clearness and precision. We readily admit, that it is very difficult to translate a novel system of metaphysics from one language into another; for the translator, to perform his task properly, must be not only a complete master of both languages, but also a profound metaphysician; and not one of the translators or abridgers of the works of Kant into our language appears to us possessed of both these qualities. Despairing, from our scanty knowledge of the German language, of performing ourselves what

Kantuffa.

fo many others have failed to perform, we have applied for affiftance to an illuftrious Frenchman, who has refided many years in Germany, who is mafter of both languages, who is a profound metaphyfician, and whofe name, were we at liberty to publifh it, would reflect luftre upon our Work. From him we have reafon to expect a clear and comprehenfive view of the *Critical Philosophy*, as Kant terms his fyftem; but fhould we be difappointed of our expectation, we fhall, under that title, lay before our readers a *fpecimen* of the fyftem from the different views of it which have been publifhed in our own tongue.

KANTUFFA, a fpecies of thorn peculiar to Abyffinia, is thus defcribed by Mr Bruce: The branches ftand two and two upon the ftalk; the leaves are difpofed two and two likewife, without any fingle one at the point, whereas the branches bearing the leaves part from the ftalk: at the immediate joining of them are two thick thorns placed perpendicular and parallel alternately; but there are alfo fingle ones diftributed in all the interftices throughout the branch.

The male plant has a one-leaved perianthium, divided into five fegments, and this falls off with the flower. The flower is compofed of five petals, in the middle of which rife ten ftamina or filaments, the outer row fhorter than thofe of the middle, with long ftigmata, having yellow farina upon them. The flowers grow in a branch, generally between three and four inches long, in a conical difpofition, that is, broader at the bafe than the point. The infide of the leaves are a vivid green, in the outfide much lighter. It grows in form of a bufh, with a multitude of fmall branches rifing immediately from the ground, and is generally feven or eight feet high. Our author faw it when in flower only, never when bearing fruit. It has a very ftrong fmell, refembling that of the fmall fcented flower called mignionet, fown in vafes and boxes in windows, or rooms, where flowers are kept.

Our author reprefents the kantuffa as fo very troublefome, that it renders travelling through fome places of Abyffinia almoft impoffible. The foldier fcreens himfelf from it by a goat's, a leopard's, or a lion's fkin thrown over his fhoulder, of which it has no hold. As his head is bare, he always cuts his hair fhort before he goes to battle, left his enemy fhould take advantage of it, but the women, wearing their hair long, and the great men, whether in the army or travelling in peace, being always clothed, it never fails to incommode them, whatever fpecies of raiment they wear. If their cloak is fine muflin, the leaft motion againft it puts it all in rags; but if it is a thick, foft cloth, as thofe are with which men of rank generally travel, it buries its thorns, great and fmall, fo deep in it, that the wearer muft either difmount and appear naked, which to principal people is a great difgrace, or elfe much time will be fpent before he can difengage himfelf from its thorns. In the time when one is thus employed, it rarely fails to lay hold of you by the hair, and that again brings on another operation, full as laborious, but much more painful, than the other. A proclamation is therefore iffued, every year immediately before the king commences any march, in thefe words; "Cut down the kantuffa in the four quarters of the world; for I do not know where I am going." The wild animals, both birds and beafts, efpecially the Guinea fowl, know how well it is qualified to protect them. In this fhelter, the hunter in vain could endeavour to moleft them, were it not for a hard-haired dog, or terrier of the fmalleft fize, who being defended from the thorns by the roughnefs of his coat, goes into the cover, and brings them and the partridges alive one by one to his mafter.

Kappas, Kaffon.

KAPPAS, a tribe of Illinois Indians, in Louifiana: they lie a little above the Sothouis. This nation was formerly very numerous before the difcovery of the Miffiffippi. The country they inhabit has good paftarage.—*Morse.*

KAPPAS *Old Fort*, in Louifiana, ftands on the Miffiffippi, at the mouth of the river St Francis. It was built by the French principally for a magazine of ftores and provifions, during the wars with the Chicafaws; by whom their Illinois convoys were conftantly attacked and frequently deftroyed.—*ib.*

KARATUNK, or *Carytunk*, a plantation in Lincoln county, Diftrict of Maine, confifting of about 20 families or 103 inhabitants. It is the uppermoft on Kennebeck river, 14 miles north of Brookfield.—*ib.*

KASKASKIAS *Village* lies on the S. W. bank of the river of the fame name, a water of the Miffiffippi, in the N. W. Territory, oppofite Old Fort, and 12 miles from the mouth of the river, but not half that diftance from the Miffiffippi. It contains 80 houfes, many of them well built; feveral of ftone, with gardens, and large lots adjoining. About 20 years ago it contained about 500 whites, and between 4 and 500 negroes. The former have large ftocks of black cattle, fwine, &c.—*ib.*

KASKASKIAS, an Indian nation near the river of their name in the N. W. Territory. They can furnifh 250 warriors. Three miles northerly of Kafkafkias is a village of Illinois Indians, of the Kafkafkias tribe, containing about 210 perfons, and 60 warriors. They were formerly brave and warlike, but are now degenerated and debauched. At the late peace, the United States granted them a fum of money in hand, and became bound to pay them 500 dollars a year forever. —*ib.*

KASKASKIAS, a river of the N. W. Territory which is navigable for boats 130 miles. Its courfe is S. S. W. and near its mouth it turns to the S. S. E. and flows into the Miffiffippi river 84 miles from the Illinois. It runs through a rich country, abounding in extenfive natural meadows, and numberlefs herds of buffaloe, deer, &c. High grounds lie along the eaft fide of the river, the banks being compofed of lime-ftone and freeftone, and are from 100 to 130 feet high, divided in many places by deep cavities, through which many fmall rivulets pafs before they fall into the Miffiffippi. The fides of thefe hills, fronting the river, are in many places perpendicular, and appear like folid pieces of mafonry, of various colours, figures, and fizes.—*ib.*

KASKASKUNK, a town of the Delawares, between Great Beaver creek and Alleghany river, in Pennfylvania. Here the Moravian miffionaries had a fettlement. It is 40 miles north of Pittfburg.—*ib.*

KASKINOMPA, a fmall river which runs weft, into the Miffiffippi from the State of Tenneffee, in N. lat. 36° 28′. On the north fide of its mouth is an iron mine.—*ib.*

KASSON, a populous kingdom in North Africa, of which the capital *Kamakary* is placed by Maj. Rennel

Kaffon. Kaffon.

Rennel in 14° 33′ N. Lat. and 8° 45′ W. Long. The king who reigned when Mr Park was in the country was extremely kind to our traveller, though his fon plundered him unmercifully, like other rapacious chiefs of that favage country. From the top of a high hill, at fome diftance from the capital, "I had (fays Mr Park) a moft enchanting profpect of the country. The number of towns and villages, and the extenfive cultivation around them, furpaffed every thing I had yet feen in Africa. A grofs calculation may be formed of the number of inhabitants in this delightful plain, by confidering, that the king of Kaffon can raife four thoufand fighting men by the found of his war drum."

At Teefee, a large unwalled town, where our author refided for fome days, he had an opportunity of obferving the cuftoms of the inhabitants, who confifted partly of Pagans and partly of Bufhreens, *i. e.* of negroes converted to Mahomedanifm. Though thefe people poffefs both cattle and corn in abundance, rats, moles, fquirrels, fnakes, locufts, &c. are eaten without fcruple by the higheft and loweft. Another cuftom, ftill more extraordinary, is, that no woman is allowed *to eat an egg*. This prohibition, whether arifing from ancient fuperftition, or from the craftinefs of fome old Bufhreen who loved eggs himfelf, is rigidly adhered to; and nothing will more affront a woman of Teefee than to offer her an egg. The cuftom is the more fingular, as the men eat eggs without fcruple in the prefence of their wives, and Mr Park never obferved the fame prohibition in any other of the Mandingo countries.

Our author was prefent at a palaver held by the governor of Teefee on a very extraordinary occafion; of which we fhall give his account at full length, becaufe it fhows how free men are reduced to flavery in North Africa. "The cafe was this. A young man, a Kafir, of confiderable affluence, who had recently married a young and handfome wife, applied to a very devout Bufhreen, or Muffulman prieft, of his acquaintance, to procure him faphies for his protection during the approaching war. The Bufhreen complied with the requeft; and in order, as he pretended, to render the faphies more efficacious, enjoined the young man to avoid any nuptial intercourfe with his bride for the fpace of fix weeks. Severe as the injunction was, the Kafir ftrictly obeyed; and without telling his wife the real caufe, abfented himfelf from her company. In the mean time it began to be whifpered at Teefee, that the Bufhreen, who always performed his evening devotions at the door of the Kafir's hut, was more intimate with the young wife than he ought to be. At firft, the good hufband was unwilling to fufpect the honour of his fanctified friend, and one whole month elapfed before any jealoufy rofe in his mind; but hearing the charge repeated, he at laft interrogated his wife on the fubject, who frankly confeffed that the Bufhreen had feduced her. Hereupon the Kafir put her into confinement, and called a palaver upon the Bufhreen's conduct. The fact was clearly proved againft him; and he was fentenced to be fold into flavery, or to find two flaves for his redemption, according to the pleafure of the complainant. The injured hufband, however, was unwilling to proceed againft his friend to fuch extremity, and defired rather to have him publicly flogged before the governor's gate. This was agreed to, and the fentence was immediately executed. The culprit was tied by the hands to a ftrong ftake; and a long black rod being brought forth, the executioner, after flourifhing it round his head for fome time, applied it with fuch force and dexterity to the Bufhreen's back, as to make him roar until the woods refounded with his fcreams. The furrounding multitude, by their hooting and laughing, manifefted how much they enjoyed the punifhment of this old gallant; and it is worthy of remark, that the number of ftripes was precifely the fame as are enjoined by the Mofaic law, *forty, fave one.*"

The method of converting the negro nations to the religion of the Arabian Impoftor is a very fingular one; and Mr Park faw the whole people of Teefee converted in an inftant. During his refidence in that town an embaffy of ten people belonging to Almami Abdulkader, king of Foota Torra, a country to the weft of Bondou, arrived at Teefee; and defiring Tiggity Sego the governor to call an affembly of the inhabitants, announced publicly their king's determination, to this effect: "That unlefs all the people of Kaffon would embrace the Mahomedan religion, and evince their converfion by faying eleven public prayers, he (the king of Foota Torra) could not poffibly ftand neuter in the prefent conteft, but would certainly join his arms to thofe of Kajaaga." A meffage of this nature, from fo powerful a prince, could not fail to create great alarm; and the inhabitants of Teefee, after a long confultation, agreed to conform to his good pleafure, humiliating as it was to them. Accordingly, one and all publicly offered up eleven prayers, which were confidered a fufficient teftimony of their having renounced Paganifm, and embraced the doctrines of the prophet.

Our author relates a ftory, which we cannot refufe ourfelves the pleafure of inferting, becaufe it exhibits a very pleafing picture of the affection and gratitude of the Pagan negroes. In his train was a blackfmith, who had lived fome years on the Gambia, and who now returned to his own country *Kaffon.* "Soon after we came in fight of Jumbo, his native town (fays Mr Park), his brother, who had by fome means been apprifed of his coming, came out to meet him, accompanied by a finging man: he brought a horfe for the blackfmith, that he might enter his native town in a dignified manner; and he defired each of us to put a good charge of powder into our guns. The finging man now led the way, followed by the two brothers; and we were prefently joined by a number of people from the town, all of whom demonftrated great joy at feeing their old acquaintance the blackfmith, by the moft extravagant jumping and finging. On entering the town, the finging man began an extempore fong in praife of the blackfmith, extolling his courage in having overcome fo many difficulties; and concluding with a ftrict injunction to his friends to drefs him plenty of victuals.

"When we arrived at the blackfmith's place of refidence, we difmounted and fired our mufkets. The meeting between him and his relations was very tender; for thefe rude children of nature, free from reftraint, difplay their emotions in the ftrongeft and moft expreffive manner. Amidft thefe tranfports, the blackfmith's aged mother was led forth, leaning upon a ftaff. Every one made way for her; and fhe ftretched out her hand to bid her fon welcome. Being totally blind, fhe ftroked his hands, arms, and face, with great care, and feemed highly delighted that her latter days were bleffed by his return,

return, and that her ears once more heard the mufic of his voice. From this interview I was fully convinced, that whatever difference there is between the Negro and European in the conformation of the nofe and the colour of the fkin, there is none in the genuine fympathies and characteriftic feelings of our common nature.

"During the tumult of thefe congratulations, I had feated myfelf apart, by the fide of one of the huts, being unwilling to interrupt the flow of filial and parental tendernefs; and the attention of the company was fo entirely taken up with the blackfmith, that I believe none of his friends had obferved me. When all the people prefent had feated themfelves, the blackfmith was defired by his father to give them fome account of his adventures; and filence being commanded, he began; and after repeatedly thanking God for the fuccefs that had attended him, related every material occurrence that had happened to him from his leaving Kaffon to his arrival at the Gambia; his employment and fuccefs in thofe parts; and the dangers he had efcaped in returning to his native country. In the latter part of his narration, he had frequently occafion to mention me; and after many ftrong expreffions concerning my kindnefs to him, he pointed to the place where I fat, and exclaimed, *affille ibi fring*, "fee him fitting there." In a moment all eyes were turned upon me; I appeared like a being dropped from the clouds; every one was furprifed that they had not obferved me before; and a few women and children expreffed great uneafinefs at being fo near a man of fuch an uncommon appearance. By degrees, however, their apprehenfions fubfided; and when the blackfmith affured them that I was perfectly inoffenfive, and would hurt nobody, fome of them ventured fo far as to examine the texture of my clothes; but many of them were ftill very fufpicious; and when by accident I happened to move myfelf, or look at the young children, their mothers would fcamper off with them with the greateft precipitation. In a few hours, however, they all became reconciled to me." With thefe worthy people our author fpent the greater part of two days in feafting and merriment; the blackfmith accompanied him to the capital; and declared, that he would not leave him while he refided there.

KATERS KILL, a weftern branch of Kaats' Kill, in New-York State.—*Morse.*

KATHTIPPACAMUNCK, an Indian village fituated on the north fide of Wabafh river, at the mouth of Rippacance creek, and about 20 miles above the Lower Weau towns. In 1791, before its deftruction by Generals Scott and Wilkinfon, it contained 120 houfes, 80 of which were fhingle roofed. The beft houfes belonged to the French traders. The gardens and improvements around were delightful. There was a tavern with cellars, bar, public and private rooms; and the whole marked no fmall degree of order and civilization.—*ib.*

KAWAKUSICA, or *Kowfaki*, a lake in the Diftrict of Maine, laid down in late maps as the head of Paffamaquoddy river. N. lat. 46° 3'.—*ib.*

KAYADAROSSORA CREEK, in New-York State, about 12 miles weft of the confluence of Fifh-creek and Hudfon's river. The celebrated fprings of Saratoga, 8 or 9 in number, are fituated on the margin of a marfh formed by a branch of this creek. Alfo the name of a tract of land in Saratoga county, New-York, bounded by the town of Schenectady.—*ib.*

KAY's ISLAND, on the N. W. coaft of America, lies in north lat. 59° 49', eaft long. 216° 58'. In the neighbourhood of this ifland, Captain Cook difcovered feveral other iflands.—*ib.*

KEATE (George, Efq; F. R. S.), defcended of an ancient and honourable family, was born about the year 1729 or 1730, and received his education at Kingfton fchool, under the Rev. Mr Woodefon. From thence he went to Geneva, where he refided fome years; and during his ftay there, became acquainted with Voltaire, with whom he continued to correfpond many years after he returned to England. After finifhing the tour of Europe, he fettled as a ftudent in the Inner Temple, was called to the bar, and fometimes attended Weftminfter Hall; though he did not meet with encouragement enough to induce his perfeverance in his profeffion, nor indeed does it feem probable that he had fufficient application for it. His firft literary performance was "Ancient and Modern Rome," a poem, written at Rome in the year 1755, printed in the year 1760, and received with confiderable applaufe. The next year he publifhed "A Short account of the Ancient Hiftory, Prefent Government, and Laws, of the Republic of Geneva, 8vo." This work was compiled during the author's refidence at Geneva; is a very ufeful one; and is dedicated to Monfieur de Voltaire; to whom he fays, "When I reflect, that it was in this Republic, whofe government I have attempted to defcribe, that I was firft introduced to your acquaintance; when memory renews the hours of focial mirth and refined entertainment which your hofpitality and converfation afforded me—I cannot but rejoice in this occafion of expreffing my gratitude; proud that, as your friendfhip diftinguifhed the author of thefe pages in a foreign country, your name may at home adorn his labour." It was at one time the intention of Voltaire to tranflate this account into French, though he afterwards relinquifhed the defign.

The next year, 1762, he produced an "Epiftle from Lady Jane Gray to Lord Guildford Dudley:" and in 1763, "The Alps," a poem; the fubject of which comprehends all that chain of mountains known under the general name of the Alps, extending from Italy to Germany, and from France to Tyrol, by whatever denomination they are particularly diftinguifhed. Of all the poetical works of Mr Keate, this is entitled to the higheft praife for truth of defcription, elegance of verfification, and vigour of fancy.

Continuing to employ the prefs, in 1764 he publifhed "Netley Abbey," which he afterwards, in 1769, enlarged and reprinted: and, in 1765, produced "The Temple Student, an Epiftle to a Friend;" humouroufly rallying his own want of application to the ftudy of the law, his preference of the belles lettres, and his confequent want of fuccefs in his profeffion. The death of Mrs Cibber in 1766, of whofe merits as an actrefs he entertained the higheft opinion, gave occafion for a poem to her memory, which celebrates her excellent performances on the ftage, and laments the lofs the theatre would fuftain by her death.

In February 1769, he married Mifs Hudfon; and about the fame time publifhed "Ferney; an Epiftle to M.

M. de Voltaire." In this poem, after praising with energy the various beauties of his friend's poetical works, he introduces the following panegyric on Shakespeare:

Yes! jealous wits may still for empire strive,
Still keep the flames of critic rage alive:
Our Shakespeare yet shall all his rights maintain,
And crown the triumphs of Eliza's reign.
Above controul, above each classic rule,
His tut'ress Nature, and the world his school,
On soaring pinions borne, to him was given
Th' aerial range of Fancy's brightest heav'n;
To bid wrapt thought o'er noblest heights aspire,
And wake each passion with a muse of fire.
Revere his genius. To the dead be just,
And spare the laurels that o'ershade the dust.
Low sleeps the bard, *in cold obstruction laid*,
Nor asks the chaplet from a rival's head.
O'er the drear vault, Ambition's utmost bound,
Unheard shall Fame her airy trumpet sound!
Unheard alike; nor grief nor transport raise
The blast of censure, or the note of praise;
As Raphael's own creation grac'd his hearse,
And sham'd the pomp of ostentatious verse,
Shall Shakespeare's honours by himself be paid,
And Nature perish ere his pictures fade.

This eulogium on Shakespeare, in an epistle to Voltaire, who had laboured so long and so strenuously to detract from the merit of our immortal bard, shews that Mr Keate had not given up his judgment to the sage of Ferney. How the old and envious sophister would relish his friend's conduct, may be easily conceived. His feelings were certainly very different from those of the mayor and burgesses of Stratford, when, in consequence of this panegyric on their townsman, they complimented Mr Keate with a standish, mounted with silver, made out of the famous Mulberry tree planted by Shakespeare.

In 1773, he published "The Monument in Arcadia," a dramatic poem, built on the picture of Poussin, mentioned by Abbé du Bos in his "Critical Reflections on Poetry and Painting."

In 1779, Mr Keate produced one of his most successful works, intitled "Sketches from Nature; taken and coloured in a Journey to Margate," 2 vols. 12mo. This performance, allowing it to be, as it really is, an imitation of Sterne's "Sentimental Journey;" yet contains so many pleasing delineations of life, so many strokes of humour, and so much elegance of composition, that few will hesitate to give it the preference to any other of Sterne's imitators.

In 1781, he collected his poetical works in two vols. 12mo, and added several new pieces not before printed. The principal of these was "The Helvetiad," a fragment, written at Geneva in the year 1756. In the preface to this performance he gives the following account of it: "During a long stay I many years since made at Geneva, I visited most of the principal places in Switzerland. The many sublime scenes with which nature had enriched this romantic country; the tranquillity and content with which every individual enjoys his property; and, above all, that independence of mind which is ever the result of liberty—animated me with such veneration for the first authors of that freedom, whose figures are recorded to posterity either by sculpture or painting in the public parts of the towns thro' those little states, that my enthusiasm betrayed me into a design of writing a poem on this singular revolution; the argument of which I had divided into *ten cantos*, beginning the work with the oppressions of the House of Austria, and closing it with the battle of Mongarten; by which those injured people finally renounced its usurpation, and formed among themselves those various confederacies that ended in the great union and alliance of the present *thirteen cantons*. When I had settled the whole plan of this work, I occasionally, as I found a disposition in myself, took up any part of the poem which at the moment most invited my thoughts; and enjoying at this time such an intercourse with M. de Voltaire as afforded me a constant access to him, I acquainted him with my intention, shewing him the argument I had drawn out for the conduct of the whole design. He kept it a few days; and, in returning it, told me, that he thought the great object of the piece, the episodes connected with the history, together with the scenery of the country, presented subject matter whereon to form a fine poem; "but the time (added he) which such an undertaking will require, I would rather counsel you to employ on subjects that might more engage the public attention; for should you devote yourself to the completion of your present design, the Swiss would be much obliged to you, without being able to read you, and the rest of the world care little about the matter." Feeling the force and justness of the remark, Mr Keate laid aside his plan, and probably never resumed it. In the same year, 1781, he published "An Epistle to Angelica Kauffman."

A few years after, he became engaged in a long and vexatious law-suit, in consequence of the neglect (to say the least of it) of an architect who professed himself to be his friend; the particulars of which it is of no importance to detail. At the conclusion of the business, he shewed that his good humour had not forsaken him: And in 1787 he gave to the public the principal circumstances of his case in a performance, intitled, "The Distressed Poet, a serio-comic Poem, in three Cantos," 4to, with some pleasantry, and without any acrimony.

His last work did infinite honour to his head and his heart, as well as to the liberality of the bookseller for whom on the title-page it was said to be published. In the year 1782, the Antelope packet was shipwrecked on the Pelew islands, where the commander, Captain Wilson, and his crew lived some time before they could get off. On his return to England, the Captain was, for some reason or other, refused the command of another ship; and, as we have been informed, he was reduced to a state much the reverse of affluence. These circumstances being communicated to Mr Keate, who was struck with admiration of the manners of the inhabitants of the Pelew islands (See PELEW ISLANDS, *Encycl.*), he offered to draw up, for the benefit of Captain Wilson, a narrative of the occurrences which took place during that officer's residence among so singular a people. This he executed in "An Account of the Pelew Islands, situated in the Western Part of the Pacific Ocean: composed from the Journals and Communications of Captain Henry Wilson and some of his Officers, who in August 1783 were there shipwrecked, in the Antelope, a Packet belonging to the Honourable the East India Company," 4to; a work

Keate, ‖ Kennebeck.

work written with great elegance, compiled with much care, and which, if embellished (as it has been insinuated) with facts better calculated to have found a place in a novel than a genuine narrative, must be ascribed to the misinformation of those who were actors in the scene, and must first have deceived before they obtained credit. We mention this report as it has come to us, without any attempt either to establish or refute it. We shall only add, that if the charge is well founded, Mr Keate (who undertook the task on the most disinterested principle, and derived no advantage whatever from the work) was too sturdy a moralist to have had any hand in the imposition.—The manuscript was offered to Mr Dodsley for 300 guineas; but he hesitated to give for it so large a price, when another bookseller undertook to publish the work for the benefit of Mr Wilson; and, we have reason to believe, paid to that gentleman, within the compass of a year, triple the sum for which the manuscript had been offered to Dodsley. Such conduct reflects honour on the London trade.

Besides the pieces already mentioned, Mr Keate was the author of many Prologues and Epilogues, spoken at Mr Newcomb's school at Hackney. He adapted his friend Voltaire's "Semiramis" to the stage; but this was superseded in 1777 at Drury Lane, by a worthless translation of as worthless an author, one Captain Ayscough; but neither this nor the author are deserving of any further notice.

We shall conclude by observing, that Mr Keate's life passed without any vicissitudes of fortune; he inherited an ample estate, which he did not attempt to increase otherwise than by those attentions which prudence dictated in the management of it. He was hospitable and beneficent, and possessed the good-will of mankind in a very eminent degree. For the last year or two, his health visibly declined; but on the day he died, it appeared to be somewhat mended. His death was sudden, on the 27th of June 1797. He left one daughter, married in 1796 to John Henderson, Esq; of the Adelphi. At the time of his death, Mr Keate was a Bencher of the Temple, and a very old member of the Royal and Antiquary Societies, of both of which he had been frequently elected one of the council.

KEENE, a post-town of New-Hampshire, and one of the most flourishing in Cheshire county. It was incorporated in 1753, and contained in 1775, 756 and in 1790, 1,314 inhabitants. It is 14 miles from Walpole, 96 west of Portsmouth, and 86 N. W. from Boston. N. lat. 42° 53′.—*Morse*.

KELLYSBURGH, a township in Chittenden county, Vermont, at the head of the north branch of La Moille river.—*ib.*

KENAPACOMAQUA, an Indian village on the north bank of Eel river, a branch of the Wabash.—*ib.*

KENDRICK's *Island* forms the west side of Nootka Sound, into which you may enter from the west by Massachusetts Sound, along the northern side of the island.—*ib.*

KENNEBECK, next to Penobscot is the finest river in the District of Maine. Three miles from the Chops, Swan Island, 7 miles long, divides the waters of the river. The waters on both sides of it are navigable; but the channel on the east side of it is mostly used. Thirty-eight miles from the sea is the island Nahunkeag, which signifies the land where eels are taken. Within 3 miles of this island, a small river coming west from ponds which are in the town of Winthrop, runs into the Kennebeck, and is known by the name of Cobbesconte, called by the Indians Cobbisseconteag, which in their language signifies the place where sturgeon are taken. Six miles further up the river we find the head of the navigable waters. This is a bason 46 miles from the sea, and very commodious for the anchoring of vessels. On the east bank of the small fall which terminates the navigation of the Kennebeck, is Fort Western, which was erected in the year 1752. From that fort to Taconnet Fall is 11 miles. This is a great fall of water, and on the bank of it, on the eastern side of the river, is Fort Halifax, erected in 1754, and situated on the point of land formed by the confluence of the Sebastacook with the Kennebeck, by which the latter is increased one-third in size. The Sebastacook comes from lakes nearly north from its mouth; and in its windings receives brooks and small rivers, for the space of 150 miles. Thirty miles above Fort Halifax, as the river runs, the stream called Sandy river flows into the Kennebeck, at the point where the ancient town of Norridgewock stood; 40 miles or more further up, the Kennebeck takes a south-westward course. The Kennebeck turning again westward, receives the eastern branch 50 miles from Norridgewock. The main branch of the Kennebeck, winding into the wilderness, forms several carrying-places, one of which, called the Great carrying-place, is 5 miles across, and the river's course gives a distance of 35 miles, for that which is gained by 5 on the dry land. At about 100 miles distance from the mouth of the eastern branch, the source of the main or western branch of the Kennebeck is found extended a great distance along the side of the Chaudiere, which carries the waters from the high lands into the St Lawrence. There are no lakes, but a few small ponds and morasses at the source of this branch. The carrying-place from boatable waters in it, to boatable waters in the river Chaudiere, is only 5 miles over. The eastern branch of the Kennebeck, which unites with the other above Norridgewock, issues from a body of waters which lie N. about 20 miles from the confluence of the two branches. These waters are called Moose Pond or Moose Lake. The sides of the lake are so crooked, that the body of waters has an irregular figure; but the lake contains three times as much water as is found in Lake George. There are very high mountains to the north and west of the lake, and from these the waters run by many channels to the St Lawrence. The Kennebeck affords great quantities of lumber, and is inhabited at different seasons by several species of valuable fish. Salmon and sturgeon are taken here in great abundance, and shad and alewives relieve the wants of the necessitous part of the inhabitants. This river forms the nearest sea-port for the people on the upper part of the river Connecticut. From the Upper Cohos, or Coos, on the latter river to the tide-water in Kennebeck is 90 measured miles.—*ib.*

Kennebeck ‖ Kennicott.

KENNEBUNK, the Indian name of the place since called *Wells*, District of Maine, about 33 miles below Portsmouth, New-Hampshire.—*ib.*

KENNET, a township in Chester county, Pennsylvania.—*ib.*

KENNICOTT (Dr Benjamin) was a man of such eminence

eminence in the learned world, that every thing relating to him must be generally interesting. In the biographical sketch of him published in the *Encyclopædia*, we have acknowledged ourselves unacquainted with the rank and character of his parents; but this information has been since supplied by a very candid and well-informed writer in the Monthly Magazine; and as it is accompanied with circumstances peculiarly honourable to the Doctor, and ought therefore to be preserved, we shall insert it in this place.

"The parents of Dr Kennicott (says this writer) were honest characters: His father was the parish clerk of Totness, and once master of a charity school in that town. At an early age young Kennicott succeeded to the same employ in the school, being recommended to it by his remarkable sobriety and premature knowledge. It was in that situation he wrote the verses to the honourable Mrs Courtney, which recommended him to her notice, and that of many neighbouring gentlemen. They, with a laudable generosity, opened a subscription to send him to Oxford.

"He soon there distinguished himself, as is well known. As a testimony of the truth of the above statement, the following is a copy of an inscription written by Dr Kennicott, and engraved on the tomb of his father and mother. The writer of this article has transcribed it from the original in the church yard of Totness. The tomb is more elegant than persons in their situation are accustomed to have erected, and was thought, perhaps, by the envious to be somewhat ostentatious. A personal knowledge of the Doctor induces the writer of this article to think, that it was rather the tribute of a good and grateful mind, and of the pious reverence and love which he entertained for the authors of his being.

As Virtue should be of good report,
sacred
be this humble Monument
to the Memory of
Benjamin Kennicott, Parish Clerk of Totness,
and Elizabeth his Wife:
The latter
an Example of every Christian Duty;
The former,
animated with the warmest Zeal,
regulated by the best good sense,
and both constantly exerted
for the Salvation of himself and others.
Reader!
Soon shalt thou die also;
and as a Candidate for Immortality
strike thy breast and say,
Let me live the life of the Righteous,
that my last end may be like his.
Trifling are the dates of Time
where the subject is Eternity.
Erected
by their Son, B. Kennicott, D. D.
Canon of Christ-Church, Oxford.

"It is said, that when Dr Kennicott had taken orders, he came to officiate in his clerical capacity in his native town. When his father as clerk proceeded to place the surplice on his shoulders, a struggle ensued between the modesty of the son and the honest pride of the parent, who insisted on paying that respect to his son which he had been accustomed to shew to other clergymen: to this filial obedience was obliged to submit. A circumstance is added, that his mother had often declared she should never be able to support the joy of hearing her son preach; and that on her attendance at the church for the first time, she was so overcome as to be taken out in a state of temporary insensibility."

KENNOMICK, GREAT, a navigable river of the N. W. Territory, emptying into the south end of Lake Michigan, about N. lat. 42° 11′. The waters of this river communicate, by a portage of 30 yards, with Little Kennomick, a short river which runs north-easterly into the lake.—*Morse*.

KENSINGTON, a township in Rockingham county, New-Hampshire, about 6 miles southerly of Exeter, and 8 northerly of Newbury-Port. It was incorporated in 1737. In 1775, it contained 797, and in 1790, 800 inhabitants.—*ib*.

KENT, a county of Maryland on the eastern shore of Chesapeak Bay, bounded E. by New-Castle, and part of Kent county, Delaware, and W. by Chesapeak Bay. It is about 32 miles long and 13 broad and contains 12,836 inhabitants, including 5,433 slaves. Chief town, Chester.—*ib*.

Kent, a county of Rhode-Island, lying S. of Providence county, on the W. side of Narraganset Bay. It is 20 miles in length, and 10 in breadth, and is divided into four townships. It contains 8,785 inhabitants, including 63 slaves.—*ib*.

Kent, the middle of the three counties of Delaware. It is 40 miles from north to south, and 26 from east to west, and contains 18,920 inhabitants, including 2,300 slaves. The lands in Kent county are esteemed the richest in the State. It is well watered by several small streams that empty into the Delaware. Chief town, Dover.—*ib*.

Kent, an island in Queen Ann's county, Maryland, and the largest in Chesapeak Bay. It is 12 miles from north to south, and 6 in breadth.—*ib*.

Kent, a township in Litchfield county, Connecticut, bordering on the State of New-York, and 8 or 10 miles west of Litchfield.—*ib*.

KEOWE, anciently a populous town and territory of the Cherokee Indians, on the river of that name, the north easternmost branch of Savannah river. The soil is very fertile, and the adjacent heights might, with little expense, be rendered almost impregnable. The fruitful vale of Keowe is 7 or 8 miles in extent, when a high ridge of hills terminates the vale, but opens again below the ridge, and continues 10 or 12 miles down to Sinica, and in width 1 or 2 miles. This was formerly one continued and thickly inhabited settlement, well cultivated and planted. It now exhibits a very different spectacle to the feeble remains of the once potent Cherokees. Fort George formerly stood near the old scite of Keowe.—*ib*.

KEPLERS, a village in Berks county, Pennsylvania, on Little Schuylkill river, the N. branch of Schuylkill river; 21 miles N. N. W. of Reading, and 32 W. of Bethlehem.—*ib*.

KERMES (see *Coccus Ilicis*, Encycl.) has been proved by Professor Beckmann to have been used as a dye from very remote antiquity. "All the ancient Greek and

and Latin writers, he says, agree, that kermes, called by the latter *coccum*, perhaps also *coccus*, and often *granum*, were found upon a low shrubby tree, with prickly leaves, which produced acorns, and belonged to the genus of the oak; and there is no reason to doubt that they mean *coccum ilicis*, and that low ever green oak, with the prickly leaves of the holly (*aquifolium*), which is called at present in botany *quercus ilex*. This assertion appears more intitled to credit, as the ancients assign for the native country of this tree places where it it is still indigenous, and produces kermes.

"I am inclined (continues our author) to believe, that the art of employing kermes to dye a beautiful red colour was discovered in the East at a very early period; that it was soon so much improved as to excel even the Tyrian purple; and that it contributed to cause the proper purple to be at length abandoned. From the costly red dyes extolled so much by the Hebrew writers, and which, according to the opinion of learned commentators, were made from kermes, I shall not venture to adduce any proofs, as I am not acquainted with the Oriental languages to examine their accounts with accuracy; but I have found a passage in Vopiscus, which seems to render my conjecture very probable. That author informs us, that the king of Persia sent to the Emperor Aurelian, besides other articles of great value, some woollen cloth, which was of a much costlier and brighter purple colour than any that had been ever seen in the Roman empire, and, in comparison of which, all the other purple cloth worn by the Emperor and the ladies of the court appeared dull and faded. In my opinion, this cloth, which was of a beautiful purple red colour, was not dyed with the liquor of the murex, but with kermes. This idea was indeed not likely to occur to the Romans, who were acquainted only with the purple of the murex, and who had less experience in the arts in general than in that of robbing and plundering, or who, at any rate, in that respect were inferior to the Orientals. The Roman emperors caused this supposed purple to be sought for in India by the most experienced dyers; who, not being able to find it, returned with a vague report that the admired Persian purple was produced by the plant sandix. I am well aware, that some commentators have supposed that the sandix was our madder. Hesychius, however, says, very confidently, that the *sandix* is not a plant, but a kind of shrubby tree, which yields a dye like the *coccus*. The Roman dyers, perhaps prejudiced in favour of the murex, made that only the object of their search; and their labour proving fruitless, they might have heard something of kermes, or the kermes-oak, which they did not fully understand. Our dyers, even at present, believe many false accounts respecting the dye-stuffs which they use daily."

The use of kermes in dyeing seems to have been continued through every century. In the middle ages, as they are called, we meet with kermes under the name of *vermiculus* or *vermiculum*; and on that account cloth dyed with them was called *vermiculata*. Hence the French word *vermeil*, and its derivative *vermillon*, as is well known, had their extraction; the latter of which originally signified the red dye of kermes, but it is now used for any red paint, and also for fine pounded cinnabar.

KERSHAW, a county of Camden district, S. Carolina, on Wateree river, which separates it from Richland county. It is 35 miles in length and 30 in breadth. —*Morse*.

KHAS, in Bengal, lands taken into the hands of government, opposed to the management of Zemindars or farmers. See ZEMINDAR in this *Supplement*.

KHALSA, in Bengal, sometimes with the addition of *Shereefah*, the department of land and revenues; the exchequer.

KHERAJE, in Bengal, signifies strictly the tribute paid by a conquered country: it is also used for revenue in general.

KHIDMUT, office, attendance, employment, service.

KHIDMUTGAR, a waiting man.

KHISMUT, portion or division.

KHOMAR, or COMAR, a Zemindar's demesne land.

KICKAPOUS, an Indian nation whose different tribes inhabit near the entrance of Lake Superior, where 20 years ago they had 400 warriors; part reside at Lake Michigan, and between that and the Mississippi, near the Outtagomies, &c. and another tribe near the Piankeshaws, and on the Wabash and its branches.

The Kickapous and Kaskaskias, two Indian nations lately hostile, ceded lands to the United States at the treaty of Greeneville, August 3, 1795. The United States, on the other hand paid them a sum of money in hand, and engaged to pay them in goods, annually, to the value of 500 dollars forever.—*Morse*.

KICKEMUIT *River* is a N. western arm of Mount Hope Bay. It is about 2 miles long, and half a mile broad. The town of Warren, in Bristol county, in the State of Rhode-Island, lies N. W. of it.—*ib.*

KILLINGLY, a town in Windham county, Connecticut, in the north eastern part of the State, bordering on Rhode-Island, and separated from Pomfret by Quinebaug river. It lies about 18 miles eastward of Windham, and has a Congregational church. The original settlers were from Massachusetts. The town was incorporated in May, 1708. In 1728 it was divided into two parishes; one of which is now incorporated by the name of Thompson.—*ib.*

KILLINGTON, a mountainous township in Rutland county, Vermont, having Medway on the W. Barnard N. E. and Saltash on the S. E. and contains 32 inhabitants. Waterquechee river has its source in a pond in this town.—*ib.*

KILLINGWORTH, a post town in Middlesex county, Connecticut, situated on Long-Island Sound, 9 miles E. of Guilford and 27 W. of New-London. The Indian name of the township was Hammonasset; and a stream of that name runs on the W. side of the town and divides it from Guilford. It was settled in 1663, by 12 planters from Hartford, Guilford, and Windsor. The English name designed to have been given this town was *Kenilworth*, but by mistake it was recorded *Killingworth*. It was incorporated in 1703.—*ib.*

KILLISTINOES, Indians who inhabit on Lake Superior; and can furnish 250 warriors.—*ib.*

KIMBECK, a place on the east bank of Hudson's river; 17 or 18 miles north of Poughkeepsie.—*ib.*

KINDERHOOK, a post-town in Columbia county, New-York, on the eaft fide of Hudfon's river; 13 miles north of Hudfon city, 29 S. by E. of Albany, 145 north of New-York, and 25 W. by N. of Stockbridge in Maffachufetts. The townfhip contains 4,661 inhabitants; of whom 411 are electors, and 638 flaves.—*ib.*

KINDERHOOK *Landing*, in the above townfhip, is fituated under the bank of the river, furrounded with an uncleared barren country, has about 15 or 20 houfes, and nearly as many ftores and other buildings; 20 miles S. of Albany. The town, through which the ftage to New-York runs is about 5 miles eaft of the Landing.—*ib.*

KING-POST, or KING-*Piece*, is a piece of timber fet upright in the middle, between two principal rafters, and having ftruts or braces going from it to the middle of each rafter. See ROOF, *Encycl.*; and CARPENTRY, *Suppl.*

KINGSESS, a townfhip in Philadelphia county, Pennfylvania.—*Morfe.*

KING AND QUEEN, a county of Virginia, on Mattapany river, which feparates it from King William's county. It is about 25 miles long and 20 broad, and contains 9,377 inhabitants, including 5,143 flaves. —*ib.*

KING GEORGE, an ancient fort on the borders of Eaft-Florida, near St Mary's river.—*ib.*

KING GEORGE, a county of Virginia, lying between the Patowmac, and Rappahannock rivers. It is 22 miles long, and 14 broad, and contains 7,366 inhabitants of whom 4,157 are flaves.—*ib.*

KINGS, a maritime county of New-York, "containing all that part of the State, bounded eafterly by Queen's county; northerly, by New-York county; wefterly, partly by Hudfon's river, partly by the ocean; and foutherly by the Atlantic Ocean, including Coney Iflands." This fertile tract of land, fituated on the W. end of Long-Ifland, and feparated from Staten-Ifland by the Narrows, contributes largely to the fupply of the New-York market with vegetables, roots, fruits, butter, &c. It is divided into 6 townfhips, and contains 4,495 inhabitants, including 1,432 flaves. Chief towns, Brooklyn and Flatbufh.—*ib.*

KING'S, a county of Nova-Scotia, comprehending the lands on the S. W. and S. fides of the Bafin of Minas. The Habitant is navigable for veffels of 40 tons a little way up. The Canaid for veffels of 160 tons, 4 or 5 miles; and the Cornwallis is navigable for veffels of 100 tons 5 miles, for thofe of 50 tons 10 miles farther. There are confiderable fettlements on thefe rivers, and they afford a good portion of fine lands for tillage, and for herbage, and fome excellent meadows. In the rivers are found a great abundance of fhad of an excellent kind; and in the Bafin of Minas are fine cod-fifh, haddock, bafs, and flat-fifh of different kinds.—*ib.*

KING'S BRIDGE, a poft-town of New-York, 15 miles north of New-York city, and 29 fouth-weft of Stamford in Connecticut. The bridge here connects New-York ifland with the main land. It was ftrongly fortified during the war. The heights about it are commanding.—*ib.*

KINGSBURY, a townfhip in Wafhington county, New-York, bounded eafterly by the tract of land called the Provincial Patent. It contains 1120 inhabitants. —*ib.*

KING'S, or PEARL ISLAND, a fmall ifland in the Bay of Panama. It belongs to Spain, and is famous for its pearl fifhery; and lies in N. lat. 7° 12', W. long. 81° 36'.—*ib.*

KINGSTON, or ESOPUS, a poft-town of New-York, fituated in Ulfter county, on the W. fide of Hudfon's river, fix miles W. of Rhinebeck, and on the E. fide of Efopus Kill, or Creek. It was deftroyed on the 15th of October, 1777, by order of General Vaughan, commanding a fleet which failed up the Hudfon, when large quantities of ftores were confumed. It is rebuilt on a regular plan, and contains about 150 houfes, a court-houfe, jail, a Dutch Reformed church, and an academy. It is moft pleafantly fituated upon and furrounded by a fpacious plain. It is 56 miles S. of Albany, and 109 N. of New-York. N. lat. 41° 56', W. long. 73° 56'. The townfhip contains 3929 inhabitants, of whom 556 are electors, and 302 flaves.—*ib.*

KINGSTON, a townfhip in Addifon county, Vermont, containing 101 inhabitants.—*ib.*

KINGSTON, a townfhip in Plymouth county, Maffachufetts, on the weftern part of Plymouth Bay, bounded northerly by Duxborough, and contains 1004 inhabitants. There is here a flitting and rolling mill. The town was incorporated in 1707. It is 38 miles S. E. of Bofton.—*ib.*

KINGSTON, a townfhip in Rockingham county, New-Hampfhire, lying on the road which leads from Exeter to Haverhill, in Maffachufetts, 6 miles from the former, and 12 from Haverhill. It was incorporated in 1694. In 1775 it contained 961 inhabitants; and in 1790, 906.—*ib.*

KINGSTON, a village in New-Jerfey, three miles N. E. of Princeton, and 15 S. W. of Brunfwick; an elevated and pleafant fpot.—*ib.*

KINGSTON, the chief town of Lenoir county, Newbern diftrict, N. Carolina. It is a poft-town, fituated in a beautiful plain on the N. fide of Neus river, and contains a court-houfe, jail, and about 30 houfes. It is 40 miles W. of Newbern, and 24 from Waynefborough.—*ib.*

KINGSTON, a townfhip in Luzerne county, Pennfylvania.—*ib.*

KINGSTON, a town of Georgetown diftrict, S. Carolina. It is fituated on the W. fide of Wakkamau river, and contains an Epifcopal church, and about 30 houfes. It is 41 miles N. by E. of Georgetown, and 103 N. N. E. of Charlefton. N. lat. 33° 51', W. long. 79° 1'.—*ib.*

KINGSTON, a village in Talbot county, Maryland, fituated on the eaftern fide of Choptank river, 4 miles below the Forks.—*ib.*

KINGSTON, formerly called *Frontinac*, is fituated on the northern part of Lake Ontario, at the mouth of its outlet Iroquois river; 200 miles fouthward of Montreal, and 150 northward of Niagara. Here the King's ftores are kept and guarded by one company of men. Part of Old Fort Frontinac is now ftanding, the beft part of which is the magazine. Kingfton contains about 100 houfes. Large veffels go no farther than this place; thence to Niagara, &c. ftores and merchandize are conveyed in boats.—*ib.*

KINGSTON, the capital of the ifland of St Vincents, in the Weft-Indies, and the feat of government, lies at at the head of a bay of the ſame name, on the ſouth-weſtern ſhore of the iſland, in St George's pariſh.—*ib.*

KING WILLIAM, a county of Virginia, between Mattapony and Pamunky rivers. It is 47 miles long and 15 broad, and contains 8,128 inhabitants; of whom 5,151 are ſlaves.—*ib.*

KINGWOOD, a townſhip in Huntingdon county, New-Jerſey, containing 2,446 inhabitants, including 104 ſlaves. It is about 5 miles below Alexandria, and 15 S. W. of Lebanon. Alſo the name of a ſmall river of New-Jerſey.—*ib.*

KINGSALE, a poſt-town of Virginia, 16 miles from Weſtmoreland court-houſe, and 12 from Northumberland court-houſe.—*ib.*

KIOANON POINT, called in ſome maps *Kikeionec*, is the extremity of a large peninſula which projects far into the ſouth ſide of Lake Superior.—*ib.*

KIONTONA, an Indian town on Conewango river, in Pennſylvania, and 11 miles northerly from its mouth in Alleghany river.—*ib.*

KIPPIS (Andrew, D. D. F. R. and A. S.), was born at Nottingham, March 28 (O. S.) 1725. His father, a reſpectable tradeſman of that town, was deſcended from the Rev. Benjamin King of Oakham, Rutlandſhire, an ejected miniſter; and his mother, Ann Ryther, was the grand daughter of the Rev. John Ryther, who was ejected from the church of Fernby, in the county of York. In the year 1730, he loſt his father, and went to reſide with his grandfather, Andrew Kippis of Seaford in Lincolnſhire. He received his claſſical education at the grammar ſchool in that town; but what contributed moſt to his future eminence, was the friendſhip of the Rev. Mr Merrival, who was equalled by few of his contemporaries in various branches of learning, particularly in his acquaintance with the claſſics, his knowledge of ancient and modern hiſtory, and his refined taſte in the belles lettres. Dr Kippis frequently ſaid, that it was impoſſible for him to expreſs his obligations to this friend of his youth. In 1741 he removed to Northampton, and commenced his academical ſtudies under Dr Doddridge. After a reſidence of five years at the academy, he was invited by ſeveral congregations to become their miniſter. Though he was preſſed to ſettle at Dorcheſter, and had been choſen their miniſter, he gave the preference to an invitation from Boſton in Lincolnſhire, where he went to reſide in September 1746. Here he continued four years; and in November 1750, accepted the paſtoral charge of a congregation at Dorking in Surry. The congregation meeting in Princes-ſtreet Weſtminſter, having been without a miniſter about two years, he was choſen, in June 1753, to ſucceed the Rev. Dr Obadiah Hughes. On the 21ſt of September following, he married, at Boſton, Miſs Elizabeth Bott, one of the daughters of Mr Iſaac Bott, a merchant of that place; and in the month of October fixed his reſidence in Weſtminſter. In June 1767, he received the degree of D. D. from the univerſity of Edinburgh, on the unſolicited recommendation of the late learned Profeſſor Robertſon. He was elected a member of the Society of Antiquaries on the 19th of March 1778; and on the 17th of June 1779, he was choſen a Fellow of the Royal Society. In both Societies he had the honour of being in the council two years.

Dr Kippis was eminently diſtinguiſhed for the virtues and accompliſhments which form the chief ornaments of private life. With a ſuavity of manners and urbanity of behaviour peculiarly attractive, he united that knowledge of men and books which rendered his converſation uncommonly entertaining and inſtructive to the circle of his acquaintance and friends. As a miniſter, he was not leſs eminent for his profound acquaintance with every branch of theology than for the happy manner in which he applied it to the improvement of thoſe who attended his miniſtry. His ſermons were remarkable for perſpicuity, elegance, and energy; and his elocution was unaffected and very impreſſive, particularly at the cloſe of his diſcourſes. But the ſuperior powers and vigour of mind which he derived from nature, and which he had cultivated with unremitting diligence and peculiar ſucceſs, were not to be confined to the narrow limits of private life and the duties of the paſtoral charge, however important; they were deſigned for more extenſive and important ſervices to his country and to mankind. The intereſts of literature, ſcience, and religion, have received from the exertion of his talents as a writer the moſt eſſential advantages. His firſt efforts in literature were made in the Gentleman's Magazine, a periodical publication called the Library, and the Monthly Review; to each of which he contributed many important articles, eſpecially in the hiſtorical and philological departments of the laſt. He was the author of three important tracts, viz. "A Vindication of the Proteſtant Diſſenting Miniſters, &c." "Obſervations on the late Conteſts in the Royal Society;" and "Conſiderations on the Treaty with America, &c." His improved edition of Dr Doddridge's Lectures is a work of great value; and "the Hiſtory of Knowledge, Learning, and Taſte, in Great Britain," prefixed to the New Annual Regiſter, merits, and has received, the approbation of the public. He publiſhed at different times ſeveral ſingle ſermons; among which, that on the death of his friend the Rev. Mr Laugher, is intitled to very high praiſe. The greater part of theſe he republiſhed, with other practical diſcourſes, in the year 1794: but the work which, next to the ſtudies immediately connected with his office as a Chriſtian miniſter, engaged his principal attention, and by which he has long been diſtinguiſhed, is, the improved edition of the "*Biographia Britannica.*" In this great national publication, the comprehenſiveneſs and powers of his mind, the correctneſs of his judgment, the vaſt extent of his information, his indefatigable reſearches and unremitting aſſiduity, his peculiar talent of appreciating the merits, and analyzing the labours of the moſt eminent writers, and his unſhaken integrity, unbiaſſed fidelity, and impartial deciſion on the characters of the philoſopher, ſtateſman, poet, ſcholar, and divine, are ſtrongly diſplayed, and univerſally acknowledged. His ſtyle, formed on the models of Sir William Temple and the claſſical Addiſon, is remarkable for its perſpicuity, elegance, and purity; and gives a peculiar luſtre to the rich ſtores of knowledge treaſured in the volumes now publiſhed. This work has given him a high rank among the literati of his country, and will carry down his name with diſtinguiſhed reputation to poſterity. He died on the 8th October 1795.

KISHTAC, an iſland on the N. W. coaſt of North-America, lies eaſtward of Foggy Cape, on the ſouth-eaſt ſide of the peninſula of Alaſka, and on that part of it opposite the head of Bristol Bay, on the N. W. side of the peninsula. It is also opposite the mouth of Cook's river.—*Morse.*

KISKEMANITAS *River*, is a branch of Alleghany river, into which it empties in N. lat. 40° 40', in Westmoreland county, Pennsylvania. Its head waters are Little Conemaugh and Stone creek. After their junction it is called Conemaugh river. It then receives Black Lick from the N. E. and 17 miles from its mouth Loyalhannon Creek enters from the S. S. E. after which it is called Kiskemanitas river. It is navigable for batteaux 40 or 50 miles, and good portages are found between it and Juniatta and Potowmac rivers. Coal and salt are discovered in the vicinity of these rivers.—*ib.*

KITTANING, a settlement in Pennsylvania, on the east side of Alleghany river, 36 miles northward of Pittsburg.—*ib.*

KITTATINNY *Mountains*, a ridge of the Alleghany Mountains, which runs through the northern parts of New-Jersey and Pennsylvania.—*ib.*

KITTERY, a township in York county, District of Maine, incorporated in 1653, and consists of 3 parishes, containing 3,250 inhabitants. It is situated between Piscataqua and York rivers, 67 miles northerly of Boston. In this town is Sturgeon Creek, called so from the plenty of that fish, in the mouth of the creek at the first settlement of the country; but there have been none found for these many years past. This creek is famous in the history of the first settlers.—*ib.*

KNOB LICK, in Mercer county, Kentucky, lies 15 miles S. E. of Harrodstown, and about 12 southerly of Danville.—*ib.*

KNOWLTON, a township in Sussex county, New-Jersey, containing 1,937 inhabitants, of whom 13 are slaves.—*ib.*

KNOULTON, a grant in Chittenden county, Vermont, lies E. of Smithfield, and W. of Kellysburgh, and contains 10,000 acres of land.—*ib.*

KNOX, a county in the State of Tennessee, in Hamilton district, contained in 1795, according to the State census, 11,573 inhabitants, of whom 2,365 were slaves.—*ib.*

KNOX, a county in the N. W. Territory, erected June 20, 1790. "Beginning at the Standing Stone Forks of the Great Miami river, and down the said river to its confluence with the Ohio river; thence with the Ohio to the small rivulet above fort Massac; thence with the eastern boundary line of St Clair county, to the mouth of the little Michilimackinack; thence up the Illinois river to the forks or confluence of the Theakiki and Chikago; thence by a line to be drawn due north to the boundary line of the territory of the United States, and so far easterly upon said boundary as that a due south line may be drawn to the place of beginning." Also the name of a fort in the same territory.—*ib.*

KNOX, one of Ingraham's islands. Capt. Ingraham discovered two islands, which he called *Knox* and *Hancock*, which Capt. Roberts soon after discovering, called *Freeman* and *Langdon*. These islands had every appearance of fertility. Their latitude is from 8° 3', to 8° 5' S. and their longitude very nearly 141° W. from Greenwich.—*ib.*

KNOXVILLE, the metropolis of the State of Tennessee, is situated in Knox county, on the north side of Holston river, on a beautiful spot of ground, 22 miles above the junction of Holston river with the Tennessee, and 4 below the mouth of French Broad river. It is in a flourishing situation, and enjoys a communication with every part of the United States by post. It is regularly laid out, and contains about 130 houses, a court-house, gaol, and barracks large enough to contain 700 men. The supreme courts of law and equity for the district of Hamilton are held here half yearly, and the courts of pleas and quarter sessions for Knox county are held here. A college has been established here by government, called Blount College. It is 32 miles N. of Tellico Blockhouse; 200 S. E. by S. of Frankfort, in Kentucky; 485 W. by S. of Richmond, in Virginia; and 728 south-westerly of Philadelphia.—*ib.*

KOL-QUALL, the Abyssinian name of a tree, which some botanists have supposed to be the EUPHORBIA *Officinarum* of Linnæus. Mr Bruce, who gives the only description of the Kol-quall that we have seen, is of a different opinion: for which he assigns two reasons; the first is, that the flower, which he says is rosaceous, is composed of several petals, and is not campaniform; and the second, that it produces no sort of gum, either spontaneously or upon incision. We must acknowledge, that we entertain some doubts whether our author was at due pains to ascertain this fact; and these doubts are suggested by his own history of the tree. His description is not very perspicuous, and therefore, lest we should misrepresent his meaning, we shall give it in his own words:

"The first thing that presented itself was the first shoot of this extraordinary tree. It was a single stalk, about six inches measured across, in eight divisions, regularly and beautifully scolloped and rounded at the top, joining in the centre at three feet and a half high. Upon the outside of these scollops were a sort of eyes or small knots, out of every one of which came five horns, four on the sides and one in the centre, scarce half an inch long, fragil, and of no resistance, but exceedingly sharp and pointed. Its next process is to put out a branch from the first or second scollop near the top, others succeed from all directions; and this stalk, which is soft and succulent, of the consistence of the aloe, turns by degrees hard and ligneous, and after a few years, by multiplying its branches, assumes the form of a tree, the lower part of which is wood, the upper part, which is succulent, has no leaves; these are supplied by the fluted, scolloped, serrated, thorny sides of its branches. Upon the upper extremity of these branches grow its flowers, which are of a golden colour, rosaceous, and formed of five round or almost oval petala; this is succeeded by a triangular fruit, first of a light green with a slight cast of red, then turning to a deep crimson, with streaks of white both at top and bottom. In the inside it is divided into three cells, with a seed in each of them; the cells are of a greenish white, the seed round, and with no degree of humidity or moisture about it; yet the green leaves contain a quantity of bluish watery milk almost incredible.

"Upon cutting two of the finest branches of a tree in its full vigour, a quantity of this issued out, which I cannot compute to be less than four English gallons; and this was so exceedingly caustic, that though I wash-

Koona, ‖ Koraquas.

ed the fabre that cut it immediately, the ftain has not yet left it.

"When the tree grows old, the branches wither, and, in place of milk, the infide appears to be full of powder, which is fo pungent, that the fmall duft which I drew upon ftriking a withered branch, feemed to threaten to make me fneeze to death, and the touching of the milk with my fingers excoriated them as if fcalded with boiling water; yet I everywhere obferved the wood-pecker piercing the rotten branches with its beak, and eating the infects, without any impreffion upon its olfactory nerves."

If what is milk in a young tree be a dry powder in one that is old, is it not probable that the milk might by evaporation be reduced to the confiftence of gum, and that the kol-quall may be at moft but a variety of the *euphorbia officinarum?* From our author's obfervation, the kol-quall appeared to thrive beft on poor, fandy, ftony earth, at no great diftance from the fea. The Abyffinians employ the milky juice in tanning to take off the hair from the fkins, and they make no other ufe whatever of the tree.

KOONA, a fpecies of ECHITES (for which fee *Encycl.*), very common in the woods of North Africa. It is a fhrub, of which the leaves, when boiled with a fmall quantity of water, yield a thick black juice, into which the negroes dip a cotton thread. This thread they faften round the iron of their arrows, in fuch a manner that it is almoft impoffible to extract the arrow when it has funk beyond the barbs, without leaving the iron and the poifoned thread in the wound. The poifon of the koona is faid to be very deadly.—*Park's Travels.*

KORAQUAS, a tribe of Hottentots inhabiting a diftrict of South Africa, which M. Vaillant places on the confines of the Nimiqua country (See NIMIQUAS, *Suppl.*). When our author vifited them, the whole tribe was affembled for the election of a chief: and not agreeing among themfelves, fome blood had been fhed, and much more would have been fhed, had they not unanimoufly made choice of him. When he firft joined them, the whole horde paid attention to nothing but their quarrel. To fee their warmth, one might have fuppofed that their election was a matter of importance to the whole world, and that the fate of mankind was about to depend on their chief. All fpoke at the fame time; each endeavoured to drown his neighbour's voice by his own; their eyes fparkled with fury; and amidft this confufion, while they threatened each other in turns, the noife they made became truly dreadful.

Unarmed, and without any precaution, though furrounded by this enraged multitude, our author walked calmly along in the midft of them; and when he reached the kraal, he ordered his tent to be immediately formed, as if he had been furrounded by friends and relations. This appearance, raifed fuddenly, and as if by magic, before the eyes of the horde, with his fufees, horfes, and tent, objects which were all new to them, filled them with admiration. Men, women, and children, motionlefs, and with their mouths wide open, all ftood looking at them with profound filence. Anger, hatred, and every violent paffion, feemed by their countenances to be extinguifhed, and to have given place to more tranquil emotions, to ignorant furprife, and ftupid aftonifhment. Infancy is naturally curious; it is ftruck with every thing it fees; and the favage, in this refpect, is only a grown-up child. As thefe favages feemed to wifh that he would permit them to examine more clofely whatever excited their admiration, he readily condefcended to gratify their defire. They approached, furveyed, and handled every thing. But the principal object of general curiofity was his perfon. They feemed as if they would never be fatisfied with looking at his drefs. They pulled off his hat, that they might the better examine his hair and his beard, which were long. They even half unbuttoned his clothes; and furprifed to fee his fkin white, each felt it, as if defirous to afcertain that what they faw was real.

This comedy continued till the evening; and at length, when the moment of feparation arrived, M. Vaillant caufed to be hinted to the whole company, that if, two hours after fun-rife next morning, they fhould not be agreed refpecting the choice of a chief, he would immediately leave them. He added, however, that if, on the other hand, they came and prefented to him a chief, elected by general confent, he would then load them all with prefents, and beftow on him a diftinction which would raife him above all his equals, and render the horde one of the moft celebrated in the whole country. "But what was my furprife (fays he) when I learned the fame evening, that on my head the burden of the crown was depofed!" He acquiefced, however; affuring them, that if they would promife to be obedient, he would give them the only chief worthy of ruling them, and of making them happy.

By his interpreters he had learned, that the choice of the majority leaned towards one Haripa, a man about 40 years of age; tall, well made, exceedingly ftrong, and confequently formed by nature for ruling the feeble multitude. He therefore named Haripa chief; and the people appearing to approve of his choice, he commanded filence, and caufing the new monarch to approach, placed on his head, with great folemnity, a Dutch grenadier cap, of which the copperplate on the front was ornamented with the arms of Holland. This fymbol, *viz.* a lion rampant, having in one of his forepaws feven arrows, and in the other a naked fabre, could not fail to pleafe the favages, as it exhibited a reprefentation of the weapons peculiar to them, and of the moft formidable animal of their country. They teftified their admiration in the moft expreffive manner; and imagined that, fuperior to kings, the white man during the night had by magic made this crown, merely to adorn their chief, and to afford them pleafure. Vaillant then affixed to the fkin, which formed Haripa's drefs, feveral rows of glafs beads; gave him a girdle made of a ftring of very large ones; ornamented his arms with tin bracelets, and fufpended from his neck a fmall padlock, fhaped like a butterfly, the key of which had been loft. Such padlocks, made in the form of animals of every kind, are very common at the Cape. They come from China; and are brought to Africa by the captains of the Company's fhips which trade in the Indian feas.

During the ceremony of inftallation, the whole horde, dumb and motionlefs through admiration, feemed loft in ecftacy. Haripa himfelf, though highly gratified, did not dare to make the leaft movement, and obferved a gravity altogether rifible. When the inauguration was finifhed, and he was completely dreffed, our author prefented

Koraquas.

presented him with a mirror, that he might enjoy the satisfaction of surveying his own figure. He then shewed him to the people, who expressed their joy by shouts and applauses without end.

"Ye honest hearts (says M. Vaillant), who peruse this account, behold what it cost me to restore peace among a whole tribe, and to prevent them from destroying each other!" From this moment concord was re-established; universal joy prevailed through the horde; and they instantly began their dancings, which continued for three days and three nights without intermission. They killed for this festival several fat sheep, and even two oxen; an extraordinary and truly astonishing magnificence among a people who, when they barter one of their daughters for a cow, think they have made an excellent bargain.

Our author, wishing to purchase some oxen for his waggons, bought them at the price of a nail the ox; and those who had the good fortune to make such an exchange were highly satisfied with their bargain. Nails and small bits of iron were indeed of real value to them, to point the arrows and assageys with which they shot the antelopes that abound in their country, and constitute much of their food. Like other savages, the Koraquas were ready to pilfer, and appropriate to their own use whatever they found pleasing, or suited to their purposes. They attempted to carry away some of our author's effects, even before his face: and to prevent their rapacity, he was obliged either to watch over, or to deposit them in some place of safety.

The Koraquas are much taller than the Hottentots of the colonies, though they appeared evidently to be descended from the same race, having the same language and customs with their neighbours the NIMIQUAS (see that article), who are certainly of Hottentot extraction.

As the excessive dryness of the country renders springs very rare, the Koraquas would be unable to inhabit it, had they not found the means of remedying this scarcity of water. For this purpose they dig in the earth a kind of cisterns or rather wells, to which they descend gradually by steps; and these people are the only African nation among whom our author ever found the same mark of industry.

As their wells always contain little water, and as none is to be lost, they take care to secure it even from the birds, by closing up the mouth of the hole with stones and the branches of trees; so that, unless one knows the spot, it is impossible to find it. They go down into it every day, to fetch up as much water as may be necessary for the consumption of their people and cattle. They draw it in a kind of vessels made of hollowed wood, and pour it into the skins of buffaloes or giraffes, placed in a concave form on the ground to hold it; but they distribute it with the utmost parsimony, and never draw more than they absolutely have occasion for.

Nothwithstanding this strict economy, the wells often become dry; and in that case the horde is obliged to remove to some other place. Among all the western tribes, therefore, there are none who lead so wandering a life as the Koraquas: the consequence of which is, that, as they often change their abode, and acquire new neighbours, they must, in some measure, adopt the customs of the nations near which they fix their residence. Some tribes of them grease themselves like the Hottentots; while others tattoo their face, breast, and arms, after the manner of the Caffres. It is, however, to be remarked, that the same colour is not employed by all the Koraquas; each has his own, according as caprice may direct him in his choice, and it generally varies every day; which renders, as one may say, the inhabitants of the same horde strangers to each other, and gives them a motley appearance, as if they were dressed for a masquerade.

Kortright, || Krishna.

KORTRIGHT, a township in Otsego county, New-York; 122 of its inhabitants are electors.—*Morse.*

KRIS, Indians inhabiting the banks of Lake Christineaux. They can raise 1,200 warriors.—*Ib.*

KRISHNA or CRISNA, is an eastern river of considerable magnitude, which is very little known in Europe. We have the following account of it, and its tributary waters, and the countries through which it flows, in Mr Pennant's View of Hindustan:

"From Gangapatam, on the northern mouth of the Pennar, the land runs due north as far as Mottapilli, when it forms a strong curve toward the east; the point of which is one side of the great river Crisna, in about lat. 15° 43′. Its Delta, which winds round as far as Masulipatam, is not considerable. This river annually overflows a vast tract of country, like the Indus on the western side of this empire, and like all the other great rivers on this extensive coast. The Crisna rises from the foot of the western Ghauts, and not more than 45 miles from Severndrug, on the western coast. There is another branch to the east, that rises still more northerly. On that side is Sattara, a strong fortress, the capital of the Mahratta state in the time of the rajahs of Sivaji's race. It was taken by him in 1673, and found to be the depository of immense treasure; at that time it belonged to the king of Vijapur: it was afterwards used by the Mahrattas as the lodgment of their riches, and also as a retreat for the more defenceless inhabitants of Puna, and other open towns, in time of potent invasions.

"The river continues descending to the east. In latitude 17° is Meritch, a strong fortress, with a Jaghirdar territory, conquered from its owner by Hyder. In lat. 16° 45′, a small river discharges itself into the Crisna from the north. It would not be worth mentioning, but that Paunela, a fortress of vast strength, was made by Sumbuji, the profligate son of Sivaji, his residence just before his surprisal in 1689, betrayed by Cablis Khan, the vile instrument of his pleasures, corrupted by Aurengzebe. His extravagant love of women brought on him ruin. Informed by Cablis that a Hindu of rank and great beauty was on the road to be delivered by her parents to her husband, according to the custom of the Hindus, he instantly put himself at the head of a small body of horse to carry off the prize, and ordered Cablis to follow at a distance for his protection, in case of accidents in that hostile time. The traitor had given notice to Aurengzebe of this expedition, who, sending a body of cavalry, surprised Sumbuji just as he had dispersed the nuptial procession.

"Into the north side of the Crisna, in lat. 16° 20′, falls the great river Bima, after a course of 350 miles. It rises at the head of the western Ghauts, parallel to Chaul in the Concan, and not above 50 miles from the sea. It descends rapidly towards the south-east. In lat. 17° 40′ it receives a small river from the west, on the southern banks

banks of which stands Vijapur, the capital of the famous kingdom of the same name, now possessed by the Mahrattas, but once governed by its own monarchs, till conquered by Aurengzebe in 1686. It was of great extent, and reached to the western sea, where it possessed the ports of Dabul, Vingorla, and Carapatan.

"The capital Vijapur is some leagues in circuit, seated in a fine but naked country, well watered. It makes a singular appearance from an adjacent eminence, filled with numbers of small domes, and one of a majestic size. It was once a city of great splendour, and filled with palaces, mosques, mausoleums, and public and private buildings of great magnificence; many of them are fallen to ruin, and give melancholy proofs of its former splendour. I shall not attempt to detail them. The palaces of the kings, and accommodations for their attendants, were within a vast fort, surrounded with a ditch 100 yards wide; the depth appeared to be great, but is now filled with rubbish: within the fort is the citadel. Tavernier says, that the great ditch was filled with crocodiles, by way of garrison, to prevent all access by water. Lieutenant Moor has his doubts about this, imagining that there never was any water in this foss. That such garrisons have existed I doubt not. I have read in Purchas, that in Pegu the fosses of fortified places were stocked with those tremendous animals, not only to keep out enemies, but to prevent desertion. This practice has certainly been of great antiquity in some parts of India: Pliny mentions it as used in a fair city of the Horatæ, a people I cannot trace.

"The Crisna, above and below its conflux with the Bima, is fordable; and a few miles below its channel is 600 yards wide, made horrid with the number and rudeness of the variously formed rocks, which are never covered but in the rainy season.

"The Tungbuddra is another vast branch of the Crisna. It falls into it in lat. 16° 25′, and originates extremely south, from a doubtful fountain. Towards its lower part it divides into three or four small branches, which rise remote from each other; the most southern is the Curga Naïr's country; the most northern from the head of the Ghauts opposite to Onor, and scarcely 20 miles from the sea. What must give this river great celebrity, is its having had on its banks, in lat. 15° 22′, the splendid city of Vijanagar. Ferishta says, that it was founded in 1344 by Belaldeo king of the Carnatic, which in those days included the whole peninsula. It was visited by Cæsar Frederick a Venetian traveller, in 1565, and found deserted and ruinous, having been sacked by four confederated Mahomedan princes two years before, on which its monarch had retired to Penuconda. Frederick says that its circumference was 24 miles. Mr Rennel has given us a view of its present state from Lieutenant Emitt, who visited it in 1792.

"The ruins of Vijanagar are in the little Sircar of Anagundi, which does not extend above 20 miles around this vast city. It is very singular, that that little Sircar is now possessed by a lineal descendant of Rama Rajah, the last great monarch of Vijanagar, and its attendant nations Canarine and Malabar, united 700 years before under the rule of Crisna Deva. Tippu wished to reserve this little tract to himself, for the satisfaction of generously restoring to the descendant the small relique of the great empire of his ancestors. He is denied the title of Rajah, instead of which he has the diminutive Raïl bestowed on him. This is suitable to his revenues, which do not exceed two lacs of rupees, or 25,000 *per annum*, with the empty regality of a mint at Anagundi." In the remainder of its course the Crisna offers nothing remarkable.

KUARA, is a beautiful tree, which grows in the south and south-west parts of Abyssinia. With the ebony it is almost the only wood of the province of Kuara, of which it bears the name; but Mr Bruce assures us, that it is very frequent in all the countries where there is gold. "It is (says he) what naturalists call *a Corallodendron*, probably from the colour of its flowers or of its fruit, both equal in colour to coral. Its fruit is a red bean, with a black spot in the middle of it, which is inclosed in a round capsula or covering, of a woody nature, very tough and hard. This bean seems to have been in the earliest ages used for a weight of gold among the Shangalla, and, where that metal is found, all over Africa; and by repeated experiments, I have found that, from the time of its being gathered, it varies very little in weight, and may perhaps have been the very best choice that therefore could have been made between the collectors and buyers of gold.

"I have said this tree is called kuara, which signifies the sun. The bean is called *carat*, from which is derived the manner of esteeming gold as so many carats fine. From the gold country in Africa it passed to India, and there came to be the weight of precious stones, especially diamonds; so that to this day in India we hear it commonly spoken of gold or diamonds, that they are of so many carats fine or weight. I have seen these beans likewise from the West-Indian islands. They are just the same size, but, as far as I know, are not yet applied to any use there."

This is a very different account of the origin of the term CARAT from what we have given in the *Encyclopædia;* but the reader will judge for himself between the two.

KULSAGE, or *Sugar Town*, a little Cherokee town in the vale of Keowe.—*Morse.*

KUMI, the name of an island between Japan and China, of which Perouse writes in the following terms: "On the 5th of May, at one o'clock in the morning, we made an island, which bore north north east of us; we passed the rest of the night, standing off and on, under an easy sail, and at day-break I shaped my course so as to run along the west coast of this island, at the distance of half a league. We sounded several times without finding bottom. We were soon satisfied that this island was inhabited, for we saw fires in several places, and herds of oxen grazing on the sea-shore. When we had doubled its west point, which is the most beautiful and best inhabited side, several canoes put off from the shore in order to observe us. They seemed to be extremely in fear of us; their curiosity caused them to advance within musket shot, and their distrust made them immediately flee away with speed. Our shouts, gestures, signs of peace, and the sight of some stuffs, at length determined two of the canoes to come alongside of us. I made each of them a present of a piece of nankeen and some medals. It was evident that these islanders had not left the coast with any intention of trafficking with us, for they had nothing to offer in exchange for our presents; they only fastened to a rope

Kumi.

a bucket of fresh water, making signs to us, that they still thought themselves in our debt, but that they were going ashore to fetch provision, which they expressed by putting their hand into their mouth. Before coming alongside the frigate, they placed their hands upon their breast, and raised their arms towards the sky: these gestures were repeated by us, and then they resolved to come on board; but it was with a want of confidence, which was strongly expressed in their countenance during the whole time. They nevertheless invited us to approach the land, giving us to understand, that we should there want for nothing. These islanders are neither Japanese nor Chinese, but, situate between these two empires, they seem to partake of both people. Their covering was a shirt and a pair of cotton drawers. Their hair, tucked up on the crown of the head, was rolled round a needle, which seemed to us to be gold: each of them had a dagger, the handle of which was gold also. Their canoes were made out of hollowed trees, and they managed them very indifferently. I could have wished to land upon this island, but as we had brought the ship to, in order to wait for these canoes, and as the current set to the northward with extreme rapidity, we had drifted a great way to leeward, and our efforts to reach it would perhaps have been in vain: besides, we had not a moment to lose, and it was of the highest importance to us to get out of the Japan seas before the month of June; a period of storms and hurricanes, which render these seas the most dangerous in the whole world.

"It is clear, that vessels which might be in want would readily provide themselves with provision, wood, and water, in this island, and perhaps even carry on a little trade; but as it is not more than three or four leagues in circumference, there is no great probability that its population exceeds four or five hundred persons; and a few gold needles are not of themselves a proof of wealth." Our author, by observation, found the latitude of Kumi to be 24° 33′ north; its longitude 120° 56′ east from Paris.

Kuriles, ‖ Kyuquot.

KURILES, are a cluster of islands, of which some account has been given under the word KURIL, in the *Encyclopædia*. In addition to that article, the following particulars are worthy of notice: Of the 21 islands belonging to Russia, which are distinguished from each other, not by names, but by numbers, four only are inhabited, viz. those which are called the first, the second, the thirteenth, and the fourteenth. The last two may indeed be counted only as one, because the inhabitants all pass the winter upon N° 14, and return to N° 13 to pass the summer months. The others are entirely uninhabited, the islanders only landing there occasionally from their canoes for the sake of hunting foxes and otters. Several of these last mentioned islands are no better than large rocks, and there is not a tree on any one of them. The currents are very violent between the islands, particularly at the entrance of the channels, several of which are blocked up by rocks on a level with the sea. The population of the four inhabited islands amounts at most to 1400 souls. The inhabitants are very hairy, wear long beards, and live entirely upon seals, fish, and the produce of the chace. When visited by M. Perouse they had just been exempted for ten years from the tribute usually paid to Russia, because the number of otters on their islands is very much diminished. These poor people are good, hospitable, and docile, and have all embraced the Christian religion. The more southern and independant islanders sometimes pass in canoes the channels that separate them from the Russian Kuriles, in order to give some of the commodities of Japan in exchange for peltries.

KYUQUOT, a large sound or bay on the N. W. coast of N. America, having Roberts Island on the one side. N. lat. 50°, W. long. 127° 20′.—*Morse.*

L.

Labdasseba, ‖ Laboratory.

LABDASSEBA, a tribe of savage Arabs who inhabit the desart of Sahara in Africa. They are the most powerful of all those tribes except the Ouadelims; and they resemble these so much in every thing, that we shall give an account of the manners of both under the title OUADELIMS, and of their country under that of SAHARA.

LABORATORY, is an apparatus so necessary to the chemist, that every contrivance to render it more convenient, or to lessen the expence of it, must contribute greatly to the advancement of science. The abilities of *Morveau* alias *Guyton*, and the success with which he has prosecuted the study of chemistry, are well known; and therefore his different methods of saving time and expence in making chemical experiments must be worthy of the notice of younger chemists.

Laboratory.

In the second volume of the Memoirs of the Ancient Academy of Dijon, we have a description by him of a box containing a kind of portable laboratory, composed of a lamp with three wicks, disposed in the figure of an equilateral triangle, to form an internal current of air, with supports for the different vessels of digestion, distillation, evaporation, &c. He made a solution of silver with common aqua fortis and the metal in an alloyed state, which answered very well as a re-agent, without having occasion for any other utensils but this box and apothecary's phials, which are every where to be found.

This apparatus, however, was confined in its application, and he soon thought of improving it. He constructed a lamp, on the principles of Argand, with three concentric circular wicks, each having an interior and exterior current of air. The effect surpassed his expectations with regard to the intensity of the heat; but it was difficult to prevent the destruction of the hard solder round the wicks; and the glass retorts were frequently melted

melted at the bottom, and disfigured. It was attended with other inconveniences, and the quantity of oil consumed was great.

A short time afterwards, it occurred to him to substitute, instead of the glass chimney of Argand's lamp, a cylinder of copper with an indented part or ledge a few millimetres (see REVOLUTION, *Encycl.* n° 183.) above the flame, to perform the office of the indented chimney of glass, and by that means to render it practicable to raise the wick to a certain height without smoaking. This cylinder has three branches like a chafing-dish. By this apparatus two or three decilitres of water (about half an English wine pint) may be brought to boil in a copper or glass vessel in about six or seven minutes. It has served for a number of operations; but it was not till after he had observed the degree of heat obtained from the lamp in its ordinary state, and particularly since he had substituted instead of the metallic tube a chimney of glass cut off at the length of three centimetres (rather more than one English inch) above the contraction, that he perceived all the advantages it was capable of affording; and that by means of a moveable support for the reception of the different vessels, which may be fixed at pleasure by a thumb screw, this lamp furnace, at the same time that it gives light, and consequently without any additional expence, may with facility be used for almost every one of the operations of chemistry; such as digestions, solutions, crystallizations, concentrations; the rectification of acids; distillations on the sand-bath, or by the naked fire; incinerations of the most refractory residues; analyses with the pneumatic apparatus, or of minerals by the saline fusion, &c. "I have not (says he) hitherto met with any exception but for complete vitrifications and cupellations; for even the distillations to dryness may be performed with some precautions, such as that of transferring the matter into a small retort blown by the enameller's lamp, and placing its bottom on a little sand-bath in a thin metallic dish." The support here mentioned is simply a copper ring eight centimetres (3,15 inch.) in diameter, which is raised or lowered by sliding on a stem of the same metal. Nothing more was required but to adapt it to the square iron stem which passes through the reservoir of the lamp. The connection is made by a piece of wood, in order that less of the heat might be dispersed. As the lamp itself is capable of being moved on its stem, it is easy to bring it nearer or remove it at pleasure from the vessels, which remain fixed; a circumstance which, independent of the elevation or depression of the wick, affords the means of heating the retorts by degrees, of moderating or suppressing the fire instantly, or of maintaining it for several hours at a constant or determinate intensity, from the almost insensible evaporation of crystallizable solutions to the ebullition of acids; properties never possessed by the athanor, of which chemists have boasted so much. The advantage of these will be properly valued by those operators who know that the most experienced and the most attentive chemists meet with frequent accidents, by which both their vessels and the products of their operations are lost for want of power in the management of the fire."

For the analysis of stones, such as the crystals of tin, the shortened chimney of glass is to be used; and the process is to be begun by placing the mixture in a capsule of platina or silver $2\frac{1}{4}$ inches in diameter. This capsule is to be placed on the support, and the heat regulated in such a manner, that ebullition shall take place without throwing any portion of the matter out of the vessel. As soon as its contents are perfectly dry, they are to be transferred into a very thin crucible of platina, of which the weight is about $252\frac{1}{2}$ grains English, and its diameter one inch and three fourths. This crucible rests on a small support of iron-wire, which serves to contract the ring; and the wick being at its greatest elevation, with the ring lowered to the distance of $9\frac{1}{2}$ inches from the upper rim of the chimney, Guyton produced, in less than twenty minutes, the saline fusion to such a degree, that from the commencement of the operation the decomposition proceeded as far as to 0.70 of the mineral. The same apparatus, that is to say, with the shortened chimney, serves for oxidations, incinerations, torrefactions, and distillations to dryness.

In such operations as require a less heat, he leaves the lamp with its large chimney absolutely in the same state as when it is used for illumination; and by raising and lowering either the ring which supports the vessel, or the body of the lamp if the vessels be fixed in communication with others, he graduates the heat at pleasure. Vinegar distils without interruption at $2\frac{1}{2}$ inches English from the upper termination of the chimney, that is to say, $7\frac{1}{2}$ inches English from the flame. Water is made to boil in eight minutes, at the same height, in a glass vessel containing one wine pint English, and is uniformly maintained at the distance of $8\frac{3}{4}$ inches from the flame.

"I must not in this place (says our author) omit to mention a slight observation which this process has afforded, because it may lead to useful applications, and tends to point out one great advantage of this method of operating; namely, that an infinity of circumstances may be perceived, which might not even be suspected when the whole process is carried on within a furnace. I have remarked, as did likewise several of my colleagues who were then present, that a column of bubbles constantly rose from a fixed point of the retort on one side of the bottom. We were of opinion, that some particle of matter was in that place incorporated with the glass, which had a different capacity for heat from that of the rest of the glass. In order to verify this conjecture, I endeavoured the following day to distil the same quantity of the same water in the same retort, after having introduced a button of cupelled silver, weighing nine decigrammes ($20\frac{1}{2}$ grains). At the commencement of the operation there was a small stream of bubbles from the same point as before; but a short time afterwards, and during the whole remaining time of operating, the largest and most incessant stream of bubbles rose from the circumference of the button, which was often displaced by the motion; and in proportion to the time the product of the distillation was sensibly greater. Whence we may conclude, that metallic wires or rods, distributed through a mass of water required to be kept in a state of ebullition, and placed a little below its surface, would produce, without any greater expence of fuel, nearly the same effect as those cylinders filled with ignited matter which are made to pass through the boilers."

We have related this fact in Guyton's own words, or at least in a faithful translation of them; and we are far from calling it in question, for it is a fact which has

Laboratory.

been often observed; but we think his inference from it too hastily drawn. It is not conceivable that heat can be more rapidly conveyed through a mass of liquid by the conducting power of metal, than by a free circulation; but we agree with what seems to be Mr Nicholson's opinion*, that the thin stratum of water beneath the button becomes more suddenly and violently elastic than elsewhere, and therefore rises regularly to the surface. The whole of this phenomenon the reader will find explained in our article STEAM (*Encycl.*), n° 10. But this is a digression.

* *Journal*, August 1798, note, page 212.

We return therefore to Guyton's laboratory, of which the reader will form a distinct notion from plate XXXIII where fig. 1. represents the whole apparatus ready mounted for distillation, with the tube of safety and a pneumatic receiver. A is the body or reservoir of the usual lamp of Argand, with its shade and glass chimney. The lamp may be raised or lowered at pleasure by means of the thumb screw B, and the wick rises and falls by the motion of the small toothed wheel placed over the waste cup. This construction is most convenient, because it affords the facility of altering the position of the flame with regard to the vessels, which remain fixed; and the troublesome management of bended wires above the flame for the support of the vessels is avoided, at the same time that the flame itself can be brought nearer to the matter on which it is intended to act. D, a support consisting of a round stem of brass, formed of two pieces which screw together at about two-thirds of its height. Upon this the circular ring E, the arm F, and the nut G slide, and are fixable each by its respective thumb-screw. The arm also carries a moveable piece H, which serves to suspend the vessels in a convenient situation, or to secure their position. The whole support is attached to the square iron stem of the lamp by a piece of hard wood I, which may be fixed at any required situation by its screw. K represents a stand for the receivers. Its moveable tablet L is fixed at any required elevation by the wooden screw M. The piece which forms the foot of this stand is fixed on the board N; but its relative position with regard to the lamp may be changed by sliding the foot of the latter between the pieces OO. P, another stand for the pneumatic trough. It is raised or lowered, and fixed to its place, by a strong wooden screw, Q. R is a tube of safety, or reversed syphon, which serves, in a great measure, to prevent the bad effects of having the vessels either perfectly closed, or perfectly open. Suppose the upper bell-shaped vessel to be nearly of the same magnitude as the bulb at the lower end of the tube, and that a quantity of water, or other suitable fluid, somewhat less than the contents of that vessel, be poured into the apparatus: In this situation, if the elasticity of the contents of the vessels be less than that of the external air, the fluid will descend into the bulb, and atmospheric air will follow and pass through the fluid into the vessels: but, on the contrary, if the elasticity of the contents be greater, the fluid will be either sustained in the tube, or driven into the bell shaped vessel; and if the force be strong enough, the gaseous matter will pass through the fluid, and in part escape.

Fig. 2. Shews the lamp furnace disposed to produce the saline fusion; the chimney of glass shortened; the support D turned down; the capsule of platina or silver S placed on the ring very near the flame.

Labrador, || Lacsha.

Fig. 3. The same part of the apparatus, in which, instead of the capsule, a very thin and small crucible of platina T is substituted, and rests upon a triangle of iron wire placed on the ring.

Fig. 4. Exhibits the plan of this last disposition.

LABRADOR, a large lake which by its numerous branches forms a water communication through great part of the island of Cape Breton. In some maps it is called St Peter's Lake.—*Morse.*

LACERTA, in astronomy. See ASTRONOMY, n° 406. *Encycl.*

LACHAWANNOCK, a mountain in the north-western part of Pennsylvania.—*Morse.*

LACHAWANNOCK, a township in Luzerne county, Pennsylvania.—*ib.*

LACK, a township in Mifflin county, Pennsylvania.—*ib.*

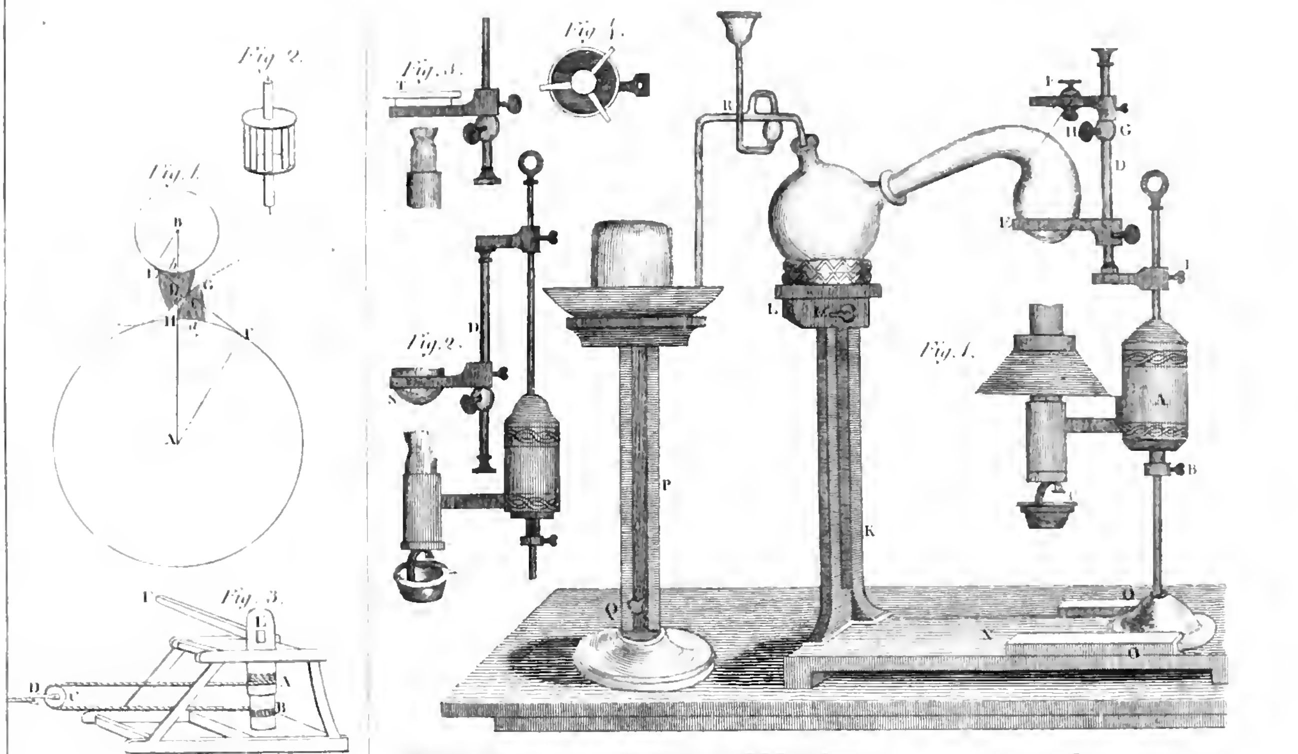
LACMUS, a dye stuff prepared by the Dutch from the LICHEN ROCELLA, which see in this *Supplement.*

LA COLE, a river which falls into lake Champlain from the W. 5 miles S. S. W. of Nut-Island, after a short course.—*Morse.*

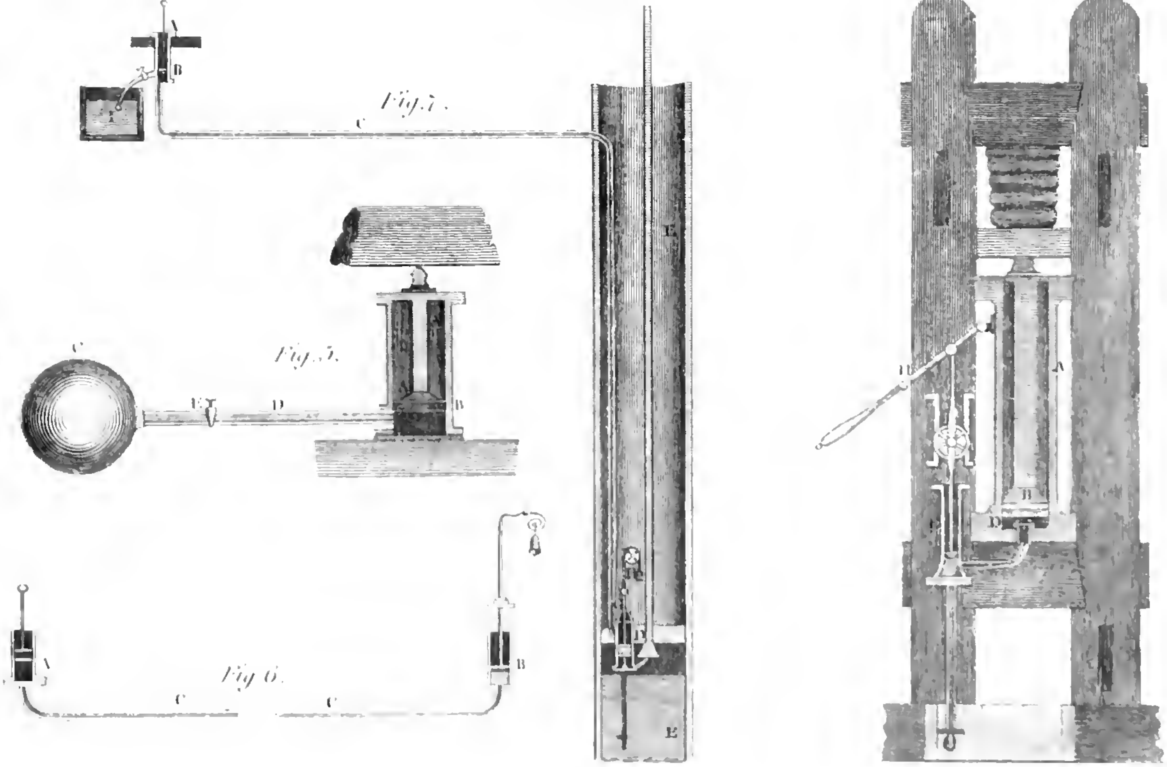
LACOMIC, a small creek which empties through the west bank of Alleghany river, in Pennsylvania, opposite Licking Creek, a short distance below fort Franklin.—*ib.*

LACSHA, the Indian name of the lac insect, which has been described in the *Encyclopædia* under the title COCCUS, *Species* 5. Since that article was published, a description of that insect, which is more to be depended upon, has been given to the world in the second volume of the Asiatic Researches. It is by Mr Roxburgh, surgeon on the Madras establishment, and was communicated to the Society by Dr James Anderson physician at Fort St George, who observes, that Mr Roxburgh's discovery will bring the lacsha as a genus into the class *Hemiptera* of Linnæus.

" Some pieces of very fresh-looking lac (says Mr Roxburgh) adhering to small branches of mimosa cinerea, were brought me from the mountains on the 20th of November 1789. I kept them carefully, and today, the 4th of December, fourteen days from the time they came from the hills, myriads of exceedingly minute animals were observed creeping about the lac and branches it adhered to, and more still issuing from small holes over the surface of the cells: other small and perforated excrescences were observed with a glass amongst the perforations, from which the minute insects issued, regularly two to each hole, and crowned with some very fine white hairs. When the hairs were rubbed off, two white spots appeared. The animals, when single, ran about pretty briskly, but in general they were so numerous as to be crowded over one another. The body is oblong, tapering most towards the tail, below plain, above convex, with a double, or flat margin: laterally on the back part of the thorax are two small tubercles, which may be the eyes: the body behind the thorax is crossed with twelve rings: legs six; feelers (antennæ) half the length of the body, jointed, hairy, each ending in two hairs as long as the antennæ: rump, a white point between two terminal hairs, which are as long as the body of the animal. The mouth I could not see. On opening the cells, the substance that they were formed of cannot be better described, with respect to appearance, than by saying it is like the transparent amber



MACHINERY



Lacsha. amber that beads are made of: the external covering of the cells may be about half a line thick, is remarkably strong, and able to resist injuries: the partitions are much thinner: the cells are in general irregular squares, pentagons and hexagons, about an eighth of an inch in diameter, and one quarter deep: they have no communication with each other. All those I opened during the time the animals were issuing, contained in one half, a small bag filled with a thick red jelly-like liquor, replete with what I take to be eggs: these bags, or utriculi, adhere to the bottom of the cells, and have each two necks, which pass through perforations in the external coat of the cells, forming the fore mentioned excrescences, and ending in some very fine hairs. The other half of the cells have a distinct opening, and contain a white substance, like some few filaments of cotton rolled together, and numbers of the insects themselves ready to make their exit. Several of the same insects I observed to have drawn up their legs, and to lie flat: they did not move on being touched, nor did they shew any signs of life with the greatest irritation.

"*December* 5. The same minute hexapedes continue issuing from their cells in numbers: they are more lively, of a deepened red colour, and fewer of the motionless sort. To-day I saw the mouth: it is a flattened point about the middle of the breast, which the little animal projects on being compressed.

"*December* 6. The male insects I have found to-day: a few of them are constantly running among the females most actively: as yet they are scarce more, I imagine, than one to 5000 females, but twice their size. The head is obtuse; eyes black, very large; antennæ clavated, feathered, about ⅘ds the length of the body: below the middle an articulation, such as those in the legs: colour between the eyes a beautiful shining green: neck very short: body oval, brown: abdomen oblong, the length of body and head: legs six: wings membranaceous, four, longer than the body, fixed to the sides of the thorax, narrow at their insertions, growing broader for ⅔ds of their length, then rounded; the anterior pair is twice the size of the posterior: a strong fibre runs along their anterior margins: they lie flat, like the wings of a common fly when it walks or rests: no hairs from the rump: it springs most actively to a considerable distance on being touched: mouth in the under part of the head: maxillæ transverse. To-day the female insects continue issuing in great numbers, and move about as on the 4th.

"*December* 7. The small red insects still more numerous, and move about as before: winged insects, still very few, continue active. There have been fresh leaves and bits of the branches of both *Mimosa Cinerea* and *Corinda* put into the wide mouthed bottle with them: they walk over them indifferently, without shewing any preference, or inclination to work or copulate. I opened a cell whence I thought the winged flies had come, and found several, eight or ten, more in it, struggling to shake off their incumbrances: they were in one of those utriculi mentioned on the 4th, which ends in two mouths, shut up with fine white hairs, but one of them was open for the exit of the flies; the other would no doubt have opened in due time: this utriculus I found now perfectly dry, and divided into cells by exceeding thin partitions. I imagine, before any of the flie made their escape, it might have contained about twenty. In these minute cells with the living flies, or whence they had made their escape, were small dry dark coloured compressed grains, which may be the dried excrements of the flies."

Ladies, || Lamanon.

LADIES *Island*, a small island of S. Carolina, near Port-Royal.—*Morse*.

LAGOON, one of the new discovered islands in the South Sea. Captain Cook visited it in 1769. S. lat. 18° 47′, W. long. from Greenwich 139° 28′.—*ib.*

LAGUNA, a town of Peru, situated on Amazon river, S. E. of the town of Borja.—*ib.*

LA GUAYRA, a maritime fortified town in Caraccas, a province of Terra Firma. This town, and Puerto Canela are the chief in the province.—*ib.*

LAMANON (Robert Paul), of the academy at Turin, correspondent of the Academy of Sciences at Paris, and member of the Museum in the same city, was born at Salon in Provence, in 1752, of an old and respectable family. Being a younger son, he was destined for the church, and sent to Paris to complete his theological studies; but getting acquainted with the philosophers (as they called themselves), he soon lost all relish for the study of theology, and devoted himself to the physical sciences, especially those of chemistry and mineralogy. Into the church, however, he got, and rose to the dignity of canon; but by the death of his father and elder brother, having acquired the right of directing his own future exertions, he hastened to quit a profession, towards which he felt no partiality.

A prelate, then in high favour at court, hearing of Lamanon's intention of quitting his office of canon, offered him a considerable sum, to induce him to resign in favour of one of his dependents. The chapter of Arles, replied our young ecclesiastic, did not sell me my benefice, I shall therefore restore it in the same manner that I received it. This conduct was certainly meritorious; and his eulogist *Ponce* mentions another trait of his character, which sets him in a very amiable point of view; he refused to accept of his paternal inheritance, otherwise than as an equal sharer with his brothers and sisters.

Thus liberated from the trammels of his former profession, Lamanon applied himself with uncommon ardour to study. Eager to raise the awful veil that conceals from our eyes the secrets of nature; persuaded, that even the greatest genius only amuses itself with false systems in the silence of a cabinet; convinced of the necessity of much and various observation, and of surprising Nature, as it were, in the very fact, in order to penetrate into the sublimity of her operations;—our young philosopher travelled through Provence and Dauphine, and scaled the Alps and Pyrenees. At the sight of these vast natural laboratories the bent of his mind burst forth instantaneously: he climbed to the summit of rocks, and explored the abyss of caverns, weighed the air, analysed specimens, and, in his ardent fancy, having attained the secrets of creation, he formed a new system of the world. On his return home, he applied with additional interest to the study of meteorology, mineralogy, natural philosophy, and the other branches of the history of nature.

Whilst he was meditating a visit to Paris for the purpose, as his eulogist expresses himself, of conversing with the luminaries of science, the inhabitants of the commune of Salon, having lost a cause against their lord, unanimously elected Lamanon, with whose integrity and abilities

abilities they were well acquainted, to go and solicit of the council the repeal of an unjust decree that had been obtained by partiality. The reply of the young philosopher on this occasion is an additional proof of his uncommon disinterestedness. "As I intend (said he) to go to Paris on business of my own, I cannot think of accepting your offer of 24 livres daily pay: a twelfth of this sum will cover the extraordinary expences of the journeys that I shall be obliged to make to Versailles on your account." He had the satisfaction of complete success in the business thus undertaken.

Having satisfied his curiosity in Paris, he went over to England. During the passage, though much incommoded by sea-sickness, and in imminent hazard of being overwhelmed by the tumbling waves of a very stormy sea, he caused himself to be tied to the main-mast, in order to contemplate at leisure so grand and fearful a spectacle. The bursts of thunder, the howling of the wind, the brilliancy of the lightning, the glancing of the spray which covered him every moment, these objects, so terrible to an ordinary man, threw him into a kind of mental intoxication, and he has often declared, that this day was the most exquisite of his whole life.

Convinced that the friendship of an eminent man elevates the soul, excites generous emulation, and becomes an additional stimulus to one whose delight is study, and whose most pressing want is an object on which to place his affection, Lamanon anxiously endeavoured to merit the regard of Condorcet, so well known by his talents, his impieties, his rebellion, and his misfortunes. This academician, justly considering that an apostate priest would be ready to join the conspiracy of the philosophists against the altar and the throne, received Lamanon with distinction, and at length admitted him to his most intimate friendship.

During the three successive years that Lamanon spent at Paris, he followed with care the track of those learned societies, of which he had been elected a member. He became at this period, together with Count de Gebelin, and some other philosophers and artists, one of the founders of the Museum, the greater part of the members of which are now reunited in the open society of sciences, letters, and arts, at Paris. Among the different papers of his that were read at various meetings of these societies, Ponce mentions with particular approbation what he calls *a notice* of Adam de Crapone, an eminent hydraulic engineer; a memoir on the Cretins; a memoir on the theory of the winds; a treatise on the alteration in the course of rivers, particularly the Rhone; and another on an enormous bone belonging to some cetaceous fish, that was dug up at Paris in laying the foundations of a house in the *rue Dauphine*. We have not seen these memoirs; but as their author was the friend of Condorcet, and fancied that he had attained the secrets of creation, we can easily conceive their tendency.

Having resolved again to revisit Switzerland and Italy, Lamanon first went to Turin, where he allied himself to the learned of that country. During his stay there, the brilliant novelty discovered by Montgolfier was occupying the attention of all the philosophers of Europe. Lamanon, desirous of making some experiments of this kind himself, ascended in a balloon from the city of Turin; but not perceiving in this discovery, which had at first highly interested him, an object of public utility; not foreseeing, that one day, on the plains of Fleurus, it would be the cause of rallying and establishing victory under the standards of France, he returned to his favourite occupations. Pursuing his route from Piedmont, he visited Italy, and returned by Switzerland, where he explored the Alps and ascended the summit of Mont Blanc: thence returning, loaden with the spoils of the countries which he had traversed, to Provence, he employed himself in the arrangement of the interesting fruits of his journey.

Of the scrupulous exactness of his observations, his eulogist gives the following instance. "Being convinced that the plain of Crau, divided by the channel of the Durance, had formerly been a lake, he wished to be absolutely assured of it. For this purpose he collected a specimen of each of the stones that are to be found in this vast plain; the number of these he found to amount to nineteen; then tracing the course of the river towards its head, near the frontiers of Savoy, he observed, that above each junction of the tributary streams with the Durance, the variety of pebbles diminished. Afterwards ascending the current of each of these smaller streams, he discovered on their banks the original rock of every pebble that overspreads the plain of Crau; thus incontestably proving, that this plain was anciently a lake formed by the waters of the Durance, and the streams that fall into it. If all philosophers (says our author) would conduct their examinations with equal precision, certain hypotheses, more brilliant than solid, would not find so many admirers; the charm of imagination, and the graces of style, would not so often encroach upon the imprescriptible rights of nature and truth."

To citizen Ponce this appears a demonstration of Lamanon's theory; but we cannot say that it does so to us. It may be a kind of proof, though not a demonstration, that in some convulsion of nature, stones had been rolled from the rock, and the plain of Crau, for a time, overflowed by the Durance; but it surely furnishes no evidence of that plain's having ever been *a permanent lake*. It *may* have been so; but such investigations as this will not guard philosophers against the delusions of favourite hypotheses.

It was at the time when Lamanon was preparing for the press his great work on the *Theory of the Earth*, that the French government conceived the vast project of completing the discoveries of Captain Cook: the academy of sciences was entrusted with the care of selecting men capable of rectifying our notions of the southern hemisphere, of improving hydrography, and advancing the progress of natural history. Condorcet, not knowing any one better qualified for this last department than Lamanon, wrote to him an invitation to share the danger and glory of this great enterprize. He accepted with eager transport a proposal that fulfilled his highest expectations, hastened to Paris, refused in a conference with the minister the salary that was offered, took a hasty leave of his friends, and departed for Brest.

On the 1st of August 1785, the armament set sail under the orders of La Perouse, an experienced commander, whose patriotism and scientific zeal were equal to his courage and good sense, and who had already merited the public confidence. The philosophers of all Europe were in expectation of those useful discoveries, the probable fruit of the zeal and talents employed in the

the expedition. The beginning of the voyage was prosperous. After various delays, and a multitude of observations, the two vessels arrived at the island of Maouna, one of the southern Archipelago. The impatient Lamanon, eager to assure himself of the truth of the published accounts of that country, debarked with Langle, the second in command. At the moment of their return, the natives, in hopes of booty, which had been excited by the number of presents that they had received, seized upon the boats, and attacked the party. The French were obliged to have recourse to arms for self-defence, and a desperate combat ensued. Lamanon, Langle, and ten of the two boats crews, fell a sacrifice to the fury of these barbarians.

Thus perished Lamanon, a young man ardent in the pursuits of science, to a high degree disinterested, and a zealot in what he thought the cause of liberty. He refused the salary which was allotted to him when he was appointed to this unfortunate expedition; for "if I do not feel satisfied (said he) on board the vessel; if my inclination or curiosity lead me to quit the ship,—I should be unhappy if any power in the world had acquired the right of preventing me."

According to M. Ponce, Lamanon seemed born to bring about a revolution in science: the depth of his ideas, the energy of his charrctar, the sagacity of his mind, united to that lively curiosity that can draw instruction out of any thing, and leaves nothing unexplored, would have led him to the most valuable discoveries. In person he was tall; and to great vivacity and expression of feature added prodigious strength and activity; in a word, Nature formed him with such care, as if she had intended him for one of those few who are destined to great exploits. His style was nervous, often poetical, without losing sight of propriety, and the language of sentiment might frequently be discovered in the midst of strong and striking expressions; and if he wanted the exquisitely dazzling polish of diction, he was eminently gifted with the precision of logical reasoning, which commands attention and enforces persuasion.

LA MOELLE, a large river in the N. W. part of Vermont. Its general course is westerly: after running about 75 miles, and receiving 14 lesser streams, it falls into Lake Champlain at Colchester, 5 miles north of the mouth of Onion river, and is of about the same magnitude.—*Morse.*

LAMBAYEQUE, a town on the road from Guayaquil to Lima in Peru, four leagues from Morrope. It consists of about 1,500 houses, built of different materials, but in general of bajareques or unburnt bricks. The meanest of the houses are the habitations of the Indians, which consist entirely of canes. The number of its inhabitants amounts to above 30,000, some of whom are opulent; but the generality are poor Spaniards, Mulattoes, Mestizoes, and Indians. It has a large and elegant stone church. It is the residence of a corregidor, having under his jurisdiction, besides many other towns, that of Morrope. One of the two officers of the revenue appointed for Truxillo, also resides here. S. lat. 6° 41′ 37″, W. long. 76° 15′.—*Ib.*

LAMP (see *Encycl.*) is an instrument comprising three articles which demand our attention, *viz.* the oil, the wick, and the supply of air. It is required that the oil should be readily inflammable, without containing any fetid substance which may prove offensive, or mucilage, or other matter, to obstruct the channels of the wick. Mr Nicholson says,* that he knows of no process by which oils can be meliorated for this purpose, except that of washing with water containing acid or alkali. Either of these is said to render the mucilage of animal oils more soluble in water; but acid is to be preferred, because it is less disposed to combine with the oil itself. Perhaps oil might be deprived of all fetid smell in burning, by being made to pass through Collier's filtering apparatus, described under the word FILTER in this *Suppl.*

* Journal, vol. i. n° 2.

The office of the wick appears to be chiefly, if not solely, to convey the oil by capillary attraction to the place of combustion. As the oil is consumed and flies off, other oil succeeds, and in this way a continued current of oil and maintenance of the flame are effected. But as the wicks of lamps are commonly formed of combustible matter, it appears to be of some consequence what the nature and structure of this material may be. It is certain that the flame afforded by a wick of rush differs very considerably from that afforded by cotton; though perhaps this difference may, in a great measure, depend on the relative dimensions of each. And if we may judge from the different odour in blowing out a candle of each sort, there is some reason to suspect that the decomposition of the oil is not effected precisely in the same manner in each. We have also some obscure accounts of prepared wicks for lamps, which are stated to possess the property of facilitating the combustion of very impure oils, so that they shall burn for many hours without smoke or smell.

The economical wicks of M. Leger, concerning which a report was presented to the Academy at Paris in 1782 by Condorcet, Lavoisier, and De Milly, were composed of cotton of different sizes and forms, namely, round and flat, according to the use they were intended to serve. They were covered with a fat substance, of a smell not disagreeable, but feebly aromatic. From the trials of these commissaries it was ascertained: 1. That they afforded a clearer flame, with less undulation. 2. That they consumed somewhat less oil; and, 3. That they possessed the remarkable property of affording neither smell nor smoke, however common the oil made use of. When using a lamp with a flat wick, we have ourselves found a piece of clean cotton stocking answer the purpose better than the cotton wicks which are sold in the shops.

The access of air is of the last importance in every process of combustion. When a lamp is fitted up with a very slender wick, the flame is small, and of a brilliant white colour: if the wick be larger, the combustion is less perfect, and the flame is brown: a still larger wick not only exhibits a brown flame, but the lower internal part appears dark, and is occupied by a portion of volatilised matter, which does not become ignited until it has ascended towards the point. When the wick is either very large or very long, part of this matter escapes combustion, and shews itself in the form of coal or smoke. The different intensity of the ignition of flame, according to the greater or less supply of air, is remarkably seen by placing a lamp with a small wick beneath a shade of glass not perfectly closed below, and more or less covered above. While the current of air through the glass shade is perfectly free, the flame is white; but in proportion as the aperture above is diminished, the flame becomes brown, long, wavering, and smoky; it instantly

inſtantly recovers its original whiteneſs when the opening is again enlarged. The inconvenience of a thick wick has been long ſince obſerved, and attempts made to remove it; in ſome inſtances, by ſubſtituting a number of ſmall wicks inſtead of a larger; and in others, by making the wick flat inſtead of cylindrical. The moſt ſcientific improvement of this kind, though perhaps leſs ſimple than the ordinary purpoſes of life demand, is the well known lamp of Argand, deſcribed in the *Encyclopædia*.

Much has been ſaid of this lamp, and great praiſe laviſhed on the inventor. It cannot indeed be denied that it was a very pretty invention, nor have we the ſlighteſt wiſh to detract from the merit of M. Argand; but truth compels us to ſay, that the ſame thought had occurred to others as early as to him, and that lamps had been conſtructed on his principles long before he had publiſhed an account of his lamp to the world (A).

Many ingenious men have endeavoured to determine the moſt economical method of lighting up large halls and workhouſes by means of different lamps and candles; and when the expence of tallow and oil is conſidered, it will be admitted that they could not employ their time in a manner more beneficial to the poor and the induſtrious. Among others, Count Rumford and M. Haſſenfratz have turned their attention to this ſubject; and the reſults of their inveſtigations are worthy of notice. To the Count, a method occurred for meaſuring the relative quantities of light emitted by lamps of different conſtructions, which is at once ſimple and accurate. It is as follows:

Let the two burning lamps, or other lights to be compared, be called A and B; and let them be placed at equal heights upon two light tables, or moveable ſtands, in a darkened room; let a ſheet of clean white paper be equally ſpread out, and faſtened upon the wainſcot, or ſide of the room, at the ſame height from the floor as the lights; and let the lights be placed over-againſt this ſheet of paper, at the diſtance of ſix or eight feet from it, and ſix or eight feet from each other, in ſuch a manner, that a line drawn from the centre of the paper, perpendicular to its ſurface, ſhall biſect the angle formed by lines drawn from the lights to that centre; in which caſe, conſidering the ſheet of paper as a plane ſpeculum, the one light will be preciſely in the line of reflection of the other.

This may be eaſily performed, by actually laying a piece of a looking-glaſs, ſix or eight inches ſquare, flat upon the paper, in the middle of it; and obſerving, by means of it, the real lines of reflection of the lights from that plane, removing it afterwards, as ſoon as the lights are properly arranged. When this is done, a ſmall cylinder of wood, about $\frac{1}{4}$th of an inch in diameter, and ſix inches long, muſt be held in a vertical poſition, about two or three inches before the centre of the ſheet of paper, and in ſuch a manner, that the two ſhadows of the cylinder, correſponding to the two lights, may be diſtinctly ſeen upon the paper.

If theſe ſhadows ſhould be found to be of unequal denſities, which will almoſt always be the caſe, then that light whoſe correſponding ſhadow is the denſeſt muſt be removed farther off, or the other muſt be brought nearer to the paper, till the denſities of the ſhadows appear to be exactly equal; or, in other words, till the denſities of the rays from the two lights are equal *at the ſurface of the paper*; when, the diſtances of the lights from the centre of the paper being meaſured, the ſquares of thoſe diſtances will be to each other as the real intenſities of the lights in queſtion at their ſources.

If, for example, the weaker light being placed at the diſtance of four feet from the centre of the paper, it ſhould be found neceſſary, in order that the ſhadows may be of the ſame denſity, to remove the ſtronger light to the diſtance of eight feet from that centre, in that caſe, the real intenſity of the ſtronger light will be to that of the weaker as 8^2 to 4^2; or as 64 to 16; or 4 to 1: and ſo for any other diſtances.

It is well known, that when any quality proceeds from a centre in ſtraight lines in all directions, like the light emitted by a luminous body, its intenſity at any given diſtance from that centre will be as the ſquare of that diſtance inverſely; and hence it is clear, that the intenſities of the lights in queſtion, at their ſources, muſt be to each other as the ſquares of their diſtances from that given point *where their rays uniting are found to be of equal denſity*. For, putting $x =$ the intenſity of B, if P repreſents the point where the rays from A and from B meeting are found to be of equal denſity or ſtrength, and if the diſtance of A from P be $= m$, and the diſtance of B from the ſame point P $= n$; then, as the intenſity of the light of A at P is $= \frac{x}{m^2}$, and the intenſity of the light of B at the ſame place $= \frac{y}{n^2}$, and as it is $\frac{x}{m^2} = \frac{y}{n^2}$ by the ſuppoſition, it will be $x : y :: m^2 : n^2$.

That the ſhadows being of equal denſity at any given point, the intenſities of the illuminating rays muſt of neceſſity be equal at that point alſo, is hence evident, that the total abſence of light being perfect blackneſs, and the ſhadow correſponding to one of the lights in queſtion being deeper or fainter, according as it is more or leſs enlightened by the other, when the ſhadows are equal, the intenſities of the illuminating rays muſt be equal likewiſe.

In removing the lights, in order to bring the ſhadows to be of the ſame denſity, care muſt be taken to recede from, or advance towards, the centre of the paper in a ſtraight line, ſo that the one light may always be found exactly in the line of reflection of the other; otherwiſe the rays from the different lights falling upon the paper, and conſequently upon the ſhadows, at different angles, will render the experiment fallacious.

When the intenſity of one ſtrong light is compared with the intenſities of ſeveral ſmaller lights taken together, the ſmaller lights ſhould be placed in a line perpendicular to a line drawn to the centre of the paper, and as near to each other as poſſible; and it is likewiſe neceſſary to place them at a greater diſtance from the paper than when only ſingle lights are compared.

In all caſes, it is abſolutely neceſſary to take the greateſt care that the lights compared be properly trimmed, and that they burn clear and equally, otherwiſe the

(A) One of theſe was employed in the college of Glaſgow, by the lecturer on chemiſtry, ſo long ago as 1766.

Lamp.

the results of the experiments will be extremely irregular and inconclusive. It is astonishing what a difference there is in the quantities of light emitted by the same candle, when it burns with its greatest brilliancy, and when it has grown dim for want of snuffing. But as this diminution of light is progressive, and as the eye insensibly conforms to the quantity of light actually present, it is not always taken notice of by the spectators; it is nevertheless very considerable, in fact, as will be apparent to any one who will take the trouble to make the experiment; and so great is the fluctuation in the quantity of light emitted by burning bodies, lamps, or candles, in all cases, even under the most favourable circumstances, that this is the source of the greatest difficulties which our author met with in determining the relative intensities of lights by the method here proposed.

To ascertain by this method the comparative densities, or intensities, of the light of the moon and of that of a candle, the moon's direct rays must be received upon a plane white surface, at an angle of incidence of about 60°, and the candle placed in the line of the reflection of the moon's rays from this surface; when the shadows of the cylinder, corresponding to the moon's light and to that of the candle, being brought to be of equal density, by removing the candle farther off, or bringing it nearer to the centre of the white plane, as the occasion may require, the intensity of the moon's light will be equal to that of the candle *at the given distance of the candle from the plane.*

To ascertain the intensity of the light of the heavens, by day or by night, this light must be let into a darkened room through a long tube blackened on the inside, when its intensity may be compared with that of a candle or lamp by the method above described.

The Count, however, has contrived an apparatus for ascertaining the intensity of the sun's light, compared with the light emitted by an artificial illuminator, with much greater accuracy than it can be done by this simple method. That apparatus we shall describe under the title PHOTOMETER in this *Supplement*; and in the mean time we proceed to lay before our readers the results of his experiments as they relate to economy in the production of artificial light.

1
Of the relative quantities of oil consumed, and of light emitted, by an Argand's lamp, and by a lamp on the common construction, with a riband wick.

The brilliancy of Argand's lamp is not only unrivalled, but the invention is in the highest degree ingenious, and the instrument useful for many purposes; but still, to judge of its real merits, as an illuminator, it was necessary to know whether it gives more light than another lamp *in proportion to the oil consumed.* This point he determined in the following manner:

Having placed an Argand's lamp, well trimmed, and burning with its greatest brilliancy, before his *photometer*, and over against it a very excellent common lamp, with a riband wick about an inch wide, and which burnt with a clear, bright flame, without the least appearance of smoke, he found the intensities of the light emitted by the two lamps to be to each other as 17956 to 9063; the densities of the shadows being equal when, the Argand's being placed at the distance of 134 inches, the common lamp was placed at the distance of 95,2 inches, from the field of the photometer.

Both lamps having been very exactly weighed when they were lighted, they were now (without being removed from their places before the photometer) caused to burn with the same brilliancy just 30 minutes; they were then extinguished and weighed again, and were found to have consumed of oil, the Argand's lamp $\frac{253}{8192}$, and the common lamp $\frac{163}{8192}$, of a Bavarian pound.

Now, as the quantity of light produced by the Argand's lamp, in this experiment, is to the quantity produced by the common lamp as 17956 to 9063, or as 187 to 100, while the quantity of oil consumed by the former is to that consumed by the latter only in the ratio of 253 to 163, or as 155 to 100, it is evident that the quantity of light produced by the combustion of a given quantity of oil in an Argand's lamp is greater than that produced by burning the same quantity in a common lamp, in the ratio of 187 to 155, or as 100 to 85.

The saving, therefore, of oil which arises from making use of an Argand's lamp instead of a common lamp, in the production of light, is evident; and it appears, from this experiment, that that saving cannot amount to less than fifteen *per cent.* How far the advantage of this saving may, under certain circumstances, be counterbalanced by inconveniences that may attend the making use of this improved lamp, our author does not pretend to determine.

2
Of the relative quantities of light emitted by an Argand's lamp and by a common wax candle.

The Count made a considerable number of experiments to determine the relative quantities of light emitted by an Argand's lamp and a common wax candle; and the general result of them is, that a common Argand's lamp, burning with its usual brightness, gives about as much light as nine good wax candles; but the sizes and qualities of candles are so various, and the light produced by the same candle so fluctuating, that it is very difficult to ascertain, with any kind of precision, what a common wax-candle is, or how much light it ought to give. He once found that his Argand's lamp, when it was burning with its greatest brilliancy, gave twelve times as much light as a good wax candle $\frac{3}{4}$ths of an inch in diameter, but never more.

3
Of the fluctuations of the light emitted by candles.

To determine to what the ordinary variations in the quantity of light emitted by a common wax-candle might amount, he took such a candle, and, lighting it, placed it before the photometer, and over against it an Argand's lamp, which was burning with a very steady flame; and measuring the intensity of the light emitted by the candle from time to time, during an hour, the candle being occasionally snuffed when it appeared to stand in need of it, its light was found to vary from 100 to about 60. The light of a wax-candle of an inferior quality was still more unequal; but even this was but trifling, compared to the inequalities of the light of a tallow-candle.

An ordinary tallow candle, of rather an inferior quality, having been just snuffed, and burning with its greatest brilliancy, its light was as 100; in eleven minutes it was but 39; after eight minutes more had elapsed, its light was reduced to 23; and in ten minutes more, or twenty-nine minutes after it had been last snuffed, its light was reduced to 16. Upon being again snuffed, it recovered its original brilliancy, 100.

4
Of the relative quantities of bees-wax, tallow, olive-oil, rape-oil, and spermaceti-oil, consumed in the production of light.

In order to ascertain the relative quantities of bees wax and of olive-oil consumed, in the production of light, the Count proceeded in the following manner: Having provided an end of a wax candle of the best quality, ,68 of an inch in diameter, and about four inches in length, and a lamp with five small wicks, which

Lamp. he had found upon trial to give the same quantity of light as the candle, he weighed very exactly the candle and the lamp filled with oil, and then, placing them at equal distances (forty inches) before the field of the photometer, he lighted them both at the same time; and, after having caused them to burn with precisely the same degree of brightness *just one complete hour*, he extinguished them both, and, weighing them a second time, he found that 100 parts of wax and 129 parts of oil had been consumed.

Hence it appears, that the consumption of bees wax is to the consumption of olive-oil, in the production of the same given quantity of light, as 100 is to 129.

In this experiment no circumstance was neglected that could tend to render the result of it conclusive; care was taken to snuff the candle very often with a pair of sharp scissars, in order to make it burn constantly with the same degree of brilliancy; and the light of the lamp was, during the whole time, kept in the most exact equilibrium with the light of the candle, which was easily done by occasionally drawing out, a little more or less, one or more of its five equal wicks. These wicks, which were placed in a right line, perpendicular to a line drawn from the middle wick to the middle of the field of the photometer, were about $\frac{1}{10}$th of an inch in diameter each, and $\frac{1}{4}$th of an inch from each other; and, when they were lighted, their flames united into one broad, thin, and very clear, white flame, without the least appearance of smoke.

In order to ascertain the relative consumption of olive-oil and rape oil, in the production of light, two lamps, like that just described, were made use of; and, the experiment being made with all possible care, the consumption of olive-oil appeared to be to that of rape-oil, in the production of the same quantity of light, as 129 is to 125.

The experiment being afterwards repeated with olive-oil and very pure linseed-oil, the consumption of olive-oil appeared to be to that of linseed oil as 129 to 120.

The experiment being twice made with olive-oil and with a tallow-candle; once when the candle, by being often snuffed, was made to burn constantly with the greatest possible brilliancy, and once when it was suffered to burn the whole time with a very dim light, owing to the want of snuffing; the results of these experiments were very remarkable.

When the candle burnt with a clear, bright flame, the consumption of the olive-oil was to the consumption of the tallow as 129 is to 101; but when the candle burnt with a dim light, the consumption of the olive-oil was to the consumption of the tallow as 129 is to 229. So that it appeared, from this last experiment, that the tallow, instead of being nearly as productive of light in its combustion as bees wax, as it appeared to be when the candle was kept constantly well snuffed, was now, when the candle was suffered to burn with a dim light, by far less so than oil.

But this is not all; what is still more extraordinary is, that the very same candle, burning with a long wick, and a dim light, actually consumed *more tallow* than when, being properly snuffed, it burnt with a clear, bright flame, and gave near *three times as much light*.

To be enabled to judge of the relative quantities of light actually produced by the candle in the two experiments, it will suffice to know, that in order to counterbalance this light at the field of the *photometer*, it required, in the former experiment, the consumption of 141 parts, but in the latter only the consumption of 64 parts, of olive-oil. But in the former experiment 110, and in the latter 114, parts of tallow were actually found to be consumed. These parts were 8192ths of a Bavarian pound. Lamp.

From the results of all the foregoing experiments, it appears that the relative expence of the undermentioned inflammable substances, in the production of light, is as follows:

	Equal Parts in Weight.
Bees wax. A good wax-candle, kept well snuffed, and burning with a clear, bright flame, . . .	100
Tallow. A good tallow candle, kept well snuffed, and burning with a bright flame, ...	101
The same tallow-candle, burning very dim for want of snuffing,	229
Olive-oil. Burnt in an Argand's lamp, . .	110
The same burnt in a common lamp, with a clear, bright flame, without smoke, ...	129
Rape-oil. Burnt in the same manner, . .	125
Linseed-oil. Likewise burnt in the same manner, ...	120

With the foregoing table, and the prices current of the therein mentioned articles, the relative prices of light produced by those different materials may very readily be computed.

In the year 1795, Mr J. H. Hassenfratz was employed by the French government to make a series of experiments to determine the most economical method of procuring light from the different combustible substances usually employed for that purpose. The materials of his experiments were, wax, spermaceti, and tallow candles, fish-oil, oil of colesfeed, and of poppy seeds. In using these oils, both the Argand and common lamps were employed. The wicks of the latter were round, containing thirty-six cotton threads. The tallow and spermaceti candles were mould, six to the pound. The wax candles five to the pound. Mr Hassenfratz used the same method with Count Rumford for determining the comparative intensity of the lights.

Count Rumford, as we have seen, used the Argand lamp as a standard for comparison; but as the intensity of its light varies according to the height of the wick, Mr Hassenfratz preferred a wax-candle, making use of it soon after it was lighted. When two luminous bodies, of different intensities, are put in comparison with each other, the shadows are of two colours. That from the weakest light is blue, and from the strongest, red. When the lights of two different combustible bodies are compared, they are either red or blue in a compound ratio of the colour and intensity. Thus in comparing the shadows from different luminous bodies, they will be red or blue respectively, in the following order:

Light of the sun.
——- of the moon.
——- of Argand lamps.
——- of tallow-candles.
——- of wax ditto.

——of

Lamp.

——— of spermaceti ditto.
——— of common lamps.

That is to say, when a body is illuminated by the sun and by any other luminous substance, the shadow of the former is red, and of the latter, blue. In like manner, the shadow from an Argand lamp is red, when placed by that of a tallow candle, which is blue.

The following table will shew, according to Mr Hassenfratz, the proportional distance that different luminous bodies should be placed at to produce an equally intense shadow from the same object. The second column gives the proportional intensity of each light, which is known to be in proportion to the squares of the distances of luminous bodies giving the same depth of shadow. The third column shews the quantity of combustible matter consumed in the hour by each mode of giving light, which Mr Hassenfratz calculates from the average of many repeated experiments.

		Distance.	Intensity.	Quantity consumed per hour.	Quantity required for equal intensities.
Argand lamps with	Oil of poppy-seed	10	10.000	23	23
	— of fishes	10	10.000	23.77	23.77
	— of cole-seed	9.246	8.549	14.18	16.59
Common lamps with	Oil of cole-seed	6.774	4.588	8.81	19.2
	— of fishes	6.524	4.556	9.14	20.06
	— of poppy-seed	5.917	3.501	7.05	20.14
Spermaceti candle		5.917	3.501	9.23	26.37
Old tallow-candle		5.473	2.995	7.54	25.17
New ditto		5.473	2.995	8.23	27.48
Wax candle		4.275	1.827	9.54	53

The relative quantity of combustible matter required to produce *equal* lights at equal distances, may be obtained by a simple rule of proportion from the above data. Thus, if a given intensity of light, expressed by 3.501, has been produced by a consumption of 9.23 of spermaceti in the hour, the same luminous body will produce a light of 10.000, by consuming in the same time a quantity of spermaceti $= \frac{10\,000 \times 9\,23}{3\,501} = 26.37$.— Therefore we may add to the table a fourth column, expressing the quantity of combustible which each body must consume to produce a light of 10.000.

From what has been laid down, it will also appear that the number of lights required to produce a given light, will be as follows: To produce a light equal to 100 Argand lamps, burning poppy-seed oil, it will require

100 Argand lamps with fish-oil
117 Ditto do. with cole-seed oil
218 Common lamps with cole seed oil
219 Ditto do. with fish-oil
285 Ditto do. with poppy-seed oil
285 Spermaceti candles
333 Tallow ditto
546 Wax ditto.

Mr Hassenfratz next takes notice of the comparative price of these articles; by which he finds, that in Paris the most expensive light is that produced from wax-candles; and the most *economical*, that from oil of cole-seed, burned in Argand lamps.

Lamps, || Lancaster.

The chief difference between the Argand and common lamp is, that in the latter much of the oil is volatilized without combustion, and hence the unpleasant smell which it produces; whereas in the former, the heat is so great at the top of the wick, that all the oil is decomposed in passing through, the disposition of the wick allowing the free access of air to assist combustion. It should therefore follow, that the Argand lamp consumes less fuel to produce a given light than the common lamp, and this, as we have seen, is the opinion of Count Rumford. Yet (Mr Hassenfratz observes) there are two circumstances that prevent the full effect of the complete combustion in the Argand lamp. The one is, that the glass cylinder absorbs a part of the rays of light as they pass through; the other, that the column of light proceeding from the inner surface of the wick, is, in part, lost, by being obliged to pass through that from the outer surface. Count Rumford allows the first cause of diminution of light, and estimates it at .1854, but not the latter. The author of this memoir, in repeating Count Rumford's experiments, asserts, that when two candles are placed so that the light of the one is obliged to pass through that of the other, the sum of the light so produced is not so strong as when they are placed side by side; for in the first case, a part of the hindmost light is absorbed by the foremost.

LAMPA, a jurisdiction of Cusco, in Peru, in S. America. It begins about 30 leagues south of the city of Cusco; and is the principal province included under the name of Callao. Here are excellent pastures and silver mines. The air is very cold.—*Morse.*

LAMPETER, a township in Lancaster county, Pennsylvania.—*ib.*

LANCASHIRE. In the account which we have given of that county in the *Encyclopædia*, an obliging correspondent has pointed out to us some mistakes. He assures us, that the sea coast, where we understood the atmosphere to be loaded with such exhalations as produce malignant and intermitting fevers, is remarkably healthy; and he speaks from experience, having lived on that coast for forty years. He assures us likewise, that the Duke of Bridgewater's inland navigation was begun soon after, if not before, the year 1756, and that he (the writer), so early as 1764, was one of a party who sailed up the sough or edit a considerable way to see how the coals were worked. The same correspondent has pointed out a few mistakes in our account of

LANCASTER, the capital of the county. "That town (he says) carries on no trade whatever with North America, but a very considerable one with Jamaica and the other West India islands, in vessels of from 100 to 500 tons burthen. It exports to these islands all such British manufactures as they have occasion for, Irish linens, and salted provisions of all kinds, such as Irish beef, pork, butter, &c. It trades also to the Baltic, Portugal, Hamburgh, &c. to a large amount; and some of its ships with their cargoes have of late been worth from L.60 to L.80,000 sterling. It has, however, no communication by water with the rivers Mersey, Dee, &c. as we have said; the canal reaching as yet no farther than to near Preston in Lancashire." The communication

cation with these rivers is indeed intended to be completed; but whether the scheme be practicable is, according to our correspondent, very uncertain.

LANCASTER, a bay or sound on the western coast of Sir Thomas Smith's bay. The southernmost part lies in N. lat. 74° 20′. The most northerly is called Alderman Jonas's Sound, and lies in N. lat. 76°.—*Morse.*

LANCASTER, a populous and wealthy county in the interior part of Pennsylvania, extending south to the Maryland line. It is about 42 miles square, is divided into 25 townships, and contains 566,240 acres of land, and 36,147 inhabitants, including 348 slaves. The lands in this county are rich and well cultivated. The hills in the northern parts abound with iron ore; for the manufacturing which, 2 furnaces and 8 forges have been erected. The furnaces manufacture about 1,200 tons of pigs and nearly that number of bar-iron annually. Copper and lead have also been found here. Chief town, *Lancaster.*—*ib.*

LANCASTER, a county of Virginia, bounded east by Chesapeak Bay, and S. W. by Rappahannock river. It is about 40 miles long, and 15 broad, and contains 5,638 inhabitants, of whom 3,336 are slaves.—*ib.*

LANCASTER, a county of Camden district, S. Carolina, lying on Lynche's creek, and Wateree river. It contains 6,302 inhabitants, of whom 4,684 are whites, and 1,370 slaves.—*ib.*

LANCASTER, a post-town of S. Carolina, 36 miles from Camden, and 47 from Charlotte, N. Carolina.—*ib*

LANCASTER, a very pleasant post-town in Worcester county, Massachusetts, the oldest in the county, having been settled in 1645, and incorporated in 1653. It is situated in a branch of Nashua river, which empties into the Merrimack. It is 35 miles W. N. W. of Boston, 4 miles W. of Bolton, and 14 N. by E. of Worcester. The lands of the township of Lancaster, and those of Sterling on the S. W. are part of the tract called *Nashawogg* by the Indians. The pleasantness of this town has invited many persons of education and fortune to reside here. In the N. easterly part of Lancaster, there is a valuable, and perhaps inexhaustible slate pit, furnishing slates for houses, and excellent stones for tombs and graves. No slates equal to these have yet been discovered in the United States. These are sent to Boston, and exported to New-York, Virginia, &c. Two principal branches of Nashua river, over which are 9 large bridges, water this town, and have on their banks excellent intervale land. Cumberry pond in this town is observed to rise as much as two feet, just before a storm; and Sandy pond rises in a dry season.—*ib.*

LANCASTER, a township in Grafton county, New-Hampshire, on the east bank of Connecticut river, about 41 miles above Hanover. It was incorporated in 1763. In 1775 it contained 61 inhabitants, and in 1790—161.—*ib.*

LANCE ISLES, on the N. W. coast of N. America, lie off Cape Scott, which is the southern point at the mouth of Pintard's Sound, opposite to Point Disappointment. There is a narrow channel between the largest isle and the cape.—*ib.*

LANDAFF, a township in Grafton county, New-Hampshire. It was incorporated in 1774, and contains 292 inhabitants.—*ib.*

LAND'S HEIGHT, in North America, is the high ground on the chain of lakes between Lake la Pluie and Lake Superior, where there is a portage of 7 miles. It is 80 miles east of the grand portage from the west end of Lake Superior.—*ib.*

LANGDON, a township in Cheshire county, New-Hampshire, incorporated in 1787, and contains 244 inhabitants.—*ib.*

LANESBOROUGH, a township in Berkshire county, Massachusetts, N. by E. of Hancock, 12 miles N. by W. of Lenox, and 144 W. by N. of Boston. It affords a quarry of good marble, and contains 2,142 inhabitants.—*ib.*

LANSINBURGH, *(city)* in the township of Troy, Rensselaer county, New-York, is very pleasantly situated on the E. bank of Hudson's river, opposite one of the mouths of the Mohawk, and contains about 200 dwelling houses, a brick church, the joint property of the Dutch and Presbyterian congregation, a court-house, gaol, and an academy, incorporated in 1796. Here is a library company which was incorporated in 1775. It is a very flourishing place, situated on a plain at the foot of a hill, from the top of which is a most delightful prospect. A few years ago there was but one stage between this town and Albany; now (1796) 20 stages daily pass and repass between the neighbouring towns of Lansinburgh, Troy, Waterford, and Albany; and the average number of passengers is said to exceed 150. It is 9 miles north of Albany, 3 above Troy, 175 north of New-York, and 270 N. N. E. of Philadelphia.—*ib.*

LANTERN (See *Encycl.*). Sir George Staunton informs us, that of the Chinese lanterns, some were such as we have described, *viz.* composed of thin silk gauze, painted or wrought in needle-work with figures of birds, insects, flowers, or fruit, and stretched on neat frames of wood. Others, however, were very different, being entirely made of horn. These were so thin and transparent, that they were taken at first for glass; a material to which, for this purpose, the horn is preferred by the Chinese, as cheaper, lighter, less liable to accident, and, in case of accident, more easily repaired; many of them were about two feet in the diameter, and in the form of a cylinder, with the ends rounded off, and the edges meeting in the point to which the suspending cords were tied. Each lantern consisted of an uniform piece of horn, the joints, or seams, being rendered invisible by an art found out by the Chinese; among whom, the vast number of such lanterns used in their dwelling houses and temples, as well as on the occasions of their festivals and processions, have led to many trials for improving their construction. The horns generally employed are those of sheep and goats. The usual method of managing them, according to the information obtained upon the spot, is to bend them by immersion in boiling water, after which they are cut open and flattened; they then easily scale, or are separated into two or three thin laminæ or plates. In order that these plates should be made to join, they are exposed to the penetrating effect of steam, by which they are rendered almost perfectly soft. In this state the edges of the pieces to be joined are carefully

scraped

fcraped and flanted off, fo as that the pieces overlapping each other fhall not together exceed the thicknefs of the plate in any other part. By applying the edges, thus prepared, immediately to each other, and preffing them with pincers, they intimately adhere, and incorporating, form one fubftance, fimilar in every refpect to the other parts; and thus uniform pieces of horn may be prepared to almoft any extent. It is a contrivance little known elfewhere, however fimple the procefs appears to be; and perhaps fome minute precautions are omitted in the general defcription, which may be effential to its complete fuccefs.

Such lanterns as thefe would be very proper for military ftore houfes; and Rochon of *the National Inftitute* was employed, fince the commencement of the prefent war, to make them, if he could, for the marine ftorehoufes of France. While he was thus engaged, however, it occurred to him, that he might fupply the preffing wants of the navy without horn, merely by filling up the interftices of wire-cloth with fine tranfparent glue. In carrying this thought into execution, he at firft tinned the iron wires of the fieve cloth he made ufe of; but afterwards found it more convenient, in every refpect, to give it a flight coating of oil paint to preferve it from ruft. The glue he made ufe of was afforded by boiling the clippings of parchment with the air-bladders and membranes of fea fifh; materials which he ufed, not from any notion that they were preferable to ifinglafs, but becaufe they were the cheapeft he could procure. He added the juice of garlic and cyder to his compofition, in fuch proportions as he found to communicate great tenacity, and fomewhat more of tranfparence than it would have poffeffed without them. Into this tranfparent and very pure glue or fize he plunged his wire cloth, which came out with its interftices filled with the compound. It is requifite that the fize fhould poffefs a determinate heat and confiftence, concerning which experience alone muft guide the operator.

When this prepared wire cloth is fixed in the lantern, it muft be defended from moifture by a coating of pure drying linfeed oil; but even in this ftate it is not fit to be expofed to the weather. The eafe with which thefe lanterns are repaired in cafe of accident, by a flight coating of glue, is pointed out as a great advantage by the inventor; who likewife informs us, that they were ufed in the expedition to Ireland as fignal lanterns, though contrary to his wifhes.

LAPIS Fungifer, a fpecies of earth found near Rome, Naples, and Florence, of which the following account is taken from the *New Tranfactions of the Royal Academy of Sciences at Stockholm* for the year 1797: Near Naples the lapis fungifer is found in the chalkhills like a white ftalactites, intermixed with a great many fine roots of fhrubs; and near Florence there is a fpecies of it, confifting of hardened turf, which is dug up near volcanoes. The author made experiments with a piece procured from Italy, and found that 100 parts contain from 45 to 46 filiceous earth, 23 argillaceous earth, 7 calcareous earth, and 20 calx of iron, with fome white magnefia and vegetable alkali. It is well known, that when this friable fpecies of ftone is preferved in cellars and moiftened with water, it produces abundance of eatable muſhrooms, which in Italy are highly efteemed and brought to the firft tables. Hence the origin of its name.

LAPIS LAZULI, a fmall rock furrounded with and almoft covered by the fea on the coaft of Nova-Scotia. It is about 2 miles from Menano Ifland, and fhews the paffage into St John's river.—*Morse.*

LARDIZABALA, a new genus of plants belonging to the *dioecia hexandria* of Linnæus. It is a native of Chili, and is thus defcribed in Peroufe's Voyage, from drawings fent to France by La Martiniere. The leaves are alternate, on footftalks inflated at their bafe. Each leaf is bi-ternate, that is to fay, it is divided into three leaflets, each of which is again fubdivided into three oval fharp-pointed folioles, which, when young, are entire, but afterwards become obfcurely lobed. The flowers, difpofed in fimple and pendent clufters, grow towards the top of the ftem and of the branches in the axillæ of the leaves. The plant is diœcious. At the bafe of each clufter of bloffoms are two fmall, rounded, oval, floral leaves.

Male Flower.—*Calyx* formed of fix expanding leaves, oblong oval, and obtufe, of which the three outermoft are the largeft. *Corolla* compofed of fix fharp lanceolated petals, oppofite to, and fhorter than, the leaves of the calyx. A cylinder rifes from the centre of the flower of the length of the petals, terminated by fix oblong bilocular anthers, which open from below.

Female Flower.—*Calyx*, fimilar to that of the male flower, but larger. *Corolla* inferted beneath the piftil, compofed of fix petals, rarely entire, but generally bifid or trifid at their fummit: fhorter than the leaves of the calyx. *Stamina* fix, having the fame infertion as the corolla; filaments diftinct, broad, very fhort, furrounding the piftil; *anthers*, fix, upright, oblong, acuminated, barren. *Seed bud*, cells, from three to fix, oblong, gibbous on the outfide, of nearly the length of the corolla; ftyles none; ftigmata, fitting, oblong, permanent. *Berries*, equal in number to the cells, oblong, acuminated (divided into fix cells, containing feveral angular feeds. *Flora Peruviana)*.

The general character of the lardizabala evidently places this new genus among the family of the *menifpermæ*, to which it is related by its climbing ftalk, its bunches of diœcious flowers, by its fix petals, ftamina, and leaves of its calyx, by its piftil, compofed of from three to fix cells, which contain as many feeds. It differs from the known genera of this order only in its fruit, which, inftead of being monofpermous, contains feveral feeds. This character, which requires the introduction of a new fection into the *menifpermæ*, ftrengthens the relation of this family to the next order of the *anonæ*. In fact, the greater part of the genera of the anonæ, as they have in the fame flower feveral fruits, with numerous feeds, differ in this particular from all the genera of the menifpermæ; and by placing between them the lardizabala, we eftablifh a natural tranfition. In order to confirm thefe refemblances, it only remains to examine the infide of the fruit, and particularly the ftructure of the feeds. Thofe of the menifpermæ are reniform, at leaft on the infide, inclofed in a hinged pericarpium, and containing in their upper part a very fmall dicotyledonus embryo. The characters that we have given of the lardizabala render probable a fimilar ftructure in its feeds.

LARGE ROCK lies on the S. bank of Ohio river, in the tract called Indiana, and nearly opposite the mouth of Muskingum river.—*Morse.*

LARGE ISLAND, one of the largest islands on the Labrador coast, due west of the mouth of Shecatica Bay.—*ib.*

LARICAXAS, a province of La Paz, and audience of Charcas, in Peru. It lies adjacent to the territories of the jurisdiction of La Paz, and to the north of that city, extending 118 leagues from E. to W. and about 30 from N. to S. It abounds in gold mines, the metal of which is of so fine a quality, that its standard is 23 carats and 3 grains.—*ib.*

LARMIER, in architecture, a flat square member of the cornice below the cimasium, and jets out farthest; being so called from its use, which is to disperse the water, and cause it to fall at a distance from the wall, drop by drop, or, as it were, by tears; *larme* in French signifying a tear.

LATACUNGA, *Assiento of*, the first jurisdiction to the southward of that of Quito, in Peru. The word *assiento* implies a place less than a town, but larger than a village. It stands on a wide plain, having on its east side the eastern cordillera of the Andes, from which projects a very high mountain; and at a small distance from its foot is situated Latacunga, in 55° 14′ 30″ S. lat. On its W. side is a river, which is sometimes fordable, but generally passed over a bridge. This assiento is large and regular, the streets broad and straight, the houses of stone, arched, and well contrived, one story high. This precaution the inhabitants were taught to observe by a dreadful destruction of all the buildings, on the 20th of June, 1699. Out of 600 stone houses, which the assiento then contained, only a part of one, and the Jesuit's church, were left standing, and most of the inhabitants were buried in the ruins. The stone of which the houses and churches are built, is a kind of pumice, or spongy stone, ejected from volcanoes; which have formed inexhaustible quarries in the neighbourhood. It is so light, that it will swim in the water, and from its great porosity, the lime cements the different pieces very strongly together. This jurisdiction contains 17 principal villages. The air of the assiento is colder from the place being only 6 leagues from the mountain of Cotopaxi; which as it is not less in height or extent than those of Chimborazo and Caymburo, so, like them, it is covered with ice and snow. The villages are populous; such as are seated in the vallies are hot, those in the plains temperate, whilst those which border on the mountains, like that of the assiento, are cold, and sometimes to an excessive degree. The inhabitants amount to about 12,000, chiefly Spaniards and Mestizoes. Great quantities of pork are salted here and sent to Quito, Guayaquil, and Riobamba, being highly valued for the peculiar flavour given it in the pickling. The manufactures are those of cloth, bays, and tucuyes. The inhabitants of Pugili, and Saquisili, are noted for making earthen-ware, highly valued all over the province of Quito. The clay of which they are made is of a lively red, remarkably fine, emitting a kind of fragrancy, and the workmanship very neat and ingenious.—*Morse.*

LATUS PRIMARIUM, a right line drawn through the vertex of the section of a cone, within the same, and parallel to the base.

Latus Rectum. See *Conic Section*, Encycl.

Latus Transversum of the hyperbola, is the right line between the vertices of the two opposite sections, or that part of their common axis lying between the two opposite cones.

LAUREL MOUNTAIN, a range of mountains westward of the Allegheny ridge, and a part of what is called the Alleghany Mountains. It extends from Pennsylvania to N. Carolina, and gives rise to several branches of the Ohio river. The Great Kanhaway breaks through the Laurel Ridge in its way to the Ohio, in N lat. 38° 30′, W. long. 81° 19′. In a spur of this mountain, about latitude 36°, is a spring of water, 50 feet deep, very cold, and, it is said, as blue as indigo. The lands within a small distance of the Laurel Mountain, through which the Youghiogany runs, are in many places broken and stoney, but rich and well timbered; and in some places, and particularly on Laurel Creek, they are rocky and mountainous. From the Laurel Mountain to Monongahela, the first 7 miles are good, level, farming lands, with fine meadows; the timber, white-oak, chesnut, hickory, &c.—*Morse.*

LAURENS, a county in Ninety-Six district, S. Carolina, lying between Enoree and Saluda rivers. It is about 31 miles long, and 22 broad, and contains 8,217 free inhabitants, and 1,120 slaves.—*ib.*

LAURENT *of the Mine, St*, a settlement in the island of St Domingo, near the Spanish capital, St Domingo. It stands in the place where the capital was first founded, on the east side of the Ozama, and about a quarter of a league from its confluence with the Isabella. It can only be considered as a dependency on St Domingo, and contains 300 inhabitants, all free negroes, forming a cure. It was formed in 1723, by 128 run away French negroes who being sent down to the bay of Ocoa to be shipped off, the Spaniards attacked the escort, and gave arms to the fugitives, maintaining that they were free men.—*ib.*

LAVA. In addition to the observations of Sir William Hamilton, Bergmann, Formes, and Dalmieu, on the composition of different lavas, which have been given in the *Encyclopædia*, we cannot refuse ourselves the pleasure of noticing, in this place, those of Sir James Hall. From a number of well-devised experiments, Sir James thinks himself warranted to conclude, that lava and whinstone are intrinsically the same substance; and that their apparent differences arise wholly from the circumstances under which they have passed from a liquid to a solid state. The lavas, it is well known, have been cooled rapidly in the open air, and the whins (according to Dr Hutton's theory, which Sir James seems willing to adopt) slowly in the bowels of the earth.

Though we are far from adopting that theory in all its parts, to which we think insuperable objections may be made (see EARTH, *Encycl.* n° 120), we admit, that the experiments of Sir James Hall go far to establish the identity of lava and whinstone. These experiments were made upon seven different species of whinstone and six lavas, of which four were broken from the currents of Etna and Vesuvius by Sir James himself. Each

Lava.

of the original whinſtones was reduced, by fuſion and ſubſequent rapid cooling, to a ſtate of perfect glaſs. This glaſs, being again placed in the furnace, was ſubjected to a ſecond fuſion. The heat, being then reduced to a temperature generally about 28° of Wedgewood, was maintained ſtationary for ſome hours; when the crucible was either immediately removed, or allowed to cool with the furnace. The conſequence was, that in every caſe the ſubſtance had loſt the character of glaſs, and by cryſtallization had aſſumed in all reſpects that of an original whinſtone. It muſt be owned, that in moſt caſes the new production did not exactly reſemble the particular original from which it was formed, but ſome other original of the ſame claſs; owing to accidental varieties in the mode of refrigeration, and to chemical changes which unavoidably took place during the proceſs. In the caſe, however, of the rock of Edinburgh caſtle, and of that of the baſaltic columns of Staffa, the artificial ſubſtances bear a complete reſemblance to their originals, both in colour and texture.

The lavas were now treated in the ſame way, and were each, by fuſion and rapid cooling, reduced, as the whinſtones had been, to glaſs. This glaſs, when fuſed again and cooled ſlowly, yielded the ſame kind of cryſtallized, ſtony, or earthy maſſes, completely reſembling an original whin or lava.

Although the internal ſtructure of lava was thus accounted for, yet Sir James was embarraſſed with the ſtate of its external ſurface; which, though cooled in contact with the open air, is ſeldom or never vitreous, holding an intermediate ſtation between glaſs and ſtone; but this difficulty was removed by a circumſtance which took place in the courſe of theſe experiments. It was found, that a ſmall piece of glaſs of any of the lavas, or of ſeveral of the whins, being introduced into a muffle, the temperature of which was at any point between the 20th and the 22d degree of Wedgewood's ſcale, the glaſs became quite ſoft in the ſpace of one minute; but, being allowed to remain till the end of a ſecond minute, it was found to have become hard throughout in conſequence of a rapid cryſtallization, to have loſt its character of glaſs, and to have become by 12 or 14 degrees more infuſible, being unaffected by any heat under 30, though the glaſs had been fuſible at 18° or at 16°. This accounted for the ſcoria on the ſurface of lavas; for the ſubſtance even at the ſurface, being in contact with the flowing ſtream, and ſurrounded with heated air, could not cool with exceſſive rapidity: and the experiment ſhews, that ſhould any part of the maſs, in deſcending heat, employ more than one or two minutes in cooling from 22 to 20, it would infallibly loſe its vitreous character.

Independently of any alluſion to ſyſtem or to general theory, Sir James Hall flatters himſelf that theſe experiments may be of ſome importance, by ſimplifying the hiſtory of volcanoes; and, above all, by ſuperſeding ſome very extraordinary, and, he conceives, unphiloſophical opinions advanced with regard to volcanic heat, which has been ſtated as poſſeſſing very little intenſity, and as acting by ſome occult and inconceivable influence, or with the help of ſome inviſible agent, ſo as to produce liquidity without fuſion. Theſe ſuppoſitions, which have been maintained ſeriouſly by ſome of the moſt celebrated naturaliſts in Europe, have originated from the difficulty of accounting for the ſtony character of lavas when compared with that of glaſs, which they aſſume in conſequence of fuſion in our furnaces. But now he hopes we may be relieved from the neceſſity of ſuch violent efforts of imagination, ſince the phenomena have been fully accounted for by the ſimple, though unnoticed, principle of refrigeration, and have been repeated again and again with eaſe and certainty in a ſmall chamber furnace.

Lavoiſier.

LAVOISIER (Antoine Laurent), was born in Paris on the 26th of Auguſt 1743. His father, who directed his education, was opulent, and ſpared no coſt for his improvement. The youth ſhewed a decided taſte for the phyſical ſciences. In 1764, government having propoſed an extraordinary premium for the beſt and cheapeſt mode of lighting the ſtreets of a large city, Lavoiſier obtained the gold medal; and his memoir, full of nice inveſtigation, was printed by the Academy. Into that body he was received on the 13th May 1768, in ſpite of a formidable oppoſition; and to its ſervice he ever after devoted his labours, and became one of its moſt uſeful aſſociates and coadjutors.

His attention was ſucceſſively occupied with every branch of phyſical and mathematical ſcience. The pretended converſion of water into earth, the analyſis of gypſum in the neighbourhood of Paris, the cryſtallization of ſalts, the effects produced by the *grande de loupe* of the garden of the Infanta, the project of bringing water from l'Yvette to Paris, the congelation of water, and the phenomena of thunder and the aurora borealis—all occupied his attention.

Journeys, undertaken in concert with Guettard into every diſtrict of France, enabled him to procure numberleſs materials towards a deſcription of the lithological and mineralogical empire; theſe he arranged into a kind of chart, which wanted little of being completed. They ſerved alſo as a foundation for a more laborious work of his on the revolutions of the globe, and the formation of *Couches de la Terre*; a work of which two beautiful ſketches are to be ſeen in the Memoirs of the French Academy for 1772 and 1787. All the fortune and all the time of Lavoiſier were devoted to the culture of the ſciences; nor did he ſeem to have a preponderating inclination for any one in particular, until an event, ſuch as ſeldom occurs in the annals of the human mind, decided his choice, and attached him thenceforth excluſively to chemiſtry—a purſuit which has ſince rendered his name immortal.

The important diſcovery of gaſes was juſt announced to the philoſophical world. Black, Prieſtley, Scheele, Cavendiſh, and Macbride, had opened to phyſiologiſts a ſort of new creation; they had commenced a new era in the annals of genius, which was to become equally memorable with thoſe of the compaſs, printing, electricity, &c.

It was about the year 1770 that Lavoiſier, ſtruck with the importance and grandeur of this diſcovery, turned his attention to this inexhauſtible fountain of truths, and inſtantly perceived, by a kind of inſtinct, the glorious career which lay before him, and the influence which this new ſcience would neceſſarily have over the whole train of phyſical reſearches. Of thoſe who had preceded him, the moſt indefatigable experimenter was Prieſtley: but facts the moſt brilliant remained frequently unproductive in his hands; he was often ready to draw certain concluſions which as haſtily he abandoned.

Lavoisier. ed. Lavoisier was imbued with the true spirit of inductive philosophy; his observations, eminently precise and luminous, always pointed to general views. In 1774, he published his chemical opuscules, which contained a very neat history of all that had been done with respect to gases, and concluded with the author's capital experiments, by which it was proved, that metals, in calcination, derive their augmentation of weight from the absorption of air. Soon afterward, he shewed, in opposition to Priestley, that nitrous acid is composed of air; a remark, of which the importance appeared in the sequel. His ingenuity as a chemist was now so well known, that in 1776 Turgot employed him to inspect the manufacture of gun-powder. He introduced some valuable improvements, and, suppressing the odious visits in quest of the materials of saltpetre, he yet quintupled its produce. The gun-powder would now carry 120 toises, when formerly it would not reach 90. This superiority was indeed acknowledged in the last war.

It had been alleged, that by frequent distillation water is converted into earth. This question Lavoisier resolved in 1778, having shewn that the earthy sediment was owing to the continual erosion of the internal surface of the retort. In that same year he made a more interesting discovery; namely, that the respirable portion of the atmosphere is a constituent principle of all acids, and which he therefore denominated *oxygen*; a most important fact, and the first great step towards the new chemistry; which the composition of water, ascertained in 1783, triumphantly completed.

Lavoisier possessed decisive advantages over his contemporaries; he studied a geometrical accuracy of investigation; and his wealth enabled him to make experiments on a large scale, and to use instruments of the most perfect construction. He was able to hold in his house, twice every week, assemblies, to which he invited every literary character that was most celebrated in geometrical, physical, and chemical, studies; in these instructive *conversationes*, discussions, not unlike such as preceded the first establishment of academies, regularly took place. Here the opinions of the most eminent literati in Europe were canvassed; passages the most striking and novel, out of foreign writers, were recited and animadverted on; and theories were compared with experiments. Here learned men of all nations found easy admission; Priestley, Fontana, Blagden, Ingenhousz, Landriani, Jacquin, Watt, Bolton, and other illustrious physiologists and chemists of England, Germany, and Italy, found themselves mixed in the same company with La Place, La Grange, Borda, Cousin, Meunier, Vandermonde, Monge, Morveau, and Berthollet. Happy hours passed in these learned interviews, wherein no subject was left uninvestigated that could possibly contribute to the progress of the sciences, and the amelioration and happiness of man. One of the greatest benefits resulting from these assemblages, and the influence of which was soon afterwards felt in the academy itself, and consequently in all the physical and chemical works that have been published for the last twenty years in France, was the agreement established in the methods of reasoning between the natural philosophers and the geometricians. The precision, the severity of style, the philosophical method of the latter, was insensibly transfused into the minds of the former; the philosophers became disciplined in the tactics of the geometricians, and were gradually moulded into their resemblance. Lavoisier.

It was in the assemblage of these talents that Lavoisier embellished and improved his own. When any new result from some important experiment presented itself, a result which threatened to influence the whole theory of the science, or which contradicted theories till then adopted, he repeated it before this select society. Many times successively he invited the severest objections of his critical friends; and it was not till after he had surmounted their objections, to the conviction and entire persuasion of the society; it was not till after he had removed from it all mystery and obscurity, that he ventured to announce to the world any discovery of his own.

At length he combined his philosophical views into a consistent body, which he published in 1789, under the title of *Elements of Chemistry*; a book which is a most beautiful model of scientific composition, clear, logical, and elegant. It would be foreign to our purpose to attempt an exposition of the principles, or to expatiate on the merits, of this celebrated system; which, within the space of a very few years, has been almost universally adopted, and which, if not the genuine interpretation of nature, approaches as near to it as the present state of knowledge will permit. See Chemistry in this *Supplement*.

The last, but not the least useful, of Lavoisier's philosophical researches, on the Perspiration of Animals, was read to the Academy on the 4th May 1791, and of which part was published in the volume for 1790. He found, by some delicate experiments, made in conjunction with Seguin, that a man in 24 hours perspires 45 ounces; that he consumes 33 ounces of vital air; that he discharges from the lungs 8 cubic feet of carbonic acid gas, of which one-third is carbon and two-thirds are oxygen; that the weight of water discharged from the lungs amounts to 23 ounces, of which 3 are hydrogen and 20 oxygen, exclusive of 6 ounces of water already formed, lost in pulmonary perspiration. These discoveries were directed to the improvement of medicine.

We have mentioned the assistance which Lavoisier received while he was digesting his new system of chemistry; but we must add, that to him pertains exclusively the honour of a founder. His own genius was his sole conductor, and the talents of his associates were chiefly useful in illustrating discoveries he himself had made; he first traced the plan of the revolution he had been a long time conceiving; and his colleagues had only to pursue and execute his ideas.

In the twenty volumes of the Academy of Sciences, from 1772 to 1793, are 40 memoirs of Lavoisier, replete with all the grand phenomena of the science; the doctrine of combustion general and particular; the nature and analysis of atmospherical air; the formation and fixation of elastic fluids; the properties of the matter of heat; the composition of acids; the augmentation of the ponderosity of burnt bodies; the decomposition and recomposition of water; the dissolution of metals; vegetation, fermentation, and animalization. For more than 15 years consecutive, Lavoisier pursued, with unshaken constancy, the route he had marked out for himself, without making a single false step, or suffering his ardour to be damped by the numerous and increasing obstacles which constantly beset him.

Many

Lavoisier, || Lawunak.

Many were the services rendered by Lavoisier, in a public and private capacity, to manufactures, to the sciences, and to artists. He was treasurer to the Academy after Buffon and Tillet, and introduced economy and order into the accounts. He was also a member of the Board of Consultation, and took an active share in whatever was going forwards. When the new system of measures was agitated, and it was proposed to determine a degree of the meridian, he made accurate experiments on the expansion of metals, and constructed a metalline thermometer. By the National Convention he was consulted on the means of improving the manufacture of assignats, and of increasing the difficulties of forging them.

Like a good citizen, Lavoisier turned his thoughts to political economy. Between the years 1778 and 1785, he allotted 240 *arpents* in the Vendômois to experimental agriculture, and increased the usual produce by one-half. In 1791, he was invited by the Constituent Assembly to digest a plan for simplifying the collection of the taxes. This gave occasion to an excellent report, afterwards printed with the title of *Territorial Riches of France*. At this time, also, he was appointed commissioner of the national treasury, in which he effected some beneficial reforms.

During the horrors of the Robespierrean dictatorship, Lavoisier told La Lande that he foresaw he should be stripped of his property, but that he would work for his bread. The profession of apothecary would have suited him the best. But his doom was already fixed. On the 8th of May 1794, confounded with 28 farmers-general, he suffered on the scaffold, merely because he was rich!

Lavoisier was tall, and of a graceful, sprightly appearance. He was mild, sociable, obliging, and extremely active; and in his manners he was unaffectedly plain and simple. Many young men, not blessed with the gifts of fortune, but incited by their genius to woo the sciences, have confessed their obligations to him for pecuniary aid; many, also, were the unfortunate whom he relieved in silence, and without the ostentation of virtue. In the communes of the department of the *Loir* and *Char*, where he possessed considerable estates, he would frequently visit the cottages of indigence and distress; and long will his memory be cherished there. But his reputation, influence, virtues, and wealth, gave him a great preponderance, which unfortunately provoked the jealousy of a crew of homicides, who made a sport of sacrificing the lives of the best of men to a sanguinary idol.

This great and good man married, in 1771, Marie-Anni-Pierette Paulze, daughter of a farmer-general; a woman whose wit and accomplishments constituted the charm of his life; who assisted him in his labours, and even engraved the figures of his last work.

LAWRENCE, *Fort*, is a little above the crossing place of Tuscarawas, a branch of Muskingum river. —*Morse*.

LAWRENCE-TOWN, a thinly settled agricultural township, a few miles to the eastward of Halifax in Nova-Scotia.—*ib*.

LAWUNAK-HANNOCK, a Moravian settlement nearly opposite Goshgoshink, on Alleghany river, and 20 miles north-east of Fort Franklin.—*ib*.

Leacock, || Lead.

LEACOCK, a township in Lancaster county, Pennsylvania.—*ib*.

LEAD. See that article (*Encycl.*), and CHEMISTRY-*Index* in this *Supplement*. It is well known, that lead generally contains a portion of silver, and sometimes of gold; and that there are occasions, particularly in assaying, when it is of importance to have it freed from these metals. For accomplishing these purposes different processes have been proposed; but the following by Pet. Jac. Hjelm, as it is the least expensive, promises to be the most useful:

LITHARGE (see *Encycl.*) was the substance on which this chemist made his experiments, and his principal object was to free it from all mixture of silver. This was accomplished in the following manner: He placed a crucible, in which half a pound of litharge found good room, and which was fitted with a close cover, in a wind-furnace filled with dead coals. He then put into the crucible a mixture of four ounces of potash and the same quantity of powder of flint. When the whole was well melted by strengthening the draught, and making the coals glow, he took off the cover, and laid hold of the crucible with a pair of tongs, in order to take it out, and to suffer this very fusible glass to cover the inside of the crucible, to secure it from the glass of the lead which he meant to melt in it. The superfluous glass was poured out; the crucible again placed on its foot, and half a pound of litharge thrown into it with a shovel. The cover was placed upon it while the litharge was melting; and when it was thoroughly glowing and fluid, charcoal dust was sifted into the uncovered crucible through a sieve, so that the surface of the litharge was completely covered with it. This immediately produced an effervescence, and the rising of bubbles, by means of the separation of the air occasioned by the reduction of the lead. During this process, the cover was put on, and a few coals thrown into the furnace: when these were burnt, every thing in the crucible was quiet, and the melted mass was poured into a warm conical mould. The crucible was then again filled with half a pound of the same kind of litharge, and put into the furnace, and charcoal dust was several times sifted over the melted surface, till it was well covered before the mass was thrown out, a sufficient space being every time left for the effervescence. The first mass had, in the mean time, become cool, and, on examination, contained four ounces of lead at the bottom, and litharge at the top. When this litharge was reduced with potashes and wine stone, the lead thence obtained, which weighed 23 ounces, was found to contain less than one-half grain of silver in the pound. In the second mass there was found somewhat more than six ounces of lead, which contained all the silver that had been before mixed with the litharge, because in the lead which had been reduced from the litharge in the above manner, there were no perceptible traces of silver. This lead was then melted over a slow fire, and cast into bars, which were rolled smooth, and formed into masses of a known weight, to be used for assaying gold and silver, and for other purposes of the same kind. All these meltings were made in one crucible, which, according to every appearance, remained unhurt. If the same experiments were made with red lead, the like result would infallibly follow.

 With

Leasburgh, || Ledyard.

With the same view of obtaining lead free from silver, he melted, in the like manner, half a pound of white lead, which produced half an ounce of lead. When the litharge standing over it was revived, the lead obtained was still found to contain too much silver. He therefore precipitated another half pound of white lead by charcoal powder, after the lead that fell from it had been separated; and then it produced, by reviving, a mass of lead without any mixture of silver.

LEASBURGH, the chief town of Caswell county, N. Carolina. It contains a court-house, gaol, and a few houses.—*Morse.*

LEBANON, a township in York county, District of Maine, situated on the east side of Salmon Fall river, 100 miles north of Boston. It was incorporated in 1767, and contains 1275 inhabitants. A species of stone is found here which yields copperas and sulphur.—*ib.*

Lebanon, *New*, a pleasant village in New-York State, bordering on Pittsfield, Massachusetts, situated partly in a vale, and partly on the declivity of hills. The medicinal springs here are next in celebrity to those of Saratoga. The pool is situated on a commanding eminence, overlooking the valley, and surrounded with a few houses which afford tolerable accommodations to invalids.—*ib.*

Lebanon, a township in Windham county, Connecticut, was settled in 1697. The soil is equal to almost any in the State, and the inhabitants are generally farmers, many of whom are wealthy. The thick settled part of the town forms a very wide street, and the houses are at considerable distances from each other. Academic education has been patronized in this place for above 80 years, greatly to the honour of the people. The river Shetucket is formed by the junction of Willamantic and Mount Hope rivers, which unite between this town and Windham. It lies 9 miles north of Norwich, and 30 south-east of Hartford.—*ib.*

Lebanon, a township in Grafton county, New-Hampshire, situated on Mascomy river, and on the east side of the Connecticut, 2 miles below Dartmouth College. It was incorporated in 1761. In 1775 it contained 347 inhabitants, and in 1790—1180. It is in contemplation to build a bridge on Connecticut river at the middle bar of Agar's falls in this town, where the distance between the rocks is 110 feet. It is 35 miles above the bridge built by Col. Hale at Bellows's Falls at Walpole.—*ib.*

Lebanon, a post-town of Pennsylvania, situated on the south side of Quitipahilla creek, in Dauphin county. About a mile from the town is the Susquehannah, and Schuylkill canal, which connects this creek with the Tulpehocken, a branch of the Schuylkill. Lebanon contains about 300 houses, regularly built, many of which are of brick and stone; a German Lutheran and a Calvinist church. It is 25 miles E by N. of Harrisburg, 43 E. by S. of Carlisle, and 82 N. W. by W. of Philadelphia.—*ib.*

LEDYARD (—— ——), the celebrated, though unfortunate, traveller, was a native of North America, but of what province we have not learned. We are equally ignorant of the year of his birth, and the rank of his parents; but have no reason to think that they were opulent. From his early youth he displayed a strong propensity to visit unknown and savage countries; and to gratify that propensity, he lived for several years with the American Indians, whose manners and habits he seemed in some degree to have acquired. Afterwards he sailed round the world with Captain Cook in the humble station of a corporal of marines; and on his return, he determined to traverse the vast continent of America, from the Pacific to the Atlantic Ocean.

Ledyard.

This design being frustrated by his not obtaining a passage to Nootka Sound, he determined to travel over land to Kamschatka. With this view he went over to Ostend, with only ten guineas in his pocket, and proceeded by the way of Denmark and the Sound to the capital of Sweden, and endeavoured to cross the Gulph of Bothnia on the ice; but finding, when he came to the middle, that the water was not frozen, he walked round the gulph to Petersburgh. Here he found himself without stockings or shoes; but procured relief from the Portuguese ambassador, and obtained leave to proceed with a detachment of stores to Yakutz. He made this journey of six thousand miles, and there met Mr Billengs, an Englishman, whom he had known on board Captain Cook's ship. From thence he went to Oczakow, on the coast of the Kamschatka Sea; but being too late to embark that year, returned to Yakutz to winter. Here he was, on some suspicion, seized, conveyed on a sledge through Northern Tartary, and left on the frontiers of the Polish dominions. In the midst of poverty, rags, and disease, he however reached Koningsburg, where he found friends that enabled him to reach England.

On his arrival in London, he waited on Sir Joseph Banks, on whose credit he had, in his distress, received at different times 25 guineas. Sir Joseph communicated to him the views of the African Association, and pointed out the route in which they wished Africa to be explored. On his engaging at once in the enterprise, Sir Joseph asked him when he would be able to set out. "To-morrow morning," replied Ledyard, without hesitation. At this interview the president of the Royal Society declares, that he was struck with the figure of the man, the breadth of his chest, the openness of his countenance, and the rolling of his eye. Though scarcely exceeding the middle size, his figure indicated great strength and activity. Despising the accidental distinctions of society, he seemed to regard no man as his superior; but his manners, though coarse, were not disagreeable. His uncultivated genius was original and comprehensive. From the native energy of his mind, he was adventurous, curious, and unappalled by dangers; while the strength of his judgment united caution with energy. The track pointed out to him was from Cairo to Senaar, and thence westward in the latitude and supposed direction of the Niger.

He was not ignorant, that the task assigned him was arduous and big with danger; but instead of shrinking from it, he said, on the day of his departure, "I am accustomed to hardships; I have known both hunger and nakedness to the utmost extremity of human suffering; I have known what it is to have food given me as charity to a madman; and I have at times been obliged to shelter myself under the miseries of that character to avoid a heavier calamity. My distresses have been greater than I ever owned, or ever will own to any man. Such evils are terrible to bear, but they never yet had power

to

Ledyard.

to turn me from my purpoſe. If I live, I will faithfully perform, in its utmoſt extent, my engagement to the Society: and if I periſh in the attempt, my honour will be ſafe; for death cancels all bonds."

After receiving his inſtructions and letters of recommendation, this intrepid traveller ſailed from London on the 30th of June 1788; and in 36 days arrived at Alexandria. Proceeding to Cairo, where he arrived Auguſt the 17th, he viſited the ſlave markets, and converſed with the travelling merchants of the caravans. Theſe ſources of information, generally neglected by travellers, enabled him to obtain, at a very ſmall expence, more correct information concerning the African nations and their trade, the poſition of places, the nature of the country, the manner of travelling, &c. than could have been eaſily obtained by any other method. He thus learned, that the Arabs of the deſert have an invincible attachment to liberty, though it is ſingular that they have no word to expreſs liberty in their language. The Mahomedans of Africa are a trading, ſuperſtitious, and warlike ſet of vagabonds. He ſaw near 200 black ſlaves expoſed to ſale, who had been brought from the interior parts of Africa; their appearance ſavage, but not like priſoners of war; they had head ornaments, and their hair plaited in detached plaits of great length. Another parcel, which had come from Darfoor, were moſtly women; and the beads, and ſome other ornaments which they wore, were Venetian. They were well formed, quite black, had the true Guinea face, and curled hair. Mr Ledyard was informed, that the king of Senaar was a merchant, and concerned in the caravans; that 20,000 negro ſlaves are imported into Egypt annually. Among ſome Senaar ſlaves, he ſaw three of a bright olive colour, but their heads uncommonly formed, the forehead the narroweſt, longeſt, and moſt protuberant he ever ſaw.

The Senaar caravan is the moſt rich; that of Darfoor is not equally ſo, though it trades with almoſt the ſame commodities. Beſides ſlaves, theſe are gum, elephants teeth, camels, and oſtrich-feathers; for which are received in exchange trinkets, ſoap, antimony, red linen, razors, ſciſſars, mirrors, and beads. Wangara, to which the caravans alſo trade, was repreſented to Mr Ledyard as a kingdom producing much gold; but the king ſeems to intermeddle with commerce as well as the potentate of Senaar; for in order to deceive ſtrangers, and prevent them from gueſſing at the extent of his riches, he was reported to vary continually the gold uſed in barter, which it is his province to regulate, and of which he iſſues at one time a great quantity, and at others little or none. A caravan goes from Cairo to Fezzan, which they call a journey of fifty days; and as the caravans travel about 20 miles a day, the diſtance muſt be about 1000 miles; from Fezzan to Tombuctoo is 1800 miles; from Cairo to Senaar about 600 miles.

Such was the information which Mr Ledyard derived from the merchants of the caravans in Egypt; but when he was about to verify it by his own obſervations, and had announced to the Aſſociation that his next diſpatch would be dated from Senaar, he was ſeized with a bilious complaint, which fruſtrated the ſkill of the moſt eminent phyſicians, and put a period to his travels and his life at Cairo. It is needleſs to ſay how much his death was regretted, or how well he was qualified for the arduous enterpriſe in which he had engaged. The perſon who, with ſuch ſcanty funds, could penetrate the frozen regions of Tartary, ſubſiſt among their churliſh inhabitants, and ingratiate himſelf with the ferocious Moors of Egypt, could hardly have failed to obtain a kind reception from the gentle and hoſpitable Negro, had no untoward circumſtance intervened. At Senaar, indeed, his riſk would have been great; and Mr Bruce was decidedly of opinion, that a man ſo poorly attended as Mr Ledyard, could never have made his eſcape from that treacherous and ferocious people.

Ledyard. Leeds.

The obſervations of this accurate obſerver on the female character, though they have been repeatedly quoted in other works, are well intitled to a place here; and with them we ſhall conclude this ſketch of his life: "I have always (ſays he) remarked, that women in all countries are civil and obliging, tender and humane; that they are ever inclined to be gay and cheerful, timorous and modeſt; and that they do not heſitate, like man, to perform a generous action. Not haughty, not arrogant, not ſupercilious; they are full of courteſy, and fond of ſociety; more liable, in general, to err than man; but in general alſo more virtuous, and performing more good actions than he. To a woman, whether civilized or ſavage, I never addreſſed myſelf, in the language of decency and friendſhip, without receiving a decent and friendly anſwer. With man it has often been otherwiſe. In wandering over the barren plains of inhoſpitable Denmark, through honeſt Sweden, and frozen Lapland, rude and churliſh Finland, unprincipled Ruſſia, and the wide ſpread regions of the wandering Tartar; if hungry, dry, cold, wet, or ſick, the women have ever been friendly to me, and uniformly ſo. And to add to this virtue (ſo worthy the appellation of benevolence), theſe actions have been performed in ſo free and kind a manner, that if I was dry, I drank the ſweeteſt draught; and if hungry, I eat the coarſeſt morſel with a double reliſh." For a fuller account of *Ledyard*, ſee *The Tranſactions of the African Aſſociation*, or *A View of the Late Diſcoveries in Africa*.

LEE, a ſmall town in Strafford county, New-Hampſhire, about 12 miles north of Exeter. It was formerly part of Dover and Durham, and was incorporated in 1766. In 1775 it contained 954 inhabitants, in 1790—1029.—*ib.*

Lee, *Fort*, was erected by the Americans during the late war, on the weſt bank of North river, having the tract called the Engliſh Neighbourhood on the north, and that called Hoboken on the ſouthward, in N. lat. 40° 56′, and about 9 miles above the town of Bergen. The Americans had 2,000 men in garriſon here in the late war, but evacuated it in November, 1776, with the loſs of their artillery and ſtores.—*ib.*

Lee, a county of Virginia, lately taken from Ruſſel, in the S. W. corner of the State, bounded ſouth by the State of N. Carolina, and weſt by Kentucky.—*ib.*

Lee, a townſhip in Berkſhire county, Maſſachuſetts, 5 miles ſoutherly of Lenox, 4 eaſt of Stockbridge, and 140 weſt of Boſton; was incorporated in 1777, and contains 1,170 inhabitants. Houſatonick river runs ſoutherly through this town.—*ib.*

LEEDS, a town in the eaſtern part of Glouceſter county, New-Jerſey, 4 miles weſt of the mouth of Mullicus river, and 8 north-weſterly of Brigantine Inlet.—*ib.*

LEEDS, a village of Richmond county, Virginia, situated on the north bank of Rappahannock river; 14 miles E. by S. of Port Royal, 40 S. E. of Fredericksburg, and 70 N. E. of Richmond. Near Leedstown is a famous course for horse-racing.—*ib.*

LEEFOOGA, one of the Friendly islands, in the South Sea. It was visited by Captain Cook in 1776, who considers it, in some respects, superior to Anamooka. The island is situated near Hapaee, and is about 7 miles long and 3 broad.—*ib.*

LEESBURGH, a post-town of Maryland, 25 miles from Fredericktown.—*ib.*

LEESBURG, a post town of Virginia, and capital of London county. It is situated 6 miles S. W. of the Patowmac, and 4 south of Goose Creek, a branch of that river on the great road leading from Philadelphia to the southward, and on the leading road from Alexandria to Bath. It contains about 60 houses, a courthouse, and gaol. It is 20 miles from Salisbury, 32 from Shepherdstown, 20 miles from Frederickstown in Maryland, 46 north-west of Alexandria, and 64 E. S. E. of Winchester.—*ib.*

LEESBURG, or *Leestown*, a settlement in Kentucky, on the banks of Kentucky river, 20 miles from Lexington, and about 30 from the Upper Blue Lick. It was destroyed by the Indians and abandoned. The country for many miles round is first rate land. Great plenty of marble is found on the banks of Kentucky, particularly at this place.—*ib.*

LEE'S ISLAND, in Patowmac river, in Fairfax county, Virginia, about 2 miles south-eastward of Thorp, which is on the north side of Goose Creek.—*ib.*

LEEK, a small island of Pennsylvania, in Delaware river.—*ib.*

HYPERBOLIC LEGS, are the ends of a curve line that partakes of the nature of the hyperbola, or having asymptots.

LEHIGH, or *Leeha*, a river which rises in Northampton county, Pennsylvania, about 21 miles east of Wyoming Falls, in Susquehannah river, and taking a circular course, passing through the Blue Mountains, empties into Delaware river on the south side of Easton, 11 miles N. E. of Bethlehem. It runs about 75 miles, and is navigable 30 miles.—*Morse.*

LE GRAND, a considerable river of the N. W. Territory, which rises within a few miles of the west extremity of Lake Erie, and pursuing a N. N. W. course for nearly 100 miles, thence turning to the west, empties into Lake Michigan. It is about 250 yards wide at its confluence with the lake.—*ib.*

LEICESTER, a township in Addison county, Vermont, situated on the east side of Otter Creek, having 343 inhabitants. Great Trout Pond, or Lake, is partly in this town, and partly in Salisbury, on the north. This town was granted Oct. 20, 1761.—*ib.*

LEICESTER, called by the Indian natives *Towtaid*, is a considerable town in Worcester county, Massachusetts, containing 1076 inhabitants. It is situated upon the post-road from Boston to Hartford, New-York and Philadelphia, 6 miles westerly of Worcester, and 54 W. by S. of Boston; bounded N. by Paxton and S. by Oxford. It was settled in 1713, and incorporated in 1720 or 1721. There are three meeting-houses here for Congregationalists, Anabaptists, and Quakers; who live in harmony together. The *Leicester Academy* was incorporated in 1784, and is well endowed. Wool cards are manufactured here to the annual amount of 15,000 pairs.—*ib.*

LEMINGTON PRIORS, is a village two miles east of the town of Warwick, famous for its mineral waters. One salt spring, which rises near the church yard, has been long known, as well as another which rises in the bed of the river; but the most remarkable spring was discovered in the year 1790. The waters of both springs have been analyzed with great accuracy by William Lambe, M. A. late Fellow of St John's college, Cambridge, who has given us the following synoptical table of the substances contained in them:

Gaseous Fluids contained in a Wine-gallon in Cubic Inches.

	WATER OF THE NEW SPRING.	WATER OF THE OLD SPRING.
Hepatic gas -	*Too small to be measured.*	*Too small to be measured.*
Azotic gas -	3.5	3
Carbonic acid gas	.5	—

Solid contents of a Wine-gallon in Grains.

	WATER OF THE NEW SPRING.	WATER OF THE OLD SPRING.
Carbonat of iron	.75	
Oxyds of iron and manganese -	—	*Too small to be weighed.*
Oxygenated muriat of iron and manganese - -	*Unknown, but very small.*	*Unknown, but very small.*
Sulphur - - -	*Unknown, but very small.*	——
Muriat of magnesia	11.5	58
Muriat of soda	430	330
Sulphat of soda	152	62
Sulphat of lime	112	146

In the course of his experiments, for which we must refer to the original memoir, in Transactions of the Manchester Society, Mr Lambe thinks he discovered the origin of the *muriatic acid.* He found a coincidence, very unexpected, between the hepatised solution of iron and the oxygenated muriat of iron. "I had almost concluded (says he), from the resemblance between the properties of this salt and the phenomena of the water, that the water contains this very salt. Now, I conclude, that they contain a matter, be it what it may, produced by the action of hepatic gas on iron. But they are the very same facts which form the basis, upon which each separate inference is built. Does it not follow, then, as a necessary consequence, that the hepatised solution itself contains a muriat of iron highly oxygenated, and that therefore *in this process muriatic acid is generated?* This conclusion seemed authorised by reason, and experiment has confirmed it."

LEMINGTON, a township in Essex county, Vermont, on the west bank of Connecticut river, and near the N. E. corner of the State. The Great Monadnock mountain is in this town. It contains 31 inhabitants.—*ib.*

LEMNISCATE, the name of a curve in the form of the figure of 8.

LEMON-JUICE, is an article of such harmless luxury, and in some cases of such real utility, that many of of our readers will be pleafed to know a fimple method by which they may obtain it in great purity. In the article CHEMISTRY (*Suppl.*), n° 476, we have fhewn from Scheele and Dizé, how to obtain the citric acid perfectly pure, and in the form of cryftals; but here we mean nothing more than to fhew how it may be completely feparated from that flimy fubftance with which it is always mixed in the lemon, without allowing it time to fpoil or to acquire any difagreeable tafte during the feparation. This we are enabled to do by M. Brugnatelli, who, in the 2d volume of the *Annali di Chimia*, informs us, that he expreffed in the common manner the juice of perfectly ripe lemons, and ftrained it through a piece of linen. In half an hour he ftrained it again, to free it from a little flimy matter which had fettled at the bottom of the veffel. He then added to the juice a certain quantity of the ftrongeft fpirit of wine, and preferved the mixture for fome days in a well-corked bottle. During that time there was a confiderable depofit, which to all appearance was of a flimy nature, and which he feparated by filtering paper. If the fluid was too thick to pafs through the filter, he diluted it again with fpirit of wine. After this operation, the depofit remained on the paper, which was entirely covered with it; and he obtained, in the veffel placed below, the pureft acid of lemons combined with fpirit of wine.

If it be required to obtain the acid perfectly pure, nothing is neceffary but to feparate from it the fpirit of wine, which can be beft effected by evaporation. The acid of the lemons affumes, after it has been freed from the fpirit of wine and the moifture combined with it, a yellowifh colour, and becomes fo ftrong, that by its tafte it might be confidered as a mineral acid.

It is not neceffary to evaporate the fpirit of wine in a clofe veffel, if the experiment is made only on a fmall fcale; nor is there any danger that in open veffels any of the acid will be loft, as it is too fixed to be volatilifed by the fame degree of heat at which fpirit of wine evaporates. This acid has peculiar propertie , which deferve farther examination.

LEMPSTER, an inconfiderable townfhip in Chefhire county, New-Hampfhire. It was incorporated in 1761. In 1775 it contained 128 and in 1790—414 inhabitants.—*Morse*.

LENOIR, a county of Newbern diftrict, N. Carolina, furrounded by Glafgow, Craven, Jones, and Dauphin. It contains 2,484 free inhabitants, and 957 flaves. Chief town, Kingfton.—*ib*.

LENOX, the fhire town of Berkfhire county, Maffachufetts. It is a pleafant and thriving town, and has a court-houfe and gaol. Houfatonick river paffes through the town. It lies eaft of Wafhington, fouth of Pittsfield, 17 miles fouth-wefterly of Chefter, and 145 miles north of Bofton.—*ib*

LENSES (fee LENS and DIOPTRICS, *Encycl.*), are either blown or ground.

Blown LENSES are ufed only in the fingle microfcope; and the ufual method of making them has been to draw out a fine thread of the foft white glafs called *cryftal*, and to convert the extremity of this into a fpherule by melting it at the flame of a candle. But this glafs contains lead, which is difpofed to become opake by partial reduction, unlefs the management be very carefully attended to. We are informed, however, by Mr Nicholfon, that the hard glafs ufed for windows feldom fails to afford excellent fpherules. This glafs is of a clear bright green colour when feen edgewife. A thin piece was cut from the edge of a pane of glafs lefs than one-tenth of an inch broad. This was held perpendicularly by the upper end, and the flame of a candle was directed upon it by the blow-pipe at the diftance of about an inch from the lower end. The glafs became foft, and the lower piece defcended by its own weight to the diftance of about two feet, where it remained fufpended by a thin thread of glafs about one five-hundredth of an inch in diameter. A part of this thread was applied endwife to the lower blue part of the flame of the candle without the ufe of the blow-pipe. The extremity immediately became white-hot, and formed a globule. The glafs was then gradually and regularly thruft towards the flame, but never into it, until the globule was fufficiently large. A number of thefe were made; and being afterwards examined, by viewing their focal images with a deep magnifier, proved very bright, perfect, and round. This, as the ingenious author obferves, may prove an acceptable piece of information to thofe eminent men (and there are many fuch), whofe narrow circumftances, or remote fituations, are obliged to have recourfe to their own fkill and ingenuity for experimental implements.

Ground LENSES, are fuch as are ground or rubbed into the defired fhape, and then polifhed. Different fhapes have been propofed for lenfes; but in the article OPTICS, n° 251 (*Encycl.*), it has been fhewn that, after all, the fpherical is the moft practically ufeful. By many of the methods of grinding, however, the artificer, with his utmoft care, can only produce an approximation to a truly fpherical figure; and, indeed, gentlemen have, for the moft part, nothing to depend on for the fphericity of the lenfes of their telefcopes, but the care and integrity of the workmen. In the 41ft volume of the Tranfactions of the Royal Society of London, a machine is defcribed by Mr Samuel Jenkins, which, as it is contrived to turn a fphere at one and the fame time on two axes, cutting each other at right angles, will produce the fegment of a true fphere merely by turning round the wheels, and that without any care or fkill in the workmen. The following defcription of this machine will enable our readers fully to comprehend its conftruction, and the mode of ufing it: A is a globe covered with cement, in which are fixed the pieces of glafs to be ground. This globe is faftened to the axis, and turns with the wheel B. C is the brafs cup which polifhes the glafs: this is faftened to the axis, and turns with the wheel D. The motion of the cup C, therefore, is at right angles with the motion of the globe A; whence it follows demonftrably, that the pieces of glafs ground by this double motion muft be formed into the fegments of fpheres. Plate XXXII.

LEO X. is a pontiff to whom learning, and art, and fcience, are fo deeply indebted, that not to give a fketch of his life and character, in a Work of this kind, would be an unpardonable omiffion. A character of him is indeed given in the *Encyclopædia*; but it is fo far from the truth, that it is difficult to conceive the prejudices under which the writer muft have laboured by whom it was drawn up.

Leo, whofe name, before his elevation to the pontificate, was *Giovanni de Medici*, was the fecond fon of Lo-

Leo. renzo de Medici, justly styled the Magnificent. In the life of that great man published in this *Supplement*, the reader will see by what means, and for what purpose, he got Giovanni raised to the dignity of cardinal at so early a period of life; and in the elegant work of Roscoe, to which we there refer, he will find such instructions of Lorenzo to the cardinal as must have made a deep impression on his youthful mind.

Speaking of his promotion, Lorenzo says, "The first thing that I would suggest to you, is, that you ought to be grateful to God, and continually to recollect that it is not through your merits, your prudence, or your solicitude, that this event has taken place, but through his favour, which you can repay only by a *pious, chaste*, and *exemplary life*; and that your obligations to the performance of these duties are so much the greater, as in your *early years* you have given some *reasonable expectation* that your riper age may produce such fruits. It would indeed be highly disgraceful, and as contrary to your duty as to my *hopes*, if at a time when others display a greater share of reason, and adopt a better mode of life, you should forget the *precepts of your youth*, and forsake the path in which you have *hitherto trodden*."—"I well know (continues Lorenzo), that as you are now to reside at Rome, that sink of all iniquity, the difficulty of conducting yourself by these admonitions will be increased. The influence of example is itself prevalent; but you will probably meet with those, who will particularly endeavour to corrupt and incite you to vice; because, as you yourself may perceive, your early attainment of so great a dignity is not observed without envy, and those who could not prevent your receiving that honour, will secretly endeavour to diminish it, by inducing you to forfeit the good estimation of the public."—"You are not unacquainted with the great importance of the character which you have to sustain; for you well know, that all the Christian world would prosper if the cardinals were what they ought to be; because in such a case there would always be a good pope, upon which the tranquillity of Christendom so materially depends."

As this was a confidential letter from Lorenzo to his son, the first of these extracts furnishes very sufficient evidence, that Giovanni had been at least a well behaved boy, diligent in his studies, and regular in his conduct; and without supposing him remarkably religious, the admonitions of such a father, aided by his own ambition and love of letters, would surely guard him against such gross licentiousness as that of which he is accused in the *Encyclopædia*. How much he revered his father, is apparent from the letter which he wrote to his brother immediately after Lorenzo's death. "What a father (says he) have we lost! How indulgent to his children! Wonder not, then, that I grieve, that I lament, that I find no rest. Yet, my brother, I have some consolation in reflecting that I have thee, whom I shall always regard in the place of a father." Surely this is not the language of a gross sensualist, or of one who could soon forget the salutary admonitions of such a parent as Lorenzo de Medici. But it is needless to infer the decency of his character by such reasonings as these. The story published in the *Encyclopædia*, of the manner in which the Cardinal de Medici obtained the tiara, cannot possibly be true. The reader, who shall turn to the article POPE in that Work, will find that the conclave, when fitted up for an election, is so large a place, that we may safely affirm, that had the cardinal's ulcer discharged matter so fetid as to *poison all the cells*, the assertion of the physicians would have been verified, and that in the then state of the healing art, the new pope could not have survived a month. Let it be remembered, too, that Leo, at his accession, was not 30, but 37 years of age, and that he had long ruled in Florence with sovereign sway by the same means which had upheld the authority of his father. The follies of youth, therefore, had he ever been remarkable for such follies, must have been over with him; and in such a state as Florence he could not have maintained the authority of Lorenzo, without exhibiting not only Lorenzo's liberality, but likewise his decency of manners. Leo.

The next charge brought against Leo in the *Encyclopædia* is, that he published general indulgences throughout Europe; and this is so expressed as to lead the ill-informed reader to suppose, either that no such indulgences had ever been published by any of his predecessors, or that there was something peculiarly scandalous in Leo's mode of publishing them. Both suppositions, however, are erroneous. The historian of the council of Trent, who certainly was not partial to the court of Rome, or to the dispensing power of the pope, has shewn, that the practice of raising money by the publication of indulgences, had prevailed ever since the year 1100; that many former popes had raised money in this manner for purposes much less laudable than those which Leo had in his eye; and that the real cause of Luther's attack upon Leo's indulgences was, that they were preached through Saxony by the Dominican friars; whereas the preaching of former indulgences had been committed to the hermits of St Augustine, the order to which Luther himself belonged!

Leo is likewise accused in the *Encyclopædia* of being a professed infidel, and of having called Christianity "a fable very profitable for him and his predecessors." But of the truth of this accusation there seems not to be the shadow of evidence. Leo had too much sense to utter expressions of this kind, even had he been an unbeliever in his heart; for he could not possibly expect that his indulgences and pardons would be purchased, had he declared in such strong terms that they were of no value. Father Paul indeed says, that he was not a deep divine, or so pious as some of his predecessors; but he affirms, that he *adorned the papacy* with many admirable qualities; that he was learned, affable, liberal, *good*; that he delighted in healing differences, and that his equal had not, for many years, filled the chair of St Peter. Surely this is not the character of a profane infidel!

Leo has been charged with raising his own family to grandeur at the expence of justice; and of dealing treacherously in order to effect this purpose, both with the emperor and with the French king. But the charge is either false or greatly exaggerated. He lost no opportunity indeed of aggrandizing his relations, well knowing, that in order to secure to them any lasting benefit, it was necessary that they should be powerful enough to defend themselves, after his death, from the rapacious aims of succeeding pontiffs; but, in prosecuting this plan, he was so far from acting tyrannically or injuriously to others, that during his pontificate, the papal dominions enjoyed a degree of tranquillity superior to any

any other Italian state. During the contests that took place between the emperor and the French king, so far from acting treacherously, he distinguished himself by his moderation, his vigilance, and his political address; on which account he is justly celebrated by an eminent historian of our own,* as "the only prince of the age who observed the motions of the two contending monarchs with a prudent attention, or who discovered a proper solicitude for the public safety."

* Dr Robertson.

We trust that no zealous Protestant will think we have employed our time ill, in vindicating the character of this splendid pontiff; for good learning, and, of course, true religion, are more indebted to Leo X. than to any other individual of the age in which he lived, his father Lorenzo alone excepted.

Leo Minor, the *Little Lion*, a constellation of the northern hemisphere, and one of the new ones that were formed out of what were left by the ancients, under the name of *Stellæ Informes*, or unformed stars. See ASTRONOMY, n° 406, *Encycl.*

LEOGANE, *Bay of*, called also *Bight* or Bite of Leogane, also Cul de Sac of Leogane, at the west end of the island of St Domingo, is formed by two peninsulas. It opens between Cape St Nicholas at the west end of the north peninsula, and Cape Dame Marie, the N. W. point of the south peninsula, 45 leagues apart. At the bottom of the bay are the islands Gonave, and on the north side of the south peninsula the isles Resiit and Caymite. It embosoms a vast number of fine bays. The chief bays, towns and ports from Cape St Nicholas round to Cape Dame Marie are La Plate Forme, or the Platform, Gonaives, St Marc, Montrouis, Archahaye, Port au Prince, Leogane, Goave, Miragoane, Petit Trou, Bay of Baradaires, Bay of Durot, Jeremie, Cape Dame Marie, &c. Trou Bordet, at the head of which is Port au Prince, is at the extremity of the Bay of Leogane eastward, 60 leagues E. of Cape Dame Marie, and 51 S. E. of Cape St Nicholas.—*Morse.*

LEOGANE, a sea port town in the French part of the island of St Domingo, situated on the N. side of the neck of the south peninsula in the bay or bite of Leogane, at the head of a small bay which sets up E. from the bay of Grand Goave, 4 leagues N. E. of the town of that name, 6¼ N. of Jacmel, 8 N. W. of Cayes de Jacmel, 9 W. by S. of Port au Prince, and 6½ leagues S. E. of Petite Gonave island. N. lat 18° 30′, W. long. from Paris 75° 2′. It is an agreeable, pleasant, and commercial place. The exports from Jan. 1, 1789 to Dec. 31, of the same year, were 95,871lbs. white sugar—7,079,205lbs. brown sugar—1,932,952lbs. coffee—139,887lbs. cotton—and 4,960lbs indigo. The duties on the exportation of the above, 26,103 dollars 70 cents.—*ib.*

LEOMINSTER, a post-town in Worcester county, Massachusetts, 7 miles N. by W. of Lancaster, 20 S. E. of Winchendon, 46 westward of Boston, 19 N. of Worcester, and 20 S. of Marlborough, in New-Hampshire, has a printing-office and several neat buildings. This township was taken from Lancaster, incorporated in 1740, and contains 1189 inhabitants. On the different streams which pass through the town are 2 grist-mills, 5 saw-mills, an oil mill, and clothiers works, very excellent. About 200,000 bricks are annually made here. The manufacture of combs is also carried on to great perfection and profit. *Leominster Gore*, adjoining, contains 27 inhabitants.—*ib.*

LEON, a river which falls into the Gulf of Mexico from the N. W. at the bay of St Bernard.—*ib.*

LEON, *New*, a populous kingdom of New-Spain, in N. America, in which are several silver mines.—*ib.*

LEON, a town of the province of Panuco, in Mexico. It has rich mines, and lies 30 leagues north of Mechoacan, and 55 N. W. of the city of Mexico.—*ib.*

LEON DE CARACAS, ST, a city, the capital of the province of the Caracas, situated on a river, about 6 leagues south from the coast, enclosed by mountains. The valley in which it stands is a savannah, well watered and very healthy, about 3 leagues long and 1 broad in the middle, the only entrance into which is through a crooked and steep road. The city is near a mile long; the houses handsome and well furnished; the streets regular, straight and broad, cutting each other at right angles, and terminating in a magnificent square in the centre. It contains about 4 or 5,000 inhabitants; most of whom are owners of cocoa plantations, which 12 or 13,000 negroes cultivate in the rich vallies, which is almost the only cultivation they have.—*ib.*

LEON DE NICARAGUA, a town of N. America in New-Spain, and in the province of Nicaragua; the residence of a governor, and a bishop's see. It was taken by the buccaneers in 1685, in sight of a Spanish army who were 6 to 1; is seated at the foot of a mountain which is a volcano, and occasions earthquakes. It consists of about 1000 houses, and has several monasteries and nunneries belonging to it. At one end of the town is a lake which ebbs and flows like the sea. It is 30 miles from the South Sea. N. lat. 12° 25′, W. long. 88° 10′.—*ib.*

LEONARDSTOWN, a post town of Maryland, and the capital of St Mary's county, is situated on the east side of Britton's brook, just where it falls into Britton's bay, 5 miles from its mouth in the Patowmac, and contains about 50 houses, a court-house, and gaol. It is 113 miles south of Baltimore, 62 S. by E. of Upper Marlborough, 30 south-east of Port Tobacco, and 217 south-west of Philadelphia. N. lat. 38° 18′.—*ib.*

LEPERS' *Island*, one of the *New Hebrides*. The inhabitants of this island, according to Bougainville's account of them, "are of two colours, black and mulatto. Their lips are thick, their hair frizzled, and some have a kind of yellow wool; they are small, ugly, ill-made, and in general devoured by the *leprosy*, which occasioned the discoverer Bougainville to call it the *Isle of Lepers*: few women were seen, but they were altogether as disgusting as the men. They go naked, hardly covering their waists with a mat." They carry their children on their backs in a kind of scarf. They wear ornaments in their nostrils; and have no beards.—*ib.*

LE ROACH *Island*, is near Faukland's Islands; discovered in 1657.—*ib.*

LES CAYES, a jurisdiction on the S. side of the French part of the island of St Domingo, contains 4 parishes and yields abundance of sugar, cotton, and coffee. Its exports from the town Les Cayes from January 1, 1789, to Dec. 31, of the same year, were 2,597,666lbs. white sugar; 24,526,952lbs. brown sugar; 3,025,664lbs. coffee; 855,447 cotton; 169, Leslie. 305lbs. indigo; and small articles to the value of 8,256 livres. The value of duties paid on the above on exportation 101,528 dollars, 85 cents. The town *Les Cayes* lies between the villages Torbeck and Cavaillon, on the large bay which sets up to the island Avache; from which it is about 3 leagues distant, and 5 leagues northerly of Point Abaeon. N. lat. 18° 12′, W. long. from Paris 76° 8′.—*ib.*

LESLIE (Charles), was a man so eminent for his learning, his talents, and his piety, that a fuller account of him than that which is given in the *Encyclopædia* must be acceptable to our Christian readers. He was the second son of Dr John Leslie bishop of Clogher in Ireland, who was descended from an ancient family in the north of Scotland, and being an admirable scholar, rose to the dignity of bishop of Orkney in his own country, whence he was translated, in 1633, to Raphoe in Ireland, and afterwards, in 1661, to the see of Clogher.

Our author was born in Ireland, but in what year we have not learned. A ludicrous story goes indeed of his having been begotten in prison, and of his father having said that he hoped he would in consequence become the greatest scourge of the covenanters that Great Britain or Ireland had ever seen. This story, with all its circumstances as told to us, can hardly be true; but we think it could not have been fabricated, had not Charles Leslie been born within a year of Cromwell's conquest of Ireland, when the good bishop, having sustained a siege in his castle of Raphoe against that arch rebel, was some time kept in close confinement.

We are equally ignorant of the school where he was educated as of the year of his birth; but we know that he had his academical education in Trinity College, Dublin, where he took the degree of master of arts. In the year 1671, he lost his father, when he came over to England, and, entering himself in the temple, studied law for some years, but afterwards relinquished it for the study of divinity. In 1680, he was admitted into holy orders; and, in 1687, was made chancellor of Connor.

About this period he rendered himself particularly obnoxious to the Popish party in Ireland, by his zealous opposition to them, which was thus called forth. Roger Boyle, bishop of Clogher, dying in 1687, Patrick Tyrrel was made titular Popish bishop, and had the revenues of the see assigned him by king James. He set up a convent of friars in Monaghan: and, fixing his habitation there, held a public visitation of his clergy with great solemnity; when, some subtle logicians attending him, he was so insolent as to challenge the Protestant clergy to a public disputation. Leslie undertook the task, and performed it to the satisfaction of the Protestants; though it happened, as it generally does at such contests, that both sides claimed the victory. He afterwards held another public disputation with two celebrated Popish divines, in the church of Tynan, in the diocese of Armagh, before a very numerous assembly of persons of both religions; the issue of which was, that Mr John Stewart, a Popish gentleman, solemnly renounced the errors of the church of Rome.

Biographical Dictionary.

As the Papists had got possession of an Episcopal see, they engrossed other offices too; and a Popish high-sheriff was appointed for the county of Monaghan. This proceeding alarmed the gentlemen in that county; who, depending much on Leslie's knowledge as a justice of peace, repaired to him, then confined, by the gout, to his house. He told them, that it would be as illegal in them to permit the sheriff to act as it would be in him to attempt it. But they insisting that he should appear himself on the bench at the next quarter-sessions, and all promising to stand by him, he was carried thither with much difficulty and in great pain. When the sheriff appeared, and was taking his place, he was asked whether he was legally qualified; to which he answered pertly, "That he was of the king's own religion, and it was his majesty's will that he should be sheriff." Leslie replied, "That they were not inquiring into his majesty's religion, but whether he (the pretended sheriff) had qualified himself according to law, for acting as a proper officer; that the law was the king's will, and nothing else to be deemed such; that his subjects had no other way of knowing his will, but as it is revealed to them in his laws: and it must always be thought to continue so, till the contrary is notified to them in the same authentic manner." Upon this, the bench unanimously agreed to commit the pretended sheriff, for his intrusion and arrogant contempt of the court. Leslie also committed some officers of that tumultuous army which the Lord Tyrconnel raised for robbing the country.

In this spirited conduct Leslie acted like a sound divine and an upright magistrate; but though he thought himself authorised to resist the illegal mandates of his sovereign, like many other great and good men, he distinguished between active and passive obedience, and felt not himself at liberty to transfer his allegiance from that sovereign to another. Refusing therefore to take the oaths to king William and queen Mary, he was deprived of all his preferments; and in 1689 he removed with his family to England, where he published the following works, besides those already noticed in the *Encyclopædia*: 1. Answer to Archbishop King's State of the Protestants in Ireland. 2. Cassandra, concerning the new Associations, &c. 1703, 4to. 3. Rehearsals; at first a weekly paper, published afterwards twice a-week in a half-sheet, by way of dialogue on the affairs of the times; begun in 1704, and continued for six or seven years. 4. The Wolf stripped of his Shepherd's Clothing, in Answer to Moderation a Virtue, 1704, 4to. The pamphlet it answers was written by James Owen. 5. The Bishop of Sarum's [Burnet's] proper Defence, from a Speech said to be spoken by him against occasional conformity, 1704, 4to. 6. The new Association of those called Moderate Churchmen, &c. occasioned by a pamphlet, intitled, the Danger of Priestcraft, 1705, 4to. 7. The new Association, part 2d, 1705, 4to. 8. The Principles of Dissenters concerning Toleration and occasional Conformity, 1705, 4to. 9. A Warning for the Church of England, 1706, 4to. Some have doubted whether these two pieces were his. 10. The good old Cause, or Lying in Truth; being the second Defence of the Bishop of Sarum from a second Speech, &c. 1710. For this a warrant was issued out against Leslie. 11. A Letter to the Bishop of Sarum, in Answer to his Sermon after the Queen's Death, in Defence of the Revolution, 1715. 12. Salt for the Leech. 13. The Anatomy of a Jacobite. 14. Gallienus redivivus. 15. Delenda Carthago. 16. A Letter to Mr William Molyneux, on his Case of Ireland's being bound by the English Acts of Parliament. 17. A Letter to Julian Johnson. 18. Several

Several Tracts against Dr Higden and Mr Hoadly. 19. A Discourse, shewing who they are that are now qualified to administer Baptism. 20. The History of Sin and Heresy, &c. 1698, 8vo. 21. The Truth of Christianity demonstrated, in a Dialogue between a Christian and a Deist, 1711, 8vo.—Against the Papists: 22. Of private Judgment and Authority in Matters of Faith. 23. The Case stated between the Church of Rome and the Church of England, &c. 1713. 24. The true notion of the Catholic Church, in Answer to the Bishop of Meaux's Letter to Mr Nelson, &c.

Besides these, he published the four following tracts: 25. A Sermon preached in Chester, against Marriages in different Communions, 1702, 8vo. This sermon occasioned Mr Dodwell's discourse upon the same subject. 26. A Dissertation concerning the Use and Authority of Ecclesiastical History. 27. The Case of the Regal and the Pontificate. 28. A Supplement, in Answer to a Book, intitled, The regal Supremacy in Ecclesiastical Affairs asserted, &c. These two last pieces were occasioned by the dispute about the rights of convocation, between Wake, &c. on one side, and Atterbury and his friends, among whom was Leslie, on the other.

It is said by the authors of the Biographical Dictionary, that, in consequence of a publication of his, intitled, "The hereditary right of the crown of England asserted," he was under the necessity of leaving the kingdom; and that he repaired to the Pretender at *Bar le duc*, where he was allowed to officiate, in a private chapel, after the rites of the church of England; and where he endeavoured, though in vain, to convert the Pretender to the Protestant religion.

That he repaired to *Bar le duc*, and endeavoured to convert to the church of England him whom he considered as the rightful sovereign of England, is indeed true; but we have reason to believe that this was not in consequence of his being obliged to leave the kingdom. There is, in the first place, some grounds to believe, that "The hereditary right of the crown of England asserted" was not written by him; and there is still in existence undoubted evidence, that, in consequence of his great fame as a polemic, he was sent to *Bar le duc* for the express purpose of endeavouring to convert the son of James II. by some gentlemen of fortune in England, who wished to see that prince on the throne of his ancestors. The writer of this article had the honour, 16 or 17 years ago, to be known to the granddaughter of one of those gentlemen—a lady of the strictest veracity; and from her he received many anecdotes of Leslie and his associates, which, as he did not then foresee that he should have the present occasion for them, he has suffered to slip from his memory. That lady is still alive, and we have reason to believe is in possession of many letters by Leslie, written in confidence to her grandfather, both from *Bar le duc* and from St Germains; and by the account which she gave of these letters, Leslie appears to have considered his prince as a weak and incorrigible bigot, though, in every thing but religion, an amiable and accomplished man. This may have been his genuine character; for we all know that it was the character of his father; but it is not of him that we are writing.

Mr Leslie having remained abroad from the year 1709 till 1721, returned that year to England, resolving, whatever the consequences might be, to die in his own country. Some of his friends acquainting lord Sunderland with his purposes, implored his protection for the good old man, which his lordship readily and generously promised. Mr Leslie had no sooner arrived in London, than a member of the house of commons officiously waited on lord Sunderland with the news, but met with such a reception from his lordship as the malice of his errand deserved. Our author then went over to Ireland, where he died April 13, 1722, at his own house at Glaslough in the county of Monaghan.

His character may be summed up in a few words. Consummate learning, attended by the lowest humility, the strictest piety without the least tincture of moroseness, a conversation to the last degree lively and spirited, yet to the last degree innocent, made him the delight of mankind, and leaves what Dr Hickes says of him unquestionable, that he made more converts to a sound faith and holy life than any other man of our times.

A charge, however, has been lately brought against him of such a nature, as, if well founded, must detract not only from his literary fame, but also from his integrity. "The short and easy Method with the Deists" is unquestionably his most valuable, and apparently his most original work; yet this tract is published in French among the works of the Abbé St Real, who died in 1692; and therefore it has been said, that unless it was published in English prior to that period, Charles Leslie must be considered as a shameless plagiary.

The English work was certainly not published prior to the death of Abbé St Real; for the first edition bears date July 17th 1697; and yet many reasons conspire to convince us, that our countryman was no plagiary. There is indeed a striking similarity between the English and the French works; but this is no complete proof that the one was copied from the other. The article Philology in the *Encyclopædia*, of which Dr Doig is the author, was published the very same week with Dr Vincent's dissertation on the Greek verb. It was therefore impossible that either of these learned men, who were till then strangers to each other's names, could have stolen aught from the other; and yet Dr Vincent's derivation of the Greek verb bears as striking a resemblance to Dr Doig's as the Abbé St Real's work does to Charles Leslie's. In the article Miracle (*Encycl.*), the credibility of the gospel miracles is established by an argument, which the author certainly borrowed from no man, and which the late principal Campbell considered as original; yet within half a year of the publication of that article, the credibility of the gospel-miracles was treated in the very same manner by F. Sayers, M. D. though there is in his dissertation complete internal evidence that he had not seen the article in the *Encyclopædia*. Not many months ago, the author of this sketch reviewed, in one of the journals, the work of a friend, which was at the same time reviewed in another journal, that at this moment he has never seen. Yet he has been told by a friend, who is much versant in that kind of reading, and knows nothing of his concern with either review, that the book in question must, in both journals, have been reviewed by the same hand; because in both the same character is given of it in almost the very same words!

After these instances of apparent plagiarism, which we know to be *only* apparent, has any man a right to say that Charles Leslie and the Abbé St Real might not have treated their subject in the way that they have done, without either borrowing from the other? The coincidence of arrangement and reasoning in the two works is indeed very surprising; but it is by no means so surprising as the coincidence of etymological deductions which appears in the works of the Doctors Doig and Vincent. The divines reason from the acknowledged laws of human thought; the reasonings of the grammarians, with all due deference to their superior learning, we cannot help considering as sometimes fanciful.

But this is not all that we have to urge on the subject. If there be plagiarism in the case, and the identity of titles looks very like it, it is infinitely more probable that the editor of St Real's works stole from Leslie, than that Leslie stole from St Real, unless it can be proved that the works of the Abbé, and this work in particular, were published before the year 1697. At that period, the English language was very little read or understood on the continent; whilst in Britain the French language was, by *scholars*, as generally understood as at present. Hence it is, that so many Frenchmen, and indeed foreigners of different nations, thought themselves safe in pilfering science from the British philosophers*; whilst there is not, that we know, one well authenticated instance of a British philosopher appropriating to himself the discoveries of a foreigner. If, then, such men as LEIBNITZ, John BERNOULLI, and DES CARTES, trusting to the improbability of detection, condescended to pilfer the discoveries of HOOKE, NEWTON, and HARRIOT, is it improbable that the editor of the works of St Real would claim to his friend a celebrated tract, of which he knew the real author to be obnoxious to the government of his own country, and therefore not likely to have powerful friends to maintain his right?

* See *Quantity* (Encycl.), *Astronomy*, *Dynamics*, *Impulsion*, and *Harriot*, in this Suppl.

But farther, Burnet, bishop of Sarum, was an excellent scholar, and well read, as every one knows, in the works of foreign divines. Is it conceivable, that this prelate, when smarting under the lash of Leslie, would have let slip so good an opportunity of covering with disgrace his most formidable antagonist, had he known that antagonist to be guilty of plagiarism from the writings of the Abbé St Real? Let it be granted, however, that Burnet was a stranger to these writings and to this plagiarism; it can hardly be supposed that *Le Clerc* was a stranger to them likewise. Yet this author, when, for reasons best known to himself, he chose (1706 to depreciate the argument of *the short method*, and to traduce its author as ignorant of ancient history, and as having brought forward his four marks for no other purpose than to put the deceitful traditions of Popery on the same footing with the most authentic doctrines of the gospel, does not so much as insinuate that he borrowed these marks from a Popish abbé, though such a charge, could he have established it, would have served his purpose more than all his rude railings and invective. But there was no room for such a charge. In the second volume of the works of St Real, published in 1757, there is indeed a tract entitled *Methode Courte et Aisée pour combattre les Deistes;* and there can be little doubt but that the publisher wished it to be considered as the work of his countryman. Unfortunately, however, for his design, a catalogue of the Abbé's works is given in the first volume; and in that catalogue the *Methode Courte et Aisée* is not mentioned.

We have dwelt thus long on *The Short and Easy Method with the Deists*, because it is one of the ablest works that ever was written in proof of the Divine origin of the Jewish and Christian Scriptures; a work of which the merit is acknowledged by Lord Bolingbroke, and which, as has been observed elsewhere (see THEOLOGY, n° 16. *Encycl.*) Dr Conyers Middleton confesses to be unanswerable. If by men of science we be thought to have spent our time well in vindicating the rights of our illustrious philosophers Hooke and Newton, to discoveries which have been unjustly claimed by the philosophers of Germany and France; we will not surely by the friends of Christianity be thought to have employed our time ill in vindicating Leslie's claim to this decisive argument in support of our holy religion.

LEVER, the first of the mechanical powers, for the properties of which see MECHANICS; and for a demonstration of its fundamental property, see STEEL YARD, both in the *Encyclopædia*.

LEWISBURG, a county in Orangeburgh district, S. Carolina.—*Morse.*

LEWISBURG, a post-town of N. Carolina, and capital of Franklin county. It is situated on Tar river, and contains between 20 and 30 houses, a court house and gaol. It is 30 miles N. of Raleigh, 25 south of Warrenton, 56 from Tarborough, and 411 from Philadelphia.—*ib.*

LEWISBURG, a post-town, and the chief town of Greenbriar county, Virginia; situated on the N. side of Greenbriar river, contains about 60 houses, a court-house and gaol. It is 250 miles W. by N. of Richmond, and 486 W. by S. of Philadelphia. N. lat. 38° 8'.—*ib.*

LEWISBURG, or *Tarstown*, a town of Northumberland county, Pennsylvania; situated on the west side of the Susquehannah, 7 miles above Northumberland. It contains about 60 houses, and is well situated for carrying on a brisk trade with the N. W. part of the State. It is 30 miles E. by N. of Aaronsburg.—*ib.*

LEWISTOWN, a plantation in Lincoln county, District of Maine, situated on the east side of Androscoggin river, and bounded S. W. by Bowdoin. Lewistown and Gore contain 532 inhabitants. It is 36 miles N. E. of Portland.—*ib.*

LEWISTOWN, or *Lewes*, a town in Sussex county, Delaware, is pleasantly situated on Lewes creek, 3 miles above its mouth in Delaware Bay, and as far W. by N. of the light-house on Cape Henlopen. It contains a Presbyterian and Methodist church, and about 150 houses, built chiefly on a street which is more than 3 miles in length, and extending along a creek, which separates the town from the pitch of the cape. The situation is high, and commands a full prospect of the light-house, and the sea. The court-house and the gaol are commodious buildings, and give an air of importance to the town. The situation of this place must at some future time render it of considerable importance. Placed at the entrance of a bay, which is crowded with vessels from all parts of the world, and which is frequently closed with ice a part of the winter season, necessity seems to require, and nature

nature ſeems to ſuggeſt, the forming this port into a harbour for ſhipping. The deficiency of water in the creek, may be cheaply and eaſily ſupplied by a ſmall canal ſo as to afford a paſſage for the waters of Rehoboth into Lewes creek, which would enſure an adequate ſupply. The circumjacent country is beautifully diverſified with hills, woods, ſtreams, and lakes, forming an agreeable contraſt to the naked ſandy beach, which terminates in the cape; but it is greatly infeſted with muſketoes and ſand-flies. It carries on a ſmall trade with Philadelphia in the productions of the country. A manufacture of marine and glauber ſalts, and magneſia, has been lately eſtabliſhed here, which is managed by a gentleman ſkilled in the practical knowledge of chemiſtry. It is 113 miles ſouth of Philadelphia. N. lat. 38° 6′, W. long. 75° 18′.—*ib.*

Lewistown, the chief town of Mifflin county, Pennſylvania, ſituated on the northern ſide of Juniatta river, on the W. ſide, and at the mouth of Ciſhicoquilis creek; a ſhort way weſt of the Long Narrows in Juniatta river, and about 23 miles north-eaſterly of Huntingdon. It is regularly laid out, and contains about 120 dwelling-houſes, a court-houſe and gaol. It was incorporated in 1795, and is governed by two burgeſſes, one high conſtable, a town-clerk, and two aſſiſtants. It is 150 miles W. N. W. of Philadelphia. N. lat. 40° 33′, W. long. 77° 23′.—*ib.*

LEWUNAKHANNEK, a town on the Ohio, where Chriſtian Indians ſettled under the care of the Moravian miſſionaries.—*ib.*

LEXAWACSEIN, a ſmall river of Pennſylvania, which riſes by ſeveral branches in Northampton county, Pennſylvania, on the eaſt ſide of Mount Ararat; theſe unite about 10 miles from its mouth in Delaware river. Its courſe is S. E. and eaſt. It joins the Delaware about 174 miles above Philadelphia.—*ib.*

LEXINGTON, a poſt-town of Virginia, and capital of Rockbridge county. It is ſituated on the poſt-road from Philadelphia to Kentucky, by way of the wilderneſs, and about a mile ſouth of the north branch of James's river. It contains a court-houſe, gaol, and about 100 houſes. The ſituation of the town is healthy and agreeable, and the country round highly cultivated. It is 159 miles W. by N. of Richmond, 398 from Philadelphia, and 465 from Danville in Kentucky.—*ib.*

Lexington, a poſt-town of Kentucky, and formerly the metropolis of that State. It is ſituated on a rich extenſive plain, in Fayette county, on the north ſide of Town Fork, a ſmall ſtream which falls into the ſouth branch of Elkhorn river. It is built on a regular plan, and contains about 250 houſes, 3 places of public worſhip, a court-houſe and gaol. It contains 2 printing-offices, which publiſh two weekly gazettes; has ſeveral ſtores of goods well aſſorted, and is a flouriſhing, agreeable place. It is ſituated in the midſt of a fine tract of country, on the head waters of Elkhorn river, 24 miles eaſt of Frankfort, and 774 S. W. by W. of Philadelphia. Its inhabitants are ſuppoſed to amount now (1796) to 2,000; among whom are a number of very genteel families, affording very agreeable ſociety. N. lat. 38° 6′, W. long. 85° 8′. Near this town are found curious ſepulchres full of human ſkeletons. It has been aſſerted that a man in or near the town, having dug 5 or 6 feet below the ſurface of the ground, came to a large flat ſtone, under which was a well of common depth, regularly and artificially ſtoned. In the vicinity of Lexington are found the remains of two ancient fortifications, furniſhed with ditches and baſtions, overgrown with large trees.—*ib.*

Lexington, a county in Orangeburgh diſtrict, S. Carolina.—*ib.*

Lexington, formerly called the *Great Falls*, a ſmall town of Georgia, ſituated on the ſouth ſide of Ogeechee river, on a beautiful eminence which overlooks the falls of the river. It is 2 miles from Georgetown, and 30 from Greenſborough.—*ib.*

Lexington, a town in Middleſex county, Maſſachuſetts, 10 miles N. W. of Boſton, having a neat Congregational church, and a number of compact houſes. It has been rendered famous by the battle fought in it, April 19, 1775, which may be conſidered as the commencement of the American revolution. This townſhip contains 941 inhabitants, and was incorporated in 1712.—*ib.*

LEYDEN, a townſhip in Hampſhire county, Maſſachuſetts, between Colerain and Bernardſton, 29 miles from Northampton, the ſhire town, and 117 N. W. of Boſton. It was incorporated in 1784, and contains 989 inhabitants.—*ib.*

LEZARS, an Indian nation, who inhabit between the mouth of the Ohio and Wabaſh rivers. They can furniſh 300 warriors.—*ib.*

LIBERTY, a poſt-town of Virginia, 15 miles from New-London, 35 from Fincaſtle, 40 from Franklin court-houſe, and 65 from Martinſburg.—*ib.*

Liberty-Town, a village of Maryland, ſituated in Frederick county, 10 miles north-eaſt of Frederickſ-town, and about 44 N. N. W. of the Federal City. Copper mines have been found near this town, and have been worked; but to no great extent as yet.—*ib.*

LICENSER of Books (ſee Liberty *of the Preſs*, *Encycl.*), has been an officer in almoſt every civilized nation, till the end of the laſt century that the office was aboliſhed in Great Britain. Profeſſor Beckmann, with his uſual induſtry,* has proved that ſuch an office was eſtabliſhed not only in the Roman Empire, but even in the republic, and in the free ſtates of ancient Greece. At Athens, the works of Protagoras were prohibited; and all the copies of them which could be collected were burnt by the public crier. At Rome, the writings of Numa, which had been found in his grave, were, by order of the ſenate, condemned to the fire, becauſe they were contrary to the religion which he had introduced. As the populace at Rome were, in times of public calamity, more addicted to ſuperſtition than ſeemed proper to the government, an order was iſſued, that all ſuperſtitious and aſtrological books ſhould be delivered into the hands of the prætor. This order was often repeated; and the emperor Auguſtus cauſed more than twenty thouſand of theſe books to be burnt at one time. Under the ſame emperor the ſatirical works of Labienus were condemned to the fire, which was the firſt inſtance of this nature; and it is related as ſomething ſingular, that, a few years after, the writings of the perſon who had been the cauſe of the order for that purpoſe ſhared the like fate, and were alſo publicly burnt. When Cremutius Cordus, in his hiſtory, called C. Caſſius the laſt of the Romans, the ſenate, in order to flatter Tiberius, cauſed the books to be burnt;

* *Hiſtory of Inventions*, vol. 3.

Lichen.

burnt; but a number of copies were saved by being concealed. Antiochus Epiphanes caused the books of the Jews to be burnt; and in the first centuries of our æra the books of the Christians were treated with equal severity, of which Arnobius bitterly complains. We are told by Eusebius, that Dioclesian caused the sacred Scriptures to be burnt. After the spreading of the Christian religion the clergy exercised, against books that were either unfavourable or disagreeable to them, the same severity which they had censured in the heathens as foolish and prejudicial to their own cause.

Soon after the invention of printing, laws began to be made for subjecting books to examination; a regulation proposed even by Plato; and which has been wished for by many since. Our author gives a great deal of curious information on this important subject, which our limits do not permit us to repeat; but it is apparent from his work, that the liberty of the press is but a modern privilege; and it has not been enjoyed completely in any country but in Britain and America.

LICHEN (see *Encycl.*), is a genus of plants, of which the most valuable species seems to be the LICHEN ROCELLA, or *Argol*. As that species has not been noticed in the article referred to, the following account of it from Professor Beckmann will be acceptable to many of our readers:

It is found in abundance in some of the islands near the African coast, particularly in the Canaries, and in several of the islands in the Archipelago. It grows upright, partly in single, partly in double stems, which are about two inches in height. When it is old, these stems are crowned with a button sometimes round, and sometimes of a flat form, which Tournefort, very properly, compares to the excrescences on the arms of the sepia. Its colour is sometimes a light, and sometimes a dark grey. Of this moss, with lime, urine, and alkaline salts, is formed a dark red paste, which in commerce has the same name, and which is much used in dyeing. That well known substance called lacmus is also made of it.

Theophrastus, Dioscorides, and their transcriber Pliny, give the name of *Phycos thalassion*, or *pontion*, to this plant, which, notwithstanding its name, is not a sea weed but a moss; as it grew on the rocks of different Islands, and particularly on those of Crete or Candia. It had, in their time, been long used for dyeing wool, and the colour it gave when fresh was so beautiful, that it excelled the ancient purple, which was not red, as many suppose, but violet. Pliny tells us, that with this moss dyers gave the ground or first tint to those cloths which they intended to dye with the costly purple. When it was first employed as a dye by the moderns, is not so certain, though the Professor has proved, we think completely, that it must have been at least as early as the beginning of the 14th century.

"Among the oldest and principal Florentine families (says he), is that known under the name of the Oricellarii or Rucellarii, Ruscellai or Rucellai, several of whom have distinguished themselves as statesmen and men of letters. This family are descended from a German nobleman, named Ferro or Frederigo, who lived in the beginning of the twelfth century. One of his descendants, in the year 1300, carried on a great trade in the Levant, by which he acquired considerable riches, and returning at length to Florence, with his fortune, first made known in Europe the art of dyeing with argol. It is said, that a little before his return from the Levant, happening to make water on a rock covered with this moss, he observed, that the plant, which was there called *respio*, or *respo*, and in Spain *orciglia*, acquired by the urine a purple, or, as others say, a red colour. He therefore tried several experiments; and when he had brought to perfection the art of dyeing wool with this plant, he made it known at Florence, where he alone practised it for a considerable time, to the great benefit of the state. From this useful invention, the family received the name of Oricellarii, from which, at last, was formed Rucellai." The Professor, however, does not believe that this Florentine discovered the dye by means of the above mentioned accident, but that he learned the art in the Levant, and on his return taught it to his countrymen.

"Our dyers do not purchase raw argol, but a paste made of it, which the French call *orseille en pâte*. The preparation of it was for a long time kept a secret by the Florentines. The person who, as far as I know, made it first known was Rosetti; who, as he himself tells us, carried on the trade of dyer at Florence. Some information was afterwards published concerning it by Imperati * and Micheli the botanist.† In later times this art has been much practised in France, England, and Holland. Many druggists, instead of keeping this paste in a moist state with urine, as they ought, suffer it to dry, in order to save a little dirty work. It then has the appearance of a dark violet-coloured earth, with here and there some white spots in it.

* Lib. xxvii. c. 9.

† *Nova Plantarum genera Florenciæ,* 1729.

"The Dutch (continues our author), who have found out better methods than other nations of manufacturing many commodities, so as to render them cheaper, and thereby to hurt the trade of their neighbours, are the inventors also of lacmus, a preparation of argol, called *orseille en pierre*, which has greatly lessened the use of that *en pâte*, as it is more easily transported and preserved, and fitter for use; and as it is besides, if not cheaper, at least not dearer. This art consists, undoubtedly, in mixing with that commodity some less valuable substance, which either improves or does not much impair its quality, and which, at the same time, increases its weight (A). Thus do they pound cinnabar and smalt finer than other nations, and yet sell both these articles cheaper. Thus do they sift cochineal, and sell it cheaper than what is unsifted.

"It was for a long time believed, that the Dutch prepared their lacmus from those linen rags which in the south of France are dipped in the juice of the *croton tinctorium*; but at present, it is almost certainly known, that *orseille en pâte* is the principal ingredient in *orseille en pierre* that is in lacmus; and for this curious information we are indebted to Ferber. But whence arises the smell of the lacmus, which appears so like that of the

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(A) As dry lacmus is much cheaper than moist, it may be readily supposed that it is adulterated with sand and other substances. *Valentini Historia simplicium.* Francf. ad Moen. 1716. fol. p. 152.

the Florentine iris?" Some of the latter may, perhaps, be mixed with it; for our author thinks, that he has observed in it small indissoluble particles, which may have been bits of the roots. The addition of this substance can be of no use to improve the dye; but it may increase the weight, and give the lack more body; and perhaps it may be employed to render imperceptible some unpleasant smell, for which purpose the roots of that plant are used on many other occasions.

LICHTENAU, a Moravian settlement on the east side of Muskingum river, 3 miles below Goschachguenk; but as the warriors passed constantly through this place, it was forsaken, and they removed to Salem, 5 miles below Gnadenhuetten.—*Morse.*

LICK, a name by which salt springs are called in the western parts of the United States.—*ib.*

LICKING, a navigable river of Kentucky, which rises on the western confines of Virginia; interlocks with the head waters of Kentucky river; runs in a N. W. direction, upwards of 180 miles, and by a mouth 150 yards wide flows through the south bank of Ohio river, opposite fort Washington. Upon this river are iron-works, and numerous salt springs. Its principal branch is navigable nearly 70 miles. From Limestone to this river, the country is very rich, and covered with cane, rye-grass, and natural clover.—*ib.*

LIGHT, it has been observed in the article CHEMISTRY, n° 319. (*Suppl.*), consists of rays differently flexible. This was established by some well devised experiments made by Henry Brougham, Esq; of which it may be proper to give an account here.

In the first experiment, he darkened his chamber in the usual way, and let a beam of the sun's light into it through the hole of a metal plate fixed in the shutter of the window, $\frac{1}{40}$th of an inch in diameter. At the hole within the room he placed a prism of glass, of which the refracting angle was 45 degrees, and which was everywhere covered with black paper, except a small part on each side; and through this part the light was refracted so as to form a distinct spectrum on a chart at six feet distance from the window. In the rays, at two feet from the prism, he placed a black unpolished pin, of which the diameter was $\frac{1}{40}$th of an inch, parallel to the chart, and in a vertical position. The shadow of the pin was found in the spectrum; and this shadow had a considerable penumbra, which was broadest and most distinct in the violet part, narrowest and most confused in the red, and of an intermediate thickness and distinctness in the intermediate colours. The penumbra was bounded by curvilinear sides, convex towards the axis to which they approached as to an asymptote, so as to be nearest to it in the place of the least refrangible rays. By moving the prism on its axis, and causing the colours to ascend and descend on any bodies that were used instead of the pin, the red, wherever they fell, made the least, and the violet the greatest, shadow.

In the next experiment, a screen was substituted in the place of the pin; and this screen had a large hole, on which was a brass plate, pierced with a small hole $\frac{1}{25}$d of an inch in diameter. While an assistant moved the prism slowly on its axis, the author observed the round image made by the different rays passing through the hole to the chart; that made by the red was greatest, that of the violet least, and that of each intermediate ray was of an intermediate size. When the sharp blade of a knife was held at the back of the hole, "so as to produce the fringes mentioned by Grimaldo and Newton, these fringes in the red were broadest and most moved inwards to the shadow, and most dilated when the knife was moved over the hole; and the hole itself on the chart was more dilated during the motion when illuminated by the red than when illuminated by any other of the rays, and least of all when illuminated by the violet."

From these two experiments, the author infers "that the rays of the sun's light differ in degree of flexibility, and that those which are least *refrangible* are *most inflexible*." From other experiments, he concludes, that the *most inflexible* rays are also *most deflexible*. In the sequel of his paper, he ascertains the proportion which the angle of *inflection* bears to that of *deflection* at equal incidences, and the proportion which the different *flexibilities* of the different rays bear to one another. We shall give an account of some other experiments made by him, and of the inferences drawn from them, under the word REFLEXITY, to which a reference has already been made.

LIGONIER, *Fort*, lies on the road from Philadelphia to Pittsburg; 266 miles from the former and 54 from the latter, and 9 miles from the E. side of Laurel Hill.—*Morse.*

LIGUANEA, mountains in the island of Jamaica. At the foot of these in St Andrew's parish, about 6 miles from Kingston, is the most magnificent botanical garden in the world. It was established in 1773, under the sanction of the assembly. The fortune of war having thrown into Lord Rodney's hands many rare plants, he presented to his favoured island plants of the genuine cinnamon, the mango, bread-fruit, and other oriental productions; which are now become common in the island.—*ib.*

LILLIE, a citadel at Cape Ann, in the township of Gloucester, Massachusetts.—*ib.*

LIMA, the middle division of Peru, in S. America. It has Quito on the north, the mountains called the Andes on the east, the audience of Los Charcos on the south, and the Pacific ocean on the west. There are many wild beasts in the audience.—*ib.*

LIMA, the capital of Peru, in S. America, is also called Los Reyes, or the City of Kings, and is the emporium of this part of the world. It was founded by Don Francisco Pizarro on the 18th of January, 1535; is situated in a large, spacious, and fertile plain, called the valley of Rimac, on the south side of the river Rimac, which runs westward. The name of Lima being only a corrupt pronunciation of the Indian word, which is derived from an idol to which the Indians and their Yncas used to sacrifice. This idol being supposed to return answers to the prayers offered to it, they called it, by way of distinction, Rimac, i. e. the speaker.

It is so well watered by the river Rimac, that the inhabitants command a stream, each for his own use. The N. side of the town runs nearly close to the river for the length of about 10 furlongs. At about $\frac{1}{3}$ of this space, from the western extent, an elegant stone bridge of 4 or 5 arches is built across the river leading south, about 200 yards to the great square, of which the side is about 140 yards. The street continues south from the bridge, for near a mile, having parallel streets, Lima.

8 to the weft, and 6 to the eaft, befides other ftreets which run obliquely fouth-eaftward. The 15 ftreets, running north and fouth, are croffed by 8 others running eaft and weft, befides feveral to the fouthward, not parallel to the former, and others in the eaftern parts, which have different directions. The figure of the town is nearly quadrilateral. A diagonal line running eaft and weft, would be 18 furlongs in length; and the fouthern perpendicular, about 7 furlongs, and the northern about 4 furlongs; fo that the city ftands on a fpace of ground nearly equal to a mile and a quarter fquare. The northern fide for about three quarters of a mile next the river, is fortified moftly by redans; the reft of the circuit is inclofed with 34 hollow baftions and their intermediate curtains. The whole is faced with a brick wall, and furrounded with a ditch, but has no covered way, glacis, nor outworks. Eight gates, befides that at the bridge, furnifh a communication with the adjacent country. The city ftands about 6 miles from Callao, which is the fea-port to Lima, and 180 north-weft of Guamanga. The white people in Lima are eftimated at about 15,000, and the whole number of inhabitants are about 60,000. One remarkable fact is fufficient to demonftrate the wealth of this city. When the viceroy, the Duke de la Palada, made his entry into Lima, in 1682, the inhabitants, to do him honour, caufed the ftreets to be paved with ingots of filver, amounting to 17 millions fterling. All travellers fpeak with amazement of the decorations of the churches with gold, filver, and precious ftones, which load and ornament even the walls. The only thing that could juftify thefe accounts, is the immenfe riches and extenfive commerce of the inhabitants. The merchants of Lima may be faid to deal with all the quarters of the world; and that both on their own account, and as factors for others. Here, all the productions of the fouthern provinces are conveyed, in order to be exchanged at the harbour of Lima, for fuch articles as the inhabitants of Peru ftand in need of. The fleet from Europe and the Eaft-Indies land at the fame harbour; and the commodities of Afia, Europe, and America, are there bartered for each other. But all the wealth of the inhabitants, all the beauty of the fituation, and the fertility of the climate of Lima, are infufficient to compenfate for the difafter which threatens, and has fometimes actually befallen them. Earthquakes are very frequent.

Since the year 1582, there have happened about fifteen concuffions, befides that on the 28th of October, 1746, at half an hour after 10 at night, five hours and three quarters before the full of the moon; which began with fuch violence, that in little more than three minutes, the greateft part, if not all the builings, great and fmall, in the whole city, were deftroyed; burying under their ruins thofe inhabitants who had not made fufficient hafte into the ftreets and fquares, the only probable places of fafety in thofe terrible convulfions of nature. At length the dreadful effects of the firft fhock ceafed, but the tranquillity was of fhort duration; concuffions returning fo repeatedly, that the inhabitants, according to the account fent of it, computed 200 in the firft 24 hours; and to the 24th of February, the following year, 1747, when the narrative was dated, no lefs than 450 fhocks were obferved: fome of which, if lefs permanent, were equal to the firft in violence. The fort of Callao, at the very fame hour, tumbled into ruins. But what it fuffered from the earthquake in its buildings, was inconfiderable, when compared with the terrible cataftrophe which followed. For the fea, as is ufual on fuch occafions, receding to a confiderable diftance, returned in mountainous waves, foaming with the violence of the agitation, and fuddenly overwhelmed Callao and the neighbouring country. This was not, however, performed by the firft fwelling of the waves: For the fea retiring further, returned with ftill greater impetuofity, the ftupendous water covering both the walls and other buildings of the place; fo that whatever had efcaped the firft, was now totally overwhelmed by thofe terrible mountains of waves; and nothing remained, except a piece of the wall of the fort of Santa Cruz, as a memorial of this terrible devaftation. Here were then 23 fhips and veffels, great and fmall, in the harbour, of which 19 were funk, and the other four, among which was a frigate called St Fermin, carried by the force of the waves to a confiderable diftance up the country. This terrible inundation extended to other parts of the coaft, as Cavallos and Guanape; the towns of Chancay, Guaura, and the vallies Della Baranco, Sape, and Pativilca, underwent the fame fate as the city of Lima. According to an account fent to Lima after this accident, a volcano in Lucanos burft forth the fame night, and ejected fuch quantities of water, that the whole country was overflown; and in the mountain near Patas, called Converfiones de Caxamarquilla, three other volcanoes burft, difcharging frightful torrents of water; and in the fame manner as that of Carguayraffo. Lima is the fee of an archbifhop, and the feat of an univerfity. The inhabitants are very debauched; and the monks and nuns, of whom there are great numbers, are no more chafte than the reft of the inhabitants. If any one happens to rival a monk, he is in danger of his life, for they always carry daggers concealed. Lima, according to feveral obfervations made for that purpofe, ftands in lat. 12° 2′ 31″ S. and its long. is 75° 52′ W. The variation of the needle is 9° 2′ 30″ eafterly.—*ib.*

Lima, ‖ Limeftone.

LIMBE, a village in the N. W. part of the ifland of St Domingo, 7 leagues weft by fouth of Cape Francois.—*ib.*

LIMBERS, in artillery, a fort of advanced train, joined to the carriage of a cannon on a march. It is compofed of two fhafts, wide enough to receive a horfe between them, called the *fillet horfe:* thefe fhafts are joined by two bars of wood, and a bolt of iron at one end, and mounted on a pair of rather fmall wheels. Upon the axle-tree rifes a ftrong iron fpike, which is put into a hole in the hinder part of the train of the gun-carriage, to draw it by. But when a gun is in action, the limbers are taken off, and run out behind it.

LIMERICK, a townfhip in York county, Maine, fituated near the confluence of Little Offipee river with Saco, and oppofite Gorham in Cumberland county. It was incorporated in 1787, contains 411 inhabitants and is 114 miles northerly of Bofton.—*Morfe.*

LIMERICK, a townfhip in Montgomery county, Pennfylvania.—*ib.*

LIMESTONE CREEK, in Tenneffee, is the north-eaftern branch of Nolachucky river. It rifes 22 miles fouth of Long-Ifland in Holfton river.—*ib.*

LIMIT

LIMIT OF A PLANET, has been sometimes used for its greatest heliocentric latitude.

LIMITED Problem, denotes a problem that has but one solution, or some determinate number of solutions: as to describe a circle through three given points that do not lie in a right line, which is limited to one solution only; to divide a parallelogram into two equal parts by a line parallel to one side, which admits of two solutions, according as the line is parallel to the length or breadth of the parallelogram; or to divide a triangle in any ratio by a line parallel to one side, which is limited to three solutions, as the line may be parallel to any of the three sides.

LIMONADE, a village on the north side of the French part of the island of St Domingo, 4 leagues south-west of Fort Dauphine, and 7½ measuring in a straight line south east of Cape Francois. N. lat. 19° 37′.—*Morse*.

LINCOLN, a large maritime county of the District of Maine; bounded north by Canada, south by the ocean, east by Hancock county, and west by that of Cumberland. Its sea-coast extends from that part of Penobscot Bay opposite to Deer Island eastward, to Cape Small Point westward. It is 200 miles long, and 54 broad, and comprehends 46 towns and plantations; but there are large tracts yet unsettled. The population amounts to 29,962 free persons. The sea-coast of the counties of Cumberland and Lincoln is 100 miles in extent, measured in a straight line, but is said to be above 200 by the course of the waters. It abounds with safe and commodious harbours; and the whole shore is covered by a line of islands, among which vessels may generally anchor in safety. There are in these counties many large rivers, some of them navigable far up the country; and although navigation for large vessels is interrupted by falls, when far up the rivers, yet above the falls, there is plenty of water for boats, nearly to the source of the rivers; and by the lakes and ponds and branches of the rivers, there is a water communication, with few interruptions, from the western to the eastern bounds, across the country, above the centre of it. By this route its productions may, at a small expense, be transported to the different sea ports. The supreme judicial court held in Lincoln county, has civil and criminal jurisdiction in causes arising in Hancock and Washington counties. Chief towns, Pownalborough, Hallowell and Waldoborough. —*ib*.

LINCOLN, a county of Morgan district, North-Carolina; bounded N. E. by Iredell, N. W. by Burke, west by Rutherford, and east by Cabarras. It contains 9,224 inhabitants, of whom 935 are slaves. Here are mineral springs and mines of iron. A furnace and forge have been erected, which carry on the manufacture of pig, bar iron, &c. Chief town, Lincolntown.—*ib*.

LINCOLN, a county of Kentucky, bounded north by Mercer, north-west by Washington, north-east by Maddison, and south by Logan. By the census of 1790, it contained 6,548 inhabitants, of whom 1,094 were slaves. The road from Danville on Kentucky river passes through it south-westerly, and over Cumberland mountain to Virginia.—*ib*.

LINCOLN, a town in Mercer county, Kentucky, situated on the east side of Dick's river, on the road from Danville to Virginia. It stands 12 miles south-east of Danville, and 11 north-west of Crab-Orchard.—*ib*.

LINCOLN, a township in Grafton county, New-Hampshire, incorporated in 1764, contains 22 inhabitants.—*ib*.

LINCOLN, a township in the north-east part of Addison county, Vermont, granted Nov. 7th 1780.—*ib*.

LINCOLN, a township in Middlesex county, Massachusetts, incorporated in 1754. It contains 740 inhabitants, and is 16 miles north-west of Boston.—*ib*.

LINCOLNTOWN, a post-town of N. Carolina, and capital of Lincoln county. It contains about 20 houses, a court-house, and gaol. It is 46 miles from Morgantown, 159 from Salem, and 718 south by west of Philadelphia.—*ib*.

LINDLEY, a village on the west side of the Canawisque branch of Tioga river, in New-York, 2 miles north of the Pennsylvania line, 8 S. W. by S. of the Painted Post, 64 south-east of Hartford, on the road to Niagara.—*ib*.

LINN, a township in Northampton county, Pennsylvania.—*ib*.

LISBON, a town in New-London county, Connecticut, lately a part of Norwich, about 7 miles northerly of Norwich. It contains 2 parishes, each having a Congregational church. It lies on the west side of Quinebaug river, and east of Franklin.—*ib*.

LISBON, a village of York county, Pennsylvania, situated near the south side of Yellow Breeches creek, which falls into the Susquehannah. It contains about 15 houses, and lies 18 miles from York.—*ib*.

LITCHFIELD, a township in Lincoln county, District of Maine, 45 miles from Hallowell, and 220 N. E. of Boston.—*ib*.

LITCHFIELD, a township in Hillsborough county, New-Hampshire, situated on the east side of Merrimack river, about 54 miles westerly of Portsmouth. It was settled in 1749, and in 1775 it contained 284, and in 1790, 357 inhabitants.—*ib*.

LITCHFIELD, a populous and hilly county of Connecticut; bounded north by the State of Massachusetts, south by New-Haven and Fairfield counties, east by Hartford, and west by the State of New-York. It is divided into 20 townships, containing 38,755 inhabitants, inclusive of 233 slaves. The general face of the country is rough and mountainous. The soil is fertile, yielding large crops of wheat and Indian corn, and affording fine pasture. It is separate entirely from maritime commerce, and the inhabitants are almost universally farmers.—*ib*.

LITCHFIELD, the chief town of the above county, situated upon an elevated plain, and much exposed to the cold winds of winter, but enjoys also a large share of the refreshing breezes of summer. It is a handsome situation, containing about 60 or 70 dwelling-houses, a court-house and meeting-house. It is 32 miles west of Hartford, and 42 N. N. W. of New-Haven. N. lat. 41° 46′. W. long. 73° 37′. In the S. W. corner of the township stands an high hill called Mount Tom. On several small streams, some of which fall into Great Pond, are 3 iron-works, an oil-mill and a number of saw and grist mills.—*ib*.

LITCHFIELD, a township in Herkemer county, New-York, taken from German Flats, and incorporated in 1796.—*ib*.

LITIZ, or *Leditz*, a village or town in Lancaſter county, Pennſylvania, ſituated in Warwick townſhip, on the ſouth ſide of a ſmall ſtream, which ſends its waters through Coneſtoga creek into the Suſquehannah. It contains about 50 houſes chiefly of ſtone, a ſtone tavern, and an elegant church with a ſteeple and bell. The ſettlement was begun in 1757. It is inhabited by the United Brethren, whoſe mode of life and cuſtoms are ſimilar to thoſe of Bethlehem. There is alſo a good farm and ſeveral mill-works belonging to the place. The number of inhabitants, including thoſe that belong to Litiz congregation, living on their farms in the neighbourhood, amounted, in 1787, to upwards of 300. It is 8 miles north of Lancaſter, and 66 W. by N. of Philadelphia.—*ib.*

LITTLE EGG HARBOUR, a port of entry on the eaſt coaſt of New-Jerſey, comprehending all the ſhores, bays and creeks from Barnegat Inlet to Brigantine Inlet, both incluſive. The town of *Tuckerton* is the port of entry for this diſtrict.—*ib.*

LITTLE ALGONQUINS, Indians who inhabit near the Three Rivers, and can raiſe about 100 warriors.—*ib.*

LITTLEBOROUGH, a plantation in Lincoln county, Diſtrict of Maine, having 263 inhabitants.—*ib.*

LITTLE BRITAIN, a townſhip in Lancaſter county, Pennſylvania. Alſo a townſhip in Cheſter county, in the ſame State.—*ib.*

LITTLE-COMPTON, a townſhip in Newport county, Rhode-Iſland, bounded N. by Tiverton; S. by the Atlantic ocean, where are Seakonnet rocks; W. by the eaſt paſſage into Mount Hope Bay; and E. by the State of Maſſachuſetts. It contains 1542 inhabitants, of whom 23 are ſlaves. It was called *Seconnet* or *Seakonnet* by the Indians, and is ſaid to be the beſt cultivated townſhip in the State, and affords greater quantities of meat, butter, cheeſe, vegetables, &c. than any other town of its ſize. The inhabitants are very induſtrious, and manufacture linen and tow cloth, flannels, &c. of an excellent quality, and in conſiderable quantities for ſale.—*ib.*

LITTLE FORT, in the N. W. Territory, ſtands on the ſouth-weſtern bank of lake Michigan, and on the ſouth ſide of Old Fort river, which runs a N. eaſtern courſe into the lake.—*ib.*

LITTLE HARBOUR. It is near the mouth of Paſcataqua river, about a mile from Portſmouth, in New-Hampſhire. A ſettlement was attempted here in 1623.—*ib.*

LITTLE RIVER, in Georgia, is a beautiful and rapid river, and at its confluence with Savannah river, is about 50 yards wide. On a branch of Little river is the town of Wrightſborough. Alſo a river which ſeparates, in part, N. and S. Carolina.—*ib.*

LITTLE RIVER, a plantation in Lincoln county, Diſtrict of Maine, containing 64 inhabitants.—*ib.*

LITTLE ROCKS, on the N. W. bank of Illinois river, are ſituated 60 miles from the Forks, 270 from the Miſſiſſippi river, and 43 S. W. of Fox river. The S. W. end of theſe rocks lies nearly oppoſite to the mouth of Vermilion river, and the two ſmall ponds where the French and Indians have made good ſalt, lie oppoſite the N. E. end. A coal mine half a mile long extends along the bank of the river above theſe rocks.—*ib.*

LITTLE SODUS, a ſmall harbour of lake Ontario, about 15 miles ſouthward of Oſwego.—*ib.*

LITTLETON, a townſhip in Middleſex county, Maſſachuſetts, 30 miles N. W. of Boſton.—*ib.*

LITTLETON, a townſhip in Grafton county, New-Hampſhire, (a part of Apthorpe) was incorporated in 1784, and contains 96 inhabitants. It lies on Connecticut river, below the 15 mile Falls, and nearly oppoſite Concord in Vermont.—*ib.*

LITTLETON, a townſhip in Caledonia county, Vermont, on the W. ſide of Connecticut river, oppoſite the 15 mile Falls, and contains 63 inhabitants.—*ib.*

LITTLETON, FORT, in Pennſylvania, is 27 miles E. of Bedford, 39 S. W. by W. of Carliſle, and 34 N. by E. of Fort Frederick, in Waſhington county, Maryland.—*ib.*

LIVERMORE, a plantation in Cumberland county, Diſtrict of Maine, ſituated on Androſcoggin river, 19 miles N. W. of Hallowell.—*ib.*

LIVERPOOL, a town on the S. ſide of the Bay of Fundy, in Queen's county, Nova-Scotia, ſettled by New-Englanders. Roſſignol, a conſiderable lake, lies between this town and Annapolis. It is 32 miles north-eaſt of Shelburne, and 58 north-weſt of Halifax. It was formerly called *Port Roſſignole*.—*ib.*

LIVINGSTON, a townſhip in Columbia county, New-York, ſituated on the eaſt bank of Hudſon's river, 4 miles northerly of Palatine town, 11 ſouth of Hudſon, and 9 ſouth-eaſt of Claverack. It contains 4,594 inhabitants; of whom 659 are electors, and 233 ſlaves.—*ib.*

LIVINGSTON'*s Creek*, a conſiderable branch of North-Weſt, an arm of Cape Fear river. This creek heads in vaſt ſwamps in the vicinity of the beautiful lake Waukama.—*ib.*

LOBOS, iſlands on the coaſt of Brazil. The ſouthernmoſt iſland is in ſouth latitude 6° 27′. One of theſe iſlands obtains the name of *Lobos de la mer*; the other, which lies to the north of it, and very like it in ſhape and appearance, is called *Lobos de tierra*.—*ib.*

LOBOS or WOLVES Iſland, in the river of La Plata, on the E. coaſt of South America, is the firſt iſland within that river, a little S. from the N. point of the entrance, called Cape St Mary. Palm Iſland is on the ſhore nearly N. from it, but without the cape and Maldonada Iſland is within it, off the mouth of Maladonada Bay, on the N. ſhore alſo.—*Malham.*

LOBOS or WOLVES Iſland, on the coaſt of Peru, on the W. ſide of South America, and on the S. Pacific Ocean, is a league and a half from the Morro Quemada, or headland of Quemada. It is a ſmall iſland, about three quarters of a league in length, in the direction of N. W. and S. E. and the land is indifferently high. Several flat low rocks lie between this iſland and the main, which ſtretch out towards the headland half over the channel, and leave the paſſage between very narrow and dangerous, though ſome ſhips have paſſed through by miſtake, ſuppoſing it to have been the channel between St Gallan Iſland and the headland of Paraca. But ſuch an error muſt have been occaſioned by great inattention, as they are very readily known and diſtinguiſhed from each other; becauſe this iſland of Lobos is foul and has rocks all round it, and one in particular, which is called the Breaker, ſtands above the water like a ſugar-loaf, but the iſland of St

Lobos.

Gallan is all clean and bold, and has no rocks about it, besides the advantage of a much broader channel. The appearance of the land on the main also differs very much, that of Paraca being of an equal height, but this of Morro Quemada comes down sloping from the N. side, from a vast high mountain quite to the shore, where ships anchor on the starboard side of the entrance.

But as ships have passed through between the island of Lobos and the main by mistake, it is a demonstration that the measure is practicable. It is certain that there is a sufficient depth of water, but the hazard is that ships may touch upon the rocks, because in coming out to the northward there is a ledge of rocks, as has been mentioned already, that reaches almost half over towards the main. To the northward of this ledge of rocks there is also a smooth bank of sand, which forms as it were a creek between it and the island; and the sea is here so still, being kept off by that sand, that it makes a good road, where a ship may anchor in from 7 to 8 fathoms water, and, if occasion required, might venture to careen in it; but care should be taken to sound it well before any ship ventures into it. From this island to the Morro de Vejas, or Old Man's Headland, is only half a league. The lat. of the island is about 14° 40′ S.—*ib.*

Lobos Island, or *Ilha de* Lobos, otherwise called Sea Wolves Island, off the port of Guara on the coast of Peru, is in lat. about 11° 30′ S. It is but a small island, and near to it is a shoal, without which it is particularly necessary to keep at a good distance, as being very dangerous, and having but little depth of water within it. It must be brought a-stern to anchor in the port of Guara, according to the directions there given.—*ib.*

Lobos Islands, distinguished by the Spaniards from their situation into Lobos de Barlevento and Lobos de Sotovento, or the windward and leeward islands of Lobos, are about 7 leagues from each other, and not far from the coast of Peru, in lat. 6° 25′ and 6° 45′ S. These also are called Sea Wolves or Seals Islands. It is sufficient to point out their situation, so as to avoid them, according as ships are passing to the windward or leeward of them. The Lobos de Sotovento, or the Leeward Island, to the N. W. from the other, is about 2 leagues in circuit, and is low, but has some high rocks about it; from which to Cape Aguja to the northward is about 5 leagues.—*ib.*

Lobos de Payta, or Seals Island, to the northward of Cape Anguja, so called from Port Pata, which is 11 leagues to the N. of it, is a small round island, the coast of which is not high, but has very clean ground round it, and close to it; and the bite within it is known by the name of Eucanada de Cechusa, or bay of Cechusa, which runs in so deep that this island is 11 leagues due W. from the town of Cechusa, as is the Port of Payta 10 leagues and a half at N. W. from it.—*ib.*

Lobos de la Mer Islands, in the S. Pacific Ocean, at the distance of 16 leagues from the main, are two small islands about a mile each in circumference, to the W. of one of which is a safe harbour, with a sandy bottom, for ships to careen. They are so named to distinguish them from Lobos de la Terra, or near the land. But the two largest of those which are met with under this name are 6 miles in length, and another small island is said to be to windward of the eastermost of these two, not half a mile in length, with rocks and breakers near the shore, the soil of which is a hungry white clay, and the important article of water is wholly wanting. But our accounts of these are related very imperfectly, so that they can only be given as they have come to our hands.—*ib.*

Local, || London Cove.

LOCAL Problem, is one that is capable of an infinite number of different solutions; because the point, which is to solve the problem, may be indifferently taken within a certain extent; as suppose any where in such a line, within such a plane figure, &c. which is called a *geometrical Locus*.

A local problem is *simple*, when the point sought is in a right line; *plane*, when the point sought is in the circumference of a circle; *solid*, when it is in the circumference of a conic section; or *sursolid*, when the point is in the perimeter of a line of a higher kind.

LOCI, the plural of

LOCUS, a line by which a local or indeterminate problem is solved; or a line of which any point may equally solve an indeterminate problem. See Algebra, *Encycl.*

LOCKE, a military township in New-York State, adjoining to Milton on the east, situated in Onondago county. The centre of the town is 13 miles N. E. of the S. end of Cayuga lake.—*Morse.*

LOCKARTSBURG, a town in Luzerne county, Pennsylvania, situated on an isthmus formed by the confluence of the Susquehannah and Tioga rivers, about a mile above their junction. There are as yet few houses built, but it promises to be a place of importance, as both the rivers are navigable for many miles into the State of New-York. It is 4 miles south of the New-York line, nearly 48 westerly of Harmony, and 90 above Wilksbarre.—*ib.*

LOGAN, a new county in the State of Kentucky.—*ib.*

LOGISTIC Curve, the same with Logarithmic *Curve*, for which see *Encycl.*

LOGISTICS, or Logistical *Arithmetic*, a name sometimes employed for the arithmetic of sexagesimal fractions, used in astronomical computations.

The same term has been used for the rules of computations in algebra, and in other species of arithmetic: witness the logistics of Vieta and other writers.

Shakerly, in his *Tabulæ Britannicæ*, has a table of logarithms adapted to sexagesimal fractions, and which he calls Logistical Logarithms; and the expeditious arithmetic, obtained by means of them, he calls Logistical Arithmetic.

LOGSTOWN, on the western side of the Ohio, lies south of Butler's Town, and 18 miles from Pittsburgh.—*Morse.*

LOGWOOD COUNTRY, lies N. W. of the Mosquito Shore, at the head of the Bay of Honduras, and extends from Vera Paz to Yucatan from 15½° to 18½° N. lat. The whole coast is overspread with islots, keys and shoals, and the navigation is intricate.—*ib.*

LONDON, a town in Ann Arundel county, Maryland, 5 miles S. W. of Annapolis.—*ib.*

LONDON COVE, a narrow water of Long-Island Sound, which sets up north into the township of New-London, 4 miles west of the mouth of Thames river.

Millstone Point separates it from another much broader on the west, across which is a handsome bridge, with a draw at Rope Ferry.—*ib.*

LONDONDERRY, a post-town in Rockingham county, New-Hampshire, situated near the head of Beaver river, which empties into Merrimack river, at Pawtucket Falls. It is 36 miles S. W. by W. of Portsmouth. Londonderry was settled in 1718, and incorporated 1722, and contains 2590 inhabitants. The people are mostly the descendants of emigrants from it, came chiefly from Ulster county in Ireland, originally from Scotland, and attend largely to the manufacture of linen cloth and thread, and make considerable quantities for sale. The town is much indebted to them for its wealth and consequence.—*ib.*

Londonderry, a township in Halifax county, Nova-Scotia, situated on the N. side of Cobequid or Colchester river, about 30 miles from its mouth, at the basin of Minas. It was settled by the North Irish and Scotch.—*ib.*

Londonderry, a township, and the north-westernmost of Windham county, Vermont, on the head waters of West river, about 33 miles N. E. of Bennington. It was granted March 16th 1780. Moose Mountain extends into the eastern part of this town.—*ib.*

Londonderry, the name of two townships in Pennsylvania, the one in Chester county, the other in that of Dauphine.—*ib.*

LONDONGROVE, a township in Dauphine county, Pennsylvania.—*ib.*

LONG *Bay*, extends along the shore of N. and S. Carolina, from Cape Fear to the mouth of Pedee river.—*ib.*

Long *Bay*, on the south side of the island of Jamaica, extends from Gutt to Swift river, and affords anchorage for small vessels.—*ib.*

Long *Bay*, in the island of Barbadoes, in the West-Indies, lies on the west side of the island, having St Joseph's river south-easterly, and Pico Teneriffe north-westerly. Another bay of the same name lies on the south end of the island, about 2 miles easterly of the south point.—*ib.*

Long, or *Eighteen mile Beach*, on the coast of New-Jersey, lies between Little Egg Harbour inlet and that of Barnegat.—*ib.*

Long *Island*, formerly called *Manhattan*, afterwards *Nassau Island*, belongs to the State of New-York. It extends from Hudson's river opposite to Staten Island, almost to the western bounds of the coast of Rhode-Island, terminating with Montauk Point. Its length is about 140 miles, and its medium breadth not above 10 miles; and separated from Connecticut by Long-Island Sound. It contains 1,400 square miles; and is divided into 3 counties, King's, Queen's and Suffolk, and these again into 19 townships. The N. side of the island is rough and hilly. A single range of these hills extends from Jamaica to Southhold. The soil is here well calculated for raising grain, hay, and fruit. The south side of the island lies low, with a light sandy soil. On the sea-coast are extensive tracts of salt meadow, which extend from Southampton to the west end of the island. The soil, notwithstanding, is well adapted to the culture of grain, particularly Indian corn. Near the middle of the island is Hampstead Plain, in Queen's county. It is 16 miles long, and about 8 broad. This plain was never known to have any natural growth, except a particular kind of wild grass, and a few shrubs, although the soil is black, and to appearance rich. It produces some rye, and large herds of cattle are fed upon it, as well as on the salt marshes. On the E part of the island, E. of Hampstead Plain, is a large barren heath, called Brushy Plain: It is overgrown with shrub-oak, intermixed with a few pine trees, where a number of wild deer, and grouse harbour. The largest river, or stream in the island is Peakonok, an inconsiderable stream. It runs E. and empties into a large bay, that separates Southhold from Southampton. In this bay are Robbin and Shelter islands. Rockonkama pond lies about the centre of the island, between Smith-Town and Islip, and is about a mile in circumference, and has been found, by observation, to rise gradually for several years, until it had arrived to a certain height, and then to fall more rapidly to its lowest bed; and thus is continually ebbing and flowing: The cause has never been investigated. Two miles to the southward of the pond, is a stream called Connecticut river, which empties into the bay. The produce of the middle and western parts of the island is carried to New-York. The island contained, in 1790, 41,782 inhabitants, of whom 4,839 were slaves.—*ib.*

Long-Island *Sound* is a kind of inland sea, from 3 to 25 miles broad, about 140 miles long, extending the whole length of the island, and dividing it from Connecticut. It communicates with the ocean at both ends of Long-Island; and affords a very safe and convenient inland navigation.—*ib.*

Long-Island, an island in Susquehannah river.—*ib.*

Long-Island, in Holston river, in the State of Tennessee, is 3 miles long. Numbers of boats are built here every year, and loaded with the produce of the State for New-Orleans. Long-Island is 10 miles W. of the mouth of Wataugo river, 43 from Abingdon, 100 above Knoxville, 283 from Nashville, and 1000 from the mouth of the Tennessee. It is 340 miles S. W. by W. of Richmond, in Virginia, and to which there is a good waggon road.—*ib.*

Long-Island, on the coast of S. Carolina, in N. America, is to the E. N. E. of Charles Town, and N. E. from Sullivan's Island, in lat. about 32° 48′ N. and long. 78° 36′ W. It is but a small island and at a little distance only from the main land.—*Malham.*

Long-Island, on the N. side of the island of Antigua in the West Indies, is an island which lies before the opening into Parham harbour, having a smaller island, called Maiden Island, a little to the W. of S. from it, between this island and a point of land of the main island to the westward of the latter island. It is beset with banks and rocks from the N. W. by the N. to the E. From the westernmost point of the island a sand bank runs to the N. W. for half a league nearly, so that ships must keep at that distance from the said point, and at least 2 miles at N. W. from Maiden Island, before they attempt to go in on that course for the latter island. By this course they will come thwart of the westernmost point of Long-Island, about half a mile short of Maiden Island, and thereby avoid a shoal which runs out from the main island towards

wards the N. E. as well as this bank from the point in the direction of N. W. which has but from 2 to 6 feet upon it.—*ib.*

LONG ISLE, or *Isle River Indians*, inhabit on Ille, or White river, which runs westerly into the river Wabash. The mouth of White river is in N. lat. 38° 58′ W. long. 90° 7′.—*Morse.*

LONG LAKE, in the Genessee country in New-York.—*ib.*

LONG-MEADOW, a town in Hampshire county, Massachusetts, situated on the E. bank of Connecticut river, about 4 miles S. of Springfield, and 23 N. of Hartford. It was incorporated in 1783; contains a Congregational church, and about 70 dwelling houses, which lie upon one wide street, running parallel with the river. The township contains 744 inhabitants. It is 97 miles S. W. by W. of Boston.—*ib.*

LONG POINT, a peninsula on the N. side of Lake Erie, and towards the eastern end of the lake. It is composed of sand, and is very convenient to haul boats out of the surf upon, when the lake is too rough for rowing or sailing. *Vermilion Point*, between Puan Bay and Lake Michigan, is also called Long Point in some maps.—*ib.*

LONG POND, in the District of Maine, lies mostly in Bridgton, and is 10 miles long from N. W. to S. E. and about a mile broad. On each side of this pond are large swells of excellent land, with a gradual descent to the margin of the pond, and furnish a variety of romantic prospects.—*ib.*

LONGUEY BAY, on the coast of Chili on the W. coast of South America, sometimes called Tonguey or Tonguay, is 10 leagues to the N. from Limari, and in lat. 30° 30′ S. In the road is a headland opposite to a small river, where is good watering; and there is good anchorage all over the bay, and clean holding ground. This bay may be certainly known by the hill called Sierra del Guanaquero, and by a low point running out, called Lengua de Vacca, the Cow's Tongue, which close the bay to westward. This coast, though indifferently high, so as to be seen at 25 or 30 leagues off at sea, makes at first as if it was all drowned, because the mountains of the Cordilleras that appear over it, are always covered with snow. It is 7 leagues from hence to Herradura or Horse Shoe Point to the southward of Coquimbo.—*Malham.*

LONGUILLE, or as the Indians call it, *Kenapacomaqua*, an Indian village on the N. bank of Eel river, in the N. W. Territory. It was destroyed by Gen. Scott in 1791, with 200 acres of corn in its neighbourhood.—*Morse.*

LOOKOUT, *Cape*, on the coast of N. Carolina, is the southern point of a long insulated and narrow slip of land, eastward of Core Sound. Its N. point forms the S. side of Ocrecock inlet, which leads into Pamlico Sound. It lies N. E. of Cape Fear, and S. of Cape Hatteras, in about latitude 34° 50′. It had an excellent harbour, which has been filled up with sand since the year 1777.—*ib.*

LOOKOUT, *Cape*, on the southern coast of Hudson's Bay, in New South Wales, E. S. E. of the mouth of Severn river. N. lat. 56°, W. long. 84°.—*ib.*

LORENZO, *Cape St*, on the coast of Peru, S. America, lies in the province of Quito, W. of the city of that name. S. lat. 0° 20′, W. long. 80° 20′.—*ib.*

LORENZO *Island*, on the W. coast of South America, on the south Atlantic Ocean, is above 2 miles to the W. of the cape at Callao, being about 4 miles long from N. W. to S. E. and near 2 broad in the broadest part. A very small island, called La Laja, lies in the midway between them, having only a depth of from 9 to 12 feet on its E. side towards the cape, on the N. side 4 fathoms, and on the W. side towards Lorenzo still more water. There is generally from 7 to 17 fathoms round this island; off the S. E. end of which is Fronton Island, having from 5 fathoms and a half to 14 fathoms round it, and between the islands some small rocks. There are also several small islands, called Palominos, about 3 miles on the W. of Lorenzo Island, having from 13 to 18 fathoms round them.—*Malham.*

LORETTO, a small village of Christian Indians, 3 leagues N. E. of Quebec, in Canada. It has its name from a chapel built according to the model of the Santa Casa at Loretto, in Italy; from whence an image of the Holy Virgin has been sent to the converts here, resembling that in the famous Italian sanctuary. These converts are of the Huron tribe.—*Morse.*

LORETTO, *Lady of*, a place in the district of St Dennis, on the isthmus of California; the Indians call it *Cancho.* Here is a small fort erected by the missionaries, consisting of four bastions, and surrounded by a deep ditch.

LORINCHINCA, on the coast of Peru, in South America, and on the S. Pacific Ocean, is about midway between Pisco and Chinca, or 3 leagues from each, and has a tolerable good road, with a fair strand on the shore. But there runs a great sea on this coast. Ships may anchor in 6 fathoms before a house that will be seen on the shore near a white church; this house is known by the name of El Molino, or the Mill.—*Malham.*

LOROMIE'S STORE, in the territory N. W. of the Ohio, a place westerly from Fort Lawrence, and at or near a fork of a branch of the Great Miami river, which falls into the Ohio. At this spot, bounded W. by the Indian line, the Indians ceded a tract of land to the United States, 6 miles square, by the treaty signed August 3, 1795. Here the portage commences between the Miami of the Ohio, and St Mary's river, which runs into Lake Erie.—*Morse.*

LOS REYES, the chief town of the province of Uragua, in the E. division of Paraguay, in S. America.—*ib.*

LOS CHARCOS, a province in the southern division of Peru, whose chief cities are Potosi and Porco.—*ib.*

LIBYAN LOTUS has been described (*Encycl.*) under the title RHAMNUS; but the following additional particulars from Mr Park will be acceptable to our botanical readers:

The lotus is very common in all the countries which our author visited, and he had an opportunity to make a drawing of a branch in flower, of which an engraving is published in his travels, that with his permission we have copied (see Plate XXX.). The lotus produces fruit which the negroes call *tomberongs.* These are small farinaceous berries, of a yellow colour and delicious taste. They are much esteemed by the natives, who convert them into a sort of bread, by exposing them for some days to the sun, and afterwards pounding them gently in a wooden mortar, until the farinaceous part of the berry is separated from the stone. This meal is then mixed with a little water, and formed into cakes; which, when dried in the sun, resemble in colour and flavour the sweetest gingerbread. The stones are afterwards put into a vessel of water, and shaken about so as to separate the meal which may still adhere to them: this communicates a sweet and agreeable taste to the water, and with the addition of a little pounded millet, forms a pleasant gruel called *fondi*, which is the common breakfast in many parts of Ludamar, during the months of February and March. The fruit is collected by spreading a cloth upon the ground, and beating the branches with a stick. Our author thinks there can be little doubt of this being the lotus mentioned by Pliny, as the food of the Lybian Lotophagi. An army may very well have been fed with the bread made of the meal of the fruit, as is said by Pliny to have been done in Lybia; and as the taste of the bread is sweet and agreeable, it is not likely that the soldiers would complain of it.

LOUDON, a county of Virginia, on the river Potowmac, adjoining Fairfax, Berkley, and Faquier counties. It is about 50 miles long, and 20 broad, and contains 18,962 inhabitants, including 4,030 slaves. Chief town, Leesburg.—*Morse*.

Loudon, a township in Rockingham county, New-Hampshire, taken from Canterbury township and incorporated in 1773. It is situated on the E. side of Merrimack river, and contains 1084 inhabitants.—*ib.*

Loudon, a township in Berkshire county, Massachusetts, 21 miles S. E. of Lenox, 24 W. of Springfield, and 124 W. of Boston. It was incorporated in 1773, and contains 344 inhabitants. It contains 13,000 acres, of which 2,944 are ponds.—*ib.*

LOUGHABER, or *Lochaber*, a small settlement in Georgia, on a branch of Savannah river, above its confluence with the Tugulo, the W. main branch.—*ib.*

LOUIS, *Fort*, a settlement formed by the French near the mouth of the river Coza, in Florida, about 20 leagues N. E. of the nearest mouth of the Mississippi, and until the peace of 1763, was the usual residence of the principal governor of Louisiana.—*ib.*

LOUIS DE MARANHAM, St, a town on the northern coast of Brazil, and on the Atlantic ocean, situated on the east side of Mearim river; about half way between point Mocoripe, and the mouth of the river Para.—*ib.*

Louis, St, a jurisdiction and town on the south side of the island of St Domingo. The jurisdiction contains 3 parishes. Its exports shipped from the town of St Louis from Jan. 1, 1789 to Dec. 31, of the same year, were 120,665 lb. coffee; 19,253 lb. cotton; 5,751 lb. indigo. Total value of duties on exportation, 904 dollars 13 cents. St Louis is rather a borough than a town. It is situated on the head of the bay of its name, opposite a number of small isles which shelter the bay on the south towards the ocean, and on the S. side of the south peninsula, 8 leagues N. E. of Les Cayes, a little more than 3 S. W. of Aquin, and 36 leagues S. W. by W. of Port au Prince: from which last are two roads leading to it; the one by Jacmel the other by Leogane, and of much the same length; both join at Aquin. N. lat. 18° 18′, W. long. from Paris, 75° 52′.—*ib.*

Louis, St, a small, compact, beautiful bay in West-Florida, having about 7 feet water. It is 18 miles from the Regolets, and 26 from the bay of Biloxi. The land near it is of a light soil, and good for pasture. There were several settlers formerly on it, but in the year 1767, the Chactaw Indians killed their cattle and obliged them to remove.—*ib.*

Louis, St, a Spanish village on the W. side of the river Mississippi, about 13 miles below the mouth of the Missouri. Its scite is on a high piece of ground, the most healthy and pleasurable of any known in this part of the country. Here the Spanish commandant and the principal Indian traders reside; who, by conciliating the affections of the natives, have drawn all the Indian trade of the Missouri; part of that of the Mississippi (northwards) and of the tribes of Indians residing near the Ouisconsing, and Illinois rivers, to this village. About 20 years ago there were here 120 large and commodious houses, mostly built of stone, and 800 inhabitants, chiefly French. Some of them have had a liberal education, and were polite and hospitable. They had about 150 negroes, and large stocks of cattle, &c. It is 4 or 5 miles N. by W. of Cahokia, on the east side of the Mississippi, and about 150 miles W. by S. of Post St Vincent's on Wabash river. N. lat. 38° 24′, W. long. 92° 32′.—*ib.*

LOUISA, a county of Virginia, adjoining Orange, Albemarle, Fluvanna, Spottsylvania, and Goochland counties. It is about 35 miles long, and 20 broad, and contains 8,467 inhabitants, including 4,573 slaves. There are here some medicinal springs, on the head waters of South Anna, a branch of York river; but they are little frequented.—*ib.*

Louisa, a river of Virginia, the head water of Cole river, a S. W. branch of the Great Kanhaway.—*ib.*

LOUSA CHITTO, or *Loosa Chitto*, a river which rises on the borders of S. Carolina, and runs a S. westerly course through the Georgia western lands, and joins the Mississippi just below the Walnut Hills, and 10 miles from Stony river. It is 30 yards wide at its mouth, but after you enter it, is from 30 to 40 yards, and is said to be navigable for canoes 30 or 40 leagues. It is 39¾ miles below the Yazoo cliffs.—*ib.*

LOUISBOURG, the capital of Sydney, or Cape Breton island, in North-America. Its harbour is one of the finest in that country, being almost 4 leagues in circuit, and 6 or 7 fathoms water in every part of it. The anchorage or mooring, is good, and ships may run aground without any danger. Its entrance is not above 300 toises in breadth, formed by two small islands, and is known 12 leagues off at sea, by Cape Lorembec, situated near the N. E. side of it. Here is plenty of cod, and the fishery may be continued from April to the close of November. The harbour is more than half a mile in breadth, from N. W. to S. E. in the narrowest part; and 6 miles in length, from N. E. to S. W. In the N. E. part of the harbour is a fine careening wharf to heave down, and very secure from all winds. On the opposite side are the fishing stages, and room for 2000 boats to cure their fish. In winter the harbour is entirely frozen up, so as to be walked over, which season begins here at the close of November,

vember, and lafts till May or June; fometimes the frofts fet in fooner, and are more intenfe; as particularly in 1745, when by the middle of October a great part of the harbour was already frozen. The town of Louifbourg ftands on a point of land, on the S. E. fide of the ifland; its ftreets are regular and broad, confifting for the moft part of ftone houfes, with a large parade at a little diftance from the citadel; the infide of which is a fine fquare, near 200 feet every way. On its N. fide, while poffeffed by the French, ftood the governor's houfe and the church: the other fides were taken up with barracks, bomb proof; in which the French fecured their women and children during the fiege. The town is near half a mile in length, and 2 in circuit. The principal trade of Louifbourg is the cod fifhery, from which vaft profits accrue to the inhabitants; the plenty of fifh being remarkable, and at the fame time better than any about Newfoundland. N. latitude 45° 54′, weft longitude 59° 55′.—*ib.*

LOUISIANA, a Spanifh province of North-America, bounded E. by the Miffiffippi, S. by the gulf of Mexico, W. by New-Mexico, and N. by undefined boundaries. Both fides of the Miffiffippi were under the French government till the peace of 1762; when the eaftern fide was ceded to the king of Great Britain; and the day before the preliminaries of peace were figned, his Chriftian Majefty ceded to Spain all his territories to the weftward of the Miffiffippi, together with the town of New Orleans; with a ftipulation that the French laws and ufages fhould not be altered: this precaution, however, proved afterwards of no avail.

Louifiana is interfected by a number of fine rivers, among which are St Francis, the Natchitoches, the Adayes, or Mexicano river, the Miffouri, Rouge, Noir, and many others which are defcribed under their refpective names. The greater part of the white inhabitants are Roman Catholics. They are governed by a viceroy from Spain. The number of inhabitants is unknown. The quantity of good land on the Miffiffippi and its branches, from the bay of Mexico to Ohio river, a diftance of nearly 1000 miles, is very great; but that in the neighbourhood of the Natchez, and of the river Yazoo, is the flower of it all. There have been fome plantations of fugar canes; but it is not a crop to be depended upon, as the froft has fometimes been too powerful for that plant. The chief articles of exportation are indigo, cotton, rice, beans, myrtle wax, and lumber.

The climate is faid to be favourable for health and to the culture of fruits of various kinds, and particularly for garden vegetables. Iron and lead mines and falt fprings, it is afferted, are found in fuch plenty as to afford an abundant fupply of thefe neceffary articles. The banks of the Miffiffippi, for many leagues in extent, commencing about 20 miles above the mouth of Ohio, are a continued chain of lime-ftone. A fine tract of high, rich, level land, S. W. W. and N. W. of New-Madrid, about 25 miles wide, extends quite to the river St Francis.

While the United States were engaged in the revolution war againft England, the Spaniards attacked and poffeffed themfelves of all the Englifh pofts and fettlements on the Miffiffippi, from the Ibberville up to the Yazoo river, including the Natchez country; and by virtue of this conqueft have fince peopled and governed an extent three degrees north of the United States fouth boundary, claiming the exclufive navigation of the other. This bufinefs has been amicably fettled by the treaty of 1796.

The Miffiffippi, on which the fine country of Louifiana is fituated, was firft difcovered by Ferdinand de Soto, in 1541. Monfieur de la Salle was the firft who traverfed it. He, in the year 1682, having paffed down to the mouth of the Miffiffippi, and furveyed the adjacent country, returned to Canada, from whence he took paffage to France. From the flattering accounts which he gave of the country, and the confequent advantages that would accrue from fettling a colony in thofe parts, Louis XIV. was induced to eftablifh a company for the purpofe. Accordingly, a fquadron of four veffels, amply provided with men and provifions, under the command of Monfieur de la Salle, embarked with an intention to fettle near the mouth of the Miffiffippi. But he unintentionally failed a hundred leagues to the weftward of it, where he attempted to eftablifh a colony; but, through the unfavourablenefs of the climate, moft of his men miferably perifhed, and he himfelf was villanoufly murdered, not long after, by two of his own men. Monfieur Ibberville fucceeded him in his laudable attempts. He, after two fuccefsful voyages, died while preparing for a third. Crozat fucceeded him; and in 1712, the king gave him Louifiana. This grant continued but a fhort time after the death of Louis XIV. In 1763, Louifiana was ceded to the king of Spain, to whom it now belongs.—*ib.*

LOUISTOWN, in Talbot county, Maryland, lies on the weft fide of Tuckahoe creek, about 4 miles north of King's Town, and 7 or 8 north-eaft of Eafton.—*ib.*

LOUISVILLE, the prefent feat of government of Georgia, fituated in Burke county, in the lower diftrict of the State, on the N. E. bank of the Great Ogeechee river, 70 miles from its mouth. It has been lately laid out, and contains a ftate-houfe, a tobacco warehoufe, and about 30 dwelling-houfes. Large quantities of tobacco are infpected here, and boated down to Savannah. The convention for the revifal of the conftitution fat in this town in May, 1795, and appointed the records to be removed, and the legiflature to meet here in future. A college, with ample and liberal endowments, is inftituted here. It is 52 miles S. E. of Augufta, and 100 N. W. of Savannah.—*ib.*

LOUISIADE, *Land of*, difcovered and named by Bougainville in 1768, is probably a chain of iflands, forming a fouth-eaftern continuation of New Guinea. The coaft feen by the Dutch *Geelwink* Yacht in 1705, is a fmall diftance north of Louifiade.—*ib.*

LOVE-COVE, a fine opening to the weftward of Whale Cove, in New North Wales.—*ib.*

LOVELL'S POND, in New-Hampfhire, lies at the head of the eaftern branch of Salmon Fall river.—*ib.*

LOWANG, a Chinefe ifland of fome extent in the neighbourhood of the Chusan-Ifles, which fee in this *Supplement*. Some of the gentlemen belonging to the Britifh embaffy went afhore on Lowang, which they defcribed as naked both of trees and of cattle. They examined particularly a fmall level plain recovered from the fea, which was kept out by an embankment of earth,

earth, at least thirty feet thick. The quantity of ground gained by it seemed scarcely to be worth the labour that it must have cost. The plain was indeed cultivated with the utmost care, and laid out chiefly in rice-plats, supplied with water collected from the adjacent hills into little channels, through which it was conveyed to every part of those plantations. It was manured, instead of the dung of animals, with matters more offensive to the human senses, and which are not very generally applied to the purposes of agriculture in England. Earthen vessels were sunk into the ground for the reception of such manure; and for containing liquids of an analogous nature, in which the grain was steeped previously to its being sown; an operation which is supposed to hasten the growth of the future plant, as well as to prevent any injury from insects in its tender state.

The party fell in with a peasant who, though struck with their appearance, was not so scared by it as to shun them. He was dressed in loose garments of blue cotton, a straw hat upon his head fastened by a string under his chin, and half boots upon his legs. He seemed to enter into the spirit of curiosity, naturally animating travellers, and readily led them towards an adjoining village. Passing by a small farm house, they were invited into it by the tenant, who, together with his son, observed them with astonished eyes. The house was built of wood, the uprights of the natural form of the timber. No ceiling concealed the inside of the roof, which was put together strongly, and covered with the straw of rice. The floor was of earth beaten hard, and the partitions between the rooms consisted of mats hanging from the beams. Two spinning wheels for cotton were seen in the outer room; but the seats for the spinners were empty. They had probably been filled by females, who retired on the approach of strangers; while they remained, none of that sex appeared. Round the house were planted clusters of bamboo, and of that species of palm, of which each leaf resembles the form of a fan; and, used as such, becomes an article of merchandize.

LOWER ALLOWAY'S *Creek*, a township in Salem county, New-Jersey.—*Morse.*

LOWER DUBLIN, a township in Philadelphia county, Pennsylvania.—*ib.*

LOWER MILFORD, a township in Buck's county, Pennsylvania.—*ib.*

LOWER MARLBOROUGH, a post-town in Maryland, 30 miles from Annapolis, and 12 from Calvert court-house.—*ib.*

LOWER PENN'S *Neck*, a township in Salem county, New-Jersey.—*ib.*

LOWER WEAU *Towns*, in the Territory N. W. of the Ohio, lie 20 miles below Rippacanoe creek, at its mouth in Wabash river.—*ib.*

LOWHILL, a township in Northampton county, Pennsylvania.—*ib.*

LOXA, a town of Quito in Peru, at the head of a N. W. branch of Amazon river, 215 miles north-east of Paita, and north-westerly of Borja. It is the capital of a jurisdiction of the same name, and lies in lat. 5° 10′ S. long. 77° 10′ W. Besides 2 churches, it has several religious foundations; as, a college instituted by the Jesuits, an hospital, with 14 villages in its district.

The jurisdiction of the same name produces the famous specific for intermittent fevers, called Cascarilla de Logo Quinquina, or Jesuit's bark. Of it there are several kinds, but one more efficacious than the others. Here also they are employed in breeding cochineal. The inhabitants of Loja, called also Lojanus, do not exceed 10,000 souls, though formerly far more numerous. Large droves of horned cattle and mules are bred here. Carpets are also manufactured here of remarkable fineness.—*ib.*

LOXODROMIC CURVE, or *Spiral*, is the same as the rhumb line, or path of a ship sailing always on the same course in an oblique direction, or making always the same angle with every meridian. It is a species of logarithmic spiral, described on the surface of the sphere, having the meridians for its radii.

LOXODROMICS, the art or method of oblique sailing, by the loxodromic or rhumb line.

LOYALSOCK *Creek*, in Northumberland county, Pennsylvania, empties into the W. side of the branch of Susquehannah river, from the north-east, a few miles E. of Lycoming Creek, 26 from Sunbury, measuring in a straight line, and about 170 from Philadelphia. The lands from this to Sunbury are among the highest and of the best quality, and in the healthiest situation in the State. It is navigable 20 or 30 miles up for batteaux of 10 tons.—*Morse.*

LUCANAS, a jurisdiction in the diocese of Guamanga, in Peru. It begins about 25 or 30 leagues S. W. of Guamanga. Its temperature is cold and moderate. It abounds with cattle, grain and fruit; and has also silver mines; and is the centre of a very large commerce.—*ib.*

LUCAR, *Fort St*, lies on the north-east coast of Brazil; about half way between the city of Scara and Rio Grande.—*ib.*

LUCAR, CAPE ST, or *Lucas*. The S. E. end of the peninsula of California is so named.—*ib.*

LUCAYA, one of the Bahama Islands, about 70 leagues east of the coast of Florida, and 6 from Bahama Isle. It is about 9 leagues long and 2 broad, and gives name to the whole range. N. lat. 27° 27′, W. long. 78° 5′.—*ib.*

LUCAYONEQUE, another of the Bahama isles, which lies about 9 leagues further east than the former; whole length is 28 leagues and breadth 3, and lies north and south.—*ib.*

LUCIA, ST, a river of East-Florida, runs south-easterly along the east side of the peninsula; and communicates inland with Indian river. It has 6 feet water as far as the Tortolas, where are hilly knowls. A branch joins it from the south.—*ib.*

LUCIA, ST, called by the French, Sainte Alousie, from its having been discovered on St Lucia's Day; one of the Caribbee Islands, 6 leagues south of Martinico, and 21 N. W. of Barbadoes. It is about 27 miles long from north to south, and 12 broad. Here are several hills, 2 of which being very round and steep, are called the Pins heads of St Lucy, and were volcanoes. At the foot of them are fine vallies, having a good soil and well watered. In these are tall trees, with the timber of which the planters of Martinico and Barbadoes build their houses and wind-mills. Here is also plenty of cocoa and fustic. The air is reckoned healthy, the hills not being so high as to intercept

intercept the trade-winds, which always fan it from the east by which means the heat of the climate is moderated and rendered agreeable.

In St Lucia are several commodious bays and harbours, with good anchorage, particularly the Little Careenage, one of the principal inducements for the French to prefer it to the other neutral islands. This port has several noted advantages; there is every where depth enough, and the quality of the bottom is excellent. Nature has formed there three careening places, which do not want a key, and require nothing but a capstern to turn the keel above ground. Thirty ships of the line might lie there sheltered from hurricanes, without the trouble of being moored. The boats of the country, which have been kept a long time in this harbour, have never been eaten by the worms; however, they do not expect that this advantage will last, whatever be the cause. For the other harbours, the winds are always good to go out with, and the largest squadron might be in the offing in less than an hour. There are 9 parishes in the island, 8 to the leeward, and only one to the windward. This preference given to one part of the island more than another, does not proceed from the superiority of the soil, but from the greater or less conveniency in sending out or receiving ships. A high road is made round the island, and two others which cross it from east to west, afford all manner of facilities to carry the commodities of the plantations to the barcaderes, or landing places.

In January, 1769, the free inhabitants of the island amounted to 2,524; the slaves to 10,270. It had in cattle 598 mules and horses, 1,819 horned beasts, and 2,378 sheep Its plantations were 1,279,680 plants of cocoa—2,463,880 of coffee—681 squares of cotton—and 254 of sugar-canes; there were 16 sugar-works going on, and 18 nearly completed. Its produce yielded £112,000, which by improvement might be increased to £500,000. The English first settled in this island in 1637. From this time they met with various misfortunes from the natives and French; and at length it was agreed on between the latter and the English, that this island, together with Dominica and St Vincent, should remain neutral. But the French, before the war of 1756 broke out, began to settle these islands, which by the treaty of peace were yielded up to Great-Britain, and this island to France. The British made themselves master of it in 1778; but it was restored again to the French in 1783; and retaken by the British in 1794. St Lucia had 900 of its inhabitants destroyed by an earthquake, Oct. 12, 1788. It is 63 miles N. W. of Barbadoes. N. lat. 14°, W. long. 61°.—*ib.*

LUCIOLE, a name given in the *Annales de Chimie* to the *Lampyris Italica* (See Lampyris, *Encycl.*). According to Dr Carradori, the light of the luciole does not depend on the influence of any external cause, but merely on the will of those insects. While they fly about at freedom, their shining is very regular; but when they are once in our power, they shine very irregularly, or do not shine at all. When they are molested, they emit a frequent light, which appears to be a mark of their resentment. When placed on their backs, they shine almost without interruption, making continual efforts to turn themselves from that position. In the day-time it is necessary to torment them in order to make them shine; and thence it follows, that the day to them is the season of repose. The luciole emit light at pleasure from every point of their bellies, which proves that they can move all the parts of their viscera independently of each other. They can also render their phosphorescence more or less vivid, and continue it as long as they please.

A slight compression deprives the luciole of their power of ceasing to shine. The author is inclined to believe, that the movement by which they conceal their light is executed by drawing back their phosphoric substance into a particular membrane or tunic. He supposes also, that the sparkling consists in a trembling or oscillation of the phosphoric mass. He is of opinion, that there is no emanation of a phosphoric substance, and that the whole phenomenon takes place in the interior part of the luminous viscera. When the shining is at its greatest degree of height, it is so strong that a person may by it easily distinguish the hours on the smallest watch, and the letters of any type whatever.

The phosphoric part of the luciole does not extend farther than to the extreme rings of the belly. It is there inclosed in a covering composed of two portions of membranes, one of which forms the upper, and the other the lower, part of the belly, and which are joined together. Behind this receptacle is placed the phosphorus, which resembles a paste, having the smell of garlic, and very little taste. The phosphoric matter issues from a sort of bag on the slightest pressure; when squeezed out, this matter loses its splendour in a few hours, and is converted into a white dry substance. A portion of the phosphoric belly put into oil, shone only with a feeble light, and was soon extinguished. In water, a like portion shone with the same vivacity as in the air, and for a much longer time. The author thence concludes, that the phosphorescence of the luciole is not the effect of slow inflammation, nor of the fixation of azotic gas, as the oil in which they shine does not contain a single air-bubble: besides, the phosphorus of these insects shines in a barometrical vacuum. The observation made by Foster, that the luciole diffused a more vivid light in oxygen gas than in atmospheric air, does not, according to Carradori, depend upon a combustion more animated by the inspiration of this gas, but on the animals feeling themselves, while in that gas, in a better condition. "Whence, then, arises (says the author) the phosphoric light of the luciole? I am of opinion (adds he), that the light is peculiar and innate in these insects, as several other productions are peculiar to other animals. As some animals have the faculty of accumulating the electric fluid, and of keeping it condensed in particular organs, to diffuse it afterwards at pleasure, there may be other animals endowed with the faculty of keeping in a condensed state the fluid which constitutes light. It is possible, that by a peculiar organization they may have the power of extracting the light which enters into the composition of their food, and of transmitting it to the reservoir destined for that purpose, which they have in their abdomen. It is not even impossible that they may have the power to extract from the atmospheric air the luminous fluid, as other animals have the power of extracting from the same air, by a chemical process, the fluid of heat."

Carradori discovered, that the phosphorescence of the luciole

luciole is a property independent of the life of these animals, and that it is chiefly owing to the soft state of the phosphoric substance.' Its light is suspended by drying, and it is again revived by softening it in water; but only after a certain time of desiccation. Reaumur, Beccaria, and Spallanzani, observed the same thing in regard to the *pholades* and the *medusa*.

By plunging the luciole alternately into lukewarm and cold water, they shine with vivacity in the former, but their light becomes extinct in the latter; which, according to the author, depends on the alternate agreeable and disagreeable sensation which they experience. In warm water their light disappears gradually. Dr Carradori tried on the luciole and their phosphorus the action of different saline and spirituous liquors, in which they exhibited the same appearances as other phosphoric animals. These last experiments prove that the phosphoric matter of the luciole is only soluble in water.

LUDAMAR, a Moorish kingdom in the interior of Africa, of which the capital Benorm is placed by Major Rennel in 15° N. Lat. and 6° 50′ W. Long. It has for its northern boundary the great desert (see SAHARA in this *Supplement*), and is described by Mr Park as little better than a desert itself. Our traveller was taken captive on the confines of this kingdom, and carried to the camp of the king, where he was subjected to the cruelest indignities that the malice of bigotted Moors could invent. He was not suffered to travel beyond the camp; though he moved as it moved, and of course saw a considerable part of the country, and had an opportunity of observing the manners of the people. "The Moors of Ludamar subsist chiefly on the flesh of their cattle; and are always in the extreme of either gluttony or abstinence. In consequence of the frequent and severe fasts which their religion enjoins, and the toilsome journeys which they sometimes undertake across the desert, they are enabled to bear both hunger and thirst with surprising fortitude; but whenever opportunities occur of satisfying their appetite, they generally devour more at one meal than would serve an European for three. They pay but little attention to agriculture; purchasing their corn, cotton cloth, and other necessaries, from the Negroes, in exchange for salt, which they dig from the pits in the Great Desert.

"The natural barrenness of the country is such, that it furnishes but few materials for manufacture. The Moors, however, contrive to weave a strong cloth, with which they cover their tents; the thread is spun by their women from the hair of goats: and they prepare the hides of their cattle so as to furnish saddles, bridles, pouches, and other articles of leather. They are likewise sufficiently skilful to convert the native iron, which they procure from the Negroes, into spears and knives, and also into pots for boiling their food; but their sabres and other weapons, as well as their fire-arms and ammunition, they purchase from the Europeans, in exchange for the Negro slaves which they obtain in their predatory excursions. Their chief commerce of this kind is with the French traders on the Senegal river."

The Moors of this country have singular ideas of feminine perfection. The gracefulness of figure and motion, and a countenance enlivened by expression, are by no means essential points in their standard; with them corpulence and beauty appear to be terms nearly synonymous. A woman, of even moderate pretensions, must be one who cannot walk without a slave under each arm to support her; and a perfect beauty is a load for a camel. In consequence of this prevalent taste for unwieldiness of bulk, the Moorish ladies take great pains to acquire it early in life; and for this purpose many of the young girls are compelled by their mothers to devour an immense quantity of food, and drink a large bowl of camel's milk every morning. It is of no importance whether the girl has an appetite or not, the meat and the drink must be swallowed; and obedience is frequently enforced by blows. This singular practice, instead of producing indigestion and disease, soon covers the young lady with that degree of plumpness, which, in the eye of a Moor, is perfection itself.

"Although the wealth of the Moors consists chiefly in their numerous herds of cattle; yet, as the pastoral life does not afford full employment, the majority of the people are perfectly idle, and spend the day in trifling conversation about their horses, or in laying schemes of depredation on the Negro villages.

"The usual place of rendezvous for the indolent is the king's tent, where great liberty of speech seems to be exercised by the company towards each other. While in speaking of their chief, they express but one opinion. In praise of their sovereign, they are unanimous. Songs are composed in his honour, which the company frequently sing in concert; but they are so loaded with gross adulation, that no man but a Moorish despot could hear them without blushing. The king is distinguished by the fineness of his dress, which is composed of blue cotton cloth brought from Tombuctoo, or white linen or muslin from Morocco. He has likewise a larger tent than any other person, with a white cloth over it; but in his usual intercourse with his subjects, all distinctions of rank are frequently forgotten. He sometimes eats out of the same bowl with his camel driver, and reposes himself, during the heat of the day, upon the same bed.

"The military strength of Ludamar consists in cavalry. They are well mounted, and appear to be very expert in skirmishing and attacking by surprise. Every soldier furnishes his own horse, and finds his accoutrements, consisting of a large sabre, a double barrelled gun, a small red leather bag for holding his balls, and a powder horn slung over the shoulder. He has no pay, nor any remuneration but what arises from plunder. This body is not very numerous; for when Ali the king made war upon Bambara, our author was informed that his whole force did not exceed 2000 cavalry. They constitute, however, by what he could learn, but a very small proportion of his Moorish subjects. The horses are very beautiful, and so highly esteemed, that the Negro princes will sometimes give from twelve to fourteen slaves for one horse."

Cut off from all intercourse with civilized nations, and boasting an advantage over the Negroes, by possessing, though in a very limited degree, the knowledge of letters, the Moors of Ludamar are at once the vainest and proudest, and perhaps the most bigotted, ferocious, and intolerant of all the nations on the earth; combining in their character the blind superstition of the Negro with the savage cruelty and treachery of the Arab. It was with the utmost difficulty that our author made his escape from this inhospitable people.

LUDLOW,

LUDLOW, a townſhip in Hampſhire county, Maſſachuſetts, ſouth of Granby, 10 miles north-eaſterly of Springfield, and 90 weſterly of Boſton. It was incorporated in 1784, and contains 560 inhabitants.—*Morse.*

Ludlow, a townſhip on Black river, Windſor county, Vermont. It contains 179 inhabitants, and is about 10 or 12 miles W. of Weathersfield, on Connecticut river.—*ib.*

LUE, St, the chief town of the captainſhip of Petagues, in the northern diviſion of Brazil.—*ib.*

LUMBERTON, a poſt-town of N. Carolina, and capital of Robeſon county, ſituated on Drowning creek, 32 miles ſouth of Fayetteville, and 93 S. by W. of Raleigh.—*ib.*

LUNENBURG, a county of Virginia, adjoining Nottaway, Brunſwick, Mecklenburg, and Charlotte counties. It is about 30 miles long, and 20 broad, and contains 8,959 inhabitants, including 4,332 ſlaves. —*ib.*

Lunenburg, a townſhip in Eſſex county, in Vermont; ſituated on Connecticut river, S. W. of Guildhall, and N. E. of Concord. The river takes a S. E. courſe along theſe towns, ſeparating them from Lancaſter, Dalton, and Littleton, in the State of New-Hampſhire. The Upper Bar of the Fifteen mile Falls is oppoſite this town. The Cat Bow, a bend of the Connecticut, is near the middle of the town. The Upper Bar lies in lat. 44° 21′ 30″. The townſhip contains 119 inhabitants.—*ib.*

Lunenburg, a townſhip of New-York, ſituated in Albany county, on the W. ſide of Hudſon's river, oppoſite to the city of Hudſon, and 30 miles ſouth of Albany. It is a thriving village of about 20 or 30 houſes, chiefly new, with a neat Dutch church, ſtanding on the bank of the river. A new road is cutting from this village into the ſettlements on the upper branches of the Delaware and Suſquehannah rivers, which will probably prove highly beneficial to the town. A number of the Meſſrs Livingſtons have purchaſed land in and about this village, to the amount of £10,000, and have laid out a regular town, which will be a rival to Kaats' Kill, 5 miles below. The ſeite of the town is uneven, and not of a very good ſoil.—*ib.*

Lunenburg, a county of Nova-Scotia, on Mahone Bay, on the ſouthern coaſt of the province, facing the Atlantic Ocean. Its chief towns are New-Dublin, Lunenburg, Cheſter, and Blandford. In Mahone Bay, La Have, and Liverpool, ſeveral ſhips trade to England with timber and boards. Cheſter is ſettled by a few New-England families and others: from hence to Windſor is a road the diſtance of 25 miles. —*ib.*

Lunenburg, a townſhip in the above county, ſituated on Merliqueth, or Merliguaſh Bay, well ſettled by a number of induſtrious Germans. The lands are good, and generally well cultivated. It is 35 miles S. W. by S. of Halifax, and 27 N. by E. of Liverpool.—*ib.*

LUPUS, the *Wolf*, a ſouthern conſtellation, joined to the Centaur, containing together 19 ſtars in Ptolomy's catalogue, but 24 in the Britannic catalogue.

LURGAN, a townſhip in Franklin county, Pennſylvania.—*Morse.*

LUTTERELLE, an iſland in Machias Bay, in the Diſtrict of Maine.—*ib.*

LUTTERLOCK, a townſhip in Orleans county, in Vermont, north of Craftſborough, Iraſburgh, Coventry, and Salem, which lie in a N. N. E. direction from this town. Hazen's Road, which extends S. S. E. to the Oxbow on Connecticut river, paſſes through Lutterlock.—*ib.*

LUZERNE, a large county of Pennſylvania, bounded north by Tioga county, in the State of New-York, eaſt and ſouth-eaſt by Northampton, weſt by Lycoming and Northumberland counties. It is about 79 miles in length from north to ſouth, and 75 in breadth from eaſt to weſt, and is divided into 12 townſhips. In this county are 2 churches, 33 ſaw-mills, 24 griſt-mills, 2 fulling-mills, and 1 oil-mill. The number of inhabitants is 4,904, including 11 ſlaves. A great part of the county is barren where remote from rivers. It is well watered by the eaſt branch of Suſquehannah river and its tributaries, which furniſh numerous and excellent mill-ſeats. The ſoil near the river is remarkably fertile, producing good crops of wheat, flax, and hemp. The northern parts abound with pine timber and ſugar maple. In the townſhips of Wilkſbarre, Kingſton, Exeter, and Plymouth are large beds of coal. Bog-iron is found in ſeveral places, and two forges have been erected. In this county are many remains of ancient fortifications. They are of an elliptical form, and overgrown with large white-oak trees. Chief town, Wilkſbarre.—*ib.*

LYCOMING, a new county in the north-weſtern part of Pennſylvania, bounded north by the State of New-York, and weſt by Alleghany county.—*ib.*

Lycoming, a ſmall creek which runs ſouth, and empties into the weſt branch of Suſquehannah, a few miles weſt of Loyalſock Creek.—*ib.*

Lycoming, a village in Pennſylvania, 40 miles from Northumberland, and 66 from the Painted Poſt in the State of New-York.—*ib.*

LYMAN, a townſhip in Grafton county, New-Hampſhire, ſituated at the foot of a mountain on the eaſt ſide of Connecticut river, between Littleton and Bath, and 7 miles W. by N. of New-Concord. It was incorporated in 1761, and contains 202 inhabitants.—*ib.*

LYME, or *Lime*, a townſhip in Grafton county, New-Hampſhire, ſituated on the eaſt ſide of Connecticut river, 12 miles above Dartmouth College. It was incorporated in 1761, and contains 816 inhabitants. —*ib.*

Lyme, a townſhip in New-London county, Connecticut, the *Nehantick* of the Indians, is ſituated on the eaſt ſide of Connecticut river, at its mouth; bounded ſouth by Long-Iſland Sound, north by Haddam and Colcheſter, and eaſt by New-London. It was ſettled about the year 1664, and was incorporated in May, 1667. It contains three pariſhes, beſides a congregation of Separatiſts, and another of Baptiſts. In 1790, it contained 3,859 inhabitants.—*ib.*

LYNCHBURG, a poſt town of Virginia, ſituated in Bedford county, on the ſouth ſide of James river, nearly oppoſite to Madiſon, and one mile diſtant. Here are about 100 houſes, and a large ware houſe for the inſpection of tobacco. There is alſo a printing-office which iſſues a weekly gazette. In the vicinity of the town are ſeveral valuable merchant mills. It is

 12 miles

12 miles from New London, 23 from Cabellsburg, 50 from Prince Edward's court-house, 150 W. by N. of Richmond, and 408 S. W. of Philadelphia.—*ib.*

LYNDEBOROUGH, a township in Hillsborough county, New-Hampshire, about 70 miles from Portsmouth. It was incorporated in the year 1764. In 1775 it contained 713; and in 1790, 1,280 inhabitants, who are chiefly farmers.—*ib*

LYNDON, a township in Caledonia county, in Vermont, lies north of St Johnsbury, and southward of Billymead and Burke. It contains 59 inhabitants.—*ib.*

LYNN, a maritime town in Essex county, Massachusetts, situated on a bay which sets up from that of Massachusetts, north east of Boston Bay, and about 9 miles north by east of the town of Boston. The compact part of the town forms a very long street. The township, named *Saugaus* by the Indians, was incorporated in 1637, and contains 2 291 inhabitants. Here are two parishes, besides a society of Methodists, and a large number of Friends. The business which makes the greatest figure, and for which the town of Lynn is celebrated, is the manufacture of womens' silk and cloth shoes. These are disposed of at Boston, Salem, and other commercial towns, and sold for home use, or shipped to the southern States, and to the West-Indies. By a calculation made in 1795, it appeared that there were 200 master workmen and 600 apprentices constantly employed in this business, who make annually 300,000 pair of shoes. *Lynn Beach* may be reckoned a curiosity. It is a mile in length, and connects the peninsula called *Nahant* with the main land. This is a place of much resort for parties of pleasure from Boston, Charlestown, Salem, Marblehead, &c. in the summer season. The beach is used as a race-ground, for which it is well calculated, being level, smooth, and hard. A mineral spring has been discovered within the limits of the township, but is not of much note.—*ib.*

LYNNFIELD, a township in Essex county, Massachusetts, N. E. of Salem, and 15 miles N. by E. of Boston. It was incorporated in 1782, and contains 491 inhabitants.—*ib.*

LYNNHAVEN *Bay*, at the south end of Chesapeak Bay, and into which Lynnhaven river empties its waters, lies between the mouth of James's river and Cape Henry. The mouth of the river is 7 miles west of Cape Henry. Here Compte de Grasse moored the principal part of the French fleet, at the blockade of York-Town in 1781.—*ib.*

LYNX, a constellation of the northern hemisphere, composed by Hevelius out of the unformed stars. In his catalogue it consists of 19 stars, but in the Britannic 44.

LYONS, a town lately laid out in Ontario county, New-York, about 12 miles N. W. of Geneva, at the junction of Mud-Creek and Canandaque Outlet.—*Morse.*

LYSANDER, a township in Onondago county, N. York, incorporated in 1794, and comprehends the military towns of Hannibal and Cicero. The town-meetings are held at the Three Rivers in this town. It is 16 miles S. E. of Lake Ontario. In 1796 there were 10 of its inhabitants entitled to be electors.—*ib.*

LYSTRA, a small town in Nelson county, Kentucky, situated on a west water of Rolling Fork, a south branch of Salt river. N. lat. 37° 25′.—*ib.*

M.

MAATEA, one of the Society Islands, in the S. Sea, S. lat. 17° 52′, W. long. 148° 1′.—*Morse.*

MACAPA, a town situated on the north-west bank of Amazon river, W. of Caviana island, at the mouth of the river, and a few minutes north of the equinoctial line.—*ib.*

MACAS, the southern district of Quixos, a government of Peru, in S. America, bounded E. by the government of Maynas; S. by that of Bracamoros and Yaguarsongo; and on the W. the E. Cordillera of the Andes separates it from the jurisdictions of Riobamba and Cuenca. Its capital is the city of Macas, the name commonly given to the whole country. It produces, in great plenty, grain and fruits, copal, and wild wax; but the chief occupation of the country people is the cultivation of tobacco. Sugar-canes thrive also here, as also cotton; but the dread of the wild Indians prevents the inhabitants from planting more than serves for present use. Here are cinnamon trees, said to be of superior quality to those of Ceylon. There are also mines of ultra marine, from which very little is extracted, but a finer colour cannot be imagined. Among the vast variety of trees which crown the woods, is the storax, whose gum is exquisitely fragrant, but scarce.—*ib.*

MAC-COWAN'S *Ford*, on Catabaw river, is upwards of 500 feet wide, and about 3 feet deep. Lord Cornwallis crossed here in pursuit of the Americans in 1781, in his way to Hillsborough.—*ib.*

MACHALA, a town of Guayaquil, on the coast of Tumbez, in Peru, in a declining state. The jurisdiction of the same name produces great quantities of cocoa, reckoned the best in all Guayaquil. In its neighbourhood are great numbers of mangles, or mangrove trees, whose spreading branches and thick trunks cover all the plains; which lying low are frequently overflown. This tree divides itself into very knotty and distorted branches, and from each knot a multitude of others germinate, forming an impenetrable thicket. The wood of the mangrove tree is so heavy, as to sink in water, and when used in ships, &c. is found very durable, being subject neither to split or rot. The Indians of this jurisdiction pay their annual tribute in the wood of the mangrove tree.—*ib.*

MACHANGARA, a river formed by the junction of several streams, issuing from the south and west ſides of the Panecillo or Sugar Loaf mountain, on the ſouth-weſt ſide of Quito, in Peru. It waſhes the ſouth parts of the city, and has a ſtone bridge over it. —*ib*.

MACHIAS, a port of entry, poſt-town and ſeat of juſtice, in Waſhington county, Diſtrict of Maine, ſituated on a bay of its own name, 20 miles ſouth-weſt of Paſſamaquoddy, 95 E. by N. of Penobſcot, and 236 north-eaſt of Portland, in 47° 37′ N. lat. It is a thriving place, and carries on a conſiderable trade to Boſton and the Weſt-Indies in fiſh, lumber, &c. It is contemplated to eſtabliſh a regular poſt between this town and Halifax, in Nova Scotia. The name of the town is altered from the Indian name Mechiſſes, given to the river in the oldeſt maps. It is 400 miles north-eaſt of Boſton, and about 300 by water. Early attempts were made to ſettle here, but the firſt permanent ſettlement was made in 1763, by 15 perſons of both ſexes from Scarborough, in Cumberland county, and in 1784 the town was incorporated. The chief ſettlements are at the eaſt and weſt Falls, and at Middle river. *Machias river*, after running a north courſe, 6 miles diſtance from Croſs iſland, (which forms its entrance) ſeparates at a place called *the Rim;* one branch taking a north-eaſt direction, runs 2¼ miles, with a width of 30 rods to the head of the tide, where are two double ſaw-mills, and one griſt-mill. The main branch runs a north-weſt courſe, nearly 3 miles, and is 70 rods wide, to the head of the tide, where are two double and ſingle ſaw-mills, and two griſt-mills. The chief ſettlement is at Weſt Falls, the county courts being held and the gaol erected there. The main channel of the river takes its courſe to theſe falls, which, though crooked and narrow, admits veſſels of burden to load at the wharves within 50 rods of the mills. This advantage no other part of the town can enjoy. The entrance of Machias river is in N. lat. 44° 35′, W. long. 66° 56′. The town is divided into 4 diſtricts for the ſupport of ſchools; and into 2 for the convenience of public worſhip. In 1792 Waſhington academy was eſtabliſhed here. The general court incorporated a number of gentlemen as truſtees, and gave for its ſupport a townſhip of land. In 1790 the town contained 818 inhabitants. Since that time its population has rapidly increaſed. The exports of Machias conſiſt principally of lumber, viz. boards, ſhingles, clapboards, laths, and various kinds of hewed timber. The cod-fiſhery might be carried on to advantage though it has been greatly neglected. In 1793, between 70 and 80 tons were employed in the fiſhery; and not above 500 quintals were exported. The mill-ſaws, of which there are 17, cut on an average three million feet of boards annually. A great proportion of timber is uſually ſhipped in Britiſh veſſels. The total amount of exports annually exceeds 15,000 dollars. From Machias Bay to the mouth of St Croix, there are a great many fine iſlands; but the navigation is generally without theſe in the open ſea. In the year 1704, when Col. Church made an attack on the French plantation on the river Schoodick, he found one Lutterelle, a French nobleman, on one of theſe iſlands, and removed him. The iſland ſtill retains his name.—*ib*.

MACHINERY.

THE denomination *Machine* is now vulgarly given to a great variety of ſubjects, which have very little analogy by which they can be claſſed with propriety under any one name. We ſay a travelling machine, a bathing machine, a copying machine, a threſhing machine, an electrical machine, &c. &c. The only circumſtance in which all theſe agree ſeem to be, that their conſtruction is more complex and artificial than the utenſils, tools, or inſtruments which offer themſelves to the firſt thoughts of uncultivated people. They are more artificial than the common cart, the bathing tub, or the flail. In the language of ancient Athens and Rome, the term was applied to every tool by which hard labour of any kind was performed; but in the language of modern Europe, it ſeems reſtricted either to ſuch tools or inſtruments as are employed for executing ſome philoſophical purpoſe, or of which the conſtruction employs the ſimple mechanical powers in a conſpicuous manner, in which their operation and energy engage the attention. An electrical machine, a centrifugal machine, are of the firſt claſs; a threſhing machine, a fire machine, are of the other claſs. It is nearly ſynonymous, in our language, with ENGINE; a term altogether modern, and in ſome meaſure honourable, being beſtowed only, or chiefly, on contrivances for executing work in which ingenuity and mechanical ſkill are manifeſt. Perhaps, indeed, the term *engine* is limited, by careful writers, to machines of conſiderable magnitude, or at leaſt of conſiderable art and contrivance. We ſay, with propriety, ſteam engine, fire engine, plating-engine, boring-engine; and a dividing machine, a copying machine, &c. Either of theſe terms, *machine* or *engine*, are applied with impropriety to contrivances in which ſome piece of work is not executed on materials which are then ſaid to be manufactured. A travelling or bathing machine is ſurely a vulgariſm. A machine or engine is therefore a TOOL; but of complicated conſtruction, peculiarly fitted for expediting labour, or for performing it according to certain invariable principles: And we ſhould add, that the dependence of its efficacy on mechanical principles muſt be apparent, and even conſpicuous. The contrivance and erection of ſuch works conſtitute the profeſſion of the engineer; a profeſſion which ought by no means to be confounded with that of the mechanic, the artiſan, or manufacturer. It is one of the *artes liberales;* as deſerving of the title as medicine, ſurgery, architecture, painting, or ſculpture. Nay, whether we conſider the importance of it to this flouriſhing nation, or the ſcience that is neceſſary for giving eminence to the profeſſor, it is very doubtful whether it ſhould not take place of the three laſt named, and go *pari passu* with ſurgery and medicine. The inconſiderate reader, who peruſes *Cicero de Oratore* with ſatiſfaction, is apt to ſmile at Vitruvius, who requires in his architect nearly the ſame accompliſhments which Cicero requires in his orator. He has not recollected, or perhaps did not know, that the profeſſion of an architect in the

Auguftan age was the moft refpectable of all thofe which were not effentially connected with the management of ftate affairs. It appears that the architects were all Greeks, or the pupils of Greeks, altogether different from the members of the *Collegium Murariorum*, the corporation of builders and mafons. The architecture of temples, ftadiums, circufes, amphitheatres, feems to have been monopolifed, by ftate authority, by a fociety which had long fubfifted in Afia, connected by certain myfterious bonds, both civil and religious. We find it in Syria; and we learn that it was brought thither from Perfia in very ancient times. From thence it fpread into Ionia, where it became a very eminent and powerful affociation, under the particular protection of Bacchus, to whom the members had erected a magnificent temple at Teos, with a vaft eftablifhment of priefts and priefteffes, confifting of perfons of the firft rank in the ftate. They were the fole builders of temples and ftadiums throughout all Greece and the Leffer Afia; and the contractors for the machinery that was employed in the theatres, and in the great temples, for the celebration of the high myfteries of paganifm. By the imperfect accounts which remain of the Eleufinian and other myfteries, it appears, that this machinery muft have been immenfe and wonderful, and muft have required a great deal of mechanical fkill. This indeed appears, in the moft convincing manner, to any perfon who reflects on the magnificent ftructures which they erected, which excite to this day the wonder of the world, not only on account of their magnificence and incomparable elegance, but alfo on account of the mechanical knowledge that feems indifpenfably neceffary for their erection. This will ever remain a myftery. There are no traces of fuch knowledge to be found in the writings of antiquity. Even Vitruvius, writing exprefsly on the fubject, has given us nothing but what is in the loweft degree of elementary knowledge.

This affociation of the Dyonifiacs undoubtedly kept their mechanical fcience a profound fecret from the uninitiated, the profane. They were the engineers of antiquity, and Vitruvius was perhaps not one of the initiated. He fpeaks of Myro and other Greek architects in terms of refpect which border on veneration. Perhaps the modern affociation of free mafons is a remain of this ancient fraternity, continued to our times by the company of builders, who erected the cathedrals and great conventual churches. No one who confiders their works with fcientific attention, can doubt of their being deeply verfed in the principles of mechanics, and even its more refined branches. They appear to have carried the art of vault-roofing almoft to its acmé of perfection; far outftripping their Grecian inftructors in their knowledge of this moft delicate branch of their art.

It were greatly to be wifhed that fome fuch inftitution did yet exift, where men might be induced by the moft powerful motives to accomplifh themfelves in the knowledge neceffary for attaining eminence in their profeffion.

We have been informed (and we thought our authority good), that the King has fignified his intention of patronifing an inftitution of this kind. We heard, that it was propofed to inftitute degrees fimilar to our univerfity degrees, and proceeding on fimilar conditions of a regular education or ftanding, which would enfure the *opportunities* of information, and alfo on an examination of the proficiency of the candidate. This examination, being conducted by perfons eminent in the profeffion, perhaps ftill exercifing it, would probably be ferious, becaufe the fuccefsful candidate would immediately become a rival practitioner. Such an inftitution would undoubtedly prevent many grofs impofitions by unlettered mill-wrights and pump-makers, who now feldom appear under any name but that of engineer, although they are frequently ignorant even of the elements of mechanical fcience, and are totally unacquainted with the higher mathematics; without which it is abfolutely impoffible for them to contrive a machine well fuited to the intended purpofe, or to fay with any tolerable precifion what will be the performance of the engine they have erected. Yet thefe are queftions fufceptible of accurate folution, becaufe they depend on the unalterable laws of matter and motion.

All who have a juft view of the unfpeakable advantages which this highly favoured land poffeffes in the fuperiority and activity of its manufactures, and who know how much of this fuperiority fhould be afcribed to the great improvements which have been made in practical mechanics within thefe laft thirty years, will join us in wifhing fuccefs to fome fuch inftitution as that now mentioned.

We were naturally led to thefe reflections when we turned our thoughts to machinery in general, and obferved what is done in this country by the native energy of its inhabitants, unaffifted by fuch fcientific inftructions as they might have expected from the pupils of a Newton, their countryman, under the patronage of the beft of Sovereigns, eminently knowing in thefe things, and ever ready to encourage thofe fciences and arts which have fo highly contributed to the national profperity. What might not be reafonably expected from Britifh activity, if thofe among ourfelves who have knowledge and leifure had been at the fame pains with the members of the foreign academies to cultivate the Newtonian philofophy, and particularly the more refined branches of mechanics, and to deduce from their fpeculations maxims of conftruction fitted to our fituation as a great manufacturing nation? But fuch knowledge is not attainable by thofe who are acquainted only with the imperfect elements contained in the publications read by the bulk of our practitioners. Much to this purpofe has been done on the continent by the moft eminent mathematicians; but from want of individual energy, or perhaps of general fecurity and protection, the patriotic labours of thofe gentlemen have not done the fervice to their country which might have been reafonably expected. Indeed, their differtations have generally been fo compofed, that only the learned could fee their value. They feem addreffed only, or chiefly, to fuch; but it is to thofe authors that our countrymen generally have recourfe for information concerning every thing in their profeffion that rifes above mere elementary knowledge. The books in our language which profefs to be fyftems of mechanics rarely go beyond this: they contain only the principles of equilibrium. Thefe are abfolutely neceffary for the knowledge of machines; but they are very far indeed from giving what may be called a practical knowledge of *working machinery*. This is never in a ftate of equilibrium. The machine muft move in order to work. There

There must be a superiority of impelling power, beyond what is merely sufficient for balancing the resistance or contrary action of the work to be performed. The reader may turn to the article STATICS in the *Encyclopedia*, and he will there see some farther observations on this head. And in the article MECHANICS he will find a pretty ample detail of all the usual doctrines, and a description of a considerable variety of machines or engines, accompanied by such observations as are necessary for tracing the propagation or transmission of pressure from that part of the machine to which the natural power is applied to the working part of the machine. Along with these two articles, it will be proper to read with peculiar attention the article ROTATION.

By far the greatest number of our most serviceable engines consist chiefly of parts which have a motion of rotation round fixed axes, and derive all their energy from levers virtually contained in them. And these acting parts are also material, requiring force to move them, over and above what is necessary for producing the acting force at the working part of the machine. The modifications which this circumstance frequently makes of the whole motions of the machine, are indicated in the article ROTATION in an elementary way; and the propositions there investigated will be found almost continually involved in the complete theory of the operation of a machine. Lastly, it will be proper to consider attentively the propositions contained in the article *STRENGTH of Materials*, that we may combine them with those which relate wholly to the working of the machine; because it is from this combination only that we discover the strains which are excited at the various points of support, and of communication, and in every member of the machine. We suppose all these things already understood.

1 The chief question in mechanics.

Our object at present is to point out the principles which enable us to ascertain what will be the precise motion of a machine of given construction, when actuated by a natural power of known intensity, applied to a given point of the machine, while it is employed to overcome a known resistance acting at another point. To abbreviate language, we shall call that the IMPELLED POINT of the machine to which the pressure of the moving power is immediately applied; and we may call that the WORKING POINT, where the resistance arising from the work to be performed immediately acts.

To consider this important subject, even in its chief varieties, requires much more room than can be allowed in an undertaking like ours, and therefore we must content ourselves with a very limited view; but at the same time, such a view as shall give sufficient indication of the principles which should direct the practical reader in every important case. We shall consider those machines which perform their motions round fixed axes; these being by far the most numerous and important, because they involve in their construction and operations all the leading principles.

2 The proper measure of mechanical power exerted.

That we may proceed securely, it is necessary to have a precise and adequate notion of moving force, as applied to machinery, and of its measures. We think this peculiarly necessary. Different notions have been entertained on this subject by Mr Leibnitz, Des Cartes, and other eminent mechanicians of the last century; and their successors have not yet come to an agreement. Nay, some of the most eminent practitioners of the present times (for we must include Mr Smeaton in the number) have given measures of mechanical power in machinery which we think inaccurate, and tending to erroneous conclusions and maxims.

We take for the measure (as it is the effect) of exerted mechanical power the quantity of motion which it produces by its uniform exertion during some given time. We say *uniform exertion*, not because this uniformity is necessary, but only because, if any variation of the exertion has taken place, it must be known, in order to judge of the power. This would needlessly complicate the calculations; but in whatever way the exertion may have varied, the whole accumulated exertion is still accurately measured by the quantity of motion existing at the end of the exertion. The reader must perceive that this is the same thing that is expressed in the article DYNAMICS of this *Supplement*, n° 90. by the area of the figure whose abscissa or axis represents the time of exertion; and the ordinates are as the pressures in the different instants of that time, the whole being multiplied by the number of particles (that is, by the quantity of matter), because that figure represents the quantity of motion generated in one particle of matter only. All this is abundantly clear to persons conversant in these disquisitions; but we wish to carry along with us the distinct conceptions of that useful class of readers whose profession engages them in the construction and employment of machines, and to whom such discussions are not so familiar. We must endeavour therefore to justify our choice of this measure by appealing to familiar facts.

If a man, by pressing uniformly on a mass of matter for five seconds, generates in it the velocity of eight feet per second, we obtain an exact notion of the proportion of this exertion to the mechanical exertion of gravity, when we say that the man's exerted force has been precisely one-twentieth part of the action of gravity on it; for we know that the weight of that body (or, more properly, its heaviness) would, in five seconds, have given it the velocity of 160 feet per second, by acting on it during its fall. But let us attend more closely to what we mean by saying that the exerted force is one-twentieth of the exertion of gravity. The only notion we have of the exertion of gravity is what we call the weight of the body—the pressure which we feel it make on our hand. To say that this is 20 pounds weight, does not explain it; because this is only the action of gravity on another piece of matter. Both pressures are the same. But if the body weighs 20 pounds, it will draw out the rod of a steelyard to the mark 20. The rod is so divided, that the 20th part of this pressure will draw it out to 1. Now the fact is, that if the man presses on the mass of 20 pounds weight with a spring steelyard during five seconds, and if during that time the rod of the steelyard was always at the mark 1, the body will have acquired the velocity of eight feet per second. This is an acknowledged fact. Therefore we were right in saying, that the man's exertion is one-twentieth of the exertion of gravity. And since we believe the weight of bodies to be proportional to their quantity of matter, all matter being equally heavy, we may say, that the man's exertion was equal to the action of gravity on a quantity of matter whose weight is one pound. We express it much more familiarly

liarly, by saying, that the man exerted on it the pressure of one pound of matter, or the force of one pound.

In this manner, the motion communicated to a mass of matter, by acting on it during some time, informs us with accuracy of the real mechanical force or pressure which has been exerted. This is judged to be double when twice the velocity has been generated in the same mass, or where the same velocity has been generated in twice the mass; because we know, that a double pressure would have done either the one or the other.

But farther: We know that this pressure is the exertion; we have no other notion of our own force; and our notion of gravity, of elasticity, or any other natural force, is the same. We also know that the continuance of this exertion fatigues and exhausts our strength as completely as the most violent motion. A dead pull, as it is called, of a horse, at a post fixed in the ground, is a usual trial of his strength. No man can hold out his arm horizontally for much more than a quarter of an hour; and the exertion of the last minutes gives the most distressing fatigue, and disables the shoulder from action for a considerable time after. This is therefore an expenditure of mechanical power, in the strict primitive sense of the word. Of this expenditure we have an exact and adequate effect and measure in the quantity of motion produced; that is, in the product of the quantity of matter by the velocity generated in it by this exertion. And it must be particularly noticed, that this measure is applicable even to cases where no motion is produced by the exertion; that is, if we know that the exertion which is just unable to start a block of stone lying on a smooth stone pavement, but would start it, if increased by the smallest addition; and if we know that this would generate in a second 32 feet of velocity in 100 pounds of matter—we are certain that it was a pressure equal to the weight of this 100 pounds. It is a good measure, though not immediate, and may be used without danger of mistake when we have no other.

3 Mr. Smeaton's measure

The celebrated engineer Mr Smeaton, in his excellent dissertation on the power of water and wind to drive machinery, and also in two other dissertations, all published in the Philosophical Transactions, and afterwards in a little volume, has employed another measure, both of the expenditure of mechanical power, and of the mechanical effect produced. He says, that the weight of a body, multiplied by the height thro' which it descends, while driving a machine, is the only proper measure of the power expended; and that the weight, multiplied by the height through which it is uniformly raised, is the only proper measure of the effect produced. And he produces a large train of accurate experiments to prove that a certain weight, descending through a certain space, always produces the same effect, whether it has descended swiftly or slowly, employing little or much time.

Had this eminent engineer proposed this as a popular measure, of easy comprehension and remembrance, and as well accommodated to the uses of those engaged in the construction of machines, when restricted to a certain class of cases, it might have answered very good purposes; but the author is at pains to recommend it to the philosophers as a necessary correction of their theories, which he says tend to mislead the artists. His own reasonings terminate in the same conclusion with Mr Leibnitz's, namely, that the power of producing a mechanical effect, and the effect produced, are proportional to the square of the velocity. The deference justly due to Mr Smeaton's authority, and the influence of his name among those who are likely to make the most use of his instructions, render it necessary for us to examine this matter with some attention.

Mr Smeaton was led to the adoption of this measure by his professional habits. Raising a weight to a height is, in one shape or another, the general task of the machines he was employed to erect; and we may add, the opportunities of expending the mechanical powers of nature which are in our command, are generally in this proportion. A certain daily supply of water, coming from a certain height, is our best opportunity, and may very properly be said to be expended.

This being the general case, the measure was obvious, and natural, and good. The power and effect were of the same kind, and *must* be measures of each other; at least, in those circumstances in which they were set in opposition. Yet even here Mr Smeaton was obliged to make a restriction of his measures: "The height thro' which a body *slowly and equably* descended, or to which it was raised." And why was this limitation necessary? "Because in rapid or accelerated motions, the inertia of bodies occasioned some variation*." But this is too vague language for philosophical disquisition. Besides, what is meant by this variation? What is the standard from which the unrestricted measure varies? This standard, whatever it is, is the true measure, and it was needless to adopt any other. Now, the standard from which Mr Smeaton estimates the deviation, is the very measure which we wish to employ, namely, the quantity of motion produced. Strictly speaking, even this is not the immediate measure. The immediate measure is that faculty which we call pressure. This is the intermedium perceivable in all productions of motion; and it is also the intermedium of mechanical effect, even when motion is not produced; as when the weight of a body bends a spring, or the elasticity of a body supports another pressure. How it operates in all or any of these cases, we know not; but we know that all these measures of pressure agree with each other. A double quantity of motion will bend a spring doubly strong, will raise a double weight, will withstand any double pressure, &c. &c. In short, pressure is the immediate agent in every mechanical phenomenon. It penetrates bodies, overcoming their tenacity; it overcomes friction; it balances pressure; it produces motion. Mr Smeaton's measure is only nearly true, in any case, and in all cases it is far from being exact in the first instants of the motion, during its acceleration or retardation.

4 Examined,

* Page 7.

We have already noticed the complete expenditure of animal power by continued pressure, even when motion is not produced: the only difficulty is to connect this in a measurable way with the power which the same exertion has of generating motion in a body.

When a man supports a weight for a single instant, he certainly balances the pressure or action of gravity on that body; and he continues this action as long as he continues to support it: and we know that if this body were at the end of a horizontal arm turning round a vertical axis, the same effort which the man exerted in

merely

merely carrying the weight, if now exerted on the body, by pushing it horizontally round the axis, will generate in it the same velocity which gravity would generate by its falling freely. On this authority therefore we say, that the whole accumulated action of a man, when he has just carried a body whose weight is 30 pounds for one minute, is equal to the whole exertion of gravity on it during that minute; and if employed, not to counteract gravity, but to generate motion, would generate, during that minute, the same motion that gravity would, that is, 60 × 32 feet velocity per second, in a mass of 30 pounds. There would be 30 pounds of matter moving with the velocity of 1920 feet per second. We would express this production or effect by 30 × 1920, or by 57600, as the measure of the man's exertion during the minute.

But, according to Mr Smeaton, there is no expenditure of power, nor any production of mechanical effect, in thus carrying 30 pounds for a minute; there is no product of a weight by a height through which it is equably raised; yet such exertion will completely exhaust a man's strength if the body be heavy enough. Here then is a case to which Mr Smeaton's measure does not readily apply; and this case is important, including all the actions of animals at a dead pull.

But let us consider more narrowly what a man really does when he performs what Mr Smeaton allows to be the production of a measurable mechanical effect. Suppose this weight of 30 pounds hanging by a cord which passes over a pulley, and that a man, taking this cord over his shoulder, turns his back to the pulley, and walks away from it. We know, that a man of ordinary force will walk along, raising this weight, at the rate of about 60 yards in a minute, or a yard every second, and that he can continue to do this for eight or ten hours from day to day; and that this is all that he can do without fatigue. Here are 30 pounds raised uniformly 180 feet in a minute; and Mr Smeaton would express this by 30 × 180, or 5400, and would call this the measure of the mechanical effect, and also of the expenditure of power. This is very different from our measure 57600.

5 And found to be inaccurate.

But this is not an accurate and complete account of the man's *action* on the weight, and of the whole effect produced. To be convinced of this, suppose that a man A has been thus employed, while another B, walking along side of him at the same rate, suddenly takes the rope out of his hand, frees him of the task, and *continues* to raise the weight without the smallest change on its velocity of ascent. What is the action of B, and whether is it the same with that of A or not? It is acknowledged by all, that the exertion of B against the load is precisely equal to 30 pounds. If he holds the rope by a spring steelyard, it will stand constantly at the mark 30. B exerts the same action on the load as when he simply supports it from falling back into the pit. It was moving with the velocity of three feet per second when he took hold of the rope, and it would continue to move with that velocity if any thing could annihilate or counteract its gravity. If therefore there was no action when a person merely carried it, there is none at present when it is rising 180 feet in a minute. The man does indeed work more than on that occasion, but not against the load: his additional work is walking, the motion of his own body, as a thing previously necessary that he may continue to support the load, that he may continue his mechanical effort as it follows him. It appears to yield to him: but it is not to *his* efforts that it yields; its weight completely balances those efforts, and is balanced by them. It was to a *greater* effort of the man A that it yielded. It was then lying on the ground. He pulled at the cord, gradually perhaps increasing his pull till it was just equal to its weight. When this obtains, the load no longer presses on the ground, but is completely carried by the rope. But it does not move by this effort of 30 pounds; but let him exert a force of 31 pounds, and continue this for three seconds. He will put it in motion; will accelerate that motion; and at the end of three seconds the load is rising with the velocity of three feet per second. The man feels that this is as much speed as he can continue in his walk; he therefore slackens his pull, reducing his action to 30 pounds, and with this action he walks on. All this would be distinctly perceived by means of a steelyard. The rod would be pulled out beyond 30, till the load acquired the uniform velocity intended, and after this it would be observed to shrink back to 30.

More is done therefore than appears by Mr Smeaton's measure. Indeed, all that appears in it is the exertion necessary for *continuing* a motion already produced, but which would be immediately extinguished by a contrary power, which must therefore be counteracted. This measure will not apply to numberless cases of the employment of machines, where there is no such opposing power, and where, notwithstanding, mechanical power must be expended, even according to Mr Smeaton's measurement. Such are corn mills, boring mills, and many others.

How then comes it that Mr Smeaton's valuable experiments concur so exactly in shewing that the same quantity of water descending from the same height, always produces the same effect (as he measured it), whatever be the velocity? In the first place, all his experiments are cases where the power expended and the work performed are of the same kind: A heavy body descends, and by its preponderancy raises another heavy body. But even this would not ensure the precise agreement observed in his experiments, if Mr Smeaton were not careful to exclude from his calculations all that motion where there is any acceleration, and all the expenditure of water during the acceleration, and to admit only those motions that are sensibly uniform. In moderate velocities, the additional pressure required for the first acceleration is but an insignificant part of the whole; and to take these accelerated motions into the account, would have embarrassed the calculations, and perhaps confused many of the readers. We see, in the instance now given, that the addition of one pound continued for three seconds only, was all that was necessary.

Mr Smeaton's measurement is therefore abundantly exact for practice; and being accommodated to the circumstances most likely to engage the attention, is very proper for the instruction of the numerous practitioners in all manufacturing countries who are employed for ordinary erections: but it is improperly proposed as an article essential to a just theory of mechanics, and therefore it was proper to notice it in this place. Besides, there frequently occur most important cases, in which the motion of a machine is, of necessity, desultory, alternately

ternately accelerated, and retarded. We ſhould not derive all the advantages in our power from the firſt mover, if we did not attend particularly, and chiefly, to the *accelerating* forces. And in every caſe, the improvement, or the proper employment of the machine, is not attained, if we are not able to diſcriminate between the two parts of the mechanical exertion; one of them, by which the motion is produced and accelerated to a certain degree; and the other, by which that motion is continued. We muſt be able to appreciate what part of the effect belongs to each.—But it is now time to proceed to the important queſtion,

What will be the preciſe motion of a machine of given conſtruction, actuated by a power of known intenſity and manner of acting, and oppoſed by a known reſiſtance?

6 Things to be conſidered in a machine at work.

In the ſolution of this queſtion, much depends on the nature of both power and reſiſtance. In the ſtatical conſideration of machines, no attention is paid to any differences. The intenſity of the preſſures is all that it is neceſſary to regard, in order to ſtate the proportion of preſſure which will be exerted in the various parts of the machine. The preſſures at the impelled and working points, combined with the proportions of the machine, neceſſarily determine all the reſt. Preſſure being the ſole cauſe of all mechanical action among bodies, any preſſure may be ſubſtituted for another that is equal to it; and the preſſure which is moſt familiar, or of eaſieſt conſideration, may be uſed as the repreſentative of all others. This has occaſioned the mechanical writers to make uſe of the preſſure of gravity as the ſtandard of compariſon, and to repreſent all powers and reſiſtances by weights. However proper this may be in their hands, it has hurt the progreſs of the ſcience. It has rendered the uſual elementary treatiſes of mechanics very imperfect, by limiting the experiments and illuſtrations to ſuch as can be ſo repreſented with facility. This has limited them to the ſtate of equilibrium (in which condition a working machine is never found), becauſe illuſtrations by experiment out of this ſtate are neither obvious nor eaſy. It has alſo prevented the ſtudents of mechanics from accompliſhing themſelves with the mathematical knowledge required for a ſucceſsful proſecution of the ſtudy. The moſt elementary geometry is ſufficient for a thorough underſtanding of equilibrium, or the doctrines of ſtatics; but true mechanics, the knowledge of machines as inſtruments by which work is performed, requires more refined mathematics, and is inacceſſible without it.

Had not Newton or others improved mathematics by the invention of the infiniteſimal analyſis and calculus, we muſt have reſted contented with the diſcoveries (really great) of Galileo and Huyghens. But Newton, *ſuâ matheſi facem præferente*, opened a boundleſs field of inveſtigation, and has not only given a magnificent and brilliant ſpecimen of the diſcoveries to be made in it, but has alſo traced out the particular paths in which we are to find the ſolution of all queſtions of practical mechanics. This he has done by ſhewing another ſpecies of equilibrium, indicated, not by the ceſſation of all motion, but by the uniformity of motion; by the ceſſation of all acceleration or retardation. As the extinction of motion by the action of oppoſite forces is aſſumed by us as the indication of the perfect equality of thoſe forces; ſo the extinction of acceleration ſhould be received as the indication of ſomething equal and oppoſite to the force which was known to have cauſed the acceleration; and therefore as the indication of an equilibrium between oppoſite forces, or elſe of the ceſſation of all force.

7 Mechanical equilibrium.

This new view of things was the ſource of all our diſtinct notions of mechanical forces, and gave us our only unexceptionable marks and meaſures of them. The 39th propoſition of the firſt book of Newton's Principles of Natural Philoſophy, and its corollaries, contain almoſt the whole doctrine of active mechanical nature, and are peculiarly applicable to our preſent purpoſe, becauſe they enable us to comprehend in this *mechanical equilibrium* (ſo different from the *ſtatical*) every circumſtance in which thoſe preſſures which are exerted by natural powers differ from each other, and vary in their action on the impelled and working points of a machine. Indeed, when we recollect that the operations of our machines are the ſame on board a ſhip as on ſhore, and that all our machines are moving with the ground on which they ſtand, we muſt acknowledge, that even ordinary ſtatics is only an imperfect view of an equilibrium among things which are in motion; and this ſhould have taught us that, even in thoſe caſes where nothing like equilibrium appears, an equilibrium may ſtill be uſefully traced.

8 Diſtinctions muſt be made in the nature of the powers applied to working machines.

In the ſtatical conſideration of machines, the *quantity* of preſſure is all that we need attend to. But in the mechanical diſcuſſion of their *operations*, we muſt attend to their diſtinctions in kind: and it will by no means be ſufficient to repreſent them all by weights; for their diſtinction in kind is accompanied by great differences in their manner of acting on the machine. Some natural powers, in order to continue their action on the impelled point of the machine, muſt at the ſame time put into motion a quantity of matter external to the machine, in which theſe powers reſide; and this muſt be made to follow the impelled point in its motion, and not only follow, but continue to preſs it forward; or, this matter, thus continually put into motion, muſt be ſucceſſively applied to different points of the machine, which become impelled points in their turn. This is the caſe with a weight, with the action of a ſpring, the action of animals, the action of a ſtream of water or wind, and many other powers. A part of the natural mechanical powers muſt therefore be employed in producing this external motion. This is ſometimes a very conſiderable part of the whole natural power. In ſome caſes it is the whole of it. This obtains in the action of a deſcending weight, lying on the end of a lever and preſſing it down, or hanging by a chord attached to the machine.

There is alſo an important diſtinction in the manner in which this external motion is kept up. In a weight employed as the moving power, the actuating preſſure ſeems to reſide in the matter itſelf; and all that is neceſſary for continuing this preſſure is merely to continue the connection of it with the machine. But in the action of animals it may be very different: A man puſhing at a capſtan bar, muſt firſt of all walk as faſt as the bar moves round, and this requires the expenditure of his muſcular force. But this alone will not render his action an effective power: He muſt alſo *preſs forward* the capſtan bar with as much force as he has remaining over and above what he expends in walking at that rate. The proportion of theſe two expenditures may be very different

different in different circumstances; and in the judicious selection of such circumstances as make the first of these as inconsiderable as possible, lies much of the skill and sagacity of the engineer. In the common operation of thrashing corn, much more than half of the man's power is expended in giving the necessary motion to his own body, and only the remainder is employed in urging forward the swiple with a momentum sufficient for shaking off the ripe grains from the stalk. We had sufficient proof of this, by taking off the swiple of the flail, and putting the same weight of lead on the end of the staff, and then causing the hind to perform the usual motions of thrashing with all the rapidity that he could continue during the ordinary hours of work. We never could find a man who could make three motions in the same time that he could make two in the usual manner, so as to continue this for half an hour. Hence we must conclude, that half (some will say two-thirds) of a thrasher's power is expended in merely moving his own body. Such modes of animal action will therefore be avoided by a judicious engineer; but to be avoided, their inconvenience must be understood. More of this will occur hereafter.—In other cases, we are almost (never wholly) free from this unprofitable expenditure of power. Thus, in the steam engine, the operation requires that the external air follow the piston down the cylinder, in order to continue its pressure. But the force necessary for sending in this rare fluid into the cylinder with the necessary velocity, is such an insignificant part of the whole force which is at our command, that it would be ridiculous affectation in any engineer to take it into account; and this is one great ground of preference to this natural power. The same thing may be said of the action of a strong and light spring, which is therefore another very eligible first mover for machinery. The ancient artillerists had discovered this, and employed it in their warlike engines.

We must also attend to the nature of the resistance which the work to be performed opposes to the motion of our machine. Sometimes the work opposes, not a simple obstruction, but a real resistance or reaction, which, if applied alone to the machine, would cause it to move the contrary way. This always obtains in cases where a heavy body is to be raised, where a spring is to be compressed, and in some other cases. Very often, however, there is no such contrary action. A flour mill, a saw mill, a boring mill, and many such engines, exhibit no reaction of this kind. But although such machines, when at rest or not impelled by the first mover, sustain no pressure in the opposite direction, yet they will not acquire any motion whatever, unless they be impelled by a power of a certain determinate intensity. Thus in a saw mill, a certain force must be impressed on the teeth of the saw, that the cohesion of the fibres of the timber may be overcome. This requires that a certain force, determined by the proportions of the machine, be impressed on the impelled point. If this, and no more, be applied there, a force will be excited at the teeth of the saw, which will *balance* the cohesion of the wood, but will not *overcome* it. The machine will continue at rest, and no work will be performed. Any addition of force at the impelled point, will occasion an addition to the force excited in the teeth of the saw. The cohesion will be overcome, the machine will move, and work will be performed. It is only this *addition* to the impelling power that gives motion to the machine; the rest being expended merely in balancing the cohesion of the woody fibres. While therefore the machine is in motion, performing work, we must consider it as actuated by a force impressed on the impelled point by the natural power, and by another acting at the working point, furnished by or derived from the resistance of the work.

Again: It not unfrequently happens, that there is not even any such resistance or obstruction excited at the working point of the machine; the whole resistance (if we can with propriety give it that name) arises from the necessity of giving motion to a quantity of inert and inactive matter. This happens in urging round a heavy fly, as in the coining press, in the punching engine, in drawing a body along a horizontal plane without friction, and a few similar cases. Here the smallest force whatever, applied at the impelled point, will begin motion in the machine; and the *whole* force so applied is consumed in this service. Such cases are rare, as the ultimate performance of a machine; but occasionally, and for a farther purpose, they frequently occur; and it is necessary to consider them, because there are many of the most important applications of machinery where a very considerable part of the force is expended in this part of the general task.

Such are the chief circumstances of distinction among the mechanical powers of nature which must be attended to, in order to know the motion and performance of a machine. These never occur in the statical consideration of the machine, but here they are of chief importance.

9 The inertia of the machine itself must also be considered,

But farther: The action of the moving power is transferred to the working point through the parts of a machine, which are material, inert, and heavy. Or, to describe it more accurately, before the necessary force can be excited at the working point of the machine, the various connecting forces must be exerted in the different parts of the machine; and in order that the working point may follow out the impression already made, all the connecting parts or limbs of the machine must *be moved*, in different directions, and with different velocities. Force is necessary for thus changing the state of all this matter, and frequently a very considerable force. Time must also elapse before all this can be accomplished. This often consumes, and really wastes, a great part of the impelling power. Thus, in a crane worked by men walking in a wheel, it acquires motion by slow degrees; because, in order to give sufficient room for the action of the number of men or cattle that are necessary, a very capacious wheel must be employed, containing a great quantity of inert matter. All of this must be put in motion by a very moderate preponderance of the men. It accelerates slowly, and the load is raised. When it has attained the required height, all this matter, now in considerable motion, must be stopped. This cannot be done in an instant with a jolt, which would be very inconvenient, and even hurtful; it is therefore brought to rest gradually. This also consumes time; nay, the wheel must get a motion in the contrary direction, that the load may be lowered into the cart or lighter. This can only be accomplished by degrees. Then the tackle must be lowered down again for another load, which also must be done gradually. All this wastes a great deal both of time and of of force, and renders a walking wheel a very improper form for the first mover of a crane, or any machine whose use requires such frequent changes of motion. The same thing obtains, although in a lower degree, in the steam engine, where the great beam and pump rods, sometimes weighing very many tons, must be made to acquire a very brisk motion in opposite directions twice in every working stroke. It obtains, in a greater or a less degree, in all engines which have a reciprocating motion in any of their parts. Pump mills are of necessity subjected to this inconvenience. In the famous engine at Marly, about $\frac{4}{5}$ of the whole moving power of some of the water wheels is employed in giving a reciprocating motion to a set of rods and chains, which extend from the wheels to a cistern about three-fourths of a mile distant, where they work a set of pumps. This engine is, by such injudicious construction, a monument of magnificence, and the struggle of ignorance with the unchangeable laws of Nature. In machines, all the parts of which continue the direction of their motions unchanged, the inertia of a great mass of matter does no harm; but, on the contrary, contributes to the steadiness of the motion, in spite of small inequalities of power or resistance, or unavoidable irregularities of force in the interior parts. But in all reciprocations, it is highly prejudicial to the performance; and therefore constructions which admit such reciprocation without necessity, are avoided by all intelligent engineers. The mere copying artist, indeed, who derives all his knowledge from the common treatises of mechanics, will never suspect such imperfections, because they do not occur in the statical consideration of machines.

10 And its friction. Lastly, no machine can move without a mutual rubbing of its parts, at all points of communication; such as the teeth of wheelwork, the wipers and lifts, and the gudgeons of its different axes. In many machines, the ultimate task performed by the working point, is either friction, or very much resembles it. This is the case in polishing mills, grinding mills, nay in boring mills, saw mills, and others. A knowledge of friction, in all its varieties, seems therefore absolutely necessary, even for a moderate acquaintance with the principles of machinery. This is a very abstruse subject; and although a good deal of attention has been paid to it by some ingenious men, we do not think that a great deal has been added to our knowledge of it; nor do the experiments which have been made seem to us well calculated to lead us to a distinct knowledge of its nature and modifications. It has been considered chiefly with a view to diminish it as much as possible in the communicating parts of machinery, and to obtain some general rules for ascertaining the quantity of what unavoidably remains. Mr Amontons, of the Royal Academy of Sciences at Paris, gave us, about the beginning of this century, the chief information that we have on the subject. He discovered, that the obstruction which it gave to motion was very nearly proportional to the force by which the rubbing surfaces are pressed together. Thus he found, that a smooth oaken board, laid on another smooth board of the same wood, requires a force nearly equal to one-third of what presses the surfaces together. Different substances required different proportions.

11 Measure of it by Amontons. He also found, that neither the extent of the rubbing surfaces, nor the velocity of the motion, made any considerable variation on the obstruction to motion. These were curious and unexpected results. Subsequent observations have made several corrections necessary in all these propositions. This subject will be more particularly considered in another place; but since the deviations from Mr Amontons's rule are not very considerable, at least in the cases which occur in this general consideration of machines, we shall make use of it in the mean time. It gives us a very easy method of estimating the effect of friction on machines. It is a certain proportion of the mutual pressure of the rubbing surfaces, and therefore must vary in the same proportion with this pressure. Now, we learn from the principles of statics, that whatever pressures are exerted on the impelled and working point of the machine, all the pressures on its different parts have the same constant proportion to these, and vary as these vary: Therefore the whole friction of the machine varies in the same proportion. But farther, since it is found that the friction does not sensibly change with the velocity, the force which is just sufficient to overcome the friction, and put the loaded machine in motion, must be very nearly the same with the force expended in overcoming the friction while the machine is moving with any velocity whatever, and performing work. Therefore if we deduct from the force which just puts the loaded machine in motion that part of it which balances the reaction of the impelled point occasioned by the resistance of the work, or which balances the resistance of the work, the remainder is the part of the impelling power which is employed in overcoming the friction. If indeed the actual resisting pressure of the work varies with the velocity of the working point, all the pressures, and all the frictions in the different communicating parts of the machine, vary in the same proportion. But the law of this variation of working resistance being known, the friction is again ascertained.

We can now state the dynamical equilibrium of forces in the working machine in two ways. We may either consider the efficient impelling power as diminished by all that portion which is expended in overcoming the friction, and which only prepares the machine for performing work, or we may consider the impelling power as entire, and the work as increased by the friction of the machine; that is, we may suppose the machine without friction, and that it is loaded with a quantity of additional resistance acting at the working point. Either of these methods will give the same result, and each has its advantages. We took the last method in the slight view which we took of this subject in the *Encycl.* art. ROTATION, n° 64. and shall therefore use it here.

Supposing now this previous knowledge of all these variable circumstances which affect the motion of machines of the rotative kind, so that, for any momentary position of it while performing work, we know what are the precise pressures acting at the impelled and working points, and the construction of the machine, on which depend the friction, and the momentum of its inertia (expressed in the article ROTATION by $\int p r^2$); we are now in a condition to determine its motion, or at least its momentary acceleration, competent to that position. Therefore,

Let there be a rotative machine, so constructed, that while

12 Composition of the formula expressing the performance of a machine. while it is performing work, the velocity of its impelled point is to that of its working point as m to n. It is easy to demonstrate, from the common principles of statics, that if a simple wheel and axle be substituted for it, having the radius of the wheel to that of the axle in the same proportion of m to n, and having the same momentum of friction and inertia, and actuated by the same pressures at the impelled and working points, then the velocities of these points will be precisely the same as in the given machine.

Let p represent the intensity (which may be measured by pounds weight) of the pressure exerted in the moment at the impelled point; and r express the pressure exerted at the working point by the resistance opposed by the work that is then performing. This may arise from the weight of a body to be raised, from the cohesion of timber to be sawed, &c. Any of these resistances may also be measured by pounds weight; because we know, that a certain number of pounds hung on the saw of a saw mill, will just overcome this cohesion, or overcome it with any degree of superiority. Therefore the impelling power p, and the resistance r, however differing in kind, may be compared as mere pressures.

Let x represent the quantity of inert matter which must be urged by the impelling power p, with the same velocity as the impelled point, in order that this pressure p may really continue to be exerted on that point. Thus, if the impelling power is a quantity of water in the bucket of an overshot wheel, acting by its weight, this weight cannot impel the wheel except by impelling the water. In this way, x may be considered as representing the inertia of the impelling power, while p represents its pressure on the machine. In like manner, let y represent the quantity of external inert matter which is really moved with the velocity of the working point in the execution of the task performed by the machine.

Whatever be the momentum of the inertia of the machine, we can always ascertain what quantity of matter, attached to the impelled point, or the working point of the wheel and axle, will require the same force to give the wheel the same angular motion; that is, which shall have the same momentum of inertia. Let the quantity a, attached to the working point, give this momentum of inertia $a\,n^2$.

Lastly, supposing that the wheel and axle have no friction, let f be such a resistance, that if applied to the working point, it shall give the same obstruction as the friction of the machine, or require the same force at the impelled point to overcome it.

13 Angular motion of the machine. These things being thus established, the angular velocity of the wheel and axle, that is, the number of turns, or the portion of a turn, which it will make in a given time, will be proportional to the fraction

$$\frac{p\,m - \overline{r+f}\,n}{x\,m^2 + \overline{a+y}\,n^2}. \quad \text{(I.)}$$

—See ROTATION, n° 64, &c. *Encycl.*

Since the whole turns together, the velocities of the different points are as their distances from the axis, and may be expressed by multiplying the common angular velocity by these distances. Therefore the above formula, multiplied by m or n, will give the velocity of the impelled or of the working point. Therefore,

14 Velocity of the impelled point.

$$\text{Velocity of impelled point} = \frac{p\,m^2 - \overline{r+f}\,m\,n}{x\,m^2 + \overline{a+y}\,n^2} \quad \text{(II.)}$$

15 Velocity of the working point.

$$\text{Velocity of working point} = \frac{p\,m\,n - \overline{r+f}\,n^2}{x\,m^2 + \overline{a+y}\,n^2}. \quad \text{(III.)}$$

In order to obtain a clear conception of these velocities, we must compare them with motions with which we are well acquainted. The proposition being universally true, we may take a case where gravity is the sole power and resistance; where, for example, p and r are the weights of the water in the bucket of a wheel, and in the tub that is raised by it. In this case, $p=x$, and $r=y$. We may also, for greater simplicity, suppose the machine without inertia and friction. The velocity of p is now $\frac{p\,m^2 - r\,m\,n}{p\,m^2 + r\,n^2}$.

16 Absolute measure of them. Let g be the velocity which gravity generates in a second. Then it will generate the velocity $g\,\dot{t}$ in the moment $\dot{t}$. Let $\dot{v}$ be the velocity generated during this moment in p, connected as it is with the wheel and axle, and with r. This connection produces a change of condition $= g\,\dot{t} - \dot{v}$. For, had it fallen freely, it would have acquired the velocity $g\,\dot{t}$, whereas it only acquires the velocity $\dot{v}$. In like manner, had r fallen freely, it would have acquired the velocity $g\,\dot{t}$. But, instead of this, it is raised with the velocity $\frac{n}{m}\dot{v}$. The change on it is therefore $= g\,\dot{t} + \frac{n}{m}\dot{v}$. These changes of mechanical condition arise from their connection with the corporeal machine. Their pressures on it bring into action its connecting forces, and each of the two external forces is in immediate equilibrium with the force exerted by the other. The force excited at the impelled point, by r acting at the working point, may be called the momentum or energy of r. These energies are precisely competent to the production of the changes which they really produce, and must therefore be conceived as having the same proportions. They are therefore equal and opposite, by the general laws *observed* in all actions of tangible matter; that is, they are such as balance each other. Thus, and only thus, the remaining motions are what we observe them to be.

$$\text{That is, } p \times \overline{g\,\dot{t} - \dot{v}} \times m = r \times \overline{g\,\dot{t} + \frac{n}{m}\dot{v}} \times n$$

$$\text{Or } p\,m\,g\,\dot{t} - p\,m\,\dot{v} = r\,n\,g\,\dot{t} + r\frac{n^2}{m}\dot{v}$$

$$\text{Or } p\,m^2 g\,\dot{t} - p\,m^2\dot{v} = r\,m\,n\,g\,\dot{t} + r\,n^2\dot{v}$$

$$\text{Or } \overline{p\,m^2 - r\,m\,n} \times g\,\dot{t} = \overline{p\,m^2 + r\,n^2} \times \dot{v}$$

$$\text{That is, } p\,m^2 + r\,n^2 : p\,m^2 - r\,m\,n = g\,\dot{t} : \dot{v}$$

That is, *the denominator of the fraction, expressing the velocity of the impelled point, is to the numerator as the velocity which a heavy body would acquire in the moment* $\dot{t}$, *by falling freely, is to the velocity which the impelled point acquires in that moment.* The same thing is true of the velocity of the working point.

This reasoning suffers no change from the more complicated nature of the general proposition. Here the impelling power is still p, but the matter to be accelerated by it at the working point is $a+y$, while its reaction, diminishing the impelling power, is only r. We have only to consider, in this case, the velocity with which $a+y$ would fall freely when impelled, not by $a+y$, but only by r. The result would be the same;

$g\,t$ would still be to v as the denominator of the same fraction to its numerator.

Thus have we discovered the momentary acceleration of our machine. It is evident, that if the pressures p and r, and the friction and inertia of the machine, and the external matter, continue the same, the acceleration will continue the same; the motion of rotation will be uniformly accelerated, and $p\,m^2 + \overline{a+y}\,n^2$ will be to $p\,m^2 - \overline{r+f}\,m\,n$ as the space s, through which a heavy body would fall in any given time, t, is to the space through which the impelled point will really have moved in the same time. In like manner, the space through which the working point moves in the same time is $= \frac{p\,m\,n - \overline{r+f}\,n^2}{p\,m^2 + \overline{a+y}\,n^2}s$.

Thus are the motions of the working machine determined. We may illustrate it by a very simple example. Suppose a weight p of five pounds, descending from a pulley, and dragging up another weight r of three pounds on the other side. m and n are equal, and each may be called 1. The formula becomes $\frac{p-r}{p+r}s$, or $\frac{5-3}{5+3}s$, or $\frac{2}{8}$, $= \frac{1}{4}s$. Therefore, in a second, the weight p will descend $\frac{1}{4}$th of 16 feet, or 4 feet; and will acquire the velocity of 8 feet per second.

17 Performance of the machine.

Having obtained a knowledge of the velocity of every point of the machine, we can easily ascertain its performance. This depends on a combination of the quantity of resistance that is overcome at the working point, and the velocity with which it is overcome. Thus, in raising water, it depends on the quantity (proportional to the weight) of water in the bucket or pump, and the velocity with which it is lifted up. This will be had by multiplying the third formula by r, or by $r\,g\,t$, or by $r\,s$. Therefore we obtain this expression,

$$\text{Work done} = \frac{p\,m\,r\,n - \overline{r+f}\,r\,n^2}{p\,m^2 + \overline{a+y}\,n^2}\,g\,t. \quad \text{(IV.)}$$

Such is the general expression of the momentary performance of the machine, including every circumstance which can affect it. But a variation of those circumstances produces great changes in the results. These must be distinctly noticed.

Cor. 1. If $p\,m\,r\,n$ be equal to $\overline{r+f}\,r\,n^2$, there will be no work done, because the numerator of the fraction is annihilated. There is then no unbalanced force, and the natural power is only able to balance the pressure propagated from the working point to the impelled point.

2. In like manner, if $n = o$, no work is done altho' the machine turns round. The working point has no motion. For the same reason, if m be infinitely great, although there is a great prevalence of impelling momentum, there will not be any sensible performance during a finite time. For the velocity which p can impress is a finite quantity, and the impelled point cannot move faster than x would be moved by it if detached from the machine. Now when the infinitely remote impelled point is moved through any finite space, the motion of the working point must be infinitely less, or nothing, and no work will be done.

Remark. We see that there are two values of n, viz. v, and $m \times \frac{p}{r}$, which give no performance. But in all other proportions of m and n some work is done. Therefore, as we gradually vary the proportion of m to n, we obtain a series of values expressing the performance, which must gradually increase from nothing, and then decrease to nothing. There must therefore be some proportion of m to n, depending on the proportion of p to $\overline{r+f}$, and of x to $\overline{a+y}$, which will give the greatest possible value of the performance. And, on the other hand, if the proportion of m to n be already determined by the construction of the machine already erected, there must be some proportion of p to $\overline{r+f}$, and of x to $\overline{a+y}$, by which the greatest performance of a machine may be ensured. It is evident, that the determination of these two proportions is of the utmost importance to the improvement of machines. The well informed reader will pardon us for endeavouring to make this appear more forcibly to those who are less instructed, by means of some very simple examples of the first principle.

Suppose that we have a stream of water affording three tons per minute, and that we want to drain a pit which receives one ton per minute, and that this is to be done by a wheel and axle? We wish to know the best proportion of their diameters m and n. Le m be taken $= 6$; and suppose,

1. That $n = 5$.

Then $\frac{p\,m\,r\,n - r^2 n^2}{p\,m^2 + r\,n^2} = \frac{3.6.1.5 - 1.25}{3.36 + 1.36}, = \frac{65}{133}, = 0{,}4887$

2. Let n be $= 6$. The formula is $= 0{,}5$.

3. Let $n = 7$. The formula is $= 0{,}49045$. Hence we find, that the performance is greater when n is 6, than when it is either 5 or 7.

As an example of the second principle, suppose the machine a simple pulley, and let p be 10.

1. Let r be $= 3$. The formula is $\frac{10 \times 3 - 9}{10 + 3}, = \frac{21}{13}$, $= 1{,}6154$.

2. Let r be $= 4$. The formula is $= \frac{10 \times 4 - 16}{10 + 4}$, $= \frac{24}{14}, = 1{,}7143$.

3. Let r be $= 5$. The formula is $= \frac{10 \times 5 - 25}{10 + 5}$, $= \frac{25}{15}, = 1{,}6666$. Here it appears, that more work is done when r is 4 than when it is 5 or 3.

It must therefore be allowed to be one of the most important problems in practical mechanics to determine that construction by which a given power shall overcome a given resistance with the greatest advantage, and the proportion of work which should be given to a machine already constructed so as to gain a similar end.

I. The general determination of the first question has but little difficulty. We must consider n as the variable magnitude in the formula $\frac{p\,m\,r\,n - \overline{r+f}\,r\,n^2}{p\,m^2 + \overline{a+y}\,n^2}$, which expresses the work done; and find its value when the formula is a maximum. Taking this method, we shall find that the formula IV. is a maximum when n is 18 Proportion of the machine which gives the greatest work.

$$= m\,\frac{\sqrt{x^2\,(r+f)^2 + p^2\,x\,(a+y)} - x\,(r+f)}{p\,(a+y)}.$$

This

This expreſſion of the performance, in its beſt ſtate, appears pretty complex; but it becomes much more ſimple in all the particular applications of it, as the circumſtances of the caſe occur in practice.

We have obtained a value of n expreſſed in parts of m. If we ſubſtitute this for n in the third formula, we obtain the greateſt velocity with which the reſiſtance r, connected with the inertia y, can be overcome by the power p, connected with the inertia x, by the intervention of a machine, whoſe momentum of inertia and friction are $a\,n^2$ and $f\,n$. This is $= \frac{r+f}{2\,a+y} \times \left(\sqrt{\frac{p^2\,\overline{a+y}}{\overline{r+f}^2\,x}+1}-1\right) g\,t$. This expreſſes the velocity of the working point in feet per ſecond, and therefore the actual performance of the machine.

But the proper proportion of m to n, aſcertained by this proceſs, varies exceedingly, according to the nature both of the impelling power, and of the work to be performed by the machine.

1. It frequently happens that the work exerts no contrary ſtrain on the machine, and conſiſts merely in impelling a body which reſiſts only by its inertia. This is the caſe in urging round a millſtone or a heavy fly; in urging a body along a horizontal plane, &c. In this caſe r does not enter into the formula, which now becomes $m \times \frac{\sqrt{x^2 f^2 + p^2 x\,(a+y)} - x f}{p\,(a+y)}$. If the friction be inſignificant we may take $n = m\sqrt{\frac{p^2 x\,(a+y)}{p^2\,(a+y)^2}} = m\sqrt{\frac{x}{a+y}}$. The velocity of the working point is nearly $= \frac{p}{2\sqrt{x\,\overline{a+y}}}$. In this caſe, it will be found that the velocity acquired at the end of a given time will be nearly in the proportion of the power applied to the machine.

2. On the other hand, and more frequently, the inertia of the external matter which muſt be moved in performing the work need not be regarded. Thus, in the grinding of grain, ſawing of timber, boring of cylinders, &c. the quantity of motion communicated to the flour, to the ſaw duſt, &c. is too inſignificant to be taken into the account. In this caſe, y vaniſhes from the formula, which becomes extremely ſimple when the friction and inertia of the machine are inconſiderable. We ſhall not be far from the truth if we make m to n as $2\,r$ to p, or $n = m \times \frac{p}{2\,r+f}$. In this caſe, the velocity of the working point is $\frac{p^2}{4\,x\,(r+f) + \frac{a\,p^2}{4\,(r+f)}}$.

But it is rare that machines of this kind have a ſmall inertia. They are generally very ponderous and powerful; and the force which is neceſſary for generating even a very moderate motion in the unloaded machine (that is, unloaded with any work), bears a great proportion to the force neceſſary for overcoming the reſiſtance oppoſed by the work. The formula muſt therefore be uſed in all the terms, becauſe a is joined with y. It would have been ſimpler in this particular, had a been joined with x in the expreſſion of the angular velocity.

3. In ſome caſes we need not attend to the inertia of the power, as in the ſteam engine. In this caſe, if taken ſtrictly, n appears to have no value, becauſe x is a factor of every term of the numerator. But the formula gives this general indication, that the more inſignificant the inertia of the moving power is ſuppoſed, the larger ſhould m be in proportion to n; provided always, that the impelling power is not, by its nature, greatly diminiſhed, by giving ſo great a velocity to the impelled point. This circumſtance will be particularly conſidered afterwards.

4. If the inertia of the power and the reſiſtance be proportional to their preſſures, as when the impelling power is water lying in the buckets of an overſhot wheel, and the work is the raiſing of water, minerals, or other heavy body, acting *only* by its weight; then p and r may be ſubſtituted for x and y, and the formula expreſſing the value of n, when the performance is a maximum, becomes

$$n = m\,\frac{\sqrt{p^2 \times \overline{r+f}^2 + p^3 \times \overline{a+r}} - p \times \overline{r+f}}{p \times \overline{a+r}}.$$

If, in this caſe, the inertia and friction of the machine may be diſregarded, as may often be done in pulleys, we have

$$n = m\sqrt{\frac{p}{r}+1} - 1.$$

If we make m the unit of the radii, and r the unit of force, we have

$$n = \sqrt{p+1} - 1, \text{ in parts of } m = 1.$$

Or, making $p = 1$, we have $n = \sqrt{\frac{1}{r}+1} - 1$.

Theſe very ſimple expreſſions are of conſiderable uſe, even in caſes where the inertia of the machine is very conſiderable, provided that it have no reciprocating motions. A ſimple wheel and axle, or a train of good wheelwork, have very moderate friction. The general reſults, therefore, which even very unlettered readers can deduce from theſe ſimple formulæ, will give notions that are uſeful in the caſes which they cannot ſo thoroughly comprehend. Some ſervice of this kind may be derived from the following little table of the beſt proportions of m to n, correſponding to the proportions of the power furniſhed to the engineer, and the reſiſtance which muſt be overcome by it. The quantity r is always $= 10$, and $m = 1$.

p	n	p	n
1	0,0488	10	0,4142
2	0,0954	20	0,7321
3	0,1402	30	1,
4	0,1832	40	1,2362
5	0,2246	50	1,4495
6	0,2649	60	1,6457
7	0,3038	70	1,8284
8	0,3416	80	2,
9	0,3784	90	2,1623
10	0,4142	100	2,3166

This muſt ſuffice for a very general view of the firſt problem.

II. The next queſtion is not leſs momentous, namely, to

19 Best proportion of the power and work.

to determine for a machine of a given construction that proportion of the resistance at the working point to the impelling power which will ensure the greatest performance of the machine; that is, the proportion of m to n being given, to find the best proportion of p to r.

This is a much more complicated problem than the other; for here we have to attend to the variations both of the pressures p and r, and also of the external matters x and y, which are generally connected with them. It will not be sufficient therefore to treat the question by the usual fluxionary process for determining the maximum, in which r is considered as the only varying quantity. We must, in this cursory discussion, rest satisfied with a comprehension of the circumstances which most generally prevail in practice.

It must either happen, that when r changes, there is no change (that is, of moment) in the mass of external matter which must be moved in performing the work, or that there is also a change in this circumstance. If no change happens, the denominator of the fourth formula, expressing the performance, remains the same; and then the formula attains a maximum when the numerator $p\,r\,m\,n - \overline{r+f}\,r\,n^2$ is a maximum. Also, we may include f without complicating the process, by the consideration, that f is always in nearly the same ratio to r; and therefore $r+f$ may be considered as a certain multiple of r, such as $b\,r$. We may therefore omit f in the fluxionary equations for obtaining the maximum, and then, in computing the performance, divide the whole by b. Thus if the whole friction be $\frac{1}{20}$th of the resisting pressure r, we have $r+f = \frac{21}{20}$ of r, and $b = \frac{21}{20}$. Having ascertained the best value for r, we put this in its place in the fourth formula, and take $\frac{20}{21}$ of this for the performance. This will never differ much from the truth.

This process gives us $p\,m\,n = 2\,n^2\,r$, and $r = \frac{p\,m\,n}{2\,n^2}$, $= \frac{p\,m}{2\,n}$; and if we farther simplify the process, by making $p = 1$, and $m = 1$, we have $r = \frac{1}{2\,n}$; a most simple expression, directing us to make the resistance one half of what would balance the impelling power by the intervention of the machine.

This will evidently apply to many very important cases, namely, to all those in which the matter put in motion by the working point is but trifling.

But it also happens in many important cases, that the change is at least equally considerable in the inertia of the work. In this case it is very difficult to obtain a general solution. But we can hardly imagine such a change, without supposing that the inertia of the work varies in the same proportion as the pressure excited by it at the working point of the machine; for since r continues the same in kind, it can rarely change but by a proportional change of the matter with which it is connected. Yet some very important cases occur where this does not happen. Such is a machine which forces water along a long main pipe. The resistance to motion and the quantity of water do not follow nearly the same ratio. But in the cases in which this ratio is observed, we may represent y by any multiple $b\,r$ of r, which the case in hand gives us; b being a number, integer, or fractional. In the farther treatment of this case, we think it more convenient to free r from all other combinations; and instead of supposing the force f (which we made equivalent with the friction of the machine) to be applied at the working point, we may apply it at the impelled point, making the effective power $q = p - f$. For the same reasons, instead of making the momentum of the machine's inertia $= a\,n^2$, we may make it $a\,m^2$, and make $a + x = z$. Now, supposing q, or $p - f$, $= 1$, and also $m = 1$, our formula expressing the performance becomes $\frac{r\,n - r^2\,n^2}{z + b\,r\,n^2}$. This is a maximum when

$$r = \frac{\sqrt{z^2 + z\,b\,n} - z}{b\,n^2}.$$

Cor. 1. If the inertia of the work is always equal to its pressure, as when the work consists wholly in raising a weight, such as drawing water, &c. then $b = 1$, and the formula for the maximum performance becomes

$$r = \frac{\sqrt{z\,n + z^2} - z}{n^2}.$$

2. If the inertia of the impelling power is also the same with its pressure, and if we may neglect the inertia and friction of the machine, the formula becomes

$$r = \frac{\sqrt{n+1} - 1}{n^2}.$$

Example. Let the machine be a common pulley, so that the radii m and n are equal, and therefore $n = 1$. Then, $r = \frac{\sqrt{1+1} - 1}{1}$, $= \sqrt{2} - 1$, $= 0{,}4142$, &c. more than $\frac{2}{5}$ths of what would balance it.

Here follows a series of the best values of r, corresponding to different values of n. m and p are each $= 1$. The numbers in the last column have the same proportion to 1 which r has to the resistance which will balance p.

$n = \frac{1}{4}$	$r = 1{,}8885$	0,4724 to 1
$\frac{1}{3}$	1,3928	0,4639
$\frac{1}{2}$	0,8986	0,4493
1	0,4142	0.4142
2	0,1830	0,3660
3	0,1111	0,3333
4	0,0772	0,3088

From what has now been established, we see with sufficient evidence the importance of the higher mathematics to the science of mechanics. If the velocities of the impelled and working points of an engine are not properly adjusted to the pressures, the inertia, and the friction of the machine, we do not derive all the advantages which we might from our situation. Hence also we learn the falsity of the maxim which has been received as well founded, that the augmentation of intensity of any force, by applying it to the long arm of a lever, is always fully compensated by a loss of time; or, as it is usually expressed, "what we gain by a machine in force we lose in time." If the proportion of m to n is well chosen, we shall find that the work done, when it resists by its inertia only, increases nearly in the proportion of the power employed; whereas when the inertia of the work is but a small part of the resistance, it increases nearly in the duplicate ratio of the power employed. General but erroneous maxim.

It was remarked, in the ſetting out in the preſent problem, that the formulæ do not immediately expreſs the velocity of any point of the machine, but its momentary acceleration. But this is enough for our purpoſe; becauſe, when the momentary acceleration is a maximum, the velocity acquired, and the ſpace deſcribed, in any given time, is alſo a maximum. We alſo ſhewed how the real velocities, and the ſpaces deſcribed, may be aſcertained in known meaſures. We may ſay in general, that if g repreſent the preſſure of gravity on any maſs of matter w, then $\frac{g}{w}$ is to $\frac{pmn - \overline{r+fn}}{am^2 + a + yn^2}$ as 16 feet to the ſpace deſcribed in a ſecond by the working point in a ſecond, or as 32 feet per ſecond is to the velocity acquired in that time.

20 Cauſes why machines do not continually accelerate.

A remark now remains to be made, which is of the greateſt conſequence, and gives an unexpected turn to the whole of the preceding doctrines. It appears, from all that has been ſaid, that the motion of a machine muſt be uniformly accelerated, and that any point will deſcribe ſpaces proportional to the ſquares of the times; for while the preſſures, friction, and momentum of inertia remain the ſame, the momentary acceleration muſt alſo be invariable. But this ſeems contrary to all experience. Such machines as are properly conſtructed, and work without jolts, are obſerved to quicken their pace for a few ſeconds after ſtarting; but all of them, in a very moderate time, acquire a motion that is ſenſibly uniform. Is our theory erroneous, or what are the circumſtances which remain to be conſidered, in order to make it agree with obſervation? The ſcience of machines is imperfect, till we have explained the cauſes of this deviation from the theory of uniform acceleration.

Theſe cauſes are various.

1. Increaſe of friction.

1. In ſome caſes, every increaſe of velocity of the machine produces an increaſe of friction in all its communicating parts. By theſe means, the accelerating force, which is $pm - \overline{r+fn}$, or $\overline{p-fm} - rn$, is diminiſhed, and conſequently the acceleration is diminiſhed. But it ſeldom happens that friction takes away or employs the whole accelerating force. We are not yet well inſtructed in the nature of friction. Moſt of the kinds of friction which obtain in the communicating parts of machines, are ſuch as do not ſenſibly increaſe by an increaſe of velocity; ſome of them really diminiſh. Yet even the moſt accurately conſtructed machines, unloaded with work, attain a motion that is ſenſibly uniform. If we take off the pallets from a pendulum clock, and allow it to run down amain, it accelerates for a while, but in a very moderate time it acquires an uniform motion. So does a common kitchen jack. Theſe two machines ſeem to bid the faireſt of any for an uniformly accelerated motion; for their impelling power acts with the utmoſt uniformity. There is ſomething yet unexplained in the nature of friction, which takes away ſome of this acceleration.

2. Reſiſtance of air.

But the chief cauſe of its ceſſation in theſe two inſtances, and others *of very rapid motion*, is the reſiſtance of the air. This ariſes from the motion which is communicated to the air diſplaced by the ſwift moving parts of the machine. At firſt it is very ſmall; but it increaſes nearly in the duplicate ratio of the velocity (ſee *Resistance of Fluids*, Encycl.). Thus r increaſes continually; and, in a certain ſtate of motion, $\overline{r+fn}$ becomes equal to pm. Whenever this happens, the accelerating power is at an end. The acceleration alſo ceaſes; and the machine is in a ſtate of dynamical equilibrium; not at reſt, but moving uniformly, and performing work.

3. Increaſe of reſiſtance very imperfectly known.

Still, however, this is not one of the general cauſes of the uniform motion attained by working engines. Rarely is the motion of their parts ſo rapid, as to occaſion any great reſiſtance from the air. But in the moſt frequent employments of machines, every increaſe of velocity is accompanied by an increaſe of reſiſtance from the work performed. This occurs at once to the imagination; and few perſons think of inquiring farther for a reaſon. But there is perhaps no part of mechanics that is more imperfectly underſtood, even in our preſent improved ſtate of mechanical ſcience. In many kinds of work, it is very difficult to ſtate what increaſe of labour is required in order to perform the work with twice or thrice the ſpeed. In grinding corn, for inſtance, we are almoſt entirely ignorant of this matter. It is very certain, that twice the force is not neceſſary for making the mill grind twice as faſt, nor even for making it grind twice as much grain equally well. It is not eaſy to bring this operation under mathematical treatment; but we have conſidered it with ſome attention, and we imagine that a very great improvement may ſtill be made in the conſtruction of griſt mills, founded on the law of variation of the reſiſtance to the operation of grinding, and a ſcientific adjuſtment of m to n, in conſequence of our knowledge of this law. We may make a ſimilar obſervation on many other kinds of work performed by machines. In none of theſe works where the inertia of the work is inconſiderable, are we well acquainted with the real mechanical proceſs in performing it. This is the caſe in ſawing mills, boring mills, rolling mills, ſlitting mills, and many others, where the work conſiſts in overcoming the ſtrong coheſion of a ſmall quantity of matter. In ſawing timber (which is the moſt eaſily underſtood of all theſe operations), if the ſaw move with a double velocity, it is very difficult to ſay how much the actual reſiſting preſſure on the teeth of the ſaw is increaſed. Twice the number of fibres are neceſſarily torn aſunder during the ſame time, becauſe the ſame number are torn by one deſcent of the ſaw, and it makes that ſtroke in half the time. But it is very uncertain whether the reſiſtance is double on this account; becauſe if each fibre be ſuppoſed to have the ſame tenacity in both caſes, it reſiſts with this tenacity only for half the time. The parts of bodies reſiſt a ſimilar change of condition in different manners; and there is another difference in their reſiſtance of different changes—the reſiſtance of red hot iron under the roller may vary at a very different rate from that of its reſiſtance to the cutting tool. The reſiſtance of the ſpindles of a cotton mill, ariſing partly from friction, partly from the inertia of the heaped bobbins, and partly from the reſiſtance of the air, is ſtill more complicated, and it may be difficult to learn its law. The only caſe in which we can judge with ſome preciſion is, when the inertia of matter, or a conſtant preſſure like that of gravity, conſtitutes the chief reſiſtance. Thus in a mill employed to raiſe water by a chain of buckets, the reſiſtance proceeds from the inertia only of the water. The buckets are moving with a certain velocity, and the

the lowest of them takes hold of a quantity of water lying at rest in the pit, and drags it into motion with its acquired velocity. The force required for generating this motion on the quiescent water must be double or triple, when the velocity that must be given to it is so. This absorbs the overplus of the impelling power, by which that power exceeds what is necessary for balancing the weight of the water contained in all the ascending buckets. This is a certain determinate quantity which does not change; for in the same instant that a new bucket of water is forced into motion below, and its weight added to that of the ascending buckets, an equal bucket is emptied of its water at top. The ascending buckets require only to be balanced, and they then *continue* to ascend, with any velocity already acquired. While the machine moves slow, the motion impressed on the new bucket of water is not sufficient to absorb all the overplus of impelling power. The quantity not absorbed accelerates the machine, and the next bucket must produce more motion in the water which it takes up. This consumes more of the overplus. This goes on till no overplus of power is left, and the machine accelerates no more. The complete performance of the machine now is, that "a certain quantity of water, formerly at rest, is now moving with a certain velocity." Our engineers consider it differently; "as a certain *weight* of water lifted up." But while the machine is thus moving uniformly, it is really not doing so much as before; that is, it is not exerting such great pressures as before the motion was rendered uniform: for at that time there was a pressure at the working point equal to the weight of all the water in the ascending buckets; and also an overplus of pressure, by which the whole was accelerated. In the state of uniform motion, the pressure is no more than just balances the weight of the ascending chain. We shall learn by and bye how the pressures have been diminishing, although the mill has been accelerating; a thing that seems a paradox.

In this instance, then, we see clearly, why a machine must attain a uniform motion. A pumping machine gives us the same opportunity, but in a manner so different as to require explanation. The piston may be supposed at the very surface of the pit water, and the impelling power may be less than will support a column in the pipe as high as can be raised by the pressure of the atmosphere. Suppose the impelling power to be the water lying in the buckets of an overshot wheel. Let this water be laid into the buckets by a very small stream. It will fill the buckets very slowly; and as this gives them a preponderance, the mill loses its balance, the wheel begins to move, and the piston to rise, and the water to follow it. The water may be delivered on the wheel drop by drop; the piston will rise by insensible degrees, always standing still again as soon as the atmospheric pressure on it just balances the water on the wheel. The water in the rising pipe is always a balance to the pressure of the atmosphere on the cistern; therefore the pressure of the atmosphere on the piston (which is the r in our formula) is equal to the weight of this water. Our pump-makers therefore (calling themselves engineers) say, that the weight of water in the pipe balances the water on the wheel. It does not balance it, nor is it raised by the wheel, but by the atmosphere; but it serves us at present for a measure of the power of the wheel. At last, all the buckets of the wheel are full, and the water is (for example) 25 feet high in the pipe. Now let the stream of water run its full quantity. It will only run over from bucket to bucket, and run off at the bottom of the wheel; but the mill will not move, and no work will be performed. (N. B. We are here excluding all impulse or stroke on the buckets, and supposing the water to act only by its weight.) But now let all be emptied again, and let the water be delivered on the wheel in its full quantity at the first. The wheel will immediately acquire a preponderancy, which will *greatly* exceed the first small pressure of the atmosphere on the piston. It will therefore accelerate the piston, overcoming the pressure of the air with great velocity. The piston rises fast; the water follows it, by the pressure of the atmosphere; and when it attains the former utmost height, it attains it with a considerable velocity. If allowed to run off there, it will *continue* to run off with that velocity; because there is the same quantity of water pressing round the wheel as before, and therefore enough to balance the pressure of the atmosphere on the piston. The pressure of the same atmosphere on the water in the cistern, raised the water in the pipe with this velocity; therefore it will continue to do so, and the mill will deliver water by the pump with this velocity, although there is no more pressure acting on it than before, when the water ran to waste, doing no work whatever.

This mode of action is extremely different from the former example. The mill is not acting against the inertia y of the water to be moved, but against the pressure r of the atmosphere on the piston. The pressure of the same atmosphere on the cistern is employed against the inertia of the water in the pipe; and the use of the mill is to *give occasion*, by raising the piston, to the exertion of this atmospherical pressure, which is the real raiser of the water. The maxim of construction, and the proper adjustment of m to n in this case, are different from the former; and we should run the risk of making an imperfect engine were we to confound them.

We must mention another case of a pumping mill, seemingly the same with this, but essentially different. Suppose the pipe of this pump to reach 30 feet below the surface of the pit water, and that the piston is at the very bottom of it. Suppose also, that the wheel buckets, when filled with water, only enable it to *support* 25 feet of water in the rising pipe. Let the water be delivered into the wheel drop by drop. The wheel will gradually preponderate; the piston will gradually rise, lifting the water above it, sustaining a pressure of water which gradually increases. At last, the water in the pump is 25 feet higher than that in the cistern; the wheel is full and running to waste; but no work is performed. Let all be emptied, and now let the water come to the wheel in its full stream, but without impulse. The piston will lift the water briskly, bring it to 25 feet high with a considerable velocity, and the mill will now raise it with this velocity. In this example, the mill is the immediate agent in raising the water; but, in this case also, its ultimate office is not overcoming inertia, but overcoming pressure. It was the overplus of power only that was employed in overcoming

overcoming inertia, while accelerating the water in the rising pipe, in order to give it the neceffary velocity for a continued difcharge.

21. These and fimilar examples fhew the great difference between the ftatical and dynamical equilibrium of machines, and the neceffity of a fcientific attention by all who wifh to improve practical mechanics. Without this, and even a pretty refined attention, we cannot fee the connection between a copious fupply of water to the bucket wheel and a plentiful difcharge by the pump. We believe, that the greateft part of thofe employed in erecting machines conceive it as owing to the greater weight of water impelling the wheel with greater force; but we fee that there is no difference in the preffures on the mill at reft, and the mill doing its work fteadily and uniformly, with any velocity, however great. Without keeping the notions of that part of the impelling power which fupports diftinct from that of the part which accelerates, we fhall never have a clear conception of the operation of machines, or of mechanical power in general. We cannot derive all the advantages of our natural powers, without knowing how our machine employs the preffure excited by it at the working point; that is, without perceiving in what cafes it is oppofed to inertia, and in what to the mechanical properties of tangible matter. This only can inform us at what rate the refiftance varies by a change of velocity; and when it happens that this augmentation, neceffarily accompanied by an augmentation of all the frictions, and the refiftance of the air, is in equilibrio with the whole of the impelling power, and all acceleration is at an end.

22. *The chief caufe is a real diminution of power.*

Laftly, another chief caufe of the finally uniform motion of machines is, that, in moft cafes, an increafe of velocity produces a real diminution of impelling power. We hardly know any exception to this befides the employment of *one* defcending weight as a power or firft mover. Moft of the powers which we employ refide in bodies external to the machine; and thefe bodies muft be put in motion, and continued in that motion, in order to continue their preffure on the impelled point. Frequently a great part of the power is employed in giving this neceffary motion to the external matter, and the remainder only is employed in preffing forward the machine. We mentioned a remarkable inftance of this in the operation of thrafhing. Now, the power thus employed muft increafe in proportion to the motion required; that is, in proportion to the velocity of the impelled point; what remains, urging forward the machine, is therefore diminifhed. The acceleration is therefore diminifhed, and may ceafe. At *laft* the actual preffure is fo much diminifhed, that it is no more than what is neceffary for overcoming the increafed refiftance of the work, the increafed friction. The machine therefore accelerates no more, but moves uniformly.

This caufe very general.

This caufe of the diminution of power by an increafe of velocity, obtains in all cafes where the ftrength of animals, of fprings, the force of fired gunpowder, &c. is exerted. In fome cafes, the vifible effect is not very confiderable; as in the employment of a ftrong fpring, the force of gunpowder, and a few others. In the action of animals, this defalcation of power is very great when the velocity is confiderable. Nay, even in the action of gravity, although it acts as ftrongly on a body in rapid motion as on one at reft, yet when gravity is not the immediate agent, but acts by the intervention of a body in which it refides, the neceffity of previoufly moving this body frequently diminifhes the acceleration which it would otherwife produce. Thus, in an overfhot wheel, if the water be delivered into the bucket with a velocity (eftimated in the direction of the part of the wheel into which it is delivered) lefs than that of the rim of the wheel, it muft retard the motion; for it muft be immediately dragged into that motion; that is, part of the accelerating overplus, already acting on the wheel, muft be employed in accelerating this new bucket of water, and this muft leffen the general acceleration of the machine. Hence we learn, that the water muft be delivered on the wheel with a velocity that is at leaft not lefs than that of the wheel's motion.

It obtains in all machines actuated by impulfes,

The cafe in which we fee this diminution of power on machines moft diftinctly is, when water or wind, acting by impulfe alone, is our moving power. Since the mutual impulfes of bodies depend entirely on their relative motions (fee Impulsion, *Suppl.*), it follows, that when the velocity of the impelled point is augmented, the impulfion, or effective preffure, muft be diminifhed. Nay, this velocity may be fo increafed, that there fhall be no relative motion, and therefore no impulfion. If the floats of an underfhot wheel be moving with the velocity of the ftream, they remain conjoined in their progrefs, but without any mutual action. Therefore, when an underfhot wheel is fet into a running water, the firft impulfions are ftrong, and accelerate the wheel. This diminifhes the next impulfion and acceleration: but the wheel is ftill impelled and accelerated; lefs and lefs in every fucceeding moment, as it moves fafter; by and bye, the acceleration becomes infenfible, and the wheel appears to attain a motion which is perfectly uniform. This requires a very long time, or rather it is never attained, and we only cannot difcern the very fmall additions which are ftill made to the velocity. All this happens generally after a very moderate time, by reafon of various other obftructions.

Or by the [illegible] animals.

Animal action is fubject to the fame variation. We know, that there is a certain rate at which a horfe can run, exhaufting or employing his whole ftrength. If he be made to drag any the fmalleft load after him, he muft employ part of his force on it, and his fpeed will be checked. The more he is loaded with a draught, the flower he will run, ftill employing all his ftrength. The draught may be increafed till he is reduced to a trot, to a walk, nay, till he is unable to draw it. Now, juft inverting this procefs, we fee, that there is a certain ftrain which will fufficiently tire the horfe without ftirring from the fpot, but which he could continue to exert for hours. This is greater than the load that he can juft crawl along with, employing his ftrength as much as would be prudent to continue from day to day. And, in like manner, every lefs draught has a correfponding rate, at which the horfe, employing his whole working ftrength, can continue to draw it during the working hours of a day. At fetting out, he pulls harder, and accelerates it. Following his pull, he walks fafter, and therefore pulls lefs (becaufe we are ftill fuppofing him to employ his whole working ftrength). At laft he attains that fpeed which occupies his whole ftrength in merely continuing the pull.

Other animals act in a similar manner; and it becomes a general rule, that the pressure actually exerted on the impelled point of a machine diminishes as its velocity increases.

23 We must distinguish between the power expended and the power employed.

From the concurrence of so many facts, we perceive that we must be careful to distinguish between the quantity of power expended, and the quantity that is usefully employed, which must be measured solely by the pressure exerted on the machine. When a weight of five pounds is employed to drag up a weight of three pounds by means of a thread over a pulley, it descends, with a motion uniformly accelerated, four feet in the first second. Mr Smeaton would call this an expenditure of a mechanical power 20. The weight three pounds is raised four feet. Mr Smeaton would call this a mechanical effect 12. Therefore the effect produced is not adequate to the power expended. But the fact is, that the pressure, strain, or mechanical power really exerted in this experiment, is neither five nor three pounds; the five pound weight would have fallen 16 feet, but it falls only 4. A force has therefore acted on it sufficient to make it describe 12 feet in a second, with a uniformly accelerated motion; for it has counteracted so much of its weight. The thread was strained with a force equal to $3\frac{3}{4}$ pounds, or $\frac{3}{4}$ths of 5 pounds. In like manner, the three pound weight would have fallen 16 feet; but it was raised 4 feet. Here was a change precisely equal to the other. A force of $3\frac{3}{4}$ pounds, acting on a mass whose matter is only 3, will, in a second, cause it to describe 20 feet with a uniformly accelerated motion. Now, 5×12, and 3×20, give the same product 60. And thus we see, that the quantity of motion extinguished or produced, and not the product of the weight and height, is the true unequivocal measure of mechanical power really expended, or the mechanical effect really produced; and that these two are always equal and opposite. At the same time, Mr Smeaton's theorem merits the attention of engineers; because it generally measures the opportunities that we have for procuring the exertion of power. In some sense Mr Smeaton may say, that the quantity of water multiplied by the height from which it descends in working our machines, is the measure of the power expended; because we must raise this quantity to the dam again, in order to have the same use of it. It is expended, but not employed; for the water, at leaving the wheel, is still able to do something.

24. It requires but little consideration to be sensible, that the preceding account of the cessation of accelerated motion in our principal machines, must introduce different maxims of construction from those which were expressly adapted to this acceleration; or rather, which proceeded on the erroneous supposition of the constancy of the impelling power and the resistance. The examination of this point has brought into view the fundamental principle of working machines, namely, the perfect equilibrium which takes place between the impelling power and the simultaneous resistance. It may be expressed thus:

First principle of working machines.

The force required for preserving a machine in uniform motion, with any velocity whatever, is that which is necessary for balancing the resistance then actually exerted on the working point of the machine. We saw this distinctly in the instance of the two weights acting against each other by the intervention of a thread over a fixed pulley. It is equally true of every case of acting machinery: for if the force at the impelled point be greater than what balances the resistance acting at the same point, it must accelerate that point, and therefore accelerate the whole machine; and if the impelling force be less than this, the machine must immediately retard in its motion. When the machine has once acquired this degree of motion, every part of it will continue in its present state of motion, if only the two external forces are in equilibrio, but not otherwise. But when the pressure of the external power on the impelled point balances the resistance opposed by that point, it is, in fact, maintaining the equilibrium with the external power acting at the working point; for this is the only way that external forces can be set in opposition to each other by the intervention of a body. The external forces are not in immediate equilibrio with each other, but each is in equilibrio with the force exerted by the point on which it acts. This force exerted by the point is a modification of the connecting forces of the body, all of which are brought into action by means of the actions of the external forces, and each is accompanied by a force precisely equal and opposite to it. Now, the principles of statics teach us the proportions of the external pressures which are thus set in equilibrium by the intervention of a body; and therefore teach us what proportion of power and resistance will keep a machine of a given construction in a state of uniform motion.

This proposition appears paradoxical, and contrary to common observation; for we find, that, in order to make a mill go faster, we must either diminish the resistance, or we must employ more men, or more water, or water moving with greater velocity, &c. But this arises from some of the causes already mentioned. Either the resistance of the work is greater when the machine is made to move faster, or the impulsion of the power is diminished, or both these changes obtain. Friction and resistance of air also come in for their share, &c. The actual pressure of a given quantity of the external power is diminished, and therefore more of it must be employed. When a weight is *uniformly* raised by a machine, the pressure exerted on it by the working point is precisely equal to its weight, whatever be the velocity with which it rises. But, even in this simplest case more natural power must be expended in order to raise it faster; because either more natural power must be employed to accelerate the external matter which is to press forward the impelled point, or the relative motion of the pressing matter will be diminished.

It is well known, that, in the employment of the mechanic powers, whether in their state of greatest simplicity, or any how combined in a complicated machine, if the machine be put in motion, the velocities of the extreme points (which we have called the *impelled* and *working* points) are inversely proportional to the forces which are in equilibrio when applied to these points in the direction of their motion. This is an inductive proposition, and has been used as the foundation of systems of mechanics. It is unnecessary to take up time in proving what is so familiarly known; consequently, the products of the pressures at those points by the velocities of the motions are equal; that is, the product of the pressure actually exerted at the impelled point of a machine a machine working uniformly, multiplied by the velocity of that point, is equal to the product of the resistance actually exerted at the working point, multiplied by the velocity of that point, that is, by the velocity with which the resistance is overcome,

$$p\,m = r\,n.$$

Now, the product of the resistance, by the velocity with which it is overcome, is evidently the measure of the performance of the machine, or the work done. The product of the actual pressure on the impelled point, by the velocity of that point, may be called the MOMENTUM OF IMPULSE.

Hence we deduce this proposition. :

25 Second principle. Momentum of impulse and the performance of the machine are equal.

In all working machines which have acquired a uniform motion, the performance of the machine is equal to the momentum of impulse (A).

This is a proposition of the utmost importance in the science of machines, and leads to the fundamental maxim of their construction. Since the performance of a machine is equal to the momentum of impulse, it increases and diminishes along with it, and is a maximum when the momentum of impulse is a maximum; therefore, the fundamental maxim in the construction of a machine is to fashion it in such a manner, that the momentum of impulse shall be a maximum, or that the product of the pressure actually exerted on the impelled point of the machine by the velocity with which it moves may be as great as possible. Then are we certain that the product of the resistance, by the velocity of the working point, is as great as possible, provided that we take care that none of the impulse be needlessly wasted by the way by injudicious communications of motion, by friction, by unbalanced loads, and by reciprocal motions, which irrecoverably waste the impelling power. This maxim holds good, whether the resistance remains constantly the same, or varies by any law whatever.

26 Important desiderata for practice.

But much remains to be done for the improvement of mechanical science before we can avail ourselves of this maxim, and apply it with success. The chief thing, and to this we should give the most unremitting attention, is, to learn the changes which obtain in the actual pressure exerted by those natural powers which we can command; the changes of actual pressure produced by a change of the velocity of the impelled point of the machine. These depend on the specific natures of those powers, and are different in almost every different case. Nothing will more contribute to the improvement of practical mechanics than a series of experiments, well contrived, and accurately made, for discovering those laws of variation, in the cases of these powers which are most frequently employed. Such experiments, however, would be costly, beyond the abilities of an individual; therefore, it were greatly to be wished that public aid were given to some persons of skill in the science to institute a regular train of experiments of this kind. An experimental machine might be constructed, to be wrought either by men or by cattle. This should be loaded with some kind of work which can be very accurately measured, and the load varied at pleasure. When loaded to a certain degree, the men or cattle should be made to work at the rate which they can continue from day to day. The number of turns made in an hour, multiplied by the load, will give the performance corresponding to the velocities; and thus will be discovered the most advantageous rate of motion. The same machine should also be fitted for grinding, for sawing, boring, &c. and similar experiments will discover the relation between the velocities with which these operations are performed, and the resistances which they exert. The laws of friction may be investigated by the same machine. It should also be fitted with a walking wheel, and the trial should be made of the shape and the velocity of walking which gives the greatest momentum of impulse. It is not unreasonable to expect great advantages from such a train of experiments.

Till this be done, we must content ourselves with establishing the above, in the most general terms, applicable to any case in which the law of the variation of force may hereafter be discovered. 27 A substitute for them.

There is a certain velocity of the impelled point of a machine which puts an end to the action of the moving power. Thus, if the floats of an undershot wheel be moving with the velocity of the stream, no impulse is made on them. If the arm of a gin or capstan be moving with that velocity with which a horse or a man can just move, so as to continue at that speed from day to day, employing all his working strength, but not fatiguing himself; in this state of motion, the animal can exert no pressure on the machine. This may be called the EXTINGUISHING VELOCITY, and we may express it by the symbol e. Let f be that degree of force or pressure which the animal can exert at a dead pull or thrust, as it is called. We do not mean the utmost strain of which the animal is capable, but that which it can continue unremittingly during the working hours of a day, fully employing, but not fatiguing itself. And let p be the pressure which it actually exerts on the impelled point of a machine, moving with the velocity m.

(A) The truth of this proposition has been long perceived in every particular instance that happened to engage the attention; but we do not recollect any mechanician before Mr Euler considering it as a general truth, expressing in a few words a mechanical law. This celebrated mathematician undertook, about the year 1735 or 173[illegible], a general and systematic view of machines, in order to found a complete theory immediately conducive to the improvement of practical mechanics. In 1743 he published the first propositions of this useful theory in the 1[illegible]th volume of the *Comment. Petropolitani*, containing the excellent dynamical theorems of which we have given the substance. In the 3d volume of the *Comment. Novi Petropol.* he prosecuted the subject a little farther; and in the 8th volume, he entered on what we are now engaged in, and formally announces this fundamental proposition, calling these two products the *momentum of impulse*, and the *momentum of effect*. It is much to be regretted, that this consummate mathematician did not continue these useful labours; his ardent mind being carried away by more abstruse speculations in all the most refined departments of mathematics and philosophy. No man in Europe could have prosecuted the subject with more judgment and success.—See also *Mem. Acad. Berlin*, 17[illegible] and 1752.

Let $e - m$ be called the RELATIVE VELOCITY, and let it be expreffed by v. And let it be fuppofed, that it has been difcovered, by any means whatever, that the actual preffure varies in the proportion of v^q, or $\overline{e-m}^q$. This fuppofition gives us $e^q : v^q = f : p$, and $p = f \times \frac{v^q}{e^q}$. For the machine muft be at reft, in order that the agent may be able to exert the force f on its impelled point. But when the machine is at reft, what we have named the relative velocity is e, the whole of the extinguifhing velocity.

The momentum of impulfe is $p\,m$, that is $\frac{v^q}{e^q} f m$, or $f \times \frac{v^q}{e^q} \times \overline{e-v}$ (becaufe $m = e - v$). Therefore $f \times \frac{v^q}{e^q} \times \overline{e-v}$ muft be made a maximum. But f and e^q are two quantities which fuffer no change. Therefore the momentum of impulfe will be a maximum when $v^q \times \overline{e-v}$ is a maximum. Now $v^q \times \overline{e-v} = v^q\, e - v^q\, v, = v^q\, e - v^{q+1}$. The fluxion of this is $q\, e\, v^{q-1} \dot{v} - \overline{q+1}\, v^q\, \dot{v}$. This being fuppofed $= 0$, we have the equatation

$$q\, e\, v^{q-1} = \overline{q+1}\, v^q$$

$$\text{And } q\, e = \overline{q+1}\, v$$

$$\text{Therefore } v = \frac{q\, e}{q+1}$$

And m, which is $= e - v$, becomes $\frac{e}{q+1}$. Therefore we muft order matters fo, that the velocity of the impelled point of the machine may be $= \frac{e}{q+1}$. Now p is $= f \frac{v^q}{e^q}$, and therefore $= f \times \frac{q^q}{\overline{q+1}^q}$. And $p\,m$, $= f \frac{q^q}{\overline{q+1}^q} m, = f \frac{q^q}{\overline{q+1}^q} \times \frac{e}{q+1}, = f \times \frac{q^q\, e}{\overline{q+1}^{q+1}}, =$ the momentum of impulfe, and therefore = the momentum of effect, or the performance of the machine, when in its beft ftate.

28 Example in underfhot mills by Mr Parent.

Thus may the maxim of conftruction be faid to be brought to a ftate of great fimplicity, and of moft eafy recollection. A particular cafe of this maxim has been long known, having been pointed out by Mr Parent. Since the action of bodies depends on their relative velocity, the impulfe of fluids muft be as the fquare of the relative velocity. From which Mr Parent deduced, that the moft advantageous velocity of the floats of an underfhot wheel is one third of that of the ftream. This maxim is evidently included in our general propofition; for in this cafe, the index q of that function of the relative velocity v, which is proportional to the impulfe, is $= 2$. Therefore we have the maximum when $v = \frac{2\,e}{2+1}, = \frac{2}{3} e$, and $m = \frac{1}{3} e$. e, the extinguifhing velocity, is evidently the velocity of the ftream. Our propofition alfo gives us the precife value of the performance. The impulfe of the ftream on the float at reft being fuppofed $= f$, its impulfe on the float moving with the velocity $\frac{2}{3} e$ muft be $= \frac{4}{9} f$. This is the meafure of the actual preffure p. This being multiplied by m, or by $\frac{1}{3} e$, gives $\frac{4}{27} f$. Now f is confidered as equal to the weight of a column of water, having the furface of the floatboard for its bafe, and the depth of the fluice under the furface of the refervoir (or, more accurately, the fall required for generating the velocity of the ftream) for its height. Hence it has been concluded, that the utmoft performance of an underfhot wheel is to raife $\frac{4}{27}$ of the water which impels it, to the height from which it falls. But this is not found very agreeable to obfervation. Friction, and many imperfections Not accurate.
of execution in the delivery of the water, the direction of its impulfe, &c. may be expected to make a defalcation from this theoretical performance. But the actual performance, even of mills of acknowledged imperfection, confiderably exceeds this, and fometimes is found nearly double of this quantity. The truth is, that the particular fact from which Mr Parent firft deduced this maxim (namely, the performance of what is called *Parent's* or *Dr Barker's mill*), is, perhaps of all that could have been felected, the leaft calculated for being the foundation of a general rule, being of a nature fo abftrufe, that the firft mathematicians of Europe are to this day doubtful whether they have a juft conception of its principles. Mr Smeaton's experiments fhew very diftinctly, that the maximum of performance of an underfhot wheel correfponds to a velocity confiderably greater than one-third of the ftream, and approaches nearly to one half; and he affigns fome reafons for this which feem well founded. But, independent of this, the performance of Mr Smeaton's model was much greater than what correfponds with the velocity by the above mentioned eftimation of f. The theory of the impulfion of fluids is extremely imperfect; and Daniel Bernoulli fhews, from very unqueftionable principles, that the impulfe of a narrow vein of fluid on an extended furface is double of what was generally fuppofed; and his conclufions are abundantly confirmed by the experiments adduced by him.

It is by no means pretended, that the maxim of conftruction is reduced to the great fimplicity enounced in the propofition now under confideration. We only fuppofed, that a cafe had been obferved where the preffure exerted by fome natural agent did follow the proportions of v^q. This being admitted, the propofition is ftrictly true. But we do not know any fuch cafe; yet is the propofition of confiderable ufe: for we can affirm, on the authority of our own obfervations, that the action both of men and of draught horfes does not deviate very far from the proportions of v^2. The obfervations were made on men and horfes tracking a lighter along a canal, and working feveral days together, without having any knowledge of the purpofe of the obfervations. The force exerted was firft meafured by the curvature and weight of the track rope, and afterwards by a fpring fteelyard. This was multiplied by the number of yards per hour, and the product confidered as the momentum. We found the action of men to be very nearly as $\overline{e-m}^2$. The action of horfes, loaded fo as not to be able to trot, was nearly as $\overline{e-m}^{1.7}$, 29 This fubftitute is ufeful, even where it is not altogether exact.

The practitioner can eafily avail himfelf of the maxim, although the function q fhould never be reduced to any algebraic form. He has only to inftitute a train of of experiments on the natural agent, and select that velocity which gives the highest product when multiplied by its corresponding pressure.

30 Two methods of availing ourselves of this maxim.

When this selection has been made, we have two ways of giving our working machines the maximum of effect, having once ascertained the pressure f which our natural power exerts on the impelled point of the machine when it is not allowed to move.

1. When the resistance arising from the work, and from friction, is a given quantity; as when water is to be raised to a certain height by a piston of given dimensions.

Since the friction in all the communicating parts of the machine vary in the same proportion with the pressure, and since these vary in the same proportion with the resistance, the sum of the resistance and friction may be represented by $b\,r$, b being an abstract number. Let u be the undetermined velocity of the working point; or let $m:n$ be the proportion of velocities at the impelled and working points. Then, because the pressures at these points balance each other, in the case of uniform motion, they are inversely as the velocities at those points. Therefore we must make $b\,r : p = m : n$,

and $n = \frac{p\,m}{b\,r}, = \frac{\frac{q^q}{\overline{q+1}^q} f\,m}{b\,r}, = m\,\frac{q^q f}{\overline{q+1}^q\,b\,r}$, or $m:n = \overline{q+1}^q \times b\,r : q^q f$.

2. On the other hand, when $m:n$ is already given, by the construction of the machine, but $b\,r$ is susceptible of variation, we must load the machine with more and more work, till we have reduced the velocity of its impelled point to $\frac{e}{q+1}$.

In either case, the performance is expressed by what expresses $p\,m$, that is, by $f\,e \times \frac{q^q}{\overline{q+1}^{q+1}}$. But the useful performance, which is really the work done, will be had by dividing the value now obtained by the number b, which expresses the sum of the resistance overcome by the working point and the friction of the machine.

Recapitulation.

What has been now delivered contains, we imagine, the chief principles of the theory of machines, and points out the way in which we must proceed in applying them to every case. The reader, we hope, sees clearly the imperfection of a consideration of machines which proceeds no further than the statement of the proportions of the simultaneous pressures which are excited in all the parts of the machine by the application of the external forces, which we are accustomed to call the *power* and the *weight*. Unless we take also into consideration, the immediate effect of mechanical force applied to body, and combine this with all the pressures which statical principles have enabled us to ascertain, and by this combination be able to say what portion of unbalanced force there is acting at one and all of the pressing points of the machine, and what will be the motion of *every part* of it in consequence of this overplus, we have acquired no knowledge that can be of service to us. We have been contemplating, not a working machine, but a sort of balance. But, by reasoning about these unbalanced forces in the same simple manner as about the fall of heavy bodies, we were able to discover the momentary accelerations of every part, and the sensible motion which it would acquire in any assigned time, if all the circumstances remain the same. We found that the results, although deduced from unquestionable principles, were quite unlike the observed motions of most working machines. Proceeding still on the same principles, we considered this deviation as the indication, and the precise measure, of something which we had not yet attended to, but which the deviation brought into view, and enabled us to ascertain with accuracy. These are the changes which happen in the exertions of our actuating powers by the velocity with which we find it convenient to make them act. Thus we learn more of the nature of those powers; and we found it necessary to distinguish carefully between the apparent magnitude of our actuating power and its real exertion in doing our work. This consideration led us to a fundamental proposition concerning all working machines when they have attained an uniform motion; namely, that the power and resistance then really exerted on the machine precisely balance each other, and that the machine is precisely in the condition of a steelyard loaded with its balanced weights, and moved round its axis by some external force distinct from the power and the weight. We found that this force is the previous overplus of impelling power, before the machine had acquired the uniform motion; and on this occasion we learned to estimate the effect produced, by the momentum (depending on the form of the machine) of the quantity of motion produced in the whole assemblage of power, resistance, and machine.

31 Theory of machines still intricate, especially of such as reciprocate.

The theory of machines seemed to be now brought back to that simplicity of equilibrium which we had said was so imperfect a foundation for a theory; but in the availing ourselves of the maxim founded on this general proposition, we saw that the equilibrium is of a very different kind from a quiescent equilibrium. It necessarily involves in it the knowledge of the momentary accelerations and their momenta; without which we should not perceive that one state of motion is more advantageous than another, because all give us the same proportion of forces in equilibrio.

But this is not the only use of the previous knowledge of the momentary accelerations of machines; there are many cases where the machine works in this very state. Many machines accelerate throughout while performing their work; and their efficacy depends entirely on the final acceleration. Of this kind is the coining press, the great forge or tilt mill, and some other capital engines. The steam engine, and the common pump, are necessarily of this class, although their efficacy is not estimated by their final acceleration. A great number of engines have reciprocating motions in different subordinate parts. The theory of all such engines requires for its perfection an accurate knowledge of the momentary accelerations; and we must use the formulae contained in the first part of this article.

32 Working and returning strokes.

Still, however, the application of this knowledge has many difficulties, which make a *good* theory of such machines a much more intricate and complicated matter than we have yet led the reader to suppose. In most of these engines, the whole motion may be divided into two parts. One may be called the WORKING STROKE, and the other in which the working points are brought back to a situation which fits them for acting again,

may

may be called the RETURNING STROKE. This return must be effected either by means of some immediate application of the actuating power, or by some other force, which is counteracted during the working stroke, and must be considered as making part of the resistance. In the steam engine, it is generally done by a counterpoise on the outer end of the great working beam. This must be accounted a part of the resistance, for it must be raised again; and the proportions of the machine for attaining the maximum must be computed accordingly. The quantity of this counterpoise must be adjusted by other considerations. It must be such, that the descent of the pump rods in the pit may *just employ the whole time* that is necessary for filling the cylinder with steam. If they descend more briskly (which an unskilful engineer likes to see), this must be done by means of a greater counterpoise, and this employs more power to raise it again. Desaguliers describes a very excellent machine for raising water in a bucket by a man's stepping into an opposite bucket, and descending by his preponderancy. When he comes to the bottom, he steps out, goes up a stair, and finds the bucket returned and ready to receive him again. This machine is extremely simple, and perhaps the best that can be contrived; and yet it is one of the most likely to be a very bad one. The bucket into which the man steps must be brought up to its place again by a preponderancy in the machine when unloaded. It may be returned sooner or later. It should arrive precisely at the same time with the man. If sooner, it is of no use, and wastes power in raising a counterpoise which is needlessly heavy; if later, time is lost: Therefore, the perfection of this very simple machine requires the judicious combination of two maximums, each of which varies in a ratio compounded of two other ratios. Suppose the man to employ a minute to go up stairs 50 feet, which is very nearly what he can do from day to day as his only work, and suppose him to weigh 150 pounds, and that he acts by means of a simple pulley—the maximum for a lever of equal arms would require him to raise about 60 pounds of water. But when all the other circumstances are calculated, it will be found that he must raise 138 pounds (neglecting the inertia of the machine). He should raise 542 pounds 10 feet in a minute; and this is nearly the most exact valuation of a man's work.

There is the same necessity of attending to a variety of circumstances in all machines which reciprocate in the whole or any considerable part of their motion. The force employed for bringing the machine into another working position, must be regulated by the time necessary for obtaining a new supply of power; and then the proportion of m to n must be so adjusted, that the work performed, divided by the *whole* time of the working and returning strokes, may give the greatest quotient. It is still a difficult thing, therefore, to construct a machine in the most perfect manner, or even to say what will be the performance of a machine already constructed; yet we see that every circumstance is susceptible of accurate computation.

With respect to machines which acquire a sort of uniform motion in general, although subject to partial reciprocations, as in a pumping, stamping, forging engine, it is also difficult to assign the rate even of this general uniform motion. We may, however, say, that it will not be greater than if it were uniform throughout. Were it entirely free from friction, it would be exactly the same as if uniform; because the accelerations during the advantageous situations of the impelling power would compensate the retardations. But friction diminishes the accelerations, without diminishing the retardations.

We may conclude this article with some observations tending to the general improvement of machines.

33 Uniformity of motion throughout is of great advantage.

Nothing contributes more to the perfection of a machine, especially such as is massive and ponderous, than great uniformity of motion. Every irregularity of motion wastes some of the impelling power; and it is only the greatest of the varying velocities which is equal to that which the machine would acquire if moving uniformly throughout; for while the motion accelerates, the impelling force is greater than what balances the resistance then actually opposed to it, and the velocity is less than what the machine would acquire if moving uniformly: and when the machine attains its greatest velocity, it attains it because the power is then not acting against the whole resistance. In both of these situations, therefore, the performance of the machine is less than if the power and resistance were exactly balanced; in which case it would move uniformly.

34 How to attain this.

Every attention should therefore be given to this, and we should endeavour to remove all cause of irregularity. The communications of motion should be so contrived, that if the impelled point be moving uniformly, by the uniform pressure of the power, the working point shall also be moving uniformly. Then we may generally be certain, that the massy parts of the machine will be moving uniformly. When this is not done through the whole machine, there are continual returns of strains and jolts: the inertia of the different parts acting in opposite directions. Although the whole momenta may always balance each other, yet the general motion is hobbling, and the points of support are strained. A great engine so constructed, commonly causes the building to tremble; but when uniform motion pervades the whole machine, the inertia of each part tends to preserve this uniformity, and all goes smoothly. It is also deserving of remark, that when the communications are so contrived that the uniform motion of one part produces uniform motion on the next, the pressures at the communicating points remain constant or invariable. Now the accomplishing of this is always within the reach of mechanics.

35 Best forms for the teeth of wheels. Plate XXXIII. fig. 1.

One of the most usual communications in machinery is by means of toothed wheels acting on each other. It is of importance to have the teeth so formed, that the pressure by which one of them A urges the other B round its axis shall be constantly the same. It can easily be demonstrated, that when this is the case, the uniform angular motion of the one will produce a uniform angular motion of the other; or, if the motions are thus uniform, the pressures are invariable. This is accomplished on this principle, that the mutual actions of solid bodies on each other in the way of pressure are perpendicular to the touching surfaces. Therefore let the tooth a press on the tooth b in the point C; and draw the line FCDE perpendicular to the touching surfaces in the point C. Draw AF, BE perpendicular to FE, and let FE cut the line AB in D. It is plain, from

from the common principles of mechanics, that if the line FE, drawn in the manner now described, always pass through the same point D, whatever may be the situation of the acting teeth, the mutual action of the wheels will always be the same. It will be the same as if the arm AD acted on the arm BD. In the treatises on the construction of mills, and other works of this kind, are many instructions for the formation of the teeth of wheels; and almost every noted millwright has his own nostrums. Most of them are egregiously faulty in respect of mechanical principle. Indeed they are little else than instructions how to make the teeth clear each other without sticking. Mr de la Hire first pointed out the above mentioned principle, and justly condemned the common practice of making the small wheel or pinion in the form of a lantern (whence it also took its name), consisting of two round disks, having a number of cylindrical spokes (fig. 2.). The slightest inspection of this construction shews, that, in the different situations of the working teeth, the line FCE continually changes its intersection with AB. If the wheel B be very small in comparison of the other, and if the teeth of A take deep hold of the cylindrical pins of B, the line of action EF is sometimes so disadvantageously placed, that the pressure of the one wheel has scarcely any tendency at all to turn the other. Mr de la Hire, or Dr Hooke, was, we think, the first who investigated the form of tooth which procured this constant action between the wheels; and in a very ingenious dissertation, published among the Memoirs of the Academy of Sciences at Paris 1668, the former of these gentlemen shews, that this will be ensured by forming the teeth into epicycloids. Mr Camus of the same Academy has published an elaborate dissertation on the same subject, in which he prosecutes the principle of Mr de la Hire, and applies it to all the variety of cases which can occur in practice. There is no doubt as to the goodness of the principle; and it has another excellent property, "that the mutual action of the teeth is absolutely without any friction." The one tooth only applies itself to the other, and rolls on it, but does not slide or rub in the smallest degree. This makes them last long, or rather does not allow them to wear in the least. But the construction is subject to a limitation which must not be neglected. The teeth must be so made, that the curved part of the tooth *b* is acted on by a flat part of the tooth *a* till it comes to the line AB in the course of its action; after which the curved part of *a* acts on a flat part of *b*; or the whole action of *a* on *b* is either completed, or only begins at the line AB, joining the centres of the wheels.

Epicycloids recommended by De la Hire.

36
A better form.

Another form of the teeth secures the perfect uniformity of action without this limitation, which requires very nice execution. Let the teeth of each wheel be formed by evolving its circumference; that is, let the acting face GCH of the tooth *a* have the form of the curve traced by the extremity of the thread FC, unlapped from the circumference. In like manner, let the acting face of the tooth *b* be formed by unlapping a thread from its circumference. It is evident, that the line FCE, which is drawn perpendicularly to the touching surfaces in the point C, is just the direction or position of the evolving threads by which the two acting faces are formed. This line must therefore be the common tangent to the two circles or circumferences of the wheels, and will therefore always cut the line AB in the same point D. This form allows the teeth to act on each other through the whole extent of the line FCE, and therefore will admit of several teeth to be acting at the same time (twice the number that can be admitted in Mr de la Hire's method). This, by dividing the pressure among several teeth, diminishes its quantity on any one of them, and therefore diminishes the dents or impressions which they unavoidably make on each other. It is not altogether free from sliding and friction, but the whole of it can hardly be said to be sensible. The whole slide of a tooth three inches long, belonging to a wheel of ten feet diameter, acting on a tooth of a wheel of two feet diameter, does not amount to $\frac{1}{60}$th of an inch, a quantity altogether insignificant.

In the formation of the teeth of wheels, a small deviation from these perfect forms is not perhaps of very great importance, except in cases where a very large wheel drives a very small one (a thing which a good engineer will always avoid). As the construction, however, is exceedingly easy, it would be unpardonable to omit it. Well formed teeth, and a great number of them acting at once, make the communication of motion extremely smooth and uniform. The machine works without noise, and the teeth last a very long time without sensibly changing their shape. But there are cases, such as the pallets of clocks and watches, where the utmost accuracy of form is of the greatest importance for the perfection of the work.

37
Maxim for the construction of stampers, &c.

When heavy stampers are to be raised, in order to drop on the matters to be pounded, the wipers by which they are lifted should be made of such a form, that the stamper may be raised by a uniform pressure, or with a motion almost perfectly uniform. If this is not attended to, and the wiper is only a pin sticking out from the axis, the stamper is forced into motion at once. This occasions violent jolts to the machine, and great strains on its moving parts and their points of support; whereas when they are gradually lifted, the inequality of desultory motion is never felt at the impelled point of the machine. We have seen pistons moved by means of a double rack on the piston rod. A half wheel takes hold of one rack, and raises it to the required height. The moment the half wheel has quitted that side of the rack, it lays hold of the other side, and forces the piston down again. This is proposed as a great improvement; correcting the unequable motion of the piston moved in the common way by a crank. But it is far inferior to the crank motion. It occasions such abrupt changes of motion, that the machine is shaken by jolts. Indeed if the movement were accurately executed, the machine would be shaken to pieces, if the parts did not give way by bending and yielding. Accordingly, we have always observed that this motion soon failed, and was changed for one that was more smooth. A judicious engineer will avoid all such sudden changes of motion, especially in any ponderous part of a machine.

When several stampers, pistons, or other reciprocal movers, are to be raised and depressed, common sense teaches us to distribute their times of action in a uniform manner, so that the machine may always be equally loaded with work. When this is done, and the observations in the preceding paragraph attended to, the machine may be made to move almost as smoothly as if there

there were no reciprocations in it. Nothing ſhews the ingenuity of the author more than the artful yet ſimple and effectual contrivances for obviating thoſe difficulties that unavoidably ariſe from the very nature of the work that muſt be performed by the machine, and of the power employed. The inventive genius and ſound judgment of Watt and Boulton are as perceptible to a ſkilled obſerver in theſe ſubordinate parts of ſome of their great engines, as in the original diſcovery on which their patent is founded. In ſome of thoſe engines the maſs of dead matter which muſt be put into motion, and this motion deſtroyed and again reſtored in every ſtroke, is enormous, amounting to above an hundred tons. The ingenious authors have even contrived to draw ſome advantages from it, by allowing a great want of equilibrium in certain poſitions; and this has been condemned as a blunder by engineers who did not ſee the uſe made of it.

37 The unavoidable inequalities of moving power muſt be compenſated by the conſtruction.

There is alſo great room for ingenuity and good choice in the management of the moving power, when it is ſuch as cannot immediately produce the kind of motion required for effecting the purpoſe. We mentioned the converſion of the continued rotation of an axis into the reciprocating motion of a piſton, and the improvement which was thought to have been made on the common and obvious contrivance of a crank, by ſubſtituting a double rack on the piſton-rod, and the inconvenience ariſing from the jolts occaſioned by this change. We have ſeen a great forge, where the engineer, in order to avoid the ſame inconvenience ariſing from the abrupt motion given to the great ſledge hammer of ſeven hundred weight, reſiſting with a five-fold momentum, formed the wipers into ſpirals, which communicated motion to the hammer almoſt without any jolt whatever; but the reſult was, that the hammer roſe no higher than it had been raiſed in contact with the wiper, and then fell on the iron bloom with very little effect. The cauſe of its inefficiency was not gueſſed at; but it was removed, and wipers of the common form were put in place of the ſpirals. In this operation, the rapid motion of the hammer is abſolutely neceſſary. It is not enough to *lift* it up; it muſt be *toſſed* up, ſo as to fly higher than the wiper lifts it, and to ſtrike with great force the ſtrong oaken ſpring which is placed in its way. It compreſſes this ſpring, and is reflected by it with a conſiderable velocity, ſo as to hit the iron as if it had fallen from a great height. Had it been allowed to fly to that height, it would have fallen upon the iron with ſomewhat more force (becauſe no oaken ſpring is perfectly elaſtic); but this would have required more than twice the time.

38 Great inconveniences of a reciprocating power.

In employing a power which of neceſſity reciprocates, to drive machinery which requires a continuous motion (as in applying the ſteam engine to a cotton or a griſt mill), there alſo occur great difficulties. The neceſſity of reciprocation in the firſt mover waſtes much power; becauſe the inſtrument which communicates ſuch an enormous force muſt be extremely ſtrong, and be well ſupported. The impelling power is waſted in imparting, and afterwards deſtroying, a vaſt quantity of motion in the working beam. The ſkilful engineer will attend to this, and do his utmoſt to procure the neceſſary ſtrength of this firſt mover, without making it a vaſt load of inert matter. He will alſo remark, that all the ſtrains on it, and on its ſupports, are changing their directions in every ſtroke. This requires particular attention to the manner of ſupporting it. If we obſerve the ſteam engines which have been long erected, we ſee that they have uniformly ſhaken the building to pieces. This has been owing to the ignorance or inattention of the engineer in this particular. They are much more judiciouſly erected now, experience having taught the moſt ignorant that no building can withſtand their deſultory and oppoſite jolts, and that the great movements muſt be ſupported by a frame work independent of the building of maſonry which contains it (B).

The engineer will alſo remark, that when a ſingle ſtroke ſteam engine is made to turn a mill, all the communications of motion change the direction of their preſſure twice every ſtroke. During the working ſtroke of the beam, one ſide of the teeth of the intervening wheels is preſſing the machinery forward; but during the returning ſtoke, the machinery, already in motion, is dragging the beam, and the wheels are acting with the other ſide of the teeth. This occaſions a rattling at every change, and makes it proper to faſhion both ſides of the teeth with the ſame care.

It will frequently conduce to the good performance of an engine, to make the action of the reſiſting work unequable, accommodated to the inequalities of the impelling power. This will produce a more uniform motion in machines in which the momentum of inertia is inconſiderable. There are ſome beautiful ſpecimens of this kind of adjuſtment in the mechaniſm of animal bodies.

39 Nature, operation, and uſe of a Fly.

It is very cuſtomary to add what is called a Fly to machines. This is a heavy diſk or hoop, or other maſs of matter *balanced on its axis*, and ſo connected with the machinery as to turn briſkly round with it. This may be done with the view of rendering the motion of the whole more regular, notwithſtanding unavoidable inequalities of the accelerating forces, or of the reſiſtances occaſioned by the work. It becomes a Regulator. Suppoſe the reſiſtance extremely unequal, and the impelling power perfectly conſtant; as when a bucket wheel is employed to work *one* pump. When the piſton has ended its working ſtroke, and while it is going down the barrel, the power of the wheel being ſcarcely oppoſed, it accelerates the whole machine, and the piſton arrives at the bottom of the barrel with a conſiderable velocity. But in the riſing again, the wheel is oppoſed by the column of water now preſſing on the piſton. This immediately retards the wheel; and when the piſton has reached the top of the barrel, all the acceleration is undone, and is to begin again. The motion of

(B) The gudgeons of a water-wheel ſhould never reſt on the wall of the building. It ſhakes it; and if ſet up ſoon after the building has been erected, it prevents the mortar from taking firm bond; perhaps by ſhattering the calcareous cryſtals as they form. When the engineer is obliged to reſt the gudgeons in this way, they ſhould be ſupported by a block of oak laid a little hollow. This ſoftens all tremors, like the ſprings of a wheel carriage. This practice would be very ſerviceable in many other parts of the conſtruction.

of such a machine is very hobbling: but the superplus of accelerating force at the beginning of a returning stroke will not make such a change in the motion of the machine if we connect the fly with it. For the accelerating momentum is a determinate quantity. Therefore, if the radius of the fly be great, this momentum will be attained by communicating a small angular motion to the machine. The momentum of the fly is as the square of its radius; therefore it resists acceleration in this proportion; and although the overplus of power generates the same momentum of rotation in the whole machine as before, it makes but a small addition to its velocity. If the diameter of the fly be doubled, the augmentation of rotation will be reduced to one-fourth. Thus, by giving a rapid motion to a small quantity of matter, the great acceleration during the returning stroke of the piston is prevented. This acceleration continues, however, during the whole of the returning stroke, and at the end of it the machine has acquired its greatest velocity. Now the working stroke begins, and the overplus of power is at an end. The machine accelerates no more; but if the power is just in equilibrio with the resistance, it keeps the velocity which it has acquired, and is still more accelerated during the *next* returning stroke. But now, at the beginning of the subsequent working stroke, there is an overplus of resistance, and a retardation begins, and continues during the whole rise of the piston; but it is inconsiderable in comparison of what it would have been without the fly; for the fly, retaining its acquired momentum, drags forward the rest of the machine, aiding the impelling power of the wheel. It does this by all the communications taking into each other in the opposite direction. The teeth of the intervening wheels are heard to drop from their former contact on one side, to a contact on the other. By considering this process with attention, we easily perceive that, in a few strokes, the overplus of power during the returning stroke comes to be so adjusted to the deficiency during the working stroke, that the accelerations and retardations exactly destroy each other, and every succeeding stroke is made with the same velocity, and an equal number of strokes is made in every succeeding minute. Thus the machine acquires a general uniformity with periodical inequalities. It is plain, that by sufficiently enlarging either the diameter or the weight of the fly, the irregularity of the motion may be rendered as small as we please. It is much better to enlarge the diameter. This preserves the friction more moderate, and the pivot wears less. For these reasons, a fly is in general a considerable improvement in machinery, by equalising many exertions that are naturally very irregular. Thus, a man working at a common windlass, exerts a very irregular pressure on the winch. In one of his positions in each turn he can exert a force of near 70 pounds without fatigue, but in another he cannot exert above 25; nor must he be loaded with much above this in general. But if a large fly be connected properly with the windlass, he will act with equal ease and speed against 30 pounds.

40 It is a powerful regulator.

This regulating power of the fly is without bounds, and may be used to render uniform a motion produced by the most desultory and irregular power. It is thus that the most regular motion is given to mills that are driven by a single stroke steam engine, where for two or even three seconds there is no force pressing round the mill. The communication is made through a massive fly of very great diameter, whirling with great rapidity. As soon as the impulse ceases, the fly, continuing its motion, urges round the whole machinery with almost unabated speed. At this instant all the teeth, and all the joints, between the fly and the first mover, are heard to catch in the opposite direction.

If any permanent change should happen in the impelling power, or in the resistance, the fly makes no obstacle to its producing its full effect on the machine; and it will be observed to accelerate or retard uniformly, till a new general speed is acquired exactly corresponding with this new power and resistance.

Many machines include in their construction movements which are equivalent with this intentional regulator. A flour mill, for example, cannot be better regulated than by its millstone; but in the Albion mills, a heavy fly was added with great propriety; for if the mills had been regulated by their millstones only, then at every change of stroke in the steam engine, the whole train of communications between the beam, which is the first mover, and the regulating millstone, which is the very last mover, would take in the opposite direction. Although each drop in the teeth and joints be but a trifle, the whole, added together, would make a considerable jolt. This is avoided by a regulator immediately adjoining to the beam. This continually presses the working machinery in one direction. So judiciously were the movements of that noble machine contrived, and so nicely were they executed, that not the least noise was heard, nor the slightest tremor felt in the building.

Mr Valoné's beautiful pile engine employed at Westminster Bridge is another remarkable instance of the regulating power of a fly.* When the ram is dropped, and its follower disengaged immediately after it, the horses would instantly tumble down, because the load, against which they had been straining hard, is at once taken off; but the gin is connected with a very large fly, which checks any remarkable acceleration, allowing the horses to lean on it during the descent of the load; after which their draught recommences immediately. The spindles, cards, and bobbins of a cotton mill, are also a sort of flies. Indeed all bulky machines of the rotative kind tend to preserve their motion with some degree of steadiness, and their great momentum of inertia is as useful in this respect as it is prejudicial to the acceleration or any reciprocation when wanted.

* See PILE-*Engine*, Encycl.

41 A bad construction of a fly.

There is another kind of regulating fly, consisting of wings whirled briskly round till the resistance of the air prevents any great acceleration. This is a very bad one for a *working* machine, for it produces its effect by *really wasting* a part of the moving power. Frequently it employs a very great and unknown part of it, and robs the proprietor of much work. It should never be introduced into any machine employed in manufactures.

42 A conical pendulum is the most perfect regulator.

Some rare cases occur where a very different regulator is required; where a certain determined velocity is found necessary. In this case the machine is furnished, at its extreme mover, with a conical pendulum, consisting of two heavy balls hanging by rods, which move in very nice and steady joints at the top of a vertical axis. It is well known, that when this axis turns round, with an angular velocity suited to the length of those pendulums,

dulums, the time of a revolution is determined. Thus, if the length of each pendulum be 39¼ inches, the axis will make a revolution in two seconds very nearly. If we attempt to force it more swiftly round, the balls will recede a little from the axis, but it employs as long time for a revolution as before; and we cannot make it turn swifter, unless the impelling power be increased beyond all probability; in which case the pendulum will fly out from the centre till the rods are horizontal, after which every increase of power will accelerate the machine very sensibly. Watt and Boulton have applied this contrivance with great ingenuity to their steam engines, when they are employed for driving machinery for manufactures which have a very changeable resistance, and where a certain speed cannot be much departed from without great inconvenience. They have connected this recess of the balls from the axis (which gives immediate indication of an increase of power or a diminution of resistance) with the cock which admits the steam to the working cylinder. The balls flying out, cause the cock to close a little, and diminish the supply of steam. The impelling power diminishes the next moment, and the balls again approach the axis, and the rotation goes on as before, although there may have occurred a very great excess or deficiency of power. The same contrivance may be employed to raise or lower the feeding sluice of a water mill employed to drive machinery.

43 A fly sometimes collects power.

A fly is sometimes employed for a very different purpose from that of a regulator of motion—it is employed as a *collector of power*. Suppose all resistance removed from the working point of a machine furnished with a very large or heavy fly immediately connected with the working point. When a small force is applied to the impelled point of this machine, motion will begin in the machine, and the fly begin to turn. Continue to press uniformly, and the machine will accelerate. This may be continued till the fly has acquired a very rapid motion. If at this moment a resisting body be applied to the working point, it will be acted on with very great force; for the fly has now accumulated in its circumference a very great momentum. If a body were exposed immediately to the action of this circumference, it would be violently struck. Much more will it be so, if the body be exposed to the action of the working point, which perhaps makes one turn while the fly makes a hundred. It will exert a hundred times more force there (very nearly) than at its own circumference. All the motion which has been accumulated on the fly during the whole progress of its acceleration is exerted in an instant at the working point, multiplied by the momentum depending on the proportion of the parts of the machine. It is thus that the coining press performs its office; nay, it is thus that the blacksmith forges a bar of iron. Swinging the great sledge hammer round his head, and urging it with force the whole way, this accumulated motion is at once extinguished by impact on the iron. It is thus we drive a nail; and it is thus that by accumulating a very moderate force exerted during four or five turns of a fly, the whole of it is exerted on a punch set on a thick plate of iron, such as is employed for the boilers of steam engines. The plate is pierced as if it were a bit of cheese. This accumulating power of a fly has occasioned many who think themselves engineers to imagine, that a fly really adds power or mechanical force to an engine; and, not understanding on what its efficacy depends, they often place the fly in a situation where it only added a useless burden to the machine. It should always be made to move with rapidity. If intended for a mere regulator, it should be near the first mover. If it is intended to accumulate force in the working point, it should not be far separated from it. In a certain sense, a fly may be said to add power to a machine, because by accumulating into the exertion of one moment the exertions of many, we can sometimes overcome an obstacle that we never could have balanced by the same machine unaided by the fly.

It is this accumulation of force which gives such an appearance of power to some of our first movers. When a man is unfortunately catched by the teeth of a paltry country mill, he is crushed almost to mummy. The power of the stream is conceived to be prodigious; and yet we are certain, upon examination, that it amounts to the pressure of no more than fifty or sixty pounds. But it has been acting for some time; and there is a millstone of a ton weight whirling twice round in a second. This is the force that crushed the unfortunate man; and it required it all to do it, for the mill stopped. We saw a mill in the neighbourhood of Elbingroda in Hanover, where there was a contrivance which disengaged the millstone when any thing got entangled in the teeth of the wheels. It was tried in our sight with a head of cabbage. It crushed it indeed, but not violently, and would by no means have broken a man's arm.

44 Simplicity of construction recommended.

It is hardly necessary to recommend simplicity in the construction of machines. This seems now sufficiently understood. Multiplicity of motions and communications increases frictions; increases the unavoidable losses by bending and yielding in every part; exposes to all the imperfections of workmanship; and has a great chance of being indistinctly conceived, and therefore constructed without science. We think the following construction of a capstan or crab a very good example of the advantages of simplicity. It is the invention of an untaught but very ingenious country tradesman.

Fig. 3. 45 Example of a very simple and powerful capstan.

EAB is the barrel of the capstan, standing vertically in a proper frame, as usual, and urged round by bars such as EF. The upper part A of the barrel is 17 inches in diameter, and the lower B is 16. C is a strong pulley 16 inches in diameter, having a hook D, which takes hold of a hawser attached to the load. The rope ACB is wound round the barrel A, passes over the pulley C, and is then wound round the barrel B in the opposite direction. No farther description is necessary, we think, to shew that, by heaving by the bar F, so as to wind more of the rope upon A, and unwind it from B, the pulley C must be brought nearer to the capstan by about three inches for each turn of the capstan; and that this simple capstan is equivalent to an ordinary capstan of the same length of bar EF, and diameter of barrel B, combined with a 16 fold tackle of pulleys; or, in short, that it is 16 times more powerful than the common capstan; free from the great loss by friction and bending of ropes, which would absorb a third of the power of a 16 fold tackle; and that whereas all other engines become weaker as they multiply the power to a greater degree (unless they are proportionally more bulky), this engine becomes really

really ſtronger in itſelf. Suppoſe we wanted to have it twice as powerful as at preſent; nothing is neceſſary but to cover the part B of the barrel with laths a quarter of an inch thick. In ſhort, the nearer the two barrels are to equality, the more powerful does it become. We give it to the public as an excellent capſtan, and as ſuggeſting thoughts which an intelligent engineer may employ with great effect. By this contrivance, and uſing an iron wire inſtead of a catgut, we converted a common eight day clock into one which goes for two months.

We intended to conclude this article with ſome obſervations on the chief claſſes of powers which are employed to drive machinery; ſuch as water, wind, atmoſpheric preſſure, gunpowder, and the force of men and other animals, giving ſome notion of their abſolute magnitudes, and the effect which may be expected from them. We ſhould then have mentioned what has been diſcovered as to their variation by a variation of velocity. And we intended to conclude with an account of what knowledge has been acquired concerning fricton, and the loſs of power in machinery ariſing from this cauſe, and from the ſtiffneſs of ropes, and ſome other cauſes: But we have not yet been able to bring theſe matters into a connected form, which would ſuggeſt the methods and means of farther information thereon. We muſt endeavour to find another opportunity of communicating to the public what we may yet learn on thoſe ſubjects.

We have now eſtabliſhed the principles on which machines muſt be conſtructed, in order that they may produce the greateſt effect; but it would be improper to diſmiſs the ſubject without ſtating to our readers Mr Bramah's new method of producing and applying a more conſiderable degree of power to all kinds of machinery requiring motion and force, than by any means at preſent practiſed for that purpoſe. This method, for which on the 31ſt of March 1796 he obtained a patent, conſiſts in the application of water or other denſe fluids to various engines, ſo as, in ſome inſtances, to cauſe them to act with immenſe force; in others, to communicate the motion and powers of one part of a machine to ſome other part of the ſame machine; and, laſtly, to communicate the motion and force of one machine to another, where their local ſituations preclude the application of all other methods of connection.

The firſt and moſt material part of this invention will be clearly underſtood by an inſpection of fig. 4. where "A is a cylinder of iron, or other materials, ſufficiently ſtrong, and bored perfectly ſmooth and cylindrical; into which is fitted the piſton B, which muſt be made perfectly water-tight, by leather or other materials, as uſed in pump-making. The bottom of the cylinder muſt alſo be made ſufficiently ſtrong with the other part of the ſurface, to be capable of reſiſting the greateſt force or ſtrain that may at any time be required. In the bottom of the cylinder is inſerted the end of the tube C; the aperture of which communicates with the inſide of the cylinder, under the piſton B, where it is ſhut with the ſmall valve D, the ſame as the ſuction pipe of a common pump. The other end of the tube C communicates with the ſmall forcing pump or injector E, by means of which water or other denſe fluids can be forced or injected into the cylinder A, under the piſton B. Now, ſuppoſe the diameter of the cylinder A to be 12 inches, and the diameter of the piſton of the ſmall pump or injector E only one quarter of an inch, the proportion between the two ſurfaces or ends of the ſaid piſtons will be as 1 to 2304; and ſuppoſing the intermediate ſpace between them to be filled with water or other denſe fluid capable of ſufficient reſiſtance, the force of one piſton will act on the other juſt in the above proportion, viz. as 1 is to 2304. Suppoſe the ſmall piſton in the injector to be forced down when in the act of pumping or injecting water into the cylinder A, with the power of 20 cwt. which could eaſily be done by the lever H; the piſton B would then be moved up with a force equal to 20 cwt. multiplied by 2304. Thus is conſtructed a hydro-mechanical engine, whereby a weight amounting to 2304 tons can be raiſed by a ſimple lever, through equal ſpace, in much leſs time than could be done by any apparatus conſtructed on the known principles of mechanics; and it may be proper to obſerve, that the effect of all other mechanical combinations is counteracted by an accumulated complication of parts, which renders them incapable of being uſefully extended beyond a certain degree; but in machines acted upon or conſtructed on this principle, every difficulty of this kind is obviated, and their power ſubject to no finite reſtraint. To prove this, it will be only neceſſary to remark, that the force of any machine acting upon this principle can be increaſed *ad infinitum*, either by extending the proportion between the diameter of the injector and the cylinder A, or by applying greater power to the lever H.

"Fig. 5. repreſents the ſection of an engine, by which very wonderful effects may be produced inſtantaneouſly by means of compreſſed air. AA is a cylinder, with the piſton B fitting air-tight, in the ſame manner as deſcribed in fig. 4. C is a globular veſſel made of copper, iron, or other ſtrong materials, capable of reſiſting immenſe force, ſimilar to thoſe of air guns. D is a ſtrong tube of ſmall bore, in which is the ſtop-cock E. One of the ends of this tube communicates with the cylinder under the piſton B, and the other with the globe C. Now, ſuppoſe the cylinder A to be the ſame diameter as that in fig. 4. and the tube D equal to one quarter of an inch diameter, which is the ſame as the injector fig. 4.: then, ſuppoſe that air is injected into the globe C (by the common method), till it preſſes againſt the cock E. with a force equal to 20 cwt. which can eaſily be done; the conſequence will be, that when the cock E is opened, the piſton B will be moved in the cylinder AA with a power or force equal to 2304 tons; and it is obvious, as in the caſe fig. 4. that any other unlimited degree of force may be acquired by machines or engines thus conſtructed.

"Fig. 6. is a ſection, merely to ſhew how the power and motion of one machine may, by means of fluids, be transferred or communicated to another, let their diſtance and local ſituation be what they may. A and B are two ſmall cylinders, ſmooth and cylindrical; in the inſide of each of which is a piſton, made water and air tight, as in figs. 4. and 5. CC is a tube conveyed under ground, or otherwiſe, from the bottom of one cylinder to the other, to form a communication between them, notwithſtanding their diſtance be ever ſo great;

this

this tube being filled with water or other fluid, until it touch the bottom of each piston; then, by depressing the piston A, the piston B will be raised. The same effect will be produced *vice versa*: thus bells may be rung, wheels turned, or other machinery put invisibly in motion, by a power being applied to either.

"Fig. 7. is a section, shewing another instance of communicating the action and force of one machine to another; and how water may be raised out of wells of any depth, and at any distance from the place where the operating power is applied. A is a cylinder of any required dimensions, in which is the working piston B, as in the foregoing examples: into the bottom of this cylinder is inserted the tube C, which may be of less bore than the cylinder A. This tube is continued, in any required direction, down to the pump cylinder D, supposed to be fixed in the deep well EE, and forms a junction therewith above the piston F; which piston has a rod G, working through the stuffing-box, as is usual in a common pump. To this rod G is connected, over a pulley or otherwise, a weight H, sufficient to overbalance the weight of the water in the tube C, and to raise the piston F when the piston B is lifted: thus, suppose the piston B is drawn up by its rod, there will be a vacuum made in the pump cylinder D, below the piston F; this vacuum will be filled with water through the suction pipe, by the pressure of the atmosphere, as in all pumps fixed in air. The return of the piston B, by being pressed downwards in the cylinder A, will make a stroke of the piston in the pump cylinder D, which may be repeated in the usual way by the motion of the piston B, and the action of the water in the tube C. The rod G of the piston F, and the weight H, are not necessary in wells of a depth where the atmosphere will overbalance the water in the suction of the pump cylinder D, and that in the tube C. The small tube and cock in the cistern I, are for the purpose of charging the tube C."

That these contrivances are ingenious, and may occasionally prove useful, we are not inclined to controvert; but we must confess, that the advantages of them appear not to us so great as to their author. Why they do not, we need not explain to any man who, with a sufficient degree of mechanical and mathematical knowledge, has perused this article with attention. *Mr John Luccock*, however, of Marley, near Leeds, thinks so very differently from us on this subject, that, on Mr Bramah's principle, he proposes to apply water or other dense fluids, so as to make them supply the place of steam in what is commonly called the *steam engine*. He calls his engine the *paradoxical machine;* and he got a patent for it on the 28th of February 1799, though it differs in nothing from Mr Bramah's machine, represented by fig. 4. except that the tube C in the paradoxical machine is supplied with water, not by means of a forcing pump, but from a cistern elevated to such a height as, that the water descending through the tube may produce its effect merely by its weight. Whether this variation, for it is no improvement, of Mr Bramah's machine intitled its author to a patent, it is not our business to inquire.

MAC-INTOSH, a new county in the Lower district of Georgia, between Liberty and Glynn counties, on the Alatamaha river.—*Morse.*

MAC-KENZIE'S *River*, in the N. W. part of N. America, rises in Slave Lake, runs a N. N. W. course, and receives a number of large rivers, many of which are 250 yards wide, and some are 12 fathoms deep at the influx. It empties into the North Sea, at Whale Island in lat. 69° 14′, between 130° and 135° W. long. after a course of 780 miles from Slave Lake. It has its name from Mr M'Kenzie, who ascended this river in the summer of 1789. He erected a post with his name engraven on it, on Whale Island, at the mouth of this river. He saw there a number of men and canoes, also a number of animals resembling pieces of ice, supposed by him to be whales; probably sea-horses, described by Captain Cook. The tide was observed to rise 16 or 18 inches. In some places the current of the river makes a hissing noise like a boiling pot. It passes through the Stony Mountains, and has great part of that range on the W. side. The Indian nations, inhabiting the W. side from the Slave Lake are the Strongbow, Mountain, and Hare Indians; those on the E. side, the Beaver, Inland, Nathana, and Quarrelers, Indians. No discoveries W. of this river have been made by land.—*ib.*

MACOKETH, or *Mecoketch, River, Great,* empties into the Mississippi from the N. W. in N. lat. 42° 23′. *Little Macoketh* falls through the E. bank of the Mississippi, about 45 miles above the mouth of Great Macoketh, and opposite to the old Lead mine.—*ib.*

MACOPIN, a small river, which empties into the Illinois, from the S. E. 18 miles from the Mississippi; is 20 yards wide, and navigable 9 miles to the hills. The shore is low on both sides, clad with paccan, maple, ash, button-wood, &c. The land abounds with timber, and is covered with high weeds.—*ib.*

MACORIZ, a small river on the S. side of the island of St Domingo; 16 leagues E. of the city of St Domingo.—*ib.*

MACPHERSON (James, Esq;), was born in the parish of Kingusie, and county of Inverness, in the year 1738. His father was a farmer of no great affluence; and young Macpherson received the earlier part of his education in one of the parish schools in the district called Badenoch. By an anonymous writer in the Edinburgh Magazine, he is said to have been educated in the grammar school of Inverness; and he may, for ought that we know to the contrary, have spent a year in that seminary; but we rather think that he went directly from a country school to the university of Aberdeen. At this our readers need not be surprised; for at the period to which we refer, some of the parochial schoolmasters in Scotland, and more especially in the Highlands, were men eminent for taste and classical literature.

It was in the end of October or the 1st of November 1752, that James Macpherson entered the King's College;

Macpherson. lege; where he displayed more genius than learning, entertaining the society of which he was a member, and even diverting the younger part of it from their studies, by his humorous and doggerel rhimes. About two years after his admission into the university, the King's College added two months to the length of its annual *session* or *term;* which induced Macpherson, with many other young men, to remove to the Marischal College, where the session continued short; and it is this circumstance which leads us to suppose that his father was not opulent.

Soon after he left college, and perhaps before he left it, he was schoolmaster of Ruthven, or Riven, of Badenoch; and we believe he afterwards delighted as little as his great antagonist Johnson in the recollection of that period when he was compelled, by the narrowness of his fortune, to teach boys in an obscure school. It was during this period, we think in 1758, that he published *The Highlander*, an heroic poem in six cantos, 12mo. Of this work, as we have never seen it, we can say nothing. By the anonymous writer already quoted, it is mentioned as a "tissue of fustian and absurdity;" whilst others, and they too men of learning and character, have assured us, that it indicated considerable genius in so young an author.

Soon after this publication, Mr Macpherson quitted his school, and was received by Mr Graham of Balgowan into his family as tutor to his sons; an employment of which he was not fond, and to which he was not long condemned. In the year 1760 he surprised the world by the publication of *Fragments of Ancient Poetry, collected in the Highlands of Scotland, and Translated from the Gaelic or Erse Language*, 8vo. These fragments, which were declared to be genuine remains of ancient Scottish poetry, at their first appearance delighted every reader; and some very good judges, and amongst the rest Mr Gray, were extremely warm in their praises. Macpherson had intended to bury them in a Scotch magazine, but was prevented from so injudicious a step by the advice of a friend. He published them therefore in a pamphlet by themselves, and thus laid the foundation of his future fortune.

As other specimens were said to be recoverable, a subscription was set on foot by the Faculty of Advocates at Edinburgh, to enable our author to quit the family of Balgowan, perambulate the Highlands, and secure, if he could, the precious treasure. He engaged in the undertaking, and was successful; for all who possessed any of the long famed works, vied with each other in giving or sending them to a man who had shewn himself so capable of doing them justice.

With his collection of poems, and fragments of poems, he went to London; and tacking them together in the form which he thought best, he published, in 1762, *Fingal, an Ancient Epic Poem, in six books*, together with several other poems, composed by Ossian the son of Fingal, translated from the Gaelic language, 4to. The subject of this epic poem is an invasion of Ireland by Swaran king of Lochlin. Cuchullin, general of the Irish tribes during the minority of Cormac king of Ireland, upon intelligence of the invasion, assembled his forces near Tura, a castle on the coast of Ulster. The poem opens with the landing of Swaran; councils are held, battles fought, and Cuchullin is at last totally defeated. In the mean time, Fingal, king of the Highlands of Scotland, whose aid had been solicited before the enemy landed, arrived, and expelled them from the country. This war, which continued but six days and as many nights, is, including the episodes, the story of the Poem. The scene, the heath of Lena, near a mountain called Cromleoch in Ulster. This poem also was received with equal applause as the preceding Fragments.

The next year he produced *Temora*, an ancient epic poem, in eight books; together with several other poems composed by Ossian son of Fingal, 4to, which, though well received, found the public somewhat less disposed to bestow the same measure of applause. Tho' these poems had been examined by Dr Blair and others, and their authenticity asserted, there were not wanting some of equal reputation for critical abilities, who either doubted or declared their disbelief of the genuineness of them. Into this question it would be superfluous to enter here particularly, as we have said enough on it elsewhere. See Ossian, *Encycl.*

That any man should suppose Macpherson, after his translation of Homer, the *author* of the poems which he ascribes to Ossian, appears to us very extraordinary; and it is little less extraordinary, that any one should, for a moment, believe in the existence of *manuscripts* of these poems of *very high* antiquity. Part of them he undoubtedly received in manuscript from Macdonald of Clanronald; but we can affirm, on the best authority, that the said manuscript was written at different times by the Macvurichs, hereditary bards to that family. He may likewise have received short manuscripts elsewhere; but every Highland gentleman of learning and of candour (and none else have a right to decide on this question), declares, that by much the greater part of the poems had been preserved in fragments and popular songs from a very remote age by oral tradition. To these fragments Macpherson and his associates (A) gave form; and it was by uniting together fragments of different ages, that he inadvertently furnished Gibbon and others with the opportunity of objecting, that the poems are sometimes inconsistent with the truth of history. This, however, is no solid objection to their authenticity; for every West Highlander sixty years of age remembers to have heard, in his youth, great part of those poems repeated by old men; and is confident that, many centuries ago, the names of *Fione Mackuil* (Fingal), and of Ossian's other heroes and heroines, were as familiar to a Highland ear, as the names of Agamemnon, Hector, Helen, &c. were to a Grecian ear at the time when the poems of Homer were reduced into their present form. For the substance of the poems, this is such evidence as none will reject who does not prefer his own cobweb theories to the united testimony of a whole people.

With respect to authenticity, the poems of Ossian have

(A) We have been assured that he had associates; and that for the description of Cuchullin's chariot in particular he was indebted to Mr Macpherson of *Strathmashie*; a man of native genius, and though not possessed of very extensive erudition, well acquainted with Gaelic poetry.

Macpherson.

have indeed been compared with the poems of Rowley; but the comparison is absurd. The poems of the Celtic bard were not found in an old chest, and presented to a people who had never before heard either of them or of their author; they were the popular songs and traditions of ages collected together, and reduced into form, with additions occasionally made by the translator. It is ridiculous to ask how these songs and stories could be so long preserved among a rude and illiterate people; for it is only among such a people, whose objects of pursuit are too few to occupy all their attention, that the exploits of their ancestors can be handed down by tradition; and the most serious objection which we have ever met with to the translator's account of the origin of the poems, arises from his having pretended that he received the greater part of them in old manuscripts.

After the publication of Ossian's poems, by which we have reason to believe that he gained twelve hundred pounds, Mr Macpherson was called to an employment which withdrew him, for some time, both from the muses and from his country. Captain Johnstone was appointed governor of Pensacola, and Mr Macpherson accompanied him as his secretary, being at the same time made surveyor general of the Floridas. If our memory does not deceive us, some difference arose between the principal and his dependant, and they parted before their return to England. Having contributed his aid to the settlement of the civil government of that colony, he visited several of the West India islands, and some of the provinces of North America, and returned to England in the year 1766, where he retained for life his salary as surveyor, which we believe was L.200 a-year.

He soon returned to his studies, and in 1771 produced *An Introduction to the History of Great Britain and Ireland*, 4to; a work which he says, "without any of the ordinary incitements to literary labour, he was induced to proceed in by the sole motive of private amusement." The subject of this performance, it might reasonably be supposed, would not excite any violent controversial acrimony; yet neither it nor its author could escape from several most gross and bitter invectives, for some of which he perhaps gave too great occasion.

His next performance produced him neither reputation nor profit. In 1773 he published, *The Iliad of Homer*, translated in two volumes 4to; a work fraught with vanity and self-consequence, and which met with the most mortifying reception from the public. It was condemned by the critics, ridiculed by the wits, and neglected by the world. Some of his friends, and particularly Sir John Elliott, endeavoured to rescue it from contempt, and force it into notice. Their success was not equal to their efforts.

About this time seems to be the period of Mr Macpherson's literary mortifications. In 1773 Dr Johnson and Mr Boswell made the tour to the Hebrides; and in the course of it, the former took some pains to examine into the proofs of the authenticity of Ossian. The result of his inquiries he gave to the public in 1775, in his narrative of the tour; and his opinion was unfavourable. "I believe they (*i. e.* the poems, says he), never existed in any other form than that which we have seen. The editor or author never could shew the original; nor can it be shewn by any other. To revenge reasonable incredulity by refusing evidence, is a degree of insolence with which the world is not yet acquainted; and stubborn audacity is the last refuge of guilt. It would be easy to shew it if he had it. But whence could it be had? It is too long to be remembered, and the language had formerly nothing written. He has doubtless inserted names that circulate in popular stories, and may have translated some wandering ballads, if any can be found; and the names and some of the images being recollected, make an inaccurate auditor imagine that he has formerly heard the whole."

Again, he says, "I have yet supposed no imposture but in the publisher; yet I am far from certainty, that some translations have not been lately made, that may now be obtruded as parts of the original work.

"Credulity on the one part is a strong temptation to deceit on the other, especially to deceit of which no personal injury is the consequence, and which flatters the author with his own ingenuity. The Scotts have something to plead for their easy reception of an improbable fiction: they are seduced by their fondness for their supposed ancestors. Neither ought the English to be much influenced by Scotch authority; for of the past and present state of the whole Erse nation, the Lowlanders are at least as ignorant as ourselves. To be ignorant is painful; but it is dangerous to quiet our uneasiness by the delusive opiate of hasty persuasion."

These reasonings, if reasonings they can be called, might have been easily answered, had not Macpherson pretended to the possession of at least one manuscript which certainly never existed. He did not, however, attempt to answer them; but adopted a mode of proceeding which tended only to convince the world that Johnson's opinion had some foundation, and that the editor of Ossian had more imagination than sound judgment. Prompted by his evil genius, he sent a menacing letter to his illustrious antagonist, which produced the following brief but spirited reply.

"Mr James Macpherson, No date.

"I received your foolish and impudent letter. Any violence that shall be offered to me, I will do my best to repel; and what I cannot do for myself, the law shall do for me; for I will not be hindered from exposing what I think a cheat, by the menaces of a ruffian. What! Would you have me retract? I thought your work an imposition: I think so still; and, for my opinion, I have given reasons, which I dare you to refute. Your abilities, since your *Homer*, are not so formidable; and what I hear of your morality, inclines me to believe rather what you shall prove than what you shall say."

Whether this letter shewed to Macpherson the imprudence of his conduct, or that he had been made sensible of his folly by the interposition of friends, we know not; but certain it is, we hear no more afterwards of this ridiculous affair, except that our author is supposed to have assisted Mr Macnicol in an answer to Dr Johnson's Tour, printed in 1779. This supposition we are inclined to consider as well-founded, because we have been told by a gentleman of veracity, that Mr Macnicol affirms, that the scurrility of his book, which constitutes a great part of it, was inserted unknown to him, after the manuscript was sent for publication to London.

In

Macpherson.

In 1775 Mr Macpherson published *The History of Great Britain from the Restoration to the Accession of the House of Hanover*, in two volumes 4to; a work in our opinion of great merit, though by one party it has been industriously, and, we are sorry to add, too successfully, decried. As an historian, our author could not indeed boast the attic elegance of a Robertson, the splendour of a Gibbon, or the philosophical profundity of a Hume; but his *style*, though it has sometimes been the avowed, was not the real, cause of the coldness with which his history was received. The writer of this sketch once saw a gentleman of rank, and of the Whig interest, turn over one of Macpherson's volumes, and heard him say, upon shutting the book, "I cannot bear that work." He was asked if he thought the narrative false? and he replied, "No! It is too true; but I cannot bear it, because it gives me a bad opinion of those great men to whom I have been accustomed to look back with reverence as to the saviours of my country."

That it has been abhorred by others on the same account, we have not a doubt; and yet language has no name too contemptuous for those who will not follow truth whithersoever she may lead them; or who, on the absurd pretence of having already made up their minds, will not study the evidence on both sides of a disputed question in our national history. A man needs not surely disapprove of the Revolution, or of the subsequent settlements, though he should find complete proofs that Danby and Sunderland were crooked politicians, that Marlborough was ungrateful, or even that King William himself was not that upright and disinterested character which from their infancy they have been taught to believe. It is no uncommon thing for Divine Providence to accomplish good ends by wicked instruments. Every Protestant surely considers the Reformation as one of the most blessed events that have taken place in the world since the first preaching of the gospel of Christ; yet he would be a hardy champion who should undertake to vindicate the motives which influenced the conduct of the first reformers—of Henry VIII. for instance, or even of Luther himself. And why may not the Revolution be considered as in the highest degree beneficial to the country, though the conduct of some of those who brought it about should be found to be such as Macpherson represents it?

That author certainly acted with great fairness; as together with the history he published the proofs upon which his facts were founded, in two quarto volumes, intitled. *Original Papers, containing the secret History of Great Britain, from the Restoration to the Accession of the House of Hanover; to which are prefixed, Extracts from the Life of James II. as written by himself.* These papers were chiefly collected by Mr Carte, but are not all of equal authority. They, however, clear up many obscurities, and set the characters of many persons in past times in a different light from that in which they have been usually viewed. On this account we have no hesitation to say, that he who is capable of sacrificing prejudice to truth, and wishes to understand the politics of the reigns of James, and William, and Anne, should study with care the volumes of Macpherson.

Soon after this period, the tide of fortune flowed very rapidly in Mr Macpherson's favour, and his talents and industry were amply sufficient to avail himself of every favourable circumstance which arose. The resistance of the Colonies called for the aid of a ready writer to combat the arguments of the Americans, and to give force to the reasons which influenced the conduct of government, and he was selected for the purpose. Among other things (of which we should be glad to receive a more particular account), he wrote a pamphlet, which was circulated with much industry, intitled, *The Rights of Great Britain asserted against the Claims of the Colonies; being an Answer to the Declaration of the General Congress*, 8vo, 1776, and of which many editions were published. He also was the author of *A short History of Opposition during the last Session of Parliament*, 8vo, 1779; a pamphlet which, on account of its merit, was by many ascribed to Mr Gibbon.

Macpherson, ‖ Mad.

But a more lucrative employment was conferred on him about this time. He was appointed agent to the nabob of Arcot, and in that capacity exerted his talents in several appeals to the public in behalf of his client. Among others, he published, *Letters from Mahommed Ali Chan, Nabob of Arcot, to the Court of Directors; to which is annexed, a State of Facts relative to Tanjore, with an Appendix of Original Papers*, 4to, 1777; and he was supposed to be the author of *The History and Management of the East India Company from its Origin in 1600 to the present Times*, vol. i. containing the affairs of the Carnatic, in which the rights of the nabob are explained, and the injustice of the Company proved, 4to, 1779.

In his capacity of agent to the nabob, it was probably thought requisite that he should have a seat in the British Parliament. He was accordingly in 1780 chosen member for Camelford; but we do not recollect that he ever attempted to speak in the House. He was also rechosen in 1784 and 1790.

He had purchased, we think before the year 1790, an estate in the parish in which he was born; and changing its name from *Retz* to *Belville*, built on it a large and elegant mansion, commanding a very romantic and picturesque view; and thither he retired, when his health began to fail, in expectation of receiving benefit from the change of air. He continued, however, to decline, and after lingering some time, died at his seat at Belville, in Inverness, on the 17th of February 1796.

He appears to have died in very opulent circumstances; and by his will, dated June 1793, gave various annuities and legacies to several persons to a great amount. He also bequeathed L.1000 to John Mackenzie of Figtree Court, in the Temple, London, to defray the expence of printing and publishing Ossian in the original. He directed L.300 to be laid out in erecting a monument to his memory in some conspicuous situation at Belville, and ordered that his body should be carried from Scotland and interred in the Abbey Church of Westminster, the city in which he had passed the best part of his life. His remains were accordingly taken from the place where he died, and buried in the Poets Corner of Westminster church.

MACUNGY, a township in Northampton county, Pennsylvania.—*Morse.*

MAD, a river, called also *Pickawa Fork*, a rapid branch of the great Miami, having a S. W. course. It is a beautiful stream, passing through a pleasant level country of the greatest fertility.—*ib.*

MADAME,

MADAME, *Isle*, forms the N. E. side of the Gut of Canso, as you enter from the S. E. and is opposite to the eastern extremity of Nova-Scotia. The north point of the island lies 14 miles southerly of St Peter's harbour, in Cape Breton island. The isles de Madame are dependent on Cape Breton island.—*ib.*

MADBURY, a township in Stafford county, New-Hampshire, situated between Dover and Durham, about 10 miles N. W. of Portsmouth. It was incorporated in 1755, and has 592 inhabitants.—*ib.*

MADDISON, a county of Kentucky, adjoining Fayette, Clarke, Lincoln, and Mercer counties. Chief town, Milford.—*ib.*

MADDISON, a small town of Amherst county, Virginia; situated on the N. side of James's river, opposite Lynchburg. It lies 150 miles W. by N. of Richmond.—*ib.*

MADDISON'S CAVE, the largest and most celebrated cave in Virginia, situated on the N. side of the Blue Ridge. It is in a hill of about 200 feet perpendicular height, the ascent of which, on one side is so steep, that you may pitch a biscuit from its summit into the river which washes its base. The entrance of the cave is in this side, about two-thirds of the way up. It extends into the earth about 300 feet, branching into subordinate caverns, sometimes ascending a little, but more generally descending, and at length terminates in two different places, at basons of water of unknown extent, and which appear to be nearly on a level with the water of the river. The vault of this cave is of solid lime-stone, from 20 to 40 or 50 feet high, through which water is continually exuding. This trickling down the sides of the cave, has incrusted them over in the form of elegant drapery; and dripping from the top of the vault, generates on that, and on the base below, stalactites of a conical form, some of which have met and formed large massy columns.—*ib.*

MADERA, or *Madeira*, one of the largest branches of the famous Maranon or river of Amazons, in S. America. In 1741, the Portuguese sailed up this stream, till they found themselves near Santa Cruz de la Sierra, between lat. 17° and 18° S. From the mouth of this river in lat. 3° 20′ S. the Maranon is known among the inhabitants by the name of the river of Amazons; and upwards they give it the name of the river of Solimoes. At Loretto, the Madera receives two branches from the south. From Loretto to Trinidad in lat. 15° S. its course is north: thence to its mouth its general course is N. E. by N. and N.—*ib.*

MADRE DE POPA, a town and convent of Terra Firma in S. America, situated on the river Grande, or Magdalena. The pilgrims in South America respect this religious foundation with zeal, and resort to it in great numbers: many miracles being said to have been wrought here by the Holy Virgin, in favour of the Spanish fleets and their sailors, who are therefore very liberal in their donations at her shrine. It lies 54 miles E. of Carthagena. N. lat. 10° 51′, W. long. 76° 15′.—*ib.*

MAGDALEN *Isles*, a cluster of isles N. E. of the isle of St John's, and N. W. of that of Cape Breton, in the gulf of St Lawrence; situated between 47° 13′ and 47° 42′ N. lat. and in 61° 40′ W. long. They are inhabited by a few fishermen. Sea-cows used to frequent them; but they are now become scarce. These isles have been fatal to many vessels. The chief of them are the Dead Man, Entry, and Romea islands. Seamen wish to make them in fair weather, as they serve them to take a new departure; but in foggy weather or blowing weather they as studiously avoid them.—*ib.*

MAGDALENA, *La*, one of the Marquesas Islands in the South Sea; about 6 leagues in circuit, and has a harbour under a mountain on its south side nearly in lat. 10° 25′ S. long. 138° 50′ W.—*ib.*

MAGDALENA, a river of Louisiana, which empties into the gulf of Mexico, W. by S. of Mexicano river. —*ib.*

MAGDALENA, a large river, the two principal sources of which are at no great distance from the city of Popayan, in Terra Firma. Belcazar, by going down this river, found a passage to the North Sea. The river, after uniting its waters with the Cance, takes the name of Grande, and falls into the North Sea below the town of Madre de Popa. The banks of this great river are well inhabited, and it has a course of above 200 leagues. Its mouth is much frequented by smugglers, and conveys to Carthagena the productions of New Granada, viz. gold and grain. Among many other considerable places on its banks are Malambito, Teneriffe, Talaygua, Monpox, Tamalameque, &c.—*ib.*

MAGDALENE, *Cape of*, a promontory in the centre of Canada, where there is an iron mine, which promises great advantages, both with regard to the goodness of the metal and the plenty of the ore.—*ib.*

MAGEE'S *Sound*, on the N. W. coast of N. America, is situated in Washington's Islands, or what the British call Edward's, or Charlotte's Isles, so called by two different captains on their first falling in with them. Lat. 52° 46′ N. long. 131° 46′ W. This sound is divided by Dorr's Island into two parts, leading into one. The other port is called Port Perkins.—*ib.*

MAGEGADAVICK, or *Magacadava*, or *Eastern River*, falls into the bay of Passamaquoddy, and is supposed to be the true St Croix, which forms part of the eastern boundary line between the United States and New-Brunswick. This disputed line is now in train for settlement, agreeably to the treaty of 1794.—*ib.*

MAGELLAN, *Straits of*, at the south extremity of S. America, lie between 52° and 54° S. lat. and between 76° and 84° W. longitude. These straits have Patagonia on the N. and the islands of Terra del Fuego on the S. and extend from E. to W. 110 leagues, but the breadth in some places falls short of one. They were first discovered by Magellan, or Magelhaens, a Portuguese, in the service of Spain, who, in 1520 found out thereby a passage from the Atlantic to the Pacific or Southern ocean. He was the first navigator who sailed round the world.—*ib.*

MAGELLANIA, or *Terra Magellanica*, a vast tract of land, extending from the province of Rio de la Plata, quite to the utmost verge of S. America, viz. from lat. 35° to 54° S. The river Sinfondo divides the W. part from the S. of Chili: the northern part of it also borders on Chili, and Cuyo or Chicuito on the W. The South Sea bounds it, in part, on the W. The N. ocean wholly on the E. and straits of Magellan on the S. Magellan himself made no great discoveries in this country, except the two capes, of Virgins and Desire. The two principal nations discovered by the missionaries, Magellania. missionaries, are, the Chunians and Huillans; the former inhabit the continent, and several islands, to the northward of the Huillans, who inhabit the country near Magellan Straits. The soil is generally barren, hardly bearing any grain, and the trees exhibit a dismal aspect; so that the inhabitants live miserably in a cold, inhospitable climate. The Huillans are not numerous, being hunted like wild beasts, by the Chunians, who sell them for slaves. The other nations are not known, much less their genius or manner of living. The eastern coasts of Magellan are generally low, abounding with bogs, and have several islands near the shore; the most remarkable of which is the Isle of Penguins, so called from a bird of that name, which abounds on it. The islands S. of the straits are Terra del Fuego; as there is a vulcano in the largest of them, emitting fire and smoke, and appears terrible in the night. The Spaniards erected a fort on this strait, and placed a garrison in it; but the men were all starved.—*ib.*

Magma. MAGMA is properly the *refuse* of any substance which has been subjected to pressure; but, in chemistry, the term is sometimes used to denote a mixture of two or more bodies, reduced to the consistence of dough or paste.

MAGNETISM,

IN natural philosophy.—Our intention in the present article was principally to give a more distinct account of the theory of Mr Æpinus than is contained in the article MAGNETISM of the *Encyclopædia*, referring for proof and illustration to the many facts contained in that article: but, on more mature consideration, we concluded, that this method would fret and confuse the reader by continual references, and leave but a feeble impression at last. We have therefore preferred the putting the whole into the form of a short treatise on magnetism, similar to our supplementary article of ELECTRICITY. This, we hope, will be more perspicuous and satisfactory; still leaving to the reader the full use of all the information contained in the article MAGNETISM of the Dictionary.

1 Reasons why the ancients were ignorant of natural philosophy. The knowledge which the ancient naturalists possessed of this subject was extremely imperfect, and affords, we think, the strongest proof of their ignorance of the true method of philosophising; for there can hardly be named any object of physical research that is more curious in itself, or more likely to engage attention, than the apparent life and activity of a piece of rude unorganised matter. This had attracted notice in very early times; for Thales attributed the characteristic phenomenon, the attraction of a piece of iron, to the agency of a mind or soul residing in the magnet. Philosophers, as they were called, seem to have been contented with this lazy notice of a slight suggestion, unbecoming an inquirer, and rather such as might be expected from the most incurious peasant. Even Aristotle, the most zealous and the most systematic student of Nature of whose labours we have any account, has collected no information that is of any importance. We know that the general imperfection of ancient physics has been ascribed to the little importance that was attached to the knowledge of the material world by the philosophers of Greece and Rome, who thought human nature, the active pursuits of men, and the science of public affairs, the only objects deserving their attention. Most of the great philosophers of antiquity were also great actors on the stage of human life, and despised acquisitions which did not tend to accomplish them for this dignified employment: but they have not given this reason themselves, though none was more likely to be uppermost in their mind. Socrates dissuades from the study of material nature, not because it was unworthy of the attention of his pupils, but because it was too difficult, and that certainty was not attainable in it. Nothing can more distinctly prove their ignorance of what is really attainable in science, namely, the knowledge of the *laws of nature*, and their ignorance of the only method of acquiring this knowledge, viz. observation and experiment. They had entertained the hopes of discovering the *causes* of things, and had formed their philosophical language, and their mode of research, in conformity with this hopeless project. Making little advances in the discovery of the causes of the phenomena of material nature, they deserted this study for the study of the conduct of man; not because the discovery of causes was more easy and frequent here, but because the study itself was more immediately interesting, and because any thing like superior knowledge in it puts the possessor in the desirable situation of an adviser, a man of superior wisdom; and as this study was closely connected with morals, because the fear of God is truly the beginning of wisdom, the character of the philosopher acquired an eminence and dignity which was highly flattering to human vanity. Their procedure in the moral and intellectual sciences is strongly marked with the same ignorance of the true method of philosophising; for we rarely find them forming general propositions on copious inductions of facts in the conduct of men. They always proceed in the synthetic method, as if they were fully conversant in the first principles of human nature, and had nothing to do but to make the application, according to the established forms of logic. While we admire, therefore, the sagacity, the penetration, the candid observation, and the happy illustration, to be found in the works of the ancient moralists and writers on jurisprudence and politics, we cannot but lament that such great men, frequently engaged in public affairs, and therefore having the finest opportunities for deducing general laws, have done so little in this way; and that their writings, however engaging and precious, cannot be considered as any thing more refined than the observations of judicious and worthy men, with all the diffuseness and repetition of ordinary conversation. All this has arisen from the want of a just notion of what is attainable in this department of science, namely, the laws of intellectual and moral nature; and of the only possible method of attaining this knowledge, viz. observation and experiment, and the formation of general laws by the induction of particular facts.

2 Dr Gilbert was the first experimental enquirer about magnetism.

We have been led into these reflections by the inattention of the ancients to the curious phenomena of magnetism; which must have occurred in considerable and entertaining variety to any person who had taken to the experimental method. And we have hazarded these free remarks, expecting the acquiescence of our readers, because the superior knowledge which we, in these later days, have acquired of the magnetical phenomena, were the first fruits of the true method of philosophising. This was pointed out to the learned world in 1590 by our celebrated countryman Chancellor Bacon, in his two great works, the *Novum Organum Scientiarum*, and *De Argumentis Scientiarum*. Dr Gilbert of Colchester, a philosopher of eminence in many respects, but chiefly because he had the same just views of philosophy with his noble countryman, published about the same time his *Physiologia Nova, seu Tractatus de Magnete et Corporibus magneticis*. In the introduction, he recounts all the knowledge of the ancients on the subject, and their supine inattention to what was so entirely in their hands; and the impossibility of ever adding to the stock of useful knowledge, so long as men imagined themselves to be philosophising while they were only repeating a few cant words, and the unmeaning phrases of the Aristotelian school. It is curious to remark the almost perfect sameness of Dr Gilbert's sentiments and language with those of Lord Bacon. They both charge, in a peremptory manner, all those who pretend to inform others, to give over their dialectic labours, which are nothing but ringing changes on a few trite truths, and many unfounded conjectures, and immediately to betake themselves to experiment. He has pursued this method on the subject of magnetism with wonderful ardour, and with equal genius and success; for Dr Gilbert was possessed both of great ingenuity, and a mind fitted for general views of things. The work contains a prodigious number and variety of observations and experiments, collected with sagacity from the writings of others, and instituted by himself with considerable expence and labour. It would indeed be a miracle, if all Dr Gilbert's general inferences were just, or all his experiments accurate. It was untrodden ground. But, on the whole, this performance contains more real information than any writing of the age in which he lived, and is scarcely exceeded by any that has appeared since. We may hold it with justice as the first fruits of the Baconian or experimental philosophy.

This work of Dr Gilbert's relates chiefly to the loadstone, and what we call magnets, that is, pieces of steel which have acquired properties similar to those of the loadstone. But he extends the term *magnetism*, and the epithet *magnetic*, to all bodies which are affected by loadstones and magnets in a manner similar to that in which they affect each other. In the course of his investigation, indeed, he finds that these bodies are only such as contain iron in some state or other: and in proving this limitation, he mentions a great variety of phenomena which have a considerable resemblance to those which he allows to be magnetical, namely, those which he called *electrical*, because they were produced in the same way that amber is made to attract and repel light bodies. He marks with care the distinctions between these and the characteristic phenomena of magnets. He seems to have known, that all bodies may be rendered electrical, while ferruginous substances alone can be made magnetical.

It is not saying too much of this work of Dr Gilbert's to affirm, that it contains almost every thing that we know about magnetism. His unwearied diligence in searching every writing on the subject, and in getting information from navigators, and his incessant occupation in experiments, have left very few facts unknown to him. We meet with many things in the writings of posterior inquirers, some of them of high reputation, and of the present day, which are published and received as notable discoveries, but are contained in the rich collection of Dr Gilbert. We by no means ascribe all this to mean plagiarism, although we know traders in experimental knowledge who are not free from this charge. We ascribe it to the general indolence of mankind, who do not like the trouble of consulting originals, where things are mixed with others which they do not want, or treated in a way, and with a painful minuteness, which are no longer in fashion. Dr Gilbert's book, although one of those which does the highest honour to our country, is less known in Britain than on the continent. Indeed we know but of two British editions of it, which are both in Latin; and we have seen five editions published in Germany and Holland before 1628. We earnestly recommend it to the perusal of the curious reader. He will (besides the sound philosophy) find more facts in it than in the two large folios of Scarella.

3 His treatise contains many discoveries.

After this most deserved eulogy on the parent of magnetical philosophy, it is time to enter on the subject.

In mechanical philosophy, a phenomenon is not to be considered as explained, unless we can shew that it is the certain result of the laws of motion applied to matter. It is in this way that the general propositions in physical astronomy, in the theory of machines, in hydraulics, &c. are demonstrated. But the phenomena called *magnetical* have not as yet obtained such an explanation. We do not see their immediate cause, nor can we say with confidence that they are the effects of any particular kind of matter, acting on the bodies either by impulsion or pressure.

4 We can only class the phenomena.

All that can be done here is to class the phenomena in the most distinct manner, according to their generality. In this we obtain a two-fold advantage. We may take it for granted that the most general phenomenon is the nearest allied to the general cause. But, farther, we obtain by this method a true theory of all the subordinate phenomena. For a just theory is only the pointing out the general fact of which the phenomenon under consideration is a particular instance. Beginning therefore with the phenomenon which comprehends all the particular cases, we explain those cases in shewing *in what manner* they are included in the general phenomenon, and thus we shall be able to predict what will be the result of putting the body under consideration into any particular situation. And perhaps we may find, in them all, coincidences which will enable us to shew that they are all modifications of a fact still more general. If we gain this point, we shall have established a complete theory of them, having discovered the general fact in which they are all comprehended. Should we for ever remain ignorant of the cause of this general fact, we have nevertheless rendered this a complete

plete branch of mechanical theory. Nay, we may perhaps discover such circumstances of resemblance between this general fact and others, with which we are better acquainted, that we shall, with great probability at least, be able to assign the cause of the general fact itself, by shewing the law of which it is a particular instance.

We shall attempt this method on the present occasion.

5 First leading fact. Iron arranges itself in a particular position.

The leading facts in magnetism are the two following:

1. If any oblong piece of iron, such as a bar, rod, or wire, be so fitted, that it can assume any direction, it will arrange itself in a certain determinate direction with respect to the axis of the earth. Thus, if, in any part of Britain, an iron or steel wire be thrust through a piece of cork, as represented in fig. 1. so as that the whole may swim level in water, and if it be laid in the water nearly north-west and south-east, it will slowly change its position, and finally settle in a direction, making an angle of about 25 degrees with the meridian. (Plate XXXIV.)

This experiment, which we owe to Dr Gilbert (see B. I. ch. 11.), is delicate, and requires attention to many circumstances. The force with which the iron tends toward this final position is extremely weak, and will be balanced by very minute and otherwise insensible resistances; but we have never found it fail when executed as here directed. An iron wire of the size of an ordinary quill, and about eight or ten inches long, is very fit for the purpose. It should be thrust through the cork at right angles to its axis; and so adjusted, by repeated trials, as to swim level or parallel to the horizon. The experiment must also be made at a great distance from all iron; therefore in a bason of some other metal or earthen ware. It may sometimes require a very long while before the motion begin; and if the wire has been placed at right angles to the direction which we have mentioned as final, it will never change its position: therefore we have directed it to be laid in a direction not too remote, yet very sensibly different from the final direction.

But this is not the true position affected by the iron rod. If it be thrust through a piece of wood or cork perfectly spherical, in such a manner that it passes thro' its centre, and if the centre of gravity coincide with this centre, and the whole be of such weight as to remain in any part of the water, without either ascending or descending, then it will finally settle in a plane inclined to the meridian about 25°, and the north end will be depressed about 73° below the horizon.

All this is equivalent with saying, that if any oblong piece of iron or steel be very nicely poised on its centre of gravity, and at perfect liberty to turn round that centre in every direction, it will finally take the position now mentioned.

We have farther to observe with regard to this experiment, that it is indifferent which end of the rod be placed toward the north in the beginning of the experiment. That end will finally settle toward the north; and if the experiment be repeated with the same rod, but with the other end north, it will finally settle in this new attitude. It is, however, not always that we find pieces of iron thus perfectly indifferent. Very frequently one end affects the northerly position, and we cannot make the other end assume its place: the causes of this difference will be clearly seen by and bye.

6 Magnetical position.

The position thus affected by a rod of iron is called by Dr Gilbert the MAGNETICAL POSITION OR DIRECTION. It is not the same, nor parallel, in all parts of the earth, as will be more particularly noticed afterwards.

7 Second fact. Iron attracts and repels iron.

2. The other leading fact is this: When a piece of iron, lying in the *magnetical* position, or nearly so, and at perfect liberty to move in every direction, is approached by another oblong piece of iron, held nearly in the same position, it is attracted by it; that is, the moveable piece of iron will gradually approach to the one that is presented to it, and will at last come into contact with it, and may then be slowly drawn along by it.

This phenomenon, although not so delicate as the former, is still very nice, because the attraction is so weak that it is balanced by almost insensible obstructions. But the experiment will scarcely fail if conducted as follows: Let a strong iron wire be made to float on water by means of a piece of cork, in the manner already described, having one end under water. See fig. 1. B.

When it is nearly in the magnetical position, bring the end of a pretty big iron rod, such as the point of a new poker, within a quarter of an inch of its southern end (holding the poker in a position not very different from the magnetical position), and hold it there for some time, not exactly southward from it, but a little to one side. The floating iron will be observed to turn towards it with an accelerated motion; will touch it, and may then be drawn by it through the water in any direction. We shall have the same result by approaching the northern extremity of the floating iron with the upper end of the poker.

The same phenomenon may be observed by suspending the first piece of iron by its middle by a long and slender hair or thread. The suspension must be long, otherwise the stiffness of the hair or thread may be sufficient for balancing the very small force with which the pieces of iron tend toward each other. The phenomenon may also be observed in a piece of iron which turns freely on a fine point, like the needle of the mariner's compass.

In this, as in the former experiment, the ends of the pieces of iron are observed, in general, to be indifferent; that is either end of the one will attract either end of the other. It often happens, however, that the ends are not thus indifferent, and that the end of the moveable piece of iron, instead of approaching the other, will be observed to recede from it, and appear to avoid it. We shall soon learn the cause of this difference in the states of iron.

8 This action mutual.

It is scarcely necessary to remark, that we must infer from these experiments, that the action is mutual between the two pieces of iron. Either of them may be the moveable piece which approaches the other, manifesting the attraction of that other. This reciprocity of action will be abundantly verified and explained in its proper place.

9 Not peculiar to magnets or loadstone;

These two facts were long thought to be peculiar to loadstones and artificial magnets, that is, pieces of iron which have acquired this property by certain treatment with loadstones; but they were discovered by Dr

Gilbert

Gilbert to be inherent in all iron in its metallic ſtate; and were thought by him to be neceſſary conſequences of a general principle in the conſtitution of this globe. Theſe phenomena are indeed much more conſpicuous in loadſtones and magnets; and it is therefore with ſuch that experiments are beſt made for learning their various modifications.

10 But, in iron, is indifferent, and momentary, and in loadſtones it is fixed and determinate.

But there is another circumſtance, beſides the degree of vivacity, in which the magnetiſm of common iron and ſteel remarkably differs from that of a loadſtone or magnet. When a loadſtone or magnet is ſo ſupported as to be at liberty to take any poſition, it arranges itſelf in the magnetical direction, and *one determined end* of it ſettles in the northern quarter; and if it be placed ſo that the other end is in that ſituation, it does not remain there, but gradually turns round, and, after a few oſcillations, the *ſame end* ultimately ſettles in the north. This is diſtinctly ſeen in the needle of the mariner's compaſs, which is juſt a ſmall magnet prepared in the ſame way with all other magnets. The ſeveral ends of loadſtones or magnets are thus permanently the north or the ſouth ends; whereas we ſaid that either end of a piece of common iron being turned to the northern quarter, it finally ſettles there.

It is this circumſtance which has rendered magnetiſm ſo precious a diſcovery to mankind, by furniſhing us with the compaſs, an inſtrument by which we learn the different quarters of the horizon, and which thus tells the direction of a ſhip's courſe through the pathleſs ocean (ſee Compass and Variation, *Encycl.*); and alſo ſhews us the directions of the veins and workings in the deepeſt mines. It was natural therefore to call thoſe the north and ſouth ends of the mariner's needle, or of a loadſtone or magnet. Dr Gilbert called them the poles of the loadſtone or magnet. He had found it convenient for the propoſed train of his experiments to form his loadſtones into ſpheres, which he called terrellæ, from their reſemblance to this globe; in which caſe the north and ſouth ends of his loadſtones were the poles of the terrellæ. He therefore gave the name *pole* to that part of any loadſtone or magnet which thus turned to the north or ſouth. The denomination was adopted by all ſubſequent writers, and now makes a term in the language of magnetiſm.

11 Poles.

Alſo, when we approach either end of a piece of iron A to either end of another B, theſe ends mutually attract; or if either end of a magnet A be brought near either end of a piece of common iron, they mutually attract each other. But if we bring that end of a magnet A which turns to the north near to the *ſimilar* end of another magnet B, theſe ends will not attract each other, but, on the contrary, will repel. If the two magnets are made to float on pieces of wood, and have their north poles fronting each other, the magnets will retire from each other; and in doing ſo, they generally turn round their axes, till the north pole of one front the ſouth pole of the other, and then they run together. This is a very notable diſtinction between the magnetiſm of magnets and that of common iron; and whenever we ſee a piece of iron ſhew this permanent diſtinction of its ends, we muſt conſider it as a magnet, and conclude that it has met with ſome peculiar treatment.

It is not, however, ſtrictly true, that the poles of loadſtones or magnets are ſo fixed in particular parts of their ſubſtance, nor that the poles of the ſame name ſo conſtantly repel each other; for if a ſmall or weak magnet A have its pole brought near the ſimilar pole of a large or ſtrong magnet B, they are often found to attract when almoſt touching, although at more conſiderable diſtances they repel each other. But this is not an exception to the general propoſition; for when the north pole of A is thus attracted by the north pole of B, it will be found, by other trials, to have all the qualities of a ſouth pole, while thus in the neighbourhood of the north pole of B.

The magnetic properties and phenomena are conveniently diſtinguiſhed into thoſe of force and of polarity. Thoſe of the firſt claſs only were known to the ancients, and even of them their knowledge was extremely ſcanty and imperfect. They may all be claſſed under the following general propoſitions. 12 Magnetic force and polarity.

1. The ſimilar poles of two magnets repel each other with a force decreaſing as the diſtances increaſe. 13 Similar poles repel, and diſſimilar poles attract, each other.

2. The diſſimilar poles of two magnets attract each other with a force decreaſing as the diſtances increaſe.

3. Magnets arrange themſelves in a certain determinate poſition with reſpect to each other.

The firſt object of reſearch in our farther examination of theſe properties is the relation which is obſerved to obtain between the diſtances of the acting poles and their force of action. This has accordingly occupied much attention of the philoſophers, and numberleſs experiments have been made in order to aſcertain the law of variation, both of the attraction and the repulſion. A great number of theſe have been narrated in the article Magnetism of the *Encycl.* from which it appears that it has been a matter of great difficulty, and had not been aſcertained with certainty or preciſion when that article was publiſhed. It is obvious, from the nature of the thing, that the determination is very difficult, and the inveſtigation very complicated. We can only obſerve the ſimultaneous motion of the whole magnet; yet we know that there are four ſeparate actions coexiſting and contributing in different directions, and with different forces, to the ſenſible effect. The force which we meaſure, in any way whatever, is compounded of four different forces, which we cannot ſeparate and meaſure apart; for the north pole of A repels the north pole of B, and attracts its ſouth pole, while the ſouth pole of A exerts the oppoſite forces on the ſame poles of B. The attraction which we obſerve is the exceſs of two unequal attractions above two unequal repulſions. The ſame might be ſaid of an obſerved repulſion. Nay, the matter is incomparably more complicated than this; becauſe, for any thing that we know, *every* particle of A acts on *every* particle of B, and is acted on by it; and the intenſity of thoſe actions may be different at the ſame diſtances, and is certainly different when the diſtances are ſo. Thus there is a combination of an unknown number of actions, each of which is unknown individually, both in direction and intenſity. The preciſe determination is therefore, in all probability, impoſſible. By preciſe determination, we mean the law of mutual action between two magnetic particles, or that preciſe function of the diſtance which defines the intenſity of the force; ſo that meaſuring the diſtance of the acting particles on the axis of a curve, the ordinates of the curve may have the proportions of the attractions and repulſions. 14 The law of attraction and repulſion is of difficult inveſtigation.

It

It is almoſt needleſs to attempt any deduction of the law of variation from the numerous experiments which have been publiſhed by different philoſophers. An ample collection of them may be ſeen in Scarella's treatiſe. Mr Muſchenbroek has made a prodigious number; but all are ſo anomalous, and exhibit ſuch different laws of diminution by an increaſe of diſtance, that we may be certain that the experiments have been injudicious. Attention has not been paid to the proper objects. Magnets of moſt improper ſhapes have been employed, and of moſt diffuſe polarity. No notice has been taken of a circumſtance which, one ſhould think, ought to have occupied the chief attention; namely, the joint action of four poles, of which the experiment exhibits only the complex reſult. A very ſlight reflection might have made the enquirer perceive, that the attractions or repulſions are not the moſt proper phenomena for declaring the preciſe law of variation; becauſe what we obſerve is only the exceſs of a ſmall difference of attractions and repulſions above another ſmall difference. Mr Hawkſbee and Dr Brook Taylor employed a much better method, by obſerving the deviations from the meridian which a magnet occaſioned in a compaſs needle at different diſtances. This is occaſioned by the difference of the two ſums of the ſame forces; and this difference may be made a hundred times greater than the other. But they employed magnets of moſt improper ſhapes.

15 Judicious experiments by Mr Lambert.

We muſt except from this criticiſm the experiments of Mr Lambert, recorded in the Memoirs of the Academy of Berlin for 1756, publiſhed in 1758. This moſt ſagacious philoſopher (for he highly merits that name) placed a mariner's needle at various diſtances from a magnet, in the direction of its axis, and obſerved the declination from the magnetic meridian produced by the magnet, and the obliquity of the magnet to the axis of the needle. Thus, was the action of the magnet ſet in oppoſition and equilibrium with the natural polarity of the needle. But the difficulty was to diſcover in what proportion each of thoſe forces was changed by their obliquity of action on this little lever. No man excelled Mr Lambert in addreſs in deviſing methods of mathematical inveſtigation. He obſerved, that when the obliquity of the magnet to the axis of the needle was 30°, it cauſed it to decline 15°. When the obliquity was 75°, the diſtance being the ſame, it declined 30°. Call the obliquity *o*, and the declination *d*, and let *f* be that function of the angle which is proportionable to the action. Alſo let *p* be the natural polarity of the needle, and *m* the force of the magnet. It is evident that

$$p \times f,\ 15 = m \times f,\ 30$$

And $p : m = f,\ 30 : f,\ 15$; for the ſame reaſon

$$p : m = f,\ 75 : f,\ 30$$

Therefore $f,\ 15 : f\ 30 = f,\ 30 : f,\ 75°$.

But it is well known that

Sine 15 : Sine 30 = Sine 30 : Sine 75.

Hence Mr Lambert was led to conjecture, that the ſine was that function of the angle which was proportional to the action of magnetiſm on a lever. But one experiment was inſufficient for determining this point. He made a ſimilar compariſon of ſeveral other obliquities and declinations with the ſame diſtances of the magnet, and alſo with other diſtances; and he put it paſt all diſpute, that his conjecture was juſt.

Had Mr Lambert's experiments terminated here, it muſt be granted that he has made a notable diſcovery in the theory of the intimate nature of magnetiſm. It completely refutes all the theories which pretend to explain the action of a magnet by the impulſion of a ſtream of fluid, or by preſſure ariſing from the motion of ſuch a ſtream: for in this caſe the preſſure on the needle muſt have diminiſhed in the duplicate ratio of the ſine. The directive power with the angle 90 muſt be 4 times greater than with the angle 30°; whereas it was obſerved to be only twice as great. Magnetiſm does not act therefore by the impulſion or preſſure of a ſtream of fluid, but in the manner of a ſimple incitement, as we conceive attraction or repulſion to act.

Having aſcertained the effect of obliquity, Mr Lambert proceeded to examine the effect of diſtance; and, by a moſt ingenious analyſis of his obſervations, he diſcovered, that if we repreſent the force of the magnet by *f*, and the diſtance of the neareſt pole of the magnet from the centre of the needle by *δ*, and if *a* be a conſtant quantity, nearly equal to two-thirds of the length of the needle, we have *f* proportional to $\overline{\delta - a^2}$.

Mr Lambert found this hold with very great exactneſs with magnets ten times larger, and needles twice as ſhort. But he acknowledges, that it gives a very ſingular reſult, as if the action of a magnet were exerted from a centre beyond itſelf. He attributes this to its true cauſe, the ſtill great complication of the reſult, ariſing from the action of the remote pole of the magnet. He therefore takes another method of examination, which we ſhall underſtand by and bye, when we conſider the *directive* power of a magnet. We have mentioned this imperfect attempt chiefly on account of the unqueſtionable manner in which he has aſcertained the effect of obliquity, and the importance of this determination.

We have attempted this inveſtigation in a very ſimple manner. We got ſome magnets made, conſiſting of two balls connected by a ſlender rod. By a very particular mode of impregnation, we gave them a pretty good magnetiſm; and the force of each pole ſeemed to reſide almoſt in the centre of the ball. This was our object in giving them this ſhape. It reduced the examination both of the attractive and of the directive power to a very eaſy computation. The reſult was, that the force of each pole varied in the inverſe duplicate ratio of the diſtance. The error of this hypotheſis in no caſe amounted to $\frac{1}{15}$th of the whole. In computing for the phenomena of the directive power, the irregularities and deviations from this ratio were much ſmaller.

The previous knowledge of this function would greatly expedite and facilitate our farther inveſtigation: but we muſt content ourſelves with a very imperfect approximation, and with arriving at the deſired determination by degrees, and by a very circuitous route.

16 Attempt to explain the phenomena without a precise knowledge of the law.

It is a matter of experience, that when two magnets are taken, each of which is as nearly equal as poſſible in the ſtrength of both poles, then, if they are placed with their axes in one ſtraight line, and the north pole of one fronting the ſouth pole of the other, they attract each other with a force which diminiſhes as the diſtance increaſes; and this variation of force is regular, that is, without any ſudden changes of intenſity, till it becomes inſenſible. No inſtance has occurred of its breaking ſuddenly off when of any ſenſible force, but it appears

pears to diminish continually like gravity. No instance occurs in which attraction is changed into repulsion.

But it is, moreover, to be particularly remarked, that, having made this observation with the north pole of A fronting the south pole of B, if the experiment be repeated with the south pole of A fronting the north pole of B, the results will be precisely the same. And, lastly, it is a matter of unexcepted experience, that the sensible action of A on B, measured by the force which is necessary for preventing the farther approach of B, is precisely equal to the action of B on A. This is the case, however unequal the force of the two magnets may be; that is, although A may support ten pounds of iron, and B only ten ounces.

Now, the simplest view we can take of this experiment is, by supposing the whole action of one end or pole of a magnet to be exerted at one point of it. This will give us four actions of A on B, accompanied by as many equal and opposite actions of B on A. It is plain that we may content ourselves with the investigation of one only of these sets of actions.

What we observe is the excess of the attractions of the poles of A for the dissimilar poles of B above the repulsions of the same poles of A for the similar poles of B. At all distances there is such an excess. The sum of the attractions exceeds the sum of the repulsions competent to every distance.

Now this will really happen, if we suppose that the poles of a magnet are of equal strength, and that however these different magnets differ in strength, they have the same law of diminution by an increase of distance. The first circumstance is a very possible thing, and the last is demonstrated by the observed equality of action and reaction. Every thing will now appear very plain, by representing (as we did in ELECTRICITY, *Suppl.* n° 44, &c.) the intensities of attraction and repulsion by the ordinates of a curve, of which the abscissæ represent the distances of the acting poles.

Therefore let A and B (fig. 2.) represent the two magnets, placed with their four poles S, N, *s*, *n*, in a straight line. In the straight line O *q* take O *m*, O *p*, O *n*, O *q*, respectively equal to N *s*, N *n*, S *s*, S *n*; and let MPNQ be a curve line, having O *q* for its axis and assymptote; and let the curve, in every part, be convex towards its axis. Then draw the ordinates *m* M, *p* P, *n* N, *q* Q, to the curve. These ordinates will represent the intensities of the forces exerted between the poles of the magnets, in such a manner as to fulfil all the conditions that are really observed: For *m* M represents the attraction of the north pole N of the magnet, A for the south pole *s* of the magnet B; *p* P represents the repulsion of N for *n*; *n* N represents the repulsion of S for *s*; and *q* Q represents the attraction of S for *n*. The distance between *m* and *n*, or between *p* and *q*, is equal to the length of the magnet A, and *m p*, or *n q*, is equal to that of B. M *m*, P *p*, and N *n*, Q *q*, are pairs of equidistant ordinates. It surely requires only the inspection of the figure to see that, in whatever situation along the axis we place those pairs of equidistant ordinates, the sum of M *m* and Q *q* will always exceed the sum of P *p* and N *n*; that is, the sum of the attractions will always exceed that of the repulsions. This will not be the case if the curve, whose ordinates are proportional to the forces, have a point Z of contrary flexure, as is represented by the dotted curve P'ZQ'. For this curve, having O *q* for its assymptote (in order to correspond with forces which diminish continually by an increase of distance, but do not abruptly cease) must have its convexity turned toward this assymptote in the remote parts. But there will be an arch MPZ between Z and O, which is concave toward the assymptote. In which case, it is possible that M *m* + Q *q* shall be less than P *p* + N *n*; and then the repulsions will exceed the attractions; which is contrary to the whole train of observation.

It may be thought, that if the repulsion exerted between two particles be always less than the attraction at the same distance, the phenomena will be accounted for, although the law of action be not represented by such a curve as has been assumed. Undoubtedly they will, while the dissimilar poles front each other. But the results of such a supposition will not agree with the phenomena while the similar poles front each other: For it is an uncontradicted fact, that when two fine hard magnets, whose poles are nearly or exactly of equal vigour, have their similar poles fronting each other, the repulsions fall very little short of the attractions at the same distances when their position is changed: When the distances are considerable, scarcely any difference can be observed in the beginning of the experiment. The differences, also, which are observed at smaller distances, are observed to augment by continuing the magnets in their places without changing their distances; and therefore seem to arise from some change produced by each on the magnetism of the other. And, accordingly, if we invert one of the magnets, we shall find that the attractions have been diminished as much as the repulsions. Now, the consequences of magnetic repulsion, being always weaker than attraction, would be the reverse of this. The differences would appear most remarkable in the greater distances, and magnets might be found which repel at small distances, and attract at greater distances; which is contrary to all observation.

From all this it follows, with sufficient evidence for our present purpose, that the function of the distance which expresses the law of magnetic action must be represented by the ordinates of a curve of the hyperbolic kind, referred to its assymptote as an axis; and therefore always convex toward this axis. We think it also sufficiently clear, that the consequences which we have deduced from the simple supposition of four acting points, instead of the combined action of every particle, may be adopted with safety. For they would be just, if there were only those four particles; they would be just with respect to another four particles—therefore they would be just when these are joined; and so on of any number. Therefore the curve, whose ordinates express the mean action of each pole, as if exerted by its centre of effort, will have the same general form: It will be convex toward its assymptotic axis.

It will greatly aid our conceptions of the combined action of the four magnetic poles, if we notice some of the primary properties of a curve of this kind, limited by no other condition. 17

Unquestionable inferences from the phenomena.

Draw the chords MQ, PN, MP, NQ. Bisect them in B, D, E, F, and join EF. Draw the ordinates E *e* F *f*, and BD *b* (cutting EF in C). Draw P *u* parallel to the axis, cutting E *e* in ε. Draw also Q *i* parallel to the axis, cutting F *f* in φ. Also draw FHL parallel to to the axis, and Pot parallel to QN; and draw PLl, and Pex, cutting Mm in l and x.

Let each ordinate be represented by the letter at its intersection with the axis. Thus, the ordinates Mm and Qq may be represented by m and q, &c.

Because MP is bisected in E, Mt is double of Et; Ml is double of EL; Mx is double of Ee. Also, because Pt is parallel to QN, and Pu to Qi, we have $tu = Ni$. From these premises, it is easy to perceive, that,

1. $Bb = \frac{m+q}{2}$.
2. $Db = \frac{p+n}{2}$.
3. $BD = \frac{\overline{m+q} - \overline{p+n}}{2}$.
4. $Mu = m - p$.
5. $ut = n - q$.
6. $Mt = \overline{m-p} - \overline{n-q}$.
7. $Ee = \frac{m+p}{2}$.
8. $Ff = \frac{n+q}{2}$.
9. $Ml = \overline{m+p} - \overline{n+q}$.
10. $EL = \frac{\overline{m+p} = \overline{n+q}}{2}$.
11. $CD = \frac{\overline{m+q} - \overline{p+n}}{4}$.
12. $CH = \frac{\overline{m+p} - \overline{n+n}}{4}$.

These combinations will suggest to the attentive reader the explanation of many modifications of the combined action of the four poles of two magnets. They are all comprehended in one proposition, which it will be convenient to render familiar to the thought; namely, if two pairs of equidistant ordinates be taken, the sum of the two extremes exceeds that of the intermediate ones. $m+q$ is greater than $p+n$. Also, the difference between the pair nearest to O exceeds the difference between the remote pair.

Now, conceiving these ordinates to represent the mutual actions of the magnetic poles, we see that their tendency to or from each other, or their sensible attractions or repulsions, are expressed by $\overline{m+q} - \overline{n+p}$; that is, by the excess of the sum of the actions of the nearest and most remote poles above the sum of the actions of the intermediate distant poles. It will also be frequently convenient to consider this tendency as represented by $\overline{m-p} - \overline{n-q}$; that is, by the excess of the difference of the actions of the nearest pole of A on the two poles of B, above the difference of the actions of its remote pole on the same poles of B.

Let us now consider some of the chief modifications of these actions.

18 Explanation of the observed attraction of magnets, 1. Let the dissimilar poles front each other. It is plain that $m+q$ represent attractions, and that $p+n$ represent repulsions. Also $m+q$ is greater than $p+n$. Therefore the magnets will attract each other. This attraction is also represented by $\overline{m-p} - \overline{n-q}$.

Now $\overline{m+q} - \overline{p+n}$ is evidently equal to Mt, or to twice Eo, or to twice BD, or to four times CD.

This action will be increased,

1. By increasing the strength of either of the magnets. The action of the magnets is the combined action of each acting particle of the one on each acting particle of the other; and it is mutual. Therefore all the ordinates will increase in the ratio of the strength of each magnet, and their sums and differences will increase in the same ratio.

2. By diminishing the distance between the magnets. For this brings all the ordinates nearer to O, while their distances mp, pn, nq, remain as before. In this case it is plain, that Mu, the difference of Mm and Pp, will increase faster than tu or Ni, the difference between Nn and Qq. Therefore Mt will increase; that is, the attraction will increase.

3. By increasing the length of A, while the distance between them remains the same. For Om remaining the same, as also mp and nq, while nq is only removed farther from mp, it is plain Mu remains the same, and that Ni and tu are diminished; therefore Mt must increase, or the attraction must increase.

4. By increasing the length of B, the distance between them remaining the same. For this increases mp and nq; and consequently increases Mu and tu. But Mu increases more than tu; and therefore Mt is increased, and the attraction or tendency is increased.

All these consequences of our original supposition, that the magnetic action may be represented by the ordinates of a curve every where convex to an assymptotic axis, are strictly conformable to observation.

If we place the magnets with their similar poles fronting each other, it is evident that the ordinates which expressed attractions in the former case, will now express repulsions; and that the forces with which the magnets now repel each other, are equal to those with which they attracted when at the same distances. When the experiments are made with good loadstones, or very fine magnets, tempered extremely hard, and having the energy of their poles sensibly residing in a small space very near the extremities, the results are also very nearly conformable to this mathematical theory; but there is generally a weaker action. The magnets seldom repel as strongly as they attract at the same distance; at least when these distances are small. If one or both of the magnets is soft, or if one of them be much more vigorous than the other, there are observed much greater deviations from this theory. The repulsions are *considerably* weaker than the attractions at the same distance, and the law of variation becomes extremely different. When placed at very considerable distances, they repel. As the magnet B is brought nearer to A, the repulsion increases, agreeably to the theory, but not so fast. Bringing them still nearer, the repulsion ceases to increase, then gradually diminishes, and frequently vanishes altogether, before the magnets are in contact: and when brought still nearer, it is changed into attraction.

19 And of their repulsions.

But more careful observation shews, that this anomaly does not invalidate the theory. It is found that the vigour of the magnets is permanently changed by this process. The magnets act on each other in such a way as to weaken each other's magnetism. Nay, it frequently happens, that the weaker or the softer of the two has had its magnetism changed, and that the pole nearest

20 Seeming exceptions obviated.

nearest to the other has changed its nature. While they are lying in contact, or at such a distance that they attract, although their similar poles front each other, it is found that the pole of one of them is really changed; although it may sometimes recover its former species again, but never so vigorously as when the other magnet is removed. In short, it is observed, that the magnetism is diminished in all experiments in which the magnets repel each other, and that it is improved in all experiments in which they attract.

We have hitherto supposed the magnets placed with their axes in one straight line. If they are differently placed, we cannot ascertain by this single circumstance of the law of magnetic action, whether they will attract or repel—we must know somewhat more of the variation of force by a change of distance.

21 Directive power explained. If the magnet B be not at liberty to approach toward A, or recede from it, but be so supported at its centre B that it can turn round it, it is very plain that it will retain the position in which it is drawn in the figure. For its south pole s being more attracted by N than it is repelled by S, is, on the whole, attracted by the magnet A; and, by this attraction, it would vibrate like a pendulum that is supported at the centre B. In like manner, its north pole n is more repelled by N than it is attracted by S, and is, on the whole, repelled. The part B n would therefore also vibrate like a pendulum round B. Thus each half of it is urged into the very position which it now has; and if this position be deranged a little, the attraction of s B toward A, and the repulsion of n B from it, would impel it toward the position s B n.

This will be very evident, if we put the magnet B into the position s'Bn', at right angles to the line AB. The pole s' and the pole n' are urged in opposite, and therefore conspiring, directions with equal forces, very nearly at right angles to $n' s'$, if the magnet B be small. In any oblique position, the forces will be somewhat unequal, and account must be had of the obliquity of the action, in order to know the precise rotative momentum of the actions.

Dr Gilbert has given to this modification of the action of A on B, the name of VIS DISPONENS; which we may translate by DIRECTIVE POWER OR FORCE. Also, that modification of the tendency of B to or from A is called by him the VERTICITAS of B. We might call it the VERTICITY of B; but we think that the name POLARITY is sufficiently expressive of the phenomenon; and as it has come into general use, we shall abide by it.

22 Its measure. It is not so easy to give a general, and at the same time precise, measure of the directive power of A and polarity of B. The magnet B must be considered as a lever; and then the force tending to bring it into its ultimate position $n s$ depends both on the distance of its poles from N and S, and also on the angle which the axis of B makes with the line AB. When the axis of B coincides with AB, the force acting on its poles, tending to keep them in that situation, is evidently $m + p - n + q$, and therefore may be represented by M l (in fig. 2.), or by twice EL, or by four times CH. If B has the position n'Bs', perpendicular to AB, let the ordinates E e and F f cut the curve on I and K; and draw KL parallel to the axis (our figure causes this line almost to coincide with QL, and in all important cases it will be nearly the same). In this case IL will express one half of this force. Either of these estimations of this modification of the mutual action of the magnets, will be sufficient for the objects we have in view.

23 How increased and diminished. The directive power of A, and the polarity of B, are increased,

1. By increasing the strength of one or both of the magnets. This is evident,

2. By diminishing the distance of the magnets. For this, by increasing the sum of M m and P p more than the sum of N n and Q q, must increase EL or M l.

3. By increasing the length of A. For this, by removing n and q farther from m and p, must depress the points L and l, and increase EL, or IL, or M l.

4. By diminishing the length of B, while the distance N s between the magnets remains the same. For this, by bringing p and q nearer to m and n, must increase M m + P p more than N n + Q q. Or, by bringing E e and F f nearer to M m and N n, it must increase EL and M l.

If the distance N n between the pole of A and the remote pole of B remain the same, the directive force of A, and polarity of B, are diminished by diminishing the length of B, as is easily seen from what has been just now said. It is also diminished, but in a very small degree, by diminishing the length of B, when the distance between the centres of A and B remain the same. For, in this case, the ordinates I e and K f retain their places; but the points m and p approach to e; and this brings the intersection E of the ordinate and chord nearer to I, and diminishes EL, because the point L is not so much depressed by the approach of F to K as E is depressed.

24 Circumstances affecting the proportion of the attractive and directive powers. But in all cases, the *ratio* of the directive power of A to its attractive force, or of the polarity of B to its tendency to A, is increased by diminishing the length of B. For it is plain, that by diminishing $m p$ and $n q$, while I e and K f keep their places, the point o is raised, and the point L is depressed; and therefore the ratio of EL to E o, or of M l to M t, is increased. We even see that, by diminishing the length of B continually and without end, the ratio of M l to M t may be made to exceed any ratio that can be assigned.

25 The polarity of a small magnet may be great while the attraction is insensible. Now, since diminishing the length of B increases the ratio of the directive power of A to its attractive power, while increasing the length of A increases both, and also increases the ratio of EL to E o (as is very easily seen), and since this increase may be as great as we please, it necessarily follows, that if the same very small magnet B be placed at such distances from a large and strong magnet A, and from a smaller and less vigorous one C, as to have equal polarities to both, its tendency to A will be less than its tendency to C. It may even be less in any ratio we please, by sufficiently diminishing the length of B.

Dr Gilbert observed this; and he expresses his observation by saying, that the directive power extends to greater distances than the attracting power. We must just conclude, that the last becomes *insensible* at smaller distances than the first. This will be found a very important observation. It may be of use to keep in mind, that the directive power of a magnet A on another magnet B, is the difference of the *sums* of the actions of each pole of A on both poles of B; and the attractive power of A for another magnet B, is the difference of the *differences* of these actions.

It

It may be also remarked just now, that the directive force of A always exceeds its attractive force by the quantity 2 $(p-q)$. For their difference may be expressed by $t\,l$, which is equal to twice o L. Now ιe is equal to Pp, or to p; and ι L is equal to Pp — Ff, or to Pp — Qq — Fφ, or to Pp—Qq—$o\iota$. Therefore o L = Pp — Q q, and $t\,l$ = 2 (Pp — Qq), = 2 $(p-q)$.

By inspecting this figure with attention, we obtain indications of many interesting particulars. If the lengths of the magnets A and B are the same, the point n in the axis of the curve will coincide with p. As the length of A increases, the part $n\,q$ is removed farther from the part $m\,p$. The line Pt becomes less inclined to the axis, and is ultimately parallel to it, when n is infinitely remote. At this time L falls on e; so that the ultimate ratio of the attraction to the polarity is that of Eι to Ee, when the magnet A is infinitely long. It is then the ratio of the difference of the actions of the nearest pole of A on the two poles of B to the sum of these actions. Hence it follows, that when A is very great and B very small, the polarity of B is vastly greater than its tendency to A. It may have a great polarity when its tendency is insensible.

The ratio of the polarity to the attraction also increases by increasing the distance of the magnets while their dimensions continue the same. This will appear, by remarking that the chords MP and NQ must intersect in some point w; and that when the four points m, p, n, and q, move off from O, keeping the same distances from each other, Eo will diminish faster than EL, and the ratio of EL to EO will continually increase.

Therefore when a small magnet B is placed at such a distance from a great magnet A, and from a smaller one C, as to have equal polarity to both, its tendency to C will exceed its tendency to A. For the polarities being equal, it must be farther from the great magnet; in which case the ratio of its polarity to its attraction is increased.

And this will also obtain if the magnets differ also in strength. For, to have equal polarities, B must be still farther from the great and powerful magnet.

For all these reasons, a large and powerful magnet may exert a strong directive power, while its attractive power is insensible.

26
Peculiarities of oblique positions of two magnets.

We have hitherto supposed the magnet B to be placed in the direction of the axis of A, and only at liberty to turn round its centre B. But let its centre be placed on the centre of A, as in fig. 3. it must evidently take a position which may be called subcontrary to that of A, the north pole of B turning toward the south pole of A, and its south pole turning toward the north pole of A.

The same thing must happen when the centre of B is placed in B, any where in the line AE perpendicular to NS. S attracts n with a force $n\,b$, while N repels n with a force $n\,o$, somewhat smaller than $n\,b$. These two compose the force $n\,d$. In like manner, the two forces $s\,e$ and $s\,f$, exerted by N and S on the pole s, compose the force $s\,q$. Now if the axis of the magnet B be parallel to NS, but the poles in a contrary position, and if each magnet be equally vigorous in both poles, the magnet B will retain this position; because the forces $n\,b$ and $s\,e$ are equal, as also the forces $n\,c$ and $s\,f$. These must compose two forces $n\,d$ and $s\,q$, which are equal, and equally inclined to $n\,s$; and they will therefore be in equilibrio on this lever.

Let us now place the centre of the small magnet in C, neither in the axis of the other, nor in the perpendicular AE. Let its north pole n point toward the centre of A. It cannot remain in this position; for N repels n with a force $n\,c$, while S attracts it with a force $n\,b$ (smaller than $n\,c$, because the distance is greater). These two compose a force $n\,d$ considerably different from the direction $c\,n$ of its axis. In like manner, the south pole s of the small magnet is acted on by two forces $s\,e$ and $s\,f$, exerted by the two poles of A, which compose a force $s\,q$ nearly equal and parallel to $n\,d$, but in a nearly opposite direction. It is plain that these forces must turn the small magnet round its centre C, and that it cannot rest but in a position nearly parallel to $n\,d$ or $s\,f$. Its position is better represented by fig. 4. with its south pole turned toward the north pole of the other magnet, and its north pole in the opposite direction.

What the precise position will be, depends on that function of the distance which is always proportional to the intensity of the action; on the force of each of the poles of A, and on the length of the magnet B. Nay, even when we know this function, the problem is still very intricate.

27
Means of acquiring a near measure of the law of action.

There are methods by which we may approximate to the function with success. If the magnet B be indefinitely small, so that we may consider the actions on its two poles as equal, the investigation is greatly simplified. For, in this case, each pole of the small magnet B (fig. 5.) may be conceived as coinciding with its centre. Then, drawing NB, SB, and taking Bb toward N, to represent the force with which N attracts the south pole of B, and taking Bc, in SB produced, to represent the force with which S repels the same pole, the compound force acting on this pole is Bd, the diagonal of a parallelogram Bb, $d\,c$. In like manner, we must take Be, in Nb produced, and equal to Bb, to represent the repulsion of N for the north pole of B, and Bf equal to Bc, to represent the attraction of S for this pole. The compound force will be Bg, equal and opposite to Bd. It follows evidently from this investigation, that the small magnet will not rest in any position but $d\,g$. In this supposition, therefore, of extreme minuteness of the magnet B, one of the parallelograms is sufficient. We may farther remark, that we have this approximation secure against any error arising from the supposition that all the action of each pole of B is exerted by one point. Although we suppose it diffused over a considerable portion of the magnet, still the extreme minuteness of the whole makes the action, even on its extreme points, very nearly equal.

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investigated—

Hence may be derived a construction for ascertaining the position of the needle, when the function m of the distance is given, or for discovering the function by observation of the position of the needle.

Let NS (fig. 5. no 2.) meet the direction of the needle in K. Make BG = BN, and draw NF, GE, SH, perpendicular to BK. It is evident that Bb is to Bc, or $b\,d$, as the sine of the angle HBS to the sine of KBN. Therefore, because BG and BN are equal, we have Bb : Bc = GE : NF.

Therefore GE : NF = BS^m : BN^m
But SH : GE = BS : BN
Therefore SH : NF = BS^{m+1} : BN^{m+1}
And SK : NK = BS^{m+1} : BN^{m+1}

If magnetic action be inversely as the distance, we have SK : NK = BS^2 : BN^2, and B is in the circumference of a circle which passes through S and N, and has BK for a tangent, as is plain by elementary geometry. If the action be inversely as the square of the distance, we have SK : NK = BS^3 : BN^3, and B is in the circumference of a curve of more dificult investigation. But, as in the circle, the sum of the angles BSN and BNS is a constant angle; so, in this curve, the sum of the cosines of those angles is a constant quantity. This suggests a very simple construction of the curve. Let it pass through the point T of the line AT, drawn from the centre of the magnet, perpendicular to its axis. Describe the semicircle SPQN, cutting ST and NT in P and Q. Then, in order to find the point where any line SB cuts the curve, let it cut the semicircle in p, and apply the line Nq = SP + NQ — Sp, and produce it till it meet the line SB in B, which is a point in the curve; for it is evident that Sp and Nq are the cosines of BSN and BNS. We hope to give, by the help of a learned friend, the complete construction of curves for every value of m, in an Appendix to this article. It will form a new and curious class, arranged by the functions of the angles at N and S.

But, in the mean time, we have determined the position of an indefinitely small needle, in respect of a magnet of which we may conceive the polar activity concentrated in two points; and we may, on the other hand, make use of the observed positions of such a needle and magnet for discovering the value of m. For, since $\frac{SK}{NK}=\frac{SB^{m+1}}{NB^{m+1}}$, it is plain that $m = \frac{\text{Log. SK : NK}}{\text{Log. SB : NB}} - 1$. Thus, in an observation which the writer of this article made on a very small needle, and a magnet having globular poles, and 8$\frac{1}{3}$ inches between their centres, he found SB = 5$\frac{1}{3}$, NB = $\frac{1}{3}$, SK = 11,49, and NK = 3,37. This gives m = 1,97, which differs from 2 only $\frac{1}{60}$th part. Finding it so very near the inverse duplicate ratio of the distance, a circle VUZ was described, the circumference of which is the locus of SB : BN = 8 : 5,333. When the centre of the needle was placed anywhere in the circumference of this circle, it scarcely deviated from the point K, except when so far removed from the magnet that its natural polarity prevailed over the directive power of the magnet, or so near its middle that the action of the cylindrical part became very sensible.

It is plain that the length of the needle must occasion some deviation from the magnetic direction, by destroying the perfect equality of action on its two poles. He therefore employed three needles of $\frac{1}{4}$, $\frac{1}{3}$, and $\frac{1}{2}$ of an inch in length; and by noticing the differences of direction, he inferred what would be the direction, if the forces on each pole were precisely equal. He had the pleasure of seeing that the deviation from the inverse duplicate ratio of the distances was scarcely perceptible.

Mr Lambert's experiments on the directive power of the magnet, narrated in his second dissertation in the 22d volume of the Memoirs of the Academy of Berlin, are the most valuable of all that are on record; and the ingenious address with which they are conducted, and the inferences are drawn, would have done credit to Newton himself. We earnestly recommend the careful perusal of that Essay, as the most instructive of any that we have read. The writer of this found himself obliged to repeat all his former experiments, mentioned above, in Mr Lambert's manner, and with his precaution of keeping the needle in its natural position; a circumstance to which he had not sufficiently attended before. The new results were still more conformable to his conjecture as to the law of variation. Mr Lambert closes his dissertation with an hypothesis, "that the force of each transverse element of a magnet is as its distance from the centre, and its action on a particle of another magnet is inversely as the square of the distance." On this supposition, he calculates the position of a very small needle, and draws three of the curves to which it should be the tangent. These are very exactly coincident with some that he observed. We tried this with several magnetic bars, and found it very conformable to observation in some magnets; but deviating so far in the case of other magnets, that we are convinced that there is no rule for the force of each transverse element of a magnet, and that the magnetism is differently disposed in different magnets. It was chiefly this which induced us to form the magnets employed in this research of two balls united by a slender rod. Lichtenberg, in his notes on Erxleben's Natural Philosophy, says, that there is a MS. of the celebrated Tobias Mayer in the library of the Academy of Gettingen, in which he assumes the hypothesis above-mentioned, and gives a construction of the magnetic curves founded on it, making them a kind of catenaria. The interior curves do indeed resemble the catenaria, but the exterior are totally unlike. But there is no occasion for much argument to convince us, that the first part of this hypothesis is not only gratuitous, but unwarranted by any general phenomena. We know that a magnetical bar may have its magnetism very differently disposed; for it may have more than two poles, and the intermediate poles *cannot* have this disposition of the magnetism. Such a disposition is perhaps possible; but is by no means general, or even frequent. We are disposed to think, that permanent magnetism must have its intensity diminishing in the very extremity of the bar. The reader may guess at our reasons from what is said in ELECTRICITY, *Suppl.* n° 222.

The following very curious and instructive phenomenon was the first thing which greatly excited the curiosity of the writer of this article, and long puzzled him to explain it. Indeed it was his endeavours to explain it, which gradually opened up to him the theory of the mutual action of magnets contained in these paragraphs, and first gave him occasion to admire the sagacity of Dr Gilbert, and to see the connecting principle of the vast variety of observations and experiments which that philosopher had made. It seems owing to the want of this connecting principle, that a book so rich in facts should be so little read, and that so many of Dr Gilbert's observations have been published by others as new discoveries. 29 Primary and secondary, or simple and compound curves.

Amusing himself in the summer 1758 with magnetic experiments, two large and strong magnets A and B (fig. 6.), were placed with their dissimilar poles fronting each other, and about three inches apart. A small needle,

needle, supported on a point, was placed between them at D, and it arranged itself in the fame manner as the great magnets. Happening to fet it off to a good diftance on the table, as at F, he was furprifed to fee it immediately turn round on its pivot, and arrange itfelf nearly in the oppofite direction. Bringing it back to D reftored it to its former pofition. Carrying it gradually out along DF, perpendicular to NS, he obferved it to become fenfibly more feeble, vibrating more flowly; and when in a certain point E, it had no polarity whatever towards A and B, but retained any pofition that was given it. Carrying it farther out, it again acquired polarity to A and B, but in the oppofite direction; for it now arranged itfelf in a pofition that was parallel to NS, but its north pole was next to N, and its fouth pole to S.

This fingular appearance naturally excited his attention. The line on which the magnets A and B were placed had been marked on the table, as alfo the line DF perpendicular to the former. The point E was now marked as an important one. The experiments were interrupted by a friend coming in, to whom fuch things were no entertainment. Next day, wifhing to repeat them to fome friends, the magnets A and B were again laid on the line on which they had been placed the day before, and the needle was placed at E, expecting it to be neutral. But it was found to have a confiderable verticity, turning its north pole toward the magnet B; and it required to be taken farther out, toward F, before it became neutral. While ftanding there, fomething chanced to joggle the magnets A and B, and they inftantly rufhed together. At the fame inftant, the little magnet or needle turned itfelf brifkly, and arranged itfelf, as it had done the day before, at F, quivering very brifkly, and thus fhewing great verticity. This naturally furprifed the beholders; and we now found that, by gradually withdrawing the magnets A and B from each other, the needle became weaker—then became neutral—and then turned round on its pivot, and took the contrary pofition. It was very amufing to obferve how the fimply feparating the magnets A and B, or bringing them together, made the needle affume fuch a variety of pofitions and degrees of vivacity in each.

The needle was now put in various fituations, in refpect to the two great magnets: namely, off at a fide, and not in the perpendicular DF. In thefe fituations, it took an inconceivable variety of pofitions, which could not be reduced to any rule; and in moft of them, it required only a motion of one of the great magnets for an inch or two, to make the needle turn brifkly round on its pivot, and affume a pofition nearly oppofite to what it had before.

But all this was very puzzling, and it was not till after feveral months, that the writer of this article, having conceived the notion of the magnetic curves, was in a condition to explain the phenomena. With this affiftance, however, they are very clear, and very inftructive.

Nothing hinders us from fuppofing the magnets A and B perfectly equal in every refpect. Let NHM, NEL, be two magnetic curves belonging to A; that is, fuch that the needle arranges itfelf along the tangent of the curve. Then the magnet B has two curves SGK, SEI, perfectly equal, and fimilar to the other two. Let the curves NHM and SGK interfect in C and F. Let the curves NEL and SEI touch each other in E.

The needle being placed at C, would arrange itfelf in the tangent of the curve KGS, by the action of B alone, having its north pole turned toward the fouth pole S of B. But, by the action of A alone, it would be a tangent to the curve NHM, having its north pole turned away from N. Therefore, by the combined action of both magnets, it will take neither of thefe pofitions, but an intermediate one, nearly bifecting the angle formed by the two curves, having its north pole turned toward B.

But remove the needle to F. Then, by the action of the magnet A, it would be a tangent to the curve FM, having its north pole toward M. By the action of B, it would be a tangent to the curve KFG, having its north pole in the angle MFG, or turned toward A. By their joint action, it takes a pofition nearly bifecting the angle GFM, with its north pole toward A.

Let the needle be placed in E. Then, by the action of the magnet A, it would be a tangent to the curve NEL, with its north pole pointing to F. But, by the action of B, it will be a tangent to SEI, with its north pole pointing to D. Thefe actions being fuppofed equal and oppofite, it will have no verticity, or will be neutral, and retain any pofition that is given to it.

The curve SEI interfects the curve NHM in P and Q. The fame reafoning fhews, that when the needle is placed at P, it will arrange itfelf with its north pole on the angle SPH: but, when taken to Q, it will ftand with its north pole in the angle EQM.

From thefe facts and reafonings we muft infer, that, for every diftance of the magnets A and B, there will be a feries of curves, to which the indefinitely fhort needle will always be a tangent. They will rife from the adjoining poles on both fides, croffing diagonally the lozenges formed by the PRIMARY or SIMPLE curves, as in fig. 6. Thefe may be called COMPOUND or SECONDARY magnetic curves. Moreover, thefe fecondary curves will be of two kinds, according as they pafs through the firft or fecond interfections of the primary curves, and the needle will have oppofite pofitions when placed on them. Thefe two fets of curves will be feparated by a curve GEH, in the circumference of which the needle will be neutral. This curve paffes through the points where the primary curves touch each other. We may call this the *line of neutrality* or inactivity.

We now fee diftinctly the effect of bringing the magnets A and B nearer together, or feparating them farther from each other. By bringing them nearer to each other, the point E, which is now a point of neutrality, may be found in the *fecond* interfection (fuch as F) of two magnetic curves, and the needle will take a fubcontrary pofition. By drawing them farther from each other, E may be in the *firft* interfection of two magnetic curves, and the needle will take a pofition fimilar to that of C.

If the magnets A and B are not placed fo as to form a ftraight line with their four poles, but have their axes making an angle with each other, the contacts and interfections of their attending curves may be very different from thofe now reprefented; and the pofitions of the needle will differ accordingly. But it is plain, from what has been faid, that if we knew the law of action, and confequently the form of the primary curves, we fhould always be able to fay what will be the pofition of the needle. Indeed, the confideration of the fimple curves, although it was the mean of fuggefting to the writer of this article the explanation of thofe more complicated phenomena, is by no means neceffary for this purpofe. Having the law of magnetic action, we muft know each of the eight forces by which the needle is affected, both in refpect of direction and intenfity; and are therefore able to afcertain the fingle force arifing from their compofition.

Secondary curves of repulfion.

When the fimilar poles of A and B are oppofed to each other, it is eafy to fee, that the pofition of the needle muft be extremely different from what we have been defcribing. When placed anywhere in the line DF, between two magnets, whofe north poles front each other in N and S, its north pole will always point away from the middle point D. There will be no neutral point E. If the needle be placed at P or Q, its north pole will be within the angle EPH, or FQI. This pofition of the magnets gives another fet of fecondary curves, which alfo crofs the primary curves, paffing diagonally through the lozenges formed by their interfection. But it is the other diagonal of each lozenge which is a chord to thofe fecondary curves. They will, therefore, have a form totally different from the former fpecies.

30
Remarks on this inveftigation.

The confideration of this compounded magnetifm is important in the fcience, both for explaining complex phenomena, and for advancing our knowledge of the great defideratum, the law of magnetic action. It ferves this purpofe remarkably. By employing a very fmall needle, the points of neutrality afcertain very nearly where the magnetic curves have a common tangent, and fhews the pofition of this tangent. By placing the two magnets fo as to form various angles with each other, we can, by means of thefe neutral points, know the pofition of the tangent in every point of the curve, and thus can afcertain the form of the curve, and the law of action, with confiderable accuracy. The writer of this article took this method; and the refult confirmed him in the opinion, that it was in the inverfe duplicate ratio of the diftances. The chief (perhaps the only) ground of error feemed to be the difficulty of procuring large magnets, having the action of each pole very much concentrated. Large magnets muft be employed. He attempted to make fuch, confifting of two fpherical balls, joined by a flender rod. But he could not give a ftrong magnetifm to magnets of this form, and was forced to make ufe of common bars, the poles of which are confiderably diffufed. This diffufion of the pole renders it very difficult to felect with propriety the points from which the diftances are to be eftimated, in the inveftigation of the relation between the forces and diftances.

He tried another method for afcertaining this fo much defired law, which had alfo the fame refult. Having made a needle confifting of two balls joined by a flender rod, and having touched it with great care, fo that the whole ftrength of its poles feemed very little removed from the centres of the balls, he counted the number of horizontal vibrations which it made in a given time by the force of terreftrial magnetifm. He then placed it on the middle of a very fine and large magnet, placed with its poles in the magnetic meridian, the north pole pointing fouth. In this fituation he counted the vibrations made in a given time. He then raifed it up above the centre of the large magnet, till the diftance of its poles from thofe of the great magnet were changed in a certain proportion. In this fituation its vibrations were again counted. It was tried in the fame way in a third fituation, confiderably more remote from the great magnet. Then, having made the proper reduction of the forces correfponding to the obliquity of their action, the force of the poles of the great magnet was computed from the number of vibrations. To ftate here the circumftances of the experiment, the neceffary reductions, and the whole computations, would occupy feveral pages, and to an intelligent reader would anfwer little purpofe. Mr Lambert's excellent differtation in the 22d vol. of the *Mem. de l'Acad. de Berlin*, will fhew the prolixity and intricacy of this inveftigation. Suffice it to fay, that thefe experiments were the moft confiftent with each other of any made by the writer of this article, with the view of afcertaining the law of magnetic action; and it is chiefly from their refult that he thinks himfelf authorifed to fay, with fome confidence, that it is inverfely as the fquare of the diftance. Thefe experiments were firft made in a rough way in 1769 and 1770. In 1775, obferving that Mr Æpinus feemed to think the action inverfely as the diftance (fee his *Tentam. Theor. Electr. et Magn.* § 301. &c.), they were repeated with very great care; and to thefe were added another fet of experiments, made with the fame magnet and the fame needle, placed not above the magnet, but at one fide (but always in the line through the centre, perpendicular to the axis, fo that the actions of the two poles might be equal). This difpofition evidently fimplifies the procefs exceedingly. The refult of the whole was ftill more fatisfactory. This conclufion is alfo confirmed by the experiments of Mr Coulomb in the Memoirs of the Academy of Sciences at Paris for 1786 and 1787. It would feem therefore to be pretty well eftablifhed. Another method, which feems fufceptible of confiderable accuracy, ftill remains to be tried. It will be mentioned in due time.

Such then are the general laws obferved in the mutual action of magnets. We think it fcarcely neceffary to enter into a farther detail of their confequences, correfponding to the innumerable varieties of pofitions in which they may be placed with refpect to each other. We are confident, that the fenfible actions will always be found agreeable to the legitimate confequences of the general propofitions which we have eftablifhed in the preceding paragraphs. We proceed therefore to confider fome phyfical facts not yet taken notice of, which have great influence on the phenomena, and greatly affift us in our endeavours to underftand fomething of their remote caufe.

31
Magnetifm is temporary and perifhing.

Magnetifm, in all its modifications of attraction, repulfion, and direction, is, in general, of a temporary or perifhing nature. The beft loadftones and magnets, unlefs kept with care, and with attention to certain circumftances, are obferved to diminifh in their power. Natural loadftones, and magnets made of fteel, tempered as hard as poffible, retain their virtue with greateft obftinacy obstinacy, and seldom lose it altogether, unless in situations which our knowledge of magnetism teaches us to be unfavourable to its durability. Magnets of tempered steel, such as is used for watch-springs, are much sooner weakened, part with a greater proportion of their force by simple keeping, and finally retain little or none. Soft steel and iron lose their magnetism almost as soon as its producing cause is removed, and cannot be made to retain any sensible portion of it, unless their metallic state suffer some change.

1. Hurt by improper position.

1. Nothing tends so much to impair the power of a magnet as the keeping it in an improper position. If its axis be placed in the magnetic direction, but in a contrary position, that is, with the north pole of it where the south pole tends to settle, it will grow weaker from day to day; and unless it be a natural loadstone, or be of hard tempered steel, it will, after no very long time, lose its power altogether.

2. By heat; effects of thunder and electricity.

2. This dissipation of a strong magnetic power is greatly promoted by heat. Even the heat of boiling water affects it sensibly; and if it be made red hot, it is entirely destroyed. This last fact has long been known. Dr Gilbert tried it with many degrees of violent heat, and found the consequences as now stated; but having no thermometers in that dawn of science, he could not say any thing precise. He only observes, that it is destroyed by a heat not sufficient to make it visible in a dark room. Mr Canton found even boiling water to weaken it; but on cooling again the greatest part was recovered.

3. By violent treatment.

3. What is more remarkable, magnetism is impaired by any rough usage. Dr Gilbert found, that a magnet which he had impregnated very strongly, was very much impaired by a single fall on the floor; and it has been observed since his time, that falling on stones, or receiving any concussion which causes the magnet to ring or sound, hurts it much more than beating it with any thing soft and yielding. Grinding a natural loadstone with coarse powders, to bring it into shape, weakens it much; and loadstones should therefore be reduced into a shape as little different from their natural form as possible; and this should be done briskly, cutting them with the thin disks of the lapidary's wheel, cutting off only what is necessary for leaving their most active parts or poles as near their extremities as we can.

All these causes of the diminution of magnetism are more operative if the magnet be all the while in an improper position.

4. By other magnets.

4. Lastly, magnetism is impaired and destroyed by placing the magnet near another magnet, with their similar poles fronting each other. We have had occasion to remark this already, when mentioning the experiments made with magnets in this position, for ascertaining the general laws or variations of their repulsion. We there observed, that magnets so situated always weakened each other, and that a powerful magnet often changed the species of the nearest pole of one less powerful. This change is recovered, in part at least, when it has taken place in a loadstone or a magnet of hard steel; but in spring tempered steel the change is generally permanent, and almost to the full extent of its condition while the magnets are together. It is to be remarked, that this change is gradual; and is expedited by any of the other causes, particularly by heat or by knocking.

32 Magnetism may be acquired,

On the other hand, magnetism is acquired by the same means, when some other circumstances are attended to.

1. By magnetical position,

1. A bar of iron, which has long stood in the magnetic direction, or nearly so, will gradually acquire magnetism, and the ends will acquire the polarity corresponding to their situation. In this country, and the north of Europe, the old spindles of turret vanes, old bars of windows, &c. acquire a sensible magnetism; their lower extremity becoming a north pole, and the other end a south pole. Gilbert says, that this was first observed in Mantua, in the vane spindle of the Augustine church—"*Vento flexa* (says he) *de prompta, et apothecario cuidam concessa, attrahebat ferrea ramenta, vi perquam insigni.*" The upper bar of a hand rail to a stair on the north side of the highest part of the steeple of St Giles's church in Edinburgh is very magnetical; and the upper end of it, where it is lodged in the stone, is a vigorous south pole. It is worth notice, that the parts of such old bars acquire the strongest magnetism when their metallic state is changed by exposure to the air, becoming foliated and friable. It would be worth while to try, whether the æthiops martialis, produced by steam in the experiments for decomposing water, will acquire magnetism during its production. The pipe and the wires, which are converted into the shining æthiops, should be placed in the magnetic direction.

2. By hammering;

2. If a bar of steel be long hammered while lying in the magnetic direction, it acquires a sensible magnetism (See Dr Gilbert's plate, representing a blacksmith hammering a bar of iron in the magnetic direction). The points of drills, especially the great ones, which are urged by very great pressure; and broaches, worked by a long lever, so as to cut the iron very fast, acquire a strong magnetism, and the lower end always becomes the north pole (*Phil. Trans.* xx. 417.). Even driving a hard steel punch into a piece of iron, gives it magnetism by a single blow. In short, any very violent squeeze given to a piece of tempered steel renders it magnetic, and its polarity corresponds with its position during the experiment. We can scarcely take up a cutting or boring tool in a smith's shop that is not magnetical. Even soft steel and iron acquire permanent magnetism in this way. Iron also acquires it by twisting and breaking. It is therefore difficult to procure pieces of iron or steel totally void of determinate and permanent magnetism; and this frequently mars the experiments mentioned in the first paragraphs of this article. The way therefore to ensure success in these experiments is to deprive the rods of their accidental magnetism, by some of the methods mentioned a little ago. Let them be heated red hot, and allowed to cool while lying in a direction perpendicular to the magnetic direction (nearly E. N. E. and W. S. W. in this country).

3. By heating;

3. As heat is observed to destroy magnetism, so it may also be employed to induce it on substances that are susceptible of magnetism. Dr Gilbert makes this observation in many parts of his work. He says, that the ores of iron which are in that particular metallic state which he considers as most susceptible of magnetism, will acquire it by long continuance in a red heat, if laid in the magnetic direction, and that their polarity

is

is conformable to their poſition, that end of the maſs which is next the north becoming the north pole. He alſo made many experiments on iron and ſteel bars expoſed to ſtrong heats in the magnetical direction. Such experiments have been made ſince Gilbert's time in great number. Dr Hooke, in 1684, made experiments on rods of iron and ſteel one-fifth of an inch in diameter, and ſeven inches long. He found them to acquire permanent magnetiſm by expoſure to ſtrong heat in the magnetic direction, and if allowed to cool in that direction. But the magnetiſm thus acquired by ſteel rods was much ſtronger, and more permanent, if they were ſuddenly quenched with cold water, ſo as to temper them very hard. He found, that the end which was next to the north, or the lower end of a vertical bar, was always its permanent north pole. Even quenching the upper end, while the reſt was ſuffered to cool gradually, became a very ſenſible ſouth pole. No magnetiſm was acquired if this operation was performed on a rod lying at right angles to the magnetical direction.

In theſe trials the polarity was always eſtimated by the action on a mariner's needle, and the intenſity of the magnetiſm was eſtimated by the deviation cauſed in this needle from its natural poſition. Dr Gilbert made a very remarkable obſervation, which has ſince been repeated by Mr Cavallo, and publiſhed in the Philoſophical Tranſactions as a remarkable diſcovery. Dr Gilbert ſays, p. 69. "*Bacillum ferreum, valide ignitum appono verſorio excito; ſtat verſorium, nec ad tale ferrum convertitur: ſed ſtatim ut primum de candore aliquantulum remiſerit, confluit illico.*" In ſeveral other parts of his treatiſe he repeats the ſame thing with different circumſtances. It appears, therefore, that while iron is red hot, it is not ſuſceptible of magnetiſm, and that it is during the cooling in the magnetic direction that it acquires it. Gilbert endeavoured to mark the degree of heat moſt favourable for this purpoſe; but being unprovided with thermometers, he could not determine any thing with preciſion. He ſays, that the verſorium, or mariner's needle, was moſt deranged from its natural poſition a little while after the bar of iron ceaſed to ſhine in day-light, but was ſtill pretty bright in a dark room. But there are other experiments which we have made, and which will be mentioned by and bye; by which it appears, that although a bright red or a white heat makes iron unſuſceptible of magnetiſm while in that ſtate, it prediſpoſes it for becoming magnetical. When a bar of ſteel was made to acquire magnetiſm by tempering it in the magnetical direction, we found that the acquired magnetiſm was much ſtronger when the bar was made firſt of all very hot, even although allowed to come to its moſt magnetical ſtate before quenching, than if it had been heated only to that degree; nay, we always found it ſtronger when it was quenched when red hot. We offer no explanation at preſent; our ſole buſineſs juſt now being to ſtate facts, and to generalize them, in the hopes of finding ſome fact which ſhall contain all the others.

4. By juxtapoſition

4. The moſt diſtinct acquiſitions and changes of magnetiſm are by juxtapoſition to other magnets and to iron. As the magnetiſm of a loadſtone or magnet is weakened by bringing its pole near the ſimilar pole of another magnet, it is improved by bringing it near the other pole; and it is always improved by bringing it near any piece of iron or ſoft ſteel.

But this action, and the mutual relation of magnets and common iron, being the moſt general, and the moſt curious and inſtructive of all the phenomena of magnetiſm, they merit a very particular conſideration.

Of the communication of Magnetiſm.

33 Communication of magnetiſm.

The whole may be comprehended in one propoſition, which may be ſaid to contain a complete theory of magnetiſm.

Fundamental propoſition.

Any piece of iron, when in the neighbourhood of a magnet, is a magnet, and its polarity is ſo diſpoſed that the magnet and it mutually attract each other.

The phenomena which reſult from this fundamental principle are infinitely various, and we muſt content ourſelves with deſcribing a ſimple caſe or two, which will ſufficiently enable the reader to explain every other.

34 Attractive power communicated.

Take a large and ſtrong magnet NAS (fig. 7.), of which N is the north, and S the ſouth pole. Let it be properly ſupported in a horizontal poſition, with its poles free, and at a diſtance from iron or other bodies. Take any ſmall piece of common iron, not exceeding two or three inches in length, ſuch as a ſmall key. Take alſo another piece of iron, ſuch as another ſmaller key, or a bit of wire about the thickneſs of an ordinary quill.

1. Hold the key horizontally, near one of the poles, (as ſhewn at n° 1.), taking care not to touch the pole with it; and then bring the other piece of iron to the other end of the key (it is indifferent which pole is thus approached with the key, and which end of the key is held near the pole). The wire will hang by the key, and will continue to hang by it, when we gradually withdraw the key horizontally from the magnet, till, at a certain diſtance, the wire will drop from the key, becauſe the magnetiſm imparted from this diſtance is too weak. That this is the ſole reaſon of its dropping, will appear by taking a ſhorter, or rather a ſlenderer, bit of wire, and touch the remote end of the key with it: it will be ſupported, even though we remove the key ſtill farther from the magnet.

2. Hold the key *below* one of the poles, as at n° 2. or 3. and touch its remote end with the wire. It will be ſuſpended in like manner, till we remove the key too far from the magnet.

3. Hold the key *above* the poles, as at n° 4. or 5. and touch its adjacent end with the wire (taking care that the wire do not alſo touch the magnet). The wire will ſtill be ſupported by the key, till both are removed too far from the magnet.

Thus it appears, that in all theſe ſituations the key has ſhewn the characteriſtic phenomenon of magnetiſm, namely, attraction for iron. In the experiment with the key held above the pole, the wire is in the ſame ſituation in reſpect to magnetiſm as the key is when held below the pole; but the actions are mutual. As the key attracts the wire, ſo the wire attracts the key.

If the magnet be ſupported in a vertical poſition, as in fig. 8. the phenomena will be the ſame; and when the key is held directly above or directly below the pole, it will carry rather a heavier wire than in the horizontal poſition of the magnet and key.

Inſtead of approaching the magnet with the key and wire, we may bring the magnet toward them, and the phenomena will be ſtill more palpable. Thus, if the bit

bit of wire be lying on the table, and we touch one end of it with the key, they will ſhew no connection whatever. While we hold the key very near one end of the wire, bring down the pole of a magnet toward the key, and we ſhall then ſee the end of the wire riſe up and ſtick to the key, which will now ſupport it. In like manner, if we lay a quantity of iron filings on the table, and touch them with the key, in the abſence of the magnet, we find the key totally inactive. But, on bringing the magnet any how near the key, it immediately attracts the iron filings, and gathers up a heap of them.

35 Alſo a directive power.

In the next place, this vicinity of a magnet to a piece of iron gives it a directive power. Let NAS (fig. 9.) be a magnet, and BC (n° 1.) a key held near the north pole, and in the direction of the axis. Bring a very ſmall mariner's needle, ſupported on a ſharp point, near the end C of the key which is fartheſt from N. We ſhall ſee this needle immediately turn its ſouth pole towards C, and its north pole away from C. This poſition of the needle is indicated at *c*, by marking its north pole with a dart, and its ſouth with a croſs. Thus it appears that the key has got a directive power like a magnet, and that the end C is performing the office of a north pole, attracting the ſouth pole of the needle, and repelling its north pole. It may indeed be ſaid, that the needle at *c* arranges itſelf in this manner by the directive power of the magnet; for it would take the ſame poſition although the key were away. But if we place the needle at *b*, it will arrange itſelf as there repreſented, ſhewing that it is influenced by the key, and not (wholly at leaſt) by the magnet. In like manner, if we place the needle at *a*, we ſhall ſee it turn its north pole toward B, notwithſtanding the action of the magnet on it. This action evidently tends to turn its north pole quite another way; but it is influenced by B, and B is performing the office of a ſouth pole.

In like manner, if we place the key as at n° 2. we ſhall obſerve the end B attract the ſouth pole of the needle placed at *a*, and the end C attract the north pole of a needle placed in *b*. In this ſituation of the key, we ſee that B performs the office of a north pole, and C performs the office of a ſouth pole.

Thus it appears that the key in both ſituations has become a magnet, poſſeſſed of both an attractive and a directive power. It has acquired two poles.

36 The attraction of iron is owing to the diſpoſition of its own temporary magnetiſm.

Laſtly, the magnetiſm of the key is ſo diſpoſed, that the two magnets NAS and BC muſt mutually attract each other; for their diſſimilar poles front each other. Now, it is a matter of uniform and uncontradicted obſervation, that when a piece of iron is thus placed near a magnet, and the diſpoſition of its magnetiſm is thus examined by means of a mariner's needle, the diſpoſition is ſuch that two permanent magnets with their poles ſo diſpoſed muſt attract each other. The piece of iron, therefore, having the ſame magnetic relation to the magnet that a ſimilar and ſimilarly diſpoſed magnet has, muſt be affected in the ſame manner. We cannot, by any knowledge yet contained in this article, give any preciſe intimation in what way the polarity of the piece of iron will be diſpoſed. This depends on its ſhape as much as on its poſition. By deſcribing two or three examples, a notion is obviouſly enough ſuggeſted, which, although extremely gratuitous, and perhaps erroneous, is of ſervice, becauſe it has a general analogy with the obſerved appearances.

If one end of a ſlender rod or wire be held near the north pole of the magnet, while the rod is held in the direction of the axis (like the key in fig. 7. n° 1.), the near end becomes a ſouth, and the remote end a north pole. Keeping this ſouth pole in its place, and turning the rod in any direction from thence, as from a centre, the remote end is always a north pole. And, in general, the end of any oblong piece of iron which is neareſt to the pole of a magnet becomes a pole of the oppoſite name, while the remote end becomes a pole of the ſame name with that of the magnet.

If the iron rod be held perpendicularly to the axis, with its middle very near the north pole of the magnet, the two extremities of the iron become north poles, and the middle is a ſouth pole.

If the north pole of a magnet be held perpendicular to the centre of a round iron plate, and very near it, this plate will have a ſouth pole in its centre, and every part of its circumference will have the virtue of a north pole.

If the plate be ſhaped with points like a ſtar, each of theſe points will be a very diſtinct and vigorous north pole.

Something like this will be obſerved in a piece of iron of any irregular ſhape. The part immediately adjoining to the north pole of the magnet will have the virtue of a ſouth pole, and all the remote protuberances will be north poles.

The notion naturally ſuggeſted by theſe appearances is, that the virtue of a north pole ſeems to reſide in ſomething that is moveable, and that is protruded by the north pole of the magnet toward the remote parts of the iron; and is thus conſtipated in all the remote edges, points, and protuberances, much in the ſame manner as electricity is obſerved to be protruded to the remote parts and protuberances of a conducting body by the preſence of an overcharged body. This notion will greatly aſſiſt the imagination; and its conſequences very much reſemble what we obſerve.

As a farther mark of the complete communication of every magnetic power by mere vicinity to a magnet, we may here obſerve, that the wire D, of fig. 7. n° 2. and 3. will ſupport another wire, and this another; and ſo on, to a number depending on the ſtrength of the magnet. The key has therefore become a true magnet in every reſpect; for it induces complete magnetiſm on the appended wire. That this is not the ſame operation of the great magnet (at leaſt not wholly ſo), appears by examining the magnetiſm of D with the needle, which will be ſeen to be more influenced by D than by A. This fact has been long known. The ancients ſpeak of it: They obſerve, that a loadſtone cauſes an iron ring to carry another ring, and that a third; and ſo on, till the ſtring of rings appears like a chain.

37 Exception explained.

What has now been ſaid will explain a ſeeming exception to the univerſality of the propoſition. If the key be held in the ſituation and poſition repreſented by fig. 10. the bit of wire will not be attracted by it; and we may imagine that it has acquired no magnetiſm: But if we bring a mariner's needle, or a bit of wire, near to its remote end B, it will be ſtrongly attracted, and ſhew B to be a north pole. The needle held near

to

to C will also shew C to be a south pole. Also, if held near to D, it will shew D to be a north pole. Now the ends C, both of the key and of the wire, being south poles, they cannot attract each other, but, on the contrary, they will repel; and therefore the wire will not adhere to the key. And if the key of fig. 17. n° 4. with the wire hanging to it, be gradually carried outward, beyond the north pole of the magnet, and then brought down till its lower end be level with the pole, the wire will drop off.

There is, however, one exception to the proposition. If the key in fig. 7. with its appending wire D, be gradually carried from any of the situations 2, 3, 4, or 5, toward the middle of the magnet, the wire will drop off whenever it arrives very near the middle. If we suppose a plane to pass through the magnetic centre A, perpendicular to the axis (which plane is very properly called the magnetic equitorial plane by Gilbert), a slender piece of iron, held anywhere in this plane, acquires no sensible magnetism. It gives no indication of any polarity, *and it is not attracted by the magnet*. It is well known, that the activity of a loadstone or magnet resides chiefly in two parts of it, which have been called its poles; and that those are the best magnets or loadstones in which this activity is least diffused; and that a certain circumference of every loadstone or magnet is wholly inactive. When a loadstone or magnet of any shape is laid among iron filings, it collects them on two parts only of its surface, and between these there is a space all round, to which no filings attach themselves.

We presume that the reader already explains this appearance to himself. Many things shew a contrariety of action of the two poles of a magnet. We have already observed, that the north pole of a strong magnet will produce a strong northern polarity in the remote end of a small steel bar; and, if it be then applied near to that end in the opposite direction, it will destroy this polarity, and produce a southern polarity. In whatever these actions may consist, there is something not only different but opposite. They do not blend their effects, as the yellow and blue making rays do in producing green. They oppose each other, like mechanical pressures or impulsions. We have every mark of mechanical action; we have local motion, though unseen, except in the gradual progression of the magnetical faculties along the bar; but we have it distinctly in the ultimate effect, the approach or recess of the magnets: and in these phenomena we see plainly, that the forces, in producing their effects, act in opposite directions. Whatever the internal invisible motions may be, they are composed of motions whose equivalents are the same with the equivalents of the ultimate, external, sensible motions; therefore the internal motions are opposite and equal if the sensible motions are so, and conversely.

Adopting this principle, therefore, that the actions of the two poles are not only different but opposite, it follows, that if they are also equal and act similarly, each must *prevent* the action of the other; and that there will be a mechanical equilibrium—it may even be called a magnetical equilibrium. Therefore if every part of a slender rod, or of a thin plate of iron, lie in the plane of the magnetic equator, the magnetic state (in whatever it may consist) cannot be produced in it. It will exhibit no magnetism; have no polar faculties; and we can see no reason why it should be attracted by the magnet, or should attract iron. We must not forget to observe in this place, that iron in a state of incandescence acquires no magnetism by juxtaposition. We have already remarked, that iron in this state does not affect the magnet. If a bar of red hot iron be set near a mariner's needle, it does not affect it in the smallest degree till it almost ceases to appear red hot in day-light, as has been observed by Dr Gilbert. All actions that we know are accompanied by equal and opposite re-actions; and we should expect, what really happens in the present case, namely, that red hot iron should not be rendered magnetical and attractable.

38 Magnetism not impaired by communication.

There is a very remarkable circumstance which accompanies the whole of this communication of magnetism to a piece of iron. It does not impair the power of the magnet; but, on the contrary, improves it. This fact was observed, and particularly attended to, by Dr Gilbert. He remarks, that a magnet, in the hands of a judicious philosopher, may be made to impart more magnetism than it possesses to each of ten thousand bars of steel, and that it will be more vigorous than when the operations began. A magnet (says he) may be spoiled by injudicious treatment with other magnets, but never can touch a piece of common iron without being improved by it. He gives a more direct proof. Let a magnet carry as heavy a lump of iron as possible by its lower pole. Bring a great lump of iron close to its upper pole, and it will now carry more. Let it be loaded with as much as it can carry while the lump of iron touches its upper pole. Remove this lump, and the load will instantly drop off. But the following experiment shews this truth in the most convincing manner:

Let NAS (fig. 11.) be a magnet, not very large, nor of extreme hardness. Let CD be a strong iron wire, hanging perpendicularly from a hook by a short thread or loop. The magnet, by its action on CD, renders D a north pole and C a south pole, and the polarity of D's magnetism fits it for being attracted. Let it assume the position C *e*, and let this be very carefully marked. Now bring a great bar of iron *s* B *n* near to the other end of the magnet. We shall instantly perceive the wire C *e* approach to the south pole of the magnet, taking a position C *f*. Withdraw the bar of iron, and C *f* will fall back into the position C *e*. As we bring the iron bar gradually nearer to the magnet, the wire will deviate farther from the perpendicular, and when the bar B touches the magnet CD, will start a great way forward. It is also farther to be observed, that the larger the bar of iron is, the more will CD deviate from the perpendicular.

Now this must be ascribed to the action of the bar on the magnet. For if the magnet be removed, the bar alone will make no sensible change on the position of the wire. We know that the bar of iron becomes magnetical by the vicinity of the magnet. If we doubt this, we need only examine it by means of a piece of iron or a mariner's needle. This will shew us that *s* has become a south, and *n* a north pole. Here then are two magnets with their dissimilar poles fronting each other. In conformity with the whole train of magnetical phenomena, we must conclude that they attract each other, and must improve each other's magnetism.

This is a most important circumstance in the theory of

39 Therefore nothing is transferred.

of magnetiſm. For it ſhews us, that, in rendering a piece of iron magnetic, there is no material communication. There is no indication of the transference of any ſubſtance reſiding in the magnet into the piece of iron; nor is there even any transference of a power or quality. Were this the caſe, or if the ſubſtance or quality which was in A be now transferred to B, it can no longer be in A; and therefore the phenomena reſulting from its preſence and agency muſt be diminiſhed. We muſt ſay that the magnet has excited powers inherent, but dormant, in the iron; or is, at leaſt, the occaſion of this excitement, by diſturbing, in ſome adequate manner, the primitive condition of the iron. We muſt alſo ſay, that the competency of the magnet and of the iron to produce the phenomena, is owing to the ſame circumſtances in both; becauſe we ſee nothing in the phenomena which authoriſes us to make any diſtinction between them. Whatever therefore cauſes one magnet to attract another, is alſo the reaſon why a piece of iron in the neighbourhood of a magnet attracts another piece of iron; and we muſt ſay that the cauſe of polarity, or the origin of the directive power, is the ſame in both. Now we underſtand perfectly the directive power of a magnet, as exerted on another magnet. We ſee that it ariſes from a combination and mechanical compoſition of attractions and repulſions. It muſt be the ſame in this magnetiſm now inherent in the iron. The piece of iron directs a mariner's needle, as a magnet would direct it; therefore, as there is ſomething in a piece of iron which *now* attracts ſomething in another piece of iron, ſo there is ſomething in the firſt which repels ſomething in the laſt.

40 Objections anſwered by a curious fact.

It may indeed be ſaid that it is not a piece of iron, but a mariner's needle, or magnet, that is thus directed by our iron magnetiſed by vicinity to a magnet. This objection is completely removed by the moſt curious of all the facts which occur in this manner of producing magnetiſm. Take a piece of common iron, faſhion it, and fit it up preciſely like a mariner's needle, and carefully avoid every treatment that can make it magnetical. Set it on its pivot, and bring it near the north pole of a magnet, placing the end, made like the ſouth pole of the needle, next to the north pole of the magnet. In ſhort, place it by hand exactly as a real mariner's needle would arrange itſelf. It will retain that poſition. Now carry it round the magnet, along the circumference of a magnetic curve, or in any regular and continuous route. This piece of iron will, in every ſituation, aſſume the very ſame poſition or attitude which the real magnetical needle would aſſume if in the ſame place, and it will oſcillate preciſely in the ſame way.

Here then it is plain, that there is no diſtinction of power between the magnetiſm of the iron and of the real needle. To complete the proof: Inſtead of approaching the magnet with this iron needle, bring it into the vicinity of a piece of iron, which is itſelf magnetical only by vicinity to a magnet, it will arrange itſelf juſt as the real needle would do, with the ſole difference, that it does not indicate the *kind* of polarity exiſting in the extremities of the iron, becauſe either end of it will be attracted by them. And this circumſtance leads us to the conſideration of the only diſtinction between the magnetiſm of a loadſtone or magnet and that of common iron.

The magnetiſm of common iron is momentary, and therefore indifferent; whereas that of a magnet is permanent and determinate. When iron becomes magnetic in the way now mentioned, it remains ſo only while the magnet remains in its place; and when that is removed, the iron exhibits no ſigns of magnetiſm. Therefore when the north pole of a magnet has produced a ſouth pole in the neareſt end of an iron wire, and a north pole at its remote end, if we turn the magnet, and preſent its ſouth pole, the neareſt end of the wire inſtantly becomes a north pole, and the other a ſouth pole; and this change may be made as often, and as rapidly, as we pleaſe. This is the reaſon which made us direct the experimenter on the iron needle to begin his operation, by placing the end marked for a ſouth pole next to the north pole of the magnet. It becomes a real ſouth pole in an inſtant, and acts as ſuch during its peregrination round the magnet. But in any one of its ſituations, if we turn it half round with the finger, the end which formerly turned away from a pole of the magnet, will now turn as vigorouſly toward it. Therefore, in carrying the iron needle round the magnet, we directed the progreſs to be made in a continuous line, to avoid all chance of miſtaking the polarities.

41 Magnetiſm of iron is tranſitory and indifferent; but that of magnets is durable and determinate.

42 Magnetiſm of Induction.

For all the reaſons now adduced, we think ourſelves obliged to ſay, that the magnetiſm produced on common iron by mere juxtapoſition to a magnet, is generated without any *communication* of ſubſtance or faculty. The power of producing magnetical phenomena is not *ſhared* between the magnet and the iron. We ſhall call it INDUCED MAGNETISM; MAGNETISM BY INDUCTION.

We have ſaid that induced magnetiſm of common iron is quite momentary. This muſt be underſtood with careful limitations. It is ſtrictly true only in the caſe of the fineſt and pureſt ſoft iron, free of all knots and hard veins, and therefore in its moſt metallic ſtate. Iron is rarely found in a ſtate ſo very pure and metallic; and even this iron will acquire permanent and determinate magnetiſm by induction, if it has been twiſted or hammered violently, although not in the magnetic direction; alſo the changes produced (we imagine) on the pureſt iron by the action of the atmoſphere make it ſuſceptible of fixed magnetiſm. But the magnetiſm thus inducible on good iron is ſcarcely ſenſible, and of no duration, unleſs it has lain in the neighbourhood of a magnet for a very long while.

What has now been ſaid of common iron, is alſo true of it when in the ſtate of ſoft ſteel.

43 Tempered ſteel acquires durable magnetiſm.

But any degree of temper that is given to ſteel makes a very important change in this reſpect. In the firſt place, it acquires magnetiſm more ſlowly by induction than an equal and ſimilar piece of common iron, and finally acquires leſs. Theſe differences are eaſily examined by the deviations which it cauſes in the mariner's needle from the magnetic meridian, and by its attraction.

When the inducing magnet is removed, ſome magnetiſm remains in the ſteel bar, which retains the polarity which it had in the neighbourhood of the magnet.

Steel tempered to the degree fit for watch ſprings acquires a ſtrong magnetiſm, which it exhibits immediately on the removal of the magnet. But it diſſipates very faſt; and, in a very few minutes, it is reduced to leſs than one-half of its intenſity while in contact with the magnet, and not two thirds of what it was immediately on removal from it. It continues to diſſipate for

ſome

fome days, though the bar be kept with care; but the diffipation diminifhes faft, and it retains at leaft one-third of its greateft power for any length of time, unlefs carelefsly kept or injudicioufly treated.

Steel tempered for ftrong cutting tools, fuch as chifels, punches, and drills for metal, acquires magnetifm ftill more flowly by induction, and acquires lefs of it while in contact with the magnet; but it retains it more firmly, and finally retains a greater proportion of what it had acquired.

Steel made as hard as poffible, is much longer in acquiring all the magnetifm which fimple juxtapofition can give to it. It acquires lefs than the former; but it retains it with great firmnefs, and finally retains a much greater proportion.

Such ores of iron as are fufceptible of magnetifm, are nearly like hard fteel in thefe refpects; that is, in the time neceffary for their *greateft* impregnation, and in the durability of the acquired magnetifm. They differ exceedingly in refpect to the degree of power which they can attain by mere juxtapofition, and the varieties feem to depend on heterogeneous mixture. We muft obferve, that few ores of iron are fufceptible of magnetifm in their natural ftate. The ordinary ores, confifting of the metal in the ftate of an oxyd, and combined with fulphur, are not magnetizable while remaining in that ftate. Moft ores require roafting, and a fort of cementation, in contact with inflammable fubftances. This matter is not well underftood; but it would feem that complete metalization is far from being the moft favourable condition, and that a certain degree of oxydation, and perhaps fome other compofition, yet unknown, make the beft loadftones. But all this is extremely obfcure. The late Dr Gowin Knight made a compofition which acquired a very ftrong and permanent magnetifm, but the fecret died with him. Dr Gilbert fpeaks of fimilar compofitions, in which ferrugineous clays were ingredients; but we know nothing of the ftate of the metal in them, nor their mode of acquiring magnetifm.

44 Induction of magnetifm is gradual and progreffive.

It is of peculiar importance to remark that the acquifition of magnetifm is gradual and progreffive, and that the gradation is the more perceptible in proportion as the fteel is of a harder temper. When a magnet is brought to one end of a bar of common iron, its remote extremity, unlefs exceedingly long, acquires its utmoft magnetifm immediately. But when the north pole of a magnet is applied to one end of a bar of hard fteel, the part in contact immediately becomes a fouth pole, and the far end is not yet affected. We obferve a north pole formed at fome diftance from the contact, and beyond this a faint fouth pole. Thefe gradually advance along the bar. The remote extremity becomes firft a faint fouth pole, and it is not till after a very long while (if ever) that it becomes a fimple, vigorous, north pole. More frequently it remains a diffufed and feeble north pole: nay, if the bar be very long, it often happens that we have a fucceffion of north and fouth poles, which never make their way to the far end of the bar. This phenomenon was firft obferved (we think) by Dr Brook Taylor, who gives an account of his obfervations in the *Philofophical Tranfactions*, n° 344.

45 Iron is attracted only becaufe it becomes magnetical.

From the account we have given of thefe phenomena of induced magnetifm, it appears that the temporary magnetifm is always fo difpofed that the fum of the mutual attractions of the diffimilar poles exceeds the fum of the repulfions between the fimilar poles, and that therefore the two magnets tend to each other. This is evidently equivalent to faying, that a piece of unmagnetic iron is always attracted by a magnet. No exception has ever been obferved to this fact; for Pliny's ftory of a Theamedes, or loadftone, which repels iron, is allowed by all to have been a fable.

We think ourfelves authorifed to fay that this attraction of the loadftone for iron, or this tendency of iron to the loadftone, is a fecondary phenomenon, and is the *confequence* of the proper difpofition of the induced magnetifm. The proofs already given of the compound nature of this phenomenon, namely, that it arifes from the excefs of two attractions above two repulfions, need (we imagine) no addition. But the following confiderations place the matter beyond doubt:

1. The magnetifm of the two poles is evidently of an oppofite nature; the one repelling what the other attracts. If the one attracts iron, therefore, the other fhould repel it. But each pole, by inducing a magnetifm oppofite to its own, on the neareft end of the iron, and the fame with its own on the remote end, and its action diminifhing with an increafe of diftance, there muft always be an excefs of attraction, and the iron muft be attracted.

2. Each of the magnets A and B, in either of the pofitions reprefented in fig. 12. would alone attract the piece of common iron C. But when placed together, the fouth pole of A tends to render the upper end of C a north pole; while the north pole of B tends to make it a fouth pole. If their actions be nearly equal, the weight of C cannot be fupported by the magnetifm induced by any difference of action that may remain. While C is hanging by B alone, let A be gradually brought near; it gradually deftroys the action of the north pole of B, fo that C gradually lofes it magnetifm and polarity, and its weight prevails.

3. In all thofe cafes where the induction of magnetifm is flow, the attraction is weak in proportion. This is particularly remarked by Dr Gilbert. If we take pieces of common iron, and of fteel of different tempers, but all of the fame fize and form, we fhall find that the iron is much more ftrongly attracted than any of the reft, and that the attraction for each of them is weaker in proportion as they are harder. This diverfity is fo accurately obferved, that when the piece is thoroughly fufceptible of magnetifm, we can tell, with confiderable precifion, what degree will be ultimately acquired, and how much will be finally retained. Alfo, the attraction of the magnet for any of thofe pieces of fteel increafes exactly in proportion as their acquired magnetifm increafes.

4. An ore of iron incapable of acquiring magnetifm is not attracted by a magnet. But we know that, by cementation with charcoal duft, they may be rendered fufceptible of magnetifm. In this ftate they are attracted. It is an univerfal fact, that any fubftance that is attracted by a magnet may be rendered magnetical, and that none elfe can. We have already obferved that red hot iron is not attracted; nor does it acquire any directive power while in that ftate. From all this we muft conclude, that the previous induction of magnetifm is the mean of the obferved attraction of magnets for iron, and that this is not a primary fact in magnetifm.

These

These observations also complete the proof that magnetic attraction and repulsion are equal at the same distance, and follow the same law. Dr Gilbert seems to think that the repulsion is always weaker than the attraction; and this is almost the only mistake in conception into which that excellent philosopher has fallen. But it only requires a fair comparison of facts to convince a good logician, that since, *in every case*, and at every distance, either pole of a magnet attracts either end of a piece of common iron, it is impossible that one of these forces can exceed the other. It might be so, were it not that induced magnetism is durable in proper substances. And if we take magnets which have been made such by induction, and present them to each other with their similar poles fronting each other, they never fail to repel each other at considerable distances, and even at very small distances for a few moments; and this is the case whichever poles are next each other. This cannot be on any other supposition. Cases would occur of polarity without attraction, or of attraction without polarity. Such have never been seen, any more than the Theamedes, always repelling iron.

46 **Phenomena of iron shreds and filings.** Let a great number of small oblong pieces of iron be lying very near each other on the surface of quicksilver. Bring a strong magnet into the midst of them. It immediately renders them all magnetical by induction. The one nearest the north pole of the magnet immediately turns one end toward it, and the other end away from it. The same effect is produced on the one that is just beyond this nearest one. Thus the remote end of the first becomes a north pole, and the nearest end of the second becomes a south pole. These, being very near each other, must mutually attract. The same thing may be said of a third, a fourth; and so on. And thus it appears, that not only is magnetism induced on them all, but also, that the magnetism of each is so disposed, that both ends of it are in a state of attraction for the ends of some of its neighbours; and that they will therefore arrange themselves by coalescence in some particular manner. Should a parcel of them chance to be standing with their centres in a magnetic curve, with their heads and points turned in any ways whatever, the moment that the magnet is brought among them, and set in the axis of that magnetic curve, the whole pieces of this row will instantly turn towards each other, and their ends will adhere together, if they are near enough; otherwise they will only point toward each other, forming a set of tangents to the magnetic curve, reaching from one pole of the magnet to the other.

Or, suppose a vast number of small bits of iron, each shaped like a grain of barley, a little oblong. Let them be scattered over the surface of a table, so near each other as just to have room to turn round. Let a magnet be placed in the midst of them. They will all have magnetism induced on them in an instant; and such as are not already touching others, will turn round (because they rest on the table by one point only), and each will turn its ends to the ends of its neighbours; and thus they will arrange themselves in curves, which will not differ greatly from true magnetic curves (because each grain is very short), issuing from one pole of the magnet, and terminating in the other.

Does not this suggest to the reflecting reader an explanation of that curious arrangement of iron filings round a magnet, which has so long entertained and puzzled both the philosophers and the unlearned, and which has given rise to the Cartesian and other theories of magnetism? The particles of iron filings are little rags of soft iron torn off by the file, and generally a little oblong. These *must* have magnetism induced on them by a magnet, and, while falling through the air from the hand that strews them about the magnet, they are at perfect liberty to arrange themselves magnetically; and *must therefore so arrange themselves*, forming on the table curves, which differ very little indeed from the true magnetic curves. Suppose them scattered about the table before the magnet is laid on it. If we pat the table a little, so as to throw it into tremors, this will allow the particles to dance, and turn round on their points of support, till they coalesce by their ends in the manner already described.

All this is the genuine and inevitable consequence of what Dr Gilbert has taught us of induced magnetism. It must be so; and cannot be otherwise. This curious arrangement of iron filings round a magnet is therefore not a primary fact, and a foundation for a theory, but the result of principles much more general.

Most of our readers know that this disposition of iron filings has given rise to the chief mechanical theories which have been proposed by ingenious men for the explanation of all the phenomena of magnetism. An invisible fluid has been supposed to circulate through the pores of a magnet, running along its axis, issuing from one pole, streaming round the magnet, and entering again by the other pole. This is thought to be indicated by those lines formed by the filings. The stream, running also through *them*, or around them, arranges them in the direction of its motion, just as we observe a stream of water arrange the flote grass and weeds. It would require a volume to detail the different manners in which those mechanicians attempt to account for the attraction, repulsion, and polarity of magnetic bodies, by the mechanical impulsion of this fluid. Let it suffice to say, that almost every step of their theories is in contradiction to the acknowledged laws of impulsion. Nay, the whole attempt is against the first rule of all philosophical discussion, never to admit for an explanation of phenomena the agency of any cause which we do not know to exist, and to operate in the very phenomenon. We know of no such fluid; and we can demonstrate, that the genuine effects of its impulsion would be totally unlike the phenomena of magnetism. But the proper refutation of these theories would fill volumes. Let it suffice (and to every logician it will abundantly suffice) to remark, that this phenomenon is but a secondary fact, depending on, and resulting from, principles much more general, viz. the induction of magnetism, and the attraction of dissimilar, and repulsion of similar, poles. 47 **Remarks on the theories by impulsion.**

The above explanation of the curious disposition of iron filings round a magnet, occurred to the writer of this article while studying natural philosophy, on seeing the Professor exhibit Mr Henshaw's beautiful experiment in proof of terrestrial magnetism*. He at that time imagined himself the author, and promised himself some credit for the thought. But having seen the *Physiologia Nova de Magnete* by Dr Gilbert, he found that it had not escaped the notice of that sagacious philosopher; as will appear past dispute from the following passage, as well as some others, less pointed, in that work:

* See Variation, *Encycl.* p. 631.

work. "Magnetica frusta (that is, substances susceptible of magnetism) bene et convenienter intra vires posita, mutuo cohærent. Ferramenta, presente magnete (etiamsi magnetem non attingant), concurrunt, solicité se mutuo quærunt, et amplexantur, et, conjuncta, quasi ferruminantur. Scobs ferrea, vel in pulverem redacta, fistulis imposita chartaceis—supara lapidem meridionaliter locata, vel propius tantum admota, in unum coalescet corpus; et subito tam multæ partes concrescunt et combinantur; ferrumque aliud affectat conjuratorum turma et attrahit, ac si unum tantum et integrum esset ferri bacillum; dirigiturque supra lapidem in septemtriones et meridiem Sed cum longius a magnete removeantur (tanquam soluta rursus) separantur, et diffluunt singula corpuscula." B. ii. c. 23.

Mr Æpinus also had taken the same view of the subject*. It is also very clearly conceived and expressed by the celebrated David Gregory, Savilian Professor of astronomy in the University of Oxford, in a MS. volume of notes and commentaries, written by him in 1693, on Newton's *Principia*, and used by Newton in improving the second edition. The M. S. is now in the library of the university of Edinburgh. Gregory's words are as follow: "Mihi semper dubium visum est num magnetica virtus mechanicé, *i. e.* per impulsum, producatur. Mirum est, efflavia, quæ ferrum agitare valent, bracteas aureas *interpositas* ne vel minimum a loco movere. Lucretii et Cartesii theoriam, de fugato intermedio aëre, refutat experimentum infra aquam institutum. *Sul i in limatura ferri, magneti in plano cujusvis meridiani circumposita, non sunt ab effluviis secundum ipsos canales motis, sed ex inde, quod ipsa ramenta, magnetice excitata, sese secundum longitudinem et secundum polos disponunt.* Ex altera vero parte exinde quod vis magnetica, interveniente flamma aut calore, interrumpatur, quod virga ferrea, vel diuturno situ perpendiculari, vel in eo situ frigescendo, virtutem magneticam a tellure acquirat, ut nos docet perspicacissimus Gilbertus. Quod mallei super incudem ictu forti ad alterum extremum, virtutem acquirat magneticam; quod ictu forti vel saltem fortiori ad alterum extremum poli permutantur, ut qui prius septemtriones respiciebat nunc austrum respicit; quod ictu forti ad medium, virtutem illam prorius amittat. Hæc inquam, et similia, mechanicam ejus qualitates ortum arguunt. Hugenius præter gravitatem, etiam magneticam, et electricam virtutem, aliasque plures experimento novit vires naturales, ut mihi ipsi narravit hac estate anni 1693. Qualis ut hæc forsitan quod cymba papyracea, prope labia vasis aquam, cui innatet, continentis, posita, labrum vicinidimum continue, et cum impetu petat (A)." *Nat. MS. in Prop.* 23. ii. *Prin.*

* See § 306.

48 Filings are weakly attracted.

Not only the mere arrangement of the filings in curve lines follows of necessity from the properties of induced magnetism, but all the subordinate circumstances of this phenomenon are included in the same explanation. By continuing to tap the table, and throw it into tremors, the filings are observed to approach gradually, but very slowly, to the poles of the magnet. Each particle is a very small temporary magnet. The attractive power of the great magnet, $\overline{m-p}-\overline{n-q}$, is therefore extremely small in proportion to its directive power, $\overline{m+p}-\overline{n+q}$. And we observe that the accumulation of the filings round the poles of the magnet is so much the slower as the filings are finer.

49 Curious fact.

If a paper be laid above the magnet, and the filings be sprinkled on it, we observe them to constipate along its edges, while none remain immediately above its substance; they are all beyond, or on the outside of its outline, and they are observed not to be lying flat on the paper, but to be standing obliquely on one point. They move off from the paper immediately above the magnet, because they repel each other. They stand obliquely from the edges because that is the direction of a magnetic meridian at its parting from the pole. If the magnet be at some distance below the paper, then tapping the paper will cause the filings to move away from the magnet laterally. This singular and unexpected appearance is owing to the combination of gravity with the magnetic action. A particle, such as *n s* (fig. 13.), rests on the paper by the point *n*, which is a temporary north pole (S being supposed the south pole of the magnet). The particle takes a position *n s* nearer to the horizon than the position *n o*, which it would take if its centre of gravity *b* were supported. The position is such, that its weight, acting vertically at *b*, is in equilibrio with the magnetic repulsion *s d*, exerted between S and *s*. When the paper is tapped, it is beaten down, or withdrawn from *n*, and the particle of iron is left for a moment in the air. It therefore turns quickly round *b*, in order to assume a position parallel to *n o*, and it meets the paper, as that rises again after the stroke, in a point farther removed from the magnet, and again descends by its weight (turning round the newly supported point *n*), till it again takes a position parallel to *n s*, but farther off, as represented by the dotted line. Thus it travels gradually outwards from the magnet appearing to be repelled, although it is really attracted by it. If the magnet be held above the paper, at a little distance, the filings, when we repeatedly pat the paper, gradually collect into a heap under it. This will appear very plainly to one who considers the situation of a particle in the manner now explained.

50 Filings arrange in magnetic curves.

The curve lines formed by very fine filings approach very nearly to the form of the primary curve which indicates the law of magnetic action in the way already explained. If the magnet be placed under water, and if filings be sprinkled copiously on the surface of it from a gauze searce, held at some distance above it, the resistance to their motion through the water gives them time to arrange themselves magnetically before they reach the bottom, and the lines become more accurate. But they were so much deranged by any method that we could take for removing the water, and measuring them, that we were disappointed in our expectations of obtaining a very near approximation to the law of action.

51 Also in secondary curves.

We took notice of some very singular phenomena of a compass needle in the neighbourhood of two magnets, and we observed that, in this case also, the needle was always a tangent to a curve of another kind, and which we called *secondary* and *compound magnetic curves*. These are

(A) Perhaps it may be proper to observe, that Dr Gregory expresses his differing in his opinion from Newton about magnetism. Newton, in this proposition, thinks, that the law of magnetic action approaches to the inverse triplicate ratio of the distances. Dr Gregory invalidates the argument used by Newton.

are produced in the fame way, by ftrewing iron filings round the magnets. Many reprefentations have been given of thefe curves by different authors, particularly by Mufchenbroek, in his *Effais de Phyfique*; and by Fufs in the *Comment Petropolit*. Great ufe has been made of thefe arrangements of filings by two magnets in the theories of magnetifm propofed by thofe who infift on explaining all motion by impulfe. When the diffimilar poles of two magnets A and B (fig. 14.) face each other, the curves formed by the filings confiderably refemble thofe which furround a fingle magnet, and give the whole fomewhat of the appearance of a magnet with very diffufed poles. The arranging fluid, which ftreams from one pole of a magnet, is fuppofed to meet with no obftruction to its entry into the adjoining pole of the other magnet, but, on the contrary, to be impelled into it; and therefore (fay the propofers) it circulates round both as one magnet, and by its vortex brings the magnets together; which phenomenon we call the attraction of the magnets. But when the fimilar poles front each other; for example, the poles from which the arranging fluid iffues, then the two ftreams meet, obftruct each other, accumulate, and, by this accumulation, caufe the magnets to recede from each other; which we call the repulfion of the magnets. This is the only explanation of this kind that can make any pretenfions to probability, or indeed that can be conceived. For how the free circulation in the former cafe can bring the two magnets together, no perfon can form to himfelf any conception. We fee nothing like this produced by any vortex that we are acquainted with. All fuch vortices caufe bodies to feparate. But even this explanation of magnetic repulfion is inadmiffible. It will not apply to the repulfion of the receiving poles; and the phenomena of the filings are inconfiftent with the notion of accumulation. The filings indeed accumulate, and they look not unlike two ftreams which oppofe each other, and deflect to the fides (See fig 15.): But, unfortunately, by tapping the paper gently, the filings do not move off from the magnets, but approach them much fafter than in any other experiment. The phenomenon receives a complete and palpable explanation from the principles we have eftablifhed. Both magnets concur in giving the fame polarity to every particle of the filings. Thus, if the fronting poles are north poles, each particle has its neareft end made a vigorous fouth pole, and its remote end a north pole; and it is *therefore* ftrongly attracted towards both magnets while it is arranged in the tangent to the fecondary curve of that clafs, which croffes the others nearly at right angles.

52 Magnets muft affect each other.

Since it is found, that the magnetifm, even of natural loadftones and hard fteel, and ftill more thofe of fofter tempered fteel, are continually tending to decay; and fince we find that it may be induced by mere approach to a magnet; and fince we knew that magnets may oppofe, each other in producing it—it is reafonable to fuppofe, that when a piece of iron has acquired a flight, though permanent magnetifm, by the vicinity of a magnet, a magnet applied in the oppofite direction will deftroy it, and afterwards produce the oppofite magnetifm.

Accordingly, we may change the poles of foft magnets at pleafure.

Farther; fince we find that loadftones and hard tempered fteel bars are diftinguifhed from foft ones only by the *degree* of obftinacy with which they retain their prefent condition, we fhould alfo expect that hard magnets will even affect each other. It muft therefore happen, that a powerful magnet applied to a weak one, fo that their fimilar poles are in contact, fhall weaken, deftroy, and even change the the magnetifm of the weaker. Dr Knight's famous magazine of magnets enabled him to change the poles of the greateft and the ftrongeft natural loadftone, or artificial magnet, that could be given him, in the fpace of one minute.

53 Attraction muft appear to exceed repulfion.

We now fee clearly the reafon why magnetic repulfion is weaker than attraction at the fame diftance. When magnets are placed with their fimilar poles fronting each other, in order to make trials of their repulfion, they really do weaken each other and are not in the fame magnetical condition as before. For fimilar reafons, we fee how experiments with magnets attracting each other rather improve them, and make their attractive powers appear greater than they are. All thefe effects muft be moft remarkable in foft magnets, efpecially when long.

54 The obferved law differs from the true.

We alfo fee, that the obferved law of attraction and repulfion between two magnets muft be different from the real law of magnetic action. For, in the experiments made on attraction at different diftances, beginning with the greateft diftance, the magnetifm is continually increafing, and the attraction will appear to increafe in a higher rate than the juft one; the contrary may happen, if we begin with the fmaller diftances. The refults of experiments on repulfion muft be ftill more erroneous; becaufe it is eafier to diminifh any accumulation which required an exertion to produce it, than to pufh it ftill farther.

55 Magnetifm improves by inducing it on iron.

We have now a complete explanation of the remarkable fact, that the induction of magnetifm does not weaken the magnet employed; but, on the contrary, improves it. The magnetifm induced on the iron caufes it to act on the magnet employed in the very fame manner that a permanent magnet of the fame fhape, fize, and ftrength, would do. Nay, it will have even a greater effect; for as it improves the magnet, its own induced magnetifm will improve; and will therefore ftill farther improve the magnet.

56

Hence it is, that, in whatever manner a magnet touches a piece of iron, it improves by it. It may be hurt by a magnet in an improper pofition; but it always puts common iron into a ftate which increafes its own magnetifm. This has been known as long as magnetifm itfelf; and the ancients conceived the notion, that the magnet fomehow fed upon the iron (B).

We

(B) So Claudian.——" Nam ferro nutrit vitam, ferrique vigore
Vefcitur, hoc dulces epulas, hoc pabula novit
Hinc proprias renovat vires, hinc fufa per artus
Afpera fecretum fervant alimenta vigorem
Hoc abfente perit trifti moerentia torpent
Membra fame, venafque fitis confumit apertas."

Pliny fays, " Sola hæc materia (ferrum) vires ab eo lapide, accipit retinetque longo tempore, aliud apprehendens ferrum, ut annulorum catena fpectetur interdum, quod imperitum vulgus ferrum appellat vivum.

We think that these observations authorise us to say, that in reducing a loadstone into a convenient shape, as much as possible of the operation should be performed by grinding them with emery, in cavities made in large blocks of *hammered* iron. The magnetism induced on the iron must be favourable to the conservation of that in the loadstone; which, we are persuaded, is rapidly dissipated by the tremors into which this very elastic substance is thrown by the grinding with coarse powders in any mould but iron. We imagine, that the cutting off slices by the lapidaries wheel has the same bad effect.

57. Not only will a magnet lift a greater lump of iron by its north pole, when another lump is applied to its south pole, but it will lift a greater piece of iron from an anvil than from a wooden table: for the magnet induces the properly disposed polarity, not only in the iron which it lifts, but also in the anvil, or any piece of iron immediately beyond it. This is so disposed as to increase the magnetism of the piece of iron between them; and therefore to increase their attraction. The magnetism induced on the anvil is also in part, and perhaps chiefly, induced by the intervening iron. These experiments are extremely variable in their results.—Sometimes a small magnet will pull an iron wire from a large and strong one. Sometimes this will be done even by a piece of unmagnetic iron; and the results appear quite capricious. But they are accurately fixed, depending on the induced compound magnetism. Mr Æpinus has stated some of the more simple cases, in which we can tell which magnet shall prevail. But the unfolding even of these cases would take a great deal of room, and must be omitted here. Besides, we are too imperfectly acquainted with the degree of magnetism induced on the various parts of an iron rod, and the degree of magnetism inherent in the various parts of the magnets, to be able to say, with certainty, even in those simple cases, on which side the superiority of attraction will remain.

58. Making of artificial magnets.

We may now proceed to deduce from this theory (for so it may justly be called, since all is reduced to one fact) the process for communicating magnetism to bodies fitted for receiving and retaining it; that is, the method of making artificial magnets. We shall not employ much time on this, because the most approved methods have been delivered at length in the article Magnetism of the *Encyclopædia;* and therefore we shall just make such observations on them as serve to confirm, or to perfect them by the theory. We acknowledge, that we do not know the internal process by which magnetism is induced, nor even in what this magnetism consists. All that we know is, that the bringing the pole of a magnet near to any magnetisable matter, produces a magnetism of the kind opposite to that of the pole employed. We know that this is the case with both poles, and that it obtains at all the distances where magnetism is observed. We know that the action of one pole is contrary to that of the other; that is, it counteracts the other, prevents it from producing its effect, and destroys it when already produced: and we know, that the production of these effects resembles in its result the protrusion of something fluid through the pores of the body, constipating it in all remote parts; as if the virtue of a pole resided in this moveable matter. This is nearly all that we know of it; and by these facts and notions we must judge of the propriety and effect of all the processes for magnetising bodies.

The most simple method of magnetising a steel bar, is to apply the north pole of a magnet to that end which we wish to render a south pole. Attention to the effects of this application is very instructive. Have in readiness a very small compass needle, turning on its pivot. It should not exceed half an inch in length, and should be as hard tempered as possible, and strongly impregnated. Immediately after the application of the magnet, carry the needle along the side of the bar. If the bar be long, and very hard, we shall observe a south polarity at the place of contact; a north polarity at a small distance from it; beyond this a weak south polarity; then a weak and diffused north polarity, &c.; toward the remote end the polarity will be found very uncertain. The same thing may be discovered by laying a stiff paper on the bar, and sprinkling iron filings over it, and then gently tapping the paper, to make them arrange themselves in curve lines; which will point out the various poles, and shew whether they are diffused or constipated. It is very amusing and instructive to observe the progress of this impregnation. In a few minutes after the first application of the magnet, we shall perceive the state of magnetism very sensibly changed. The north pole will be farther from the magnet, and will be more distinct; the southern polarity will also be protruded, and may appear for a moment at the remote extremity. The change advances; but the progress is more slow, and at last is insensible. When the bar is not harder than the temper of a cutting tool, the process is soon over; and if the bar is but six or eight inches long, the remote end shews the north polarity in a very few minutes. When the bar is very hard, the progress of impregnation is greatly expedited by striking it so as to make it sound. If it be suspended by a string in a vertical position, and the magnet applied to its lower end, the striking it with a key will make it ring; and in this way make the progress of magnetization very quick: but it does not allow it to acquire all the magnetism that can be given it by a very strong magnet.

But this is a bad way of impregnation. It is seldom that uniform magnetism, with only two poles, and those of equal strength, can be given. Even when there are but two, the remote pole is generally diffused, and therefore feeble. It is much improved by employing two magnets, one at each end. And if the bar is not more than six or eight inches long, and good magnets are employed, the magnetism is abundantly regular. This, accordingly, is practised for the impregnation of dipping needles, which must not be touched, lest we disturb the centre of gravity of the needle. But in all cases, this method is tedious, and does not give strong magnetism.

The method which was usually practised before we had obtained a pretty clear knowledge of magnetism, was to apply the pole of a magnet to one end of the bar, and pass it along to the other end, pressing moderately. This was repeated several times on both sides of the bar, always beginning the stroke at the same end as at first, and, in bringing the magnet back to that end, keeping it at a distance from the bar. The effect

of

of this operation was to leave the end at which we began the stroke possed of the polarity of the pole employed.

A general notion of the process may be given as follows, observing, however, that there occur very many great and capricious anomalies. When the north pole N (fig. 16) of the magnet A is set on the end C of the bar CBD, a south pole is produced at C, and a north pole at D, when the length of the bar is moderate. As the magnet advances slowly along the bar, the southern polarity at C first increases, then diminishes, and vanishes entirely when N has arrived at a certain point *a*; after which, a northern polarity appears at C, and increases during the whole progress of the magnet. In the mean time, the northern polarity first produced at D increases till the magnet reaches a certain point *e*, then diminishes, vanishes when the magnet reaches a certain point *f*; after which, a southern polarity appears at D, which increases till the magnet reaches D. Mr Brugmann, who first attended minutely to these particulars (for Gilbert speaks of them pointedly), calls *a* and *f* *points of indifference*, and *e* the *culminating* point of the pole D, and *i* the culminating point of the pole C. Hardly can any general rule be given for the situation of these points, nor even for the order in which they stand; so great and capricious are the anomalies in an amazing series of experiments narrated by Brugmann and by Van Swinden. Repeating the operation, and beginning at C, the northern polarity there is weakened (sometimes destroyed), then restored, and continually increased during the rest of the stroke. The southern polarity at D is also first weakened, and sometimes destroyed; then restored, and finally augmented. The points *i*, *a*, *e*, *f*, change their situations, and frequently their order.

Van Swinden has attempted to deduce some general laws from his immense list of experiments, avoiding every consideration of a hypothesis, or the least conjecture by what means these faculties are excited. But though we have perused his investigation with care and candor, we must acknowledge, that we have not derived any knowledge which can help us to predict the result of particular modes of treatment with any greater precision than is suggested by a sort of common sense, aided (or perhaps perverted) by a vague notion, that these energies reside in something, which avoids the pole of the same name, carrying along with it this distinctive energy or polarity. This conception tallies perfectly with these observations of Brugmann and Van Swinden; and admits of all the anomalies in the situation of Brugmann's indifferent and culminating points, if we only suppose that this motion is obstructed by the particles of the body. We must leave this to the reflection of the reader, who will *guess* how, when the magnet is between C and *i*, this substance, avoiding the pole N of the magnet, escapes below it, and goes toward the farther end. As the magnet advances, it drives some of this back again, &c. &c. This is gratuitous; but it aids the fancy, which, without some conception of this kind, has no object of steady contemplation. We have no thought when we speak of the generating at C, or *a*, or *e*, a faculty of some kind, by the exertion of the same faculty in N. The conception is too abstracted, and much too complex. We must content ourselves with knowing, that N produces a south pole immediately under it, and a north pole everywhere else, or endeavours to do so. It is unnecessary to insist longer on this method: Common sense shews it to be a very injudicious one.

This method was greatly improved by beginning the friction at the centre. Apply the north pole at the centre or middle of the bar, and draw it over the end intended for the south pole. Having done this several times to one end on both sides, turn the magnet, applying its south pole to the middle of the bar, and drawing it several times over the end intended for the north pole.

It was still more improved by employing two magnets at once, placed as in fig. 17. on the middle B of the bar, and drawing them away from each other, over the ends of it, as shewn by the directing darts, and repeating this operation. It is plain that, as far as we understand any thing of this matter, this process must be much preferable to either of the former two. The magnets A and E certainly concur in producing a properly disposed magnetism on all that lies between them; and therefore on the whole bar at the end of each stroke. The end C must become a north, and D a south pole. Still, however, as the stroke goes on to the point of indifference, each magnet tends to weaken the polarity of the parts situated beyond it.

This method continued to be practised till about the year 1750. Mr Canton, availing himself of the experiments of Mr Mitchell of Cambridge, published his method by the DOUBLE TOUCH as it is called. See *Monthly Review* for 1785.

We need not repeat what has been detailed in the *Encyclopædia*, MAGNETISM, p. 440, &c. and shall only make some observations on the peculiar advantages of this process, as prescribed by Mitchell, Canton, and improved by Mr Antheaume, in his memoir *sur les Aimans Artificiels* 1766, which was crowned by the Academy of Sciences. (See also dissertations on the subject by *Le Maire and Du Hamel*, 1745). 59 Method of double touch.

There is an evident propriety in the arrangement invented by Mr Mitchell, represented in fig. 18. The magnetism induced on the two pieces of soft iron AD and BC is an excellent method for *securing* every accession of magnetism to either of the bars. A good deal depends on the proper size and length of these pieces; and our ignorance of the interior process obliges us to have recourse to experiment alone for ascertaining this. Whatever circumstances induce the strongest magnetism on those pieces of iron, will cause them to produce the greatest effect on the steel bars; and this will be indicated by a greater attraction. Therefore that distance will be the best which enables two bars AB and DC to lift the greatest weight hung on the piece AD or BC. When we impregnated bars whose breadth was about one-tenth of their length, and their thickness about one-half of their breadth, we found, that if AD was about one-fourth, or nearly one third, of AB, they carried more than if it was either much longer or much shorter. Mr Antheaume's addition of the two great bars of iron E and F makes a sensible improvement of the *beginning* of the impregnation, when very weak magnets are employed; but did not seem to us to be of any farther service on the table. This is agreeable to any theory which can be established by what we have said hitherto.

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The method of employing the magnets A and E (fig. 19.), prescribed by Mitchell and Canton, is extremely judicious. The meeting of the dissimilar poles at top increases the magnetism of each. The two dissimilar poles F and G, certainly tend to give a regular and proper magnetism to the part FG of the bar which lies between them; and this is the case on whatever part of the bar they are placed. But each pole tends to destroy the present magnetism of what lies between it and the pole of the bar on that side. But mark—they tend to produce the desired magnetism on what lies between them with the *sum* of their forces; while each tends to destroy the magnetism of the part without it by the *difference* only of their forces. Therefore, on the whole, as they are moved to and fro along the bar, and the foremost one even made to pass over the end of it a little way, they always add to the magnetism already acquired. This consideration seems to enjoin setting F and G extremely near each other; for this seems to increase the sum, and to diminish the difference of their action. But it may be a question, Whether we gain more by strongly magnetising a very small part during the very short while that the magnets pass over it, or by acting on more of the bar at once, and continuing a weaker action for a longer while on this larger portion. Mr Æpinus adds another consideration depending on his notion of the internal process; but we defer this to another opportunity. The safest direction seems to be, to place them at the distance which enables them to lift the greatest weight. They are then undoubtedly acting with the greatest effect.

Mr Antheaume directs to place the touching magnets as in fig. 20. for a reason to be mentioned afterwards. Mr Æpinus also recommends it for reasons founded on his own hypothesis. We must say, that, in our trials, we have found this method very sensibly superior, especially in the latter parts of the operation when the resistance to farther impregnation becomes nearly a balance for the accumulating power of the magnets; and we consider this as no inconsiderable argument for the justice of Mr Æpinus's hypothesis.

The great advantage of this method is the regularity of the magnetism which it produces. We never find more than two poles; and when the bars are hard, and of uniform texture, the polarity is very little diffused, and seemingly confined to a very small space at the very extremities of the bar. This is indeed a prodigious advantage in point of strength. It is no less so in order to fit the magnets for experiments on the law of magnetic action; for the latitude which the diffused condition of the poles gives in the selection of the points from which the distances are to be computed, has hitherto hindered us from pronouncing on the law of magnetic action with the precision of which we think it fully susceptible. This method also is the only one by which we have been able to impregnate two bars joined end to end, considering them as one bar. We have sometimes (though very rarely) succeeded in this; so that when filings were strewed over them, the appearance could not be distinguished from a single bar.—*N. B.* Yet even in this case, in one experiment with two bars of six inches long, treated as one, when it could not be distinguished, either by the appearance of the filings, or by going round it very near with a compass needle, a very small compass needle discovered a neutral point, and a reversion of polarity similar to fig. 14. at F, shewing that it was really acting as two bars. Perhaps it must always be so; and this question is of considerable importance in the establishment of any theory of the internal process.

It deserves remark, that, in order to succeed in this attempt, a very considerable pressure is necessary. We were obliged to clean the ends of the bars very carefully, and to force the frame of bars and soft pieces of iron strongly together by wedges, in the manner of a form of types. We thought that wetting the ends of the bars with pure water aided the experiment; and we are *very certain* that oil not only greatly obstructed it, but even sensibly impeded the common process. We had put a single drop of oil on a pair of bars which we were touching in the common Cantonian method, that the magnets might be more easily drawn along them; but we were surprised at finding that we could not give a strong impregnation. The oil undoubtedly prevents the close contact. We found the finest gold leaf produce the same effect in a great degree; as also talc, of which a square inch weighed $\frac{1}{50}$th of a grain. We do not infer any thing like obstruction to the passage of something material, but rather ascribe it to mere distance; although we are of opinion, that in the impregnation of two contiguous bars, so that the magnetism (whatever it is) is disposed *precisely* as in one bar, there *is* a material transference. But we shall speak of this in its due place.

It is not unworthy of remark, that we found bars to acquire more powerful magnetism when pretty well polished than when rough. But we also found, that bars considerably rough acquired the first degrees of it much more expeditiously than those which are smooth; although we never could bring them to that high degree of magnetism that the same bars acquired after they had been polished. We think it probable, that the tremors, occasioned by the rough and harsh surfaces of the hard steel, are the causes of this phenomenon.

Some more observations on this method of the double touch will be made afterwards, when we consider the hypothesis of Mr Æpinus: and we conclude the present subject, by attempting to explain some puzzling appearances which frequently occur in making artificial magnets.

A bar touched by a very strong magnet has been said by Muschenbroek to be impaired by going over it with a weaker magnet. If it had been made as strong as possible, the weaker magnet, when passed over it in the way practised by Muschenbroek, must *first* destroy part of this magnetism; and having done so, it is unable to raise it anew to the same degree of vigour. 60 Difficulties explained.

Yet (says Muschenbroek with surprise) a large bar of common iron has greatly improved the magnet. A very large piece of iron *must* do this (especially if shaped like a horseshoe, and applied with both heels), if the bar be not already at its maximum.

It was thought wonderful, that, in the method of double touch, not only was the magnetism of the magnets employed not impaired, but, beginning with two magnets, whose power is almost insensible, and repeating the operations in the precise manner described by Mitchell or Canton, not only the bars intended to be made magnetical, but also the magnets employed, may be brought to their highest possible state of magnetism.

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This is in evident conformity to the general facts of induced magnetifm, and affords the ftrongeft proof that nothing is communicated in this operation, but that powers refiding in the bars are excited, or brought into action. The manipulation merely *gives occafion* to this action, as a fpark of fire kindles a city.

61 Explanation of the beginning of Savery, Canton, and Antheaume's procefs.

There ftill remain fome circumftances of this method, as practifed by Savery, Canton, and Antheaume, which are extremely curious and important.

Mr Savery had obferved a fmall bit of fteel acquire very fenfible magnetifm by lying long in contact with the lower end of a great window bar. Telling this to a friend, he was, for the firft time, informed that this had been long obferved, and that Dr Gilbert had made fome curious inferences from it. Mr Savery wanted fome magnets, and was at a diftance from town. Reflecting, like a philofopher, on what he had heard and obferved, he faw here a fource of magnetifm which he could increafe, in the manner commonly practifed in making magnets. He placed the bar AB (fig. 21.) to be magnetifed between two great bars of common iron C and D, placing all the three in the magnetical direction. He took another bar EF, and put two little pieces of iron, like the armour of a loadftone, on its ends; and with thofe ends he rubbed the bar AB, rubbing the upper half of it with the end F, and the lower with the end E. The refult of this was a very brifk magnetifm in a few minutes, which, by various well devifed alternations, he brought to its higheft degree. His numerous experiments publifhed in the Philofophical Tranfactions in 1746, contain much curious information, highly deferving the attention of the philofophers. Mr Canton, proceeding on the fame principle, that bars of iron, which have been long in a vertical pofition, acquire an efficient magnetifm, begins his operations by placing his fteel bar on the head of a kitchen poker, and rubs it with the lower end of a pair of kitchen tongs. Mr Antheaume adheres more ftrictly to the inferences from the principle of terreftrial magnetifm, and repeats precifely the previous difpofition of things practifed by Mr Savery, placing his little fteel bar AB (fig. 22.) between two great bars C and D of common iron, and arranging the whole in the magnetic direction. Then, proceeding moft judicioufly on the fame principle, he greatly improves the procefs, by employing two bars EF and GH for the touch, holding them about an inch apart, inclined about 15° to the bar AB. It is plain, that the lower end of each of thefe five bars is a north pole, and the upper end a fouth pole. Therefore the poles F and G concur in giving the proper magnetifm to the portion FG of the fteel bar which is between them; and by rubbing it with thefe poles up and down, overpaffing each extremity about half an inch, he muft foon give to the bar AB a regular magnetifm; weak, perhaps, but to be afterwards increafed in the Cantonian method, on a horizontal table. In this manner did Mr Antheaume make magnets of very great ftrength in 1766. See his *Differtation* already quoted.

62 Gilbert's terreftrial magnetifm.

Thefe obfervations naturally bring us to the PHYSIOLOGIA NOVA DE MAGNET ET CORPORIBUS MAGNETICIS of Dr Gilbert; a difcovery which the fagacious Kepler claffes among the greateft in the annals of fcience.

It could not be that a phenomenon fo general, and fo interefting and important as the natural polarity of magnetic bodies, would be long known without exciting curiofity about its caufe. Accordingly the philofophers of the 16th century fpeculated much about it, and entertained a variety of opinion, if that can be called an opinion which can hardly be faid to exprefs a thought. We have in *Marfigli Ficino* a fhort notice of many of thefe opinions. Some maintained that the needle was directed by a certain point in the heavens, as if that were faying more than that it always pointed one way. Others, with more appearance of reafoning, afcribed the direction to vaft magnetic rocks. But all this was without giving themfelves the trouble of trying to afcertain what fituation of fuch rocks would produce the direction that is obferved. Fracaftori was, if we miftake not, the firft who thought this trouble at all neceffary; and he obferves very fenfibly, that if thofe rocks are fuppofed to be in any place yet vifited by navigators, and if they act as loadftones do (a circumftance which he fays muft be admitted, if we attempt to explain), the direction of the needle will be very different from what we know it to be. He therefore places them in the inacceffible polar regions, but not in the very pole. Norman, the difcoverer of the dip of the mariner's needle, or of the true magnetic direction, was naturally led by his difcovery to conceive the directing caufe as placed in the earth; becaufe the north point of the needle, in every part of Europe, points very far below the horizon. But although he calls the treatife in which he announces his difcovery the *New Attractive*, he does not exprefs himfelf as fuppofing the needle to be attracted by any point within the earth, but only that it is always directed to that point.

It is to Dr Gilbert of Colchefter that we owe the opinion now univerfally admitted, that magnetic polarity is a part of the conftitution of this globe. Norman had, not long before, difcovered, that if a fteel needle be very exactly balanced on a horizontal axis, like the beam of a common balance, fo that it would retain any pofition given it, and if it be then touched with a magnet, and placed on its axis in the magnetic meridian, it is no longer in equilibrio, but (at London) the north point of it will dip 72 or 73 degrees below the horizon. He did not, however, publifh his difcovery till he had obtained information how it ftood in other parts of the world. The differences in the variation in different places naturally fuggefted the neceffity of this to him. Being a maker of mariners compaffes, and teacher of navigation in London, he had the faireft opportunities that could be defired, by furnifhing dipping needles to fuch of the navigators, his fcholars, as he knew moft able to give him good information. And the accounts which he received made his difcovery, when announced to the world, a very complete thing; for the commanders of fhips engaged in long voyages, and particularly to China, informed him that, in the vicinity of the equator, his dipping needles remained parallel to the horizon, but that in coming toward the north pole, the north end of the needle was depreffed, and that the fouth end dipped in like manner at the Cape of Good Hope, and in the Indian Ocean; that the needle gradually approached the horizontal pofition as the fhip approached the equator, but that

that in coming to the north of it at Batavia, the north point again dipped, and at Canton was several degrees below the horizon.

On these authorities, Norman boldly said that, in the equatoreal regions, the needle was horizontal, and that either end dipped regularly as it approached either pole; and that in the poles of the earth, the needle was perpendicular to the horizon. He therefore announced this as a discovery, not only singularly curious, but also of immense importance; for by means of a dipping needle the latitude of a ship at sea may be found without seeing the sun or stars.

Dr Gilbert, comparing this position of the compass needle with the positions which he had observed small needles assume in his numerous experiments in relation to a magnet, as we have described at great length, was naturally led to the notion of the earth's being a great loadstone, or as containing one, and that this arranged the dipping, or, in general, the mariner's needle, in the same manner as he observed a great magnet arrange a small needle poised on its pivot. He therefore composed his *Physiologia Nova de Magnete, et de Tellure magno Magnete*; in which he notices so many points of resemblance to the directive power of a magnet, that the point seems no longer to admit of any doubt. Dr Gilbert's theory may be thus expressed:

All the phenomena of natural magnetism are analogous to what we should observe, if the earth were a great magnet, having its poles near the poles of the earth's equator, the north pole not far from Baffin's Bay, and the south pole nearly in the opposite part of the globe. A dipping needle, under the influence of this great magnet, must arrange itself in a plane which passes through the poles of the magnet, the position of which plane is indicated (at least nearly) by the ordinary compass needle; and it will be inclined to the horizon so much the more as we recede from the equator of the great magnet.

This opinion of Dr Gilbert was not less ingenious than important; and if firmly established, it furnishes a complete theory of all the phenomena of magnetism. But observations were neither sufficiently numerous in the time of Dr Gilbert, nor sufficiently accurate, to enable that great genius to assign the position of this great magnet, nor the laws of its action. The theory was chiefly founded on the phenomena of the dipping needle; phenomena which might have been unknown for ages, had the first notice of them fallen into any other hands than Norman's. They are not, like those of variation, which might be made by any sailor. They require for their exhibition a dipping needle, and the attention to circumstances which can occur only to a mathematician. A dipping needle is to this day, notwithstanding all our improvements in the arts, one of the most delicate and difficult tasks that an instrument maker can take in hand, and a good one cannot be had for less than twenty guineas. We are confident that such as even Norman could make were far inferior to what are now made, and quite unfit for use at sea while the ship is under sail, although they may be tolerably exact for an observation of the dip in any port; and we presume that it was such observations only that Norman confided in. Our readers will readily conceive the difficulty of poising a needle with such a perfect coincidence of its centre of gravity and axis of motion, and perfect roundness of this axis, that it shall remain in any position that is given it. Add to this, that a grain of dust, invisible to the nicest eye, getting under one side of this axis, may be sufficient for making it assume another position. It must also be a difficult matter to preserve this delicate thing, so as that no change can happen to it. Besides, all this must be performed on a piece of tempered steel which we are certain has no magnetism. Where can this be got, or what can insure us against magnetism? Nor is there less difficulty in making the observations without great risk of error. If the needle, moveable only in a vertical plane, be not set in the plane of a magnetic meridian, it will always dip too much. At London, where the magnetic direction is inclined 73° to the horizon, if it be in a plane 20° from the magnetic meridian, it will stand almost perpendicular; for it is easy to see, by the mechanical resolution of forces, that it will take the position which brings it nearest to the true magnetic direction. This, we think, is confirmed by several of Norman's and other old observations of dip. They are much greater than they have been since found in the same places.

63 Daniel Bernoulli's dipping needle.

Mr Daniel Bernoulli has given a very ingenious principle, by which we can make a dipping needle which will give a very accurate observation on shore; and being so easily executed, it deserves to be generally known. Let a dipping needle be made in the best manner that can be done by a workman of the place, and balanced with some care before impregnation, so that we may be certain that when touched it will take nearly the true dip. Touch it, and observe the dip. Destroy its magnetism, and then alter its balance in such a manner that, without any magnetism, it will arrange itself in the inclination of the observed dip. Now touch it again, giving it the same poles as before. It is plain that it will now approach exceedingly near indeed to the true dip, because its want of *perfect* equilibrium deranged it but a few degrees from the proper direction. If this second observation of the dip should differ several degrees from the first, by the inaccurate first formation of the needle, it will be proper to repeat the operation. Very rarely indeed will the third observation of the dip vary from the truth half a degree.

Mr Bernoulli makes this simple contrivance answer the purpose of an universal instrument in the following ingenious manner. A very light brass graduated circle EFG (fig. 23.) is fixed to one side of the needle, concentric with its axis, and the whole is balanced as nicely as possible before impregnation. A very light index CD is then fitted on the axis, so as to turn rather stiffly on it. This will destroy the equilibrium of the needle. If the needle has been made with perfect accuracy, and perfectly balanced, the addition of this index would cause it always to settle with the index perpendicular to the horizon, whatever degree of the circle it may chance to point at. But as this is scarcely to be expected, set the index at various degrees of the circle, and note what inclination the unmagnetic needle takes for each place of the index, and record them all in a table. Suppose, for example, that when the index is at 50, the needle inclines 46° from the horizon. If in any place we observe that the needle (rendered magnetic by lying between two strong magnets), having the index at 50, inclines 46°, we may be certain that this is the dip at that

that place; for the needle is not deranged by the magnetism from the position which gravity alone would give it. As we generally know something of the dip that is to be expected in any place, we must set the index accordingly. If the needle does not shew the expected dip, alter the position of the index, and again observe the dip. See whether this second position of the index and this dip form a pair which is in the table. If they do, we have got the true dip. If not, we must try another position of the index. Noticing whether the agreement of this last pair be greater or less than that of the former pair, we learn whether to change the position of the index in the same direction as before, or in the opposite. The writer of this article has a dipping needle of this kind, made by a person totally unacquainted with the making of philosophical instruments. It has been used at Leith, at Cronstadt in Russia, at Scarborough, and at New York, and the dip indicated by it did not in any single trial differ 1¼ degrees from other trials, or from the dip observed by the finest instruments. He tried it himself in Leith Roads, in a rough sea; and does not think it inferior, either in certainty or dispatch, to a needle of the most elaborate construction. It is worthy of its most ingenious author, and of the public notice, because it can be made for a moderate expence, and therefore may be the means of multiplying the observations of the dip, which are of immense consequence in the theory of magnetism, and for giving us an accurate knowledge of the magnetical constitution of this globe.

64
Opinions concerning the great magnet contained in this globe.

This knowledge is still very imperfect, owing to the want of a very numerous collection of observations of the dip. They are of more importance than those of the horizontal deviations from the meridian. All that we can say is, that the earth acts on the mariner's needle as a great loadstone would do. But we do not think that the appearances resemble the effects of what we would call a good loadstone, having the regular magnetism of two vigorous poles. The dips of the needle in various parts of the earth seem to be such as would result from the action of an extremely irregular loadstone, having its poles exceedingly diffused. The increase of the dip, as we recede from those places where the needle is horizontal, is too rapid to agree with the supposition of two poles of constipated magnetism, whether we suppose the magnetic action in the inverse simple or duplicate ratio of the distances, unless the great terrestrial magnet be of much smaller dimensions than what some other appearances oblige us to suppose. If there be four poles, as Dr Halley imagined, it will be next to impossible to ascertain the positions of the dipping needle. It will be a tangent to one of the secondary magnetic curves, and these will be of a very intricate species. We cannot but consider the discovery of the magnetic constitution of this globe as a point of very great importance, both to the philosopher and to society. We have considered it with some care; but hitherto we have not been able to form a systematic view of the appearances which gives us any satisfaction. The well informed reader is sensible, that the attempt by means of the horizontal or variation needle is extremely tedious in its application, and is very unlikely to succeed; at the same time it must be well understood. The two dissertations by Euler, in the 13th and 22d volumes of the Memoirs of the Royal Academy at Berlin, are most excellent performances, and give a true notion of the difficulty of the subject. Yet, even in these, a circumstance is overlooked, which, for any thing we know to the contrary, may have a very great effect. If the magnetic axis be far removed from the axis of revolution, as far, for example, as Mr Churchman places it, the magnetic meridians will be (generally) much inclined to the horizon; and we shall err very far, if we suppose (as in Euler's calculus) that the dipping needle will arrange itself in the vertical plane, passing through the direction of the horizontal or variation needle; or if we imagine that the poles of the great magnet are in that plane. We even presume to think that Mr Euler's assumption of the place of his fictitious poles (namely, where the needle is vertical), in order to obtain a manageable calculus, is erroneous. The introduction of this circumstance of inclination of the magnetic meridians to the horizon, complicates the calculation to such a degree as to make it almost unmanageable, except in some selected situations. Fortunately, they are important ones for ascertaining the places of the poles. But the investigation by the positions of the dipping needle is incomparably more simple, and more likely to give us a knowledge of a multiplicity of poles. The consideration of the magnetic curves (in the sense used in the present article), teaches us that we are not to imagine the poles immediately under those parts of the surface where the needle stands perpendicular to the horizon, nor the magnetic equator to be in those places where the needle is horizontal; a notion commonly and plausibly entertained. Unfortunately our most numerous observations of the dip are not in places where they are the most instructive. A series should be obtained, extending from New Zealand northward, across the Pacific Ocean to Cape Fairweather on the west coast of North America, and continued through that part of the continent. Another series should extend from the Cape of Good Hope, up along the west coast of Africa to the tropic of Capricorn; from thence across the interior of Africa (where it would be of great importance to mark the place of its horizontality) through Sicily, Italy, Dalmatia, the east of Germany, the Gulph of Bothnia, Lapland, and the west point of Greenland. This would be nearly a plane passing through the probable situations of the poles. Another series should be made at right angles to this, forming a small circle, crossing the other near Cape Fairweather. This would pass near Japan, through Borneo, and the west end of New Holland; also near Mexico, and a few degrees west of Easter Island. In this place, and at Borneo, the inclination of the magnetic plane to the horizon would be considerable, but we cannot find this out. It may, however, be discovered in other points of this circle, where the dip is considerable. We have not room in this short account to illustrate the advantages derived from these serieses; but the reflecting reader will be very sensible of them, if he only suppose the great magnet to be accompanied by its magnetic curves, to which the needle is always a tangent. He will then see that the first series from New Zealand to Cape Fairweather, and the second from Cape Fairweather round the other side of the globe, being in one plane, and at very different distances from the magnetic axis, must contain very instructive positions of the needle. But we still confess, that when we compare the dips already known

See Variation, Encycl.

known with the variations, they appear so irreconcileable with the results of an uniform regular magnetism, that we despair of success. Every thing seems to indicate a multiplicity of poles, or, what is still more adverse to all calculation, an irregular magnetism with very diffused polarity.

Much instruction may surely be expected from the observations of the Russian academicians and their eleves, who are employed in surveying that vast empire; yet we do not meet with a single observation of the dip of the needle in all the bygone publications of that academy, nor indeed are there many of the variation.

65 And concerning the situation of its poles. For want of such information, philosophers are extremely divided in their opinions of the situation of the magnetic poles of this globe. Professor Krufft, in the 17th volume of the Petersburgh Commentaries, places the north pole in lat. 70° N. and long. 23° W. from London; and the south pole in lat. 50° S. and long. 92° E.

Wilcke of Stockholm, in his indication chart (*Swed. Mem.* tom. xxx. p. 218.), places the north pole in N. Lat. 75°, near Baffin's Bay, in the longitude of California. The south pole is in the Pacific Ocean, in lat. 70° S.

Churchman places the north pole in lat. 59° N. and long. 135° W. a little way inland from Cape Fairweather; and the south pole in lat. 59° S. long. 165° E. due south from New Zealand.

A planisphere by the Academy of Sciences at Paris for 1786, places the magnetic equator so as to intersect the earth's equator in long. 75°, and 155° from Ferro Canary Island, with an inclination of 12 degrees nearly, making it a great circle very nearly. But we are not informed on what authority this is done; and it does not accord with many observations of the dip which we have collected from the voyages of several British navigators, and from some voyages between Stockholm and Canton. Mr Churchman has given a sketch of a planisphere with lines, which may be called parallels of the dip. Those parts of each parallel that have been ascertained by observation are marked by dots, so that we can judge of his authority for the whole construction. It is but a sketch, but gives more synoptical information than any thing yet published. The magnetic equator cuts the earth's equator in long. 15°, and 195° E from Greenwich, in an angle of nearly 17 degrees. The circles of magnetic inclination are not parallel, being considerably nearer to each other on the first meridian than on its opposite. This circumstance, being founded on observation, is one of the strongest arguments for the existence of a magnet of tolerable regularity, as the cause of all the positions of the compass needle; for such *must* be the positions of the circles of equal dip, if the axis of this magnet is far removed from the axis of rotation, and does not intersect it.

66. Now, if the situation of the poles be any thing near the average or medium of these determinations, and if we form all our notions by analogy, comparing the positions of the compass needle in relation to the great terrestrial magnet, with the positions assumed by a small needle in the neighbourhood of a magnet, we must conclude, that the magnetical constitution of this globe has little or no reference to its regular external form. The axis of the magnet is very far removed from that of the globe (at least 1500 miles), and is not nearly parallel to it, nor in the same plane. It required the sagacity and the skill of a Euler to subject such anomalous magnetism to any rules of computation; and every person qualified to judge of the subject must allow his dissertation in the 13th volume of the Berlin Memoirs to be a work of wonderful research. It is a very agreeable thing to see such a conformity between the lines which express the regular magnetism of Euler's dissertation, and the lines drawn by Dr Halley from observation, and which appeared to himself so capricious, that he despaired (notwithstanding his consummate skill in geometry) of their ever being reduced to a mathematical and precise system.

Without detracting from the merit of Dr Gilbert, we may presume to say that his notion of the earth's being a great magnet was not, in his mind, more than a sagacious conjecture, formed from a very general and even vague comparison. Yet the comparison was sufficiently good to give him great confidence in his opinion that the action of this great magnet, in perfect conformity to what we observe in our experiments with magnets, is the source of all the magnetism that we observe. If there was nothing else in proof of the justness of his theory, it is abundantly proved by the beautiful experiment of Mr Henshaw, mentioned in the article VARIATION, *Encycl.* p. 621. col. 2. An iron bar held nearly upright, attracts the south end of a compass needle with its lower end; and if that end of the bar be kept in its place, and the bar turned round till it becomes the upper end, the south point of the needle immediately turns away from it, and the north end is now attracted. This experiment may be perfectly imitated with artificial magnetism. 67 Confirmations of Dr Gilbert's physiology.

Having supported a large magnet SAN (fig. 24), so that its ends are detached from surrounding bodies, place a small needle B (poised on its pivot) about three inches below the north pole N of the magnet, and in such a situation that its polarity to the magnet may be very weak. Take now a small piece of common iron, and hold it in the position represented at C. Its lower end becomes a north pole, attracting the south pole of the needle. Keeping this in its place, turn round the piece of iron into the position D; the south pole of B will now avoid it, and the north pole will be attracted. We directed the needle to be so placed, that its polarity, in relation to the magnet, may be weak. If it be strong, it may act on the end of C or D like a magnet, and counteract the magnetism induced on C or D by vicinity to A.

An anonymous writer in the Philosophical Transactions, N° 177. Vol. XV. relates several observations made during a voyage to the East Indies, which are quite conformable to this. A few leagues northwest from the island Ascension, the south point of the compass needle hardly shewed any tendency to or from the lower end of an iron bar. It seemed rather to avoid the upper end; it was not in the least affected by the middle of the bar; but when the bar was laid horizontal, in the magnetic direction, its two ends affected the dissimilar ends of the compass needle very strongly; but when horizontal, and lying at right angles to the magnetic direction, its polarity was altogether indifferent.

As the other phenomena of induced artificial magnetism have the same resemblance to the phenomena of natural

natural magnetiſm, a bar which has remained long in the vicinity of a magnet acquires magnetiſm (permanent) in the ſame way, and modified by the ſame circumſtances, as in natural magnetiſm. Hammering a bit of common iron in the immediate vicinity of a magnet, gives it very good magnetiſm. Expoſing a red hot bar to cool in the neighbourhood of a magnet has the ſame effect. Alſo quenching it ſuddenly has the ſame effect. Quenching a ſmall red hot ſteel bar between two magnets, was found by us to communicate a much ſtronger magnetiſm than we could give it by any other method. Its form indeed was very unfavourable for the ordinary method of touching; for it conſiſted of two little ſpheres connected by a ſlender rod, and could ſcarcely be impregnated in any other way than by placing it for a very long while between magnets. In all theſe experiments, the polarity acquired is preciſely ſimilar to that acquired by the ſame treatment in relation to this ſuppoſed great terreſtrial magnet. In ſhort, in whatever manner we purſue this analogy in our experiments, we find the reſemblance moſt perfect in the phenomena.

We cannot but think, therefore, that this new phyſiology of the magnet by Dr Gilbert is well eſtabliſhed; and we think ourſelves authoriſed to aſſume it as a propoſition fully demonſtrated, that the earth is a great magnet, or contains a great magnet, the agency of which produces the direction of the magnetic needle, and all the magnetiſm which iron acquires by long continuance in a proper poſition. It is this which made us ſay, in the beginning of this article, that attraction and polarity were not confined to magnets, but were properties belonging to all iron in its metallic ſtate. We now ſee the reaſon why any piece of iron brought very near to another piece will attract it—both become magnetical, in conſequence of the agency of the great magnet; and their magnetiſm is ſo diſpoſed, that their mutual attractions exceed their repulſions. Alſo, why an iron rod, placed nearly in the magnetical direction, will finally arrange itſelf in that direction. Alſo, why the terreſtrial polarity of common iron is indifferent, and either end of the rod will ſettle in the north, if it have nearly that poſition at firſt. The magnetiſm induced by mere momentary poſition is ſo feeble as to yield to any artificial magnetiſm. As a moment was ſufficient for imparting it, a moment ſuffices for deſtroying it; and another moment will impart the oppoſite magnetiſm. But artificial magnetiſm requires more force for its production, and ſome of it remains when the producing cauſe is removed, and it does not yield at once to the contrary magnetiſm. That there is no farther difference appears from this, that long continued poſition gives determined and permanent magnetiſm, and that it is deſtroyed by an equally long continuance in the contrary poſition. It ſeems to be very generally true, that a magnet will carry more by its north than by its ſouth pole. It ſhould be ſo in this part of the world, becauſe the terreſtrial magnetiſm induced on the iron conſpires with the magnetiſm induced by the north pole of a magnet, but counteracts the magnetiſm induced by the ſouth pole.

The propriety of Mr Savery's, Mr Canton's, and Mr Antheaume's proceſſes for beginning the impregnation of hard ſteel bars is now plain, and the ſuperior effect of the two great bars of common iron in the propoſed method of Mr Antheaume. We cannot but take this opportunity of paying the proper tribute of praiſe to the ingenuity of Mr Savery. Every circumſtance of his proceſs was ſelected in conſequence of an accurate conception of magnetiſm, and the combination of this ſcience with Dr Gilbert's theory. His proceſs is the ſame with Antheaume's in every reſpect, except the circumſtance of the double touch borrowed from Mitchell and Canton. Theſe obſervations do not detract from the diſcernment of Mitchell and Canton, who ſaw in thoſe experiments what had eſcaped the attention of hundreds of readers.

68 Seeming objection deduced from the want of ſenſible attraction.

But there occurs an objection to this theory of Dr Gilbert, which was urged againſt it with great force. We obſerve no tendency in the magnet or compaſs needle toward this ſuppoſed magnet. An iron or ſteel bar is not found to increaſe its tendency downwards, that is, is not ſenſibly heavier, when its ſouth pole is uppermoſt in this part of the world. A needle ſet afloat on a piece of cork arranges itſelf quickly in the proper direction; but if continued ever ſo long afloat, it has never been obſerved to approach the north ſide of the veſſel. This is quite unlike what we obſerve in the mutual actions of magnets, or the action of magnets on iron. This objection appears to have given Dr Gilbert ſome concern; and he mentions many experiments which have been tried on purpoſe to diſcover ſome magnetical tendency. He gets rid of it as well as he can, by ſaying, that the directive power of a magnet extends much farther than its attractive power. He confirms this by ſeveral experiments. But Dr Gilbert had not ſtudied the ſimultaneous actions of the four poles, nor explained, by the principles of compound motion, how theſe produced all the poſſible poſitions of the needle. Indeed, the compoſition of mechanical forces was by no means familiar with philoſophers at the end of the 16th century. We ſee it now very diſtinctly. The polarity of the needle, or the force with which it turns itſelf into the magnetical poſition, depends on the difference between the *ſums* of the actions of each pole of the magnet on both the poles of the needle; whereas its tendency towards the magnet depends on the difference of the *differences* of thoſe actions (ſee n° 22, 25.). The firſt may thus be very great when the other is almoſt inſenſible. We ſee, that coarſe iron filings heap about the magnet very faſt, and that very fine filings approach it very ſlowly. Now, the largeſt magnet that we can employ, when compared with the great magnet in the earth, is but as a particle of the fineſt filings that can be conceived. This ſurely diminiſhes exceedingly, if it does not entirely annihilate the objection: but as we have heard it urged by many as an improbable thing, that a long magnet, kept afloat for many months (which has been done) ſhall not ſhow the *ſmalleſt* tendency towards the pole of the terreſtrial magnet, we think it deſerves to be conſidered with accuracy, and the queſtion decided in a way which will admit of no doubt.

69 This completely anſwered.

Let the very ſmall magnet C (fig. 25.) be placed near a great magnet A, and then near a ſmaller magnet B, in ſuch a manner that its polarity to both ſhall be the ſame; and then let us determine the proportion between the attractions of A and B for the ſmall magnet C.

This will evidently depend on the law of magnetic action. For greater ſimplicity of inveſtigation, we ſhall

content

content ourſelves with ſuppoſing the action to be inverſely as the diſtance.

Let AN, = AS, = a; BN = b; Cn = c, AC = d, BC = δ; and let the abſolute force of A be to that of B at the ſame diſtance as m to 1.

The magnetic action being ſuppoſed proportional to $\frac{1}{d}$, we have,

1. Action of AN on C$s = \frac{m}{d-a-c}$.

2. —— AN on C$n = -\frac{m}{d-a+c}$.

3. —— AS on C$s = -\frac{m}{d+a-c}$.

4. —— AS on C$n = \frac{m}{d+a+c}$.

5. The whole action $= \frac{8\,m\,a\,c\,d}{\overline{d^2-\overline{a+c}^2}^2 \times \overline{d^2-\overline{a-c}^2}^2}$.

6. If c be very ſmall in compariſon with a or b, the whole action of A is very nearly $= \frac{8\,m\,a\,c\,d}{\overline{d^2-a^2}^2}$.

7. And the tendency of C to B is, in like manner, $= \frac{8\,b\,c\,\delta}{\overline{\delta^2-b^2}^2}$.

The directive powers of A and B are at their maximum ſtate when C is placed with its axis at right angles to the lines AC or BC. In which caſe we have,

8. The directive power of A $= \frac{4\,m\,a}{d^2-a^2}$.

9. The directive power of B $= \frac{4\,b}{\delta^2-b^2}$.

When theſe directive powers are made equal, by placing C at the proper diſtances from A and B, we have,

10. $4\,m\,a : 4\,b$, or $m\,a : b = d^2-a^2 : \delta^2-b^2$
And $m\,a\,\delta^2 - m\,a\,b^2 = b\,d^2 - b\,a^2$
$m\,a\,\delta^2 = b\,(d^2-a^2) + m\,a\,b^2$.

11. $\delta^2 = \frac{b}{m\,a}(d^2-a^2) + b^2$.

12. $\delta = \sqrt{\frac{b}{m\,a}(d^2-a^2) + b^2}$.

Let the attractions of A and B for the very ſmall magnet C, when its polarity to both is the ſame, be expreſſed by the ſymbols α and β. We have.

$\alpha : \beta = \frac{8\,m\,a\,c\,d}{(d^2-a^2)^2} : \frac{8\,b\,c\,\delta}{(\delta^2-b^2)^2}$, which, by n° 10. is $= \frac{8\,(d^2-a^2)\,c\,d}{(d^2-a^2)^2} : \frac{8\,(\delta^2-b^2)\,c\,\delta}{(\delta^2-b^2)^2} = \frac{d}{d^2-a^2} : \frac{\delta}{\delta^2-b^2}$, $= b\,d : m\,a\,\delta$; that is,

13. Attr^n of A : attr^n of B $= b\,d : m\,a\,\delta$.

As an example of this compariſon let us ſuppoſe the great terreſtrial magnet to be a thouſand times larger and ſtronger than the magnet whoſe attraction we are comparing with that of terreſtrial magnetiſm. Let us alſo ſuppoſe the diſtance from the pole of the great magnet to be ſmall, ſo that its attraction may be conſiderable. Let us make $d = 1200$, a being $= 1000$, and $b = 1$. Theſe are all very reaſonable ſuppoſitions. Subſtituting theſe values in the formula, we have attr^n of A : attr^n of B = 1 : 1000 very nearly; and therefore when the needle, when placed near a magnet, vibrates by its polarity as faſt as it does by natural magnetiſm, its tendency toward that magnet muſt be altogether inſenſible; for the diſproportion is incomparably greater than that of 1 to 1000, in the largeſt magnets with which we can make experiments. Obſerve alſo, that we have taken the caſe where the attractions are the ſtrongeſt, viz. when the magnet C is placed in the axis of A or B. In the oblique poſitions, tangents to the magnetic curves, the attractions are ſmaller, almoſt in any ratio.

We took the inverſe ratio of the diſtances for the law of action, only becauſe the analyſis was very ſimple. It is very evident, that the diſproportion will be ſtill more remarkable if the action be inverſely as the ſquare of the diſtance.

The objection therefore to the origin of the polarity of the compaſs needle, and of all other magnets, namely, the action of a great magnet contained in the earth, appears plainly to be of no force. We rather think that the want of all ſenſible attraction, where there is a briſk polarity, is a proof of the juſtneſs of the conjecture; for if the compaſs needle were arranged by the action of magnetic rocks, or even extenſive ſtrata, near the ſurface of the earth, the attractions would bear a greater proportion to the polarities. We have even obſerved this. A conſiderable maſs of magnetic ſtratum was found to derange the needle of a ſurveyor's theodolite at a conſiderable diſtance all around (about 140 yards). The writer placed the needle on a thin lath, which juſt floated it on water in a large wooden diſh, and ſet it in a place where it was drawn about 15 degrees from the magnetic meridian. It was left in that ſituation a whole night, well defended from the wind by a board laid on the diſh. Next morning it was found applied to that ſide of the diſh which was neareſt to the diſturbing rocks. It had moved about ſix inches. This was repeated three times, and each time it moved in the ſame direction (nearly), which differed conſiderably from the direction of the needle itſelf.

It is now plain that we may, with confidence, aſſume Dr Gilbert's theory of terreſtrial magnetiſm as ſufficiently eſtabliſhed. And, ſince we muſt certainly call that the north pole of the great magnet which is ſituated in the northern parts of the earth, and ſince thoſe poles of magnets which attract each other have oppoſite polarities, we muſt ſay, that what we call the north pole of a mariner's needle, or of any other magnet, has the ſouthern polarity.

70 The great magnet is the ſource of all natural magnetiſm.

We may now venture to go farther with Dr Gilbert, and to ſay that *all* the magnetiſm which we obſerve, whether in nature or art, is either the immediate or the remote effect of the action of the great magnet. As ſoft bars ſoon acquire a tranſient magnetiſm; as hard bars, after long expoſure, acquire a ſenſible and permanent magnetiſm—we muſt infer, that ores of iron, which are in a ſtate fit for impregnation, muſt acquire a ſenſible and permanent magnetiſm, by continuing, for a ſeries of ages, in the bowels of the earth. And thus the magnetiſm of loadſtones, which, till the diſcovery of the natural magnetiſm acquired by poſition, were the ſources of all our magnetical phenomena, is now proved to be a neceſſary conſequence of the exiſtence and agency of a great magnet contained in the bowels of the earth.

It

71 Loadſtones in the mine may have their poles in any poſition.

It ſeems to reſult from this theory, that, in theſe northern parts of the world, that part of every natural loadſtone that is at the extremity of the line drawn through the ſtone in the magnetic direction ſhould be its pole; and that the loadſtone when properly poiſed, ſhould of itſelf aſſume the very poſition which it had in the mine. Dr Gilbert complains of the inattention of miners (*rude hominum genus, lucro potius quam phyſicæ conſulentes*) to this important circumſtance. Once, however, he had the good fortune to be advertiſed of a great magnetic maſs lying in its matrix. He repaired quickly to the mine, examined it, and marked its points which were in the extremities of the magnetic line. When it was detached from its matrix, he had the pleaſure of finding its poles in the very places he expected. The loadſtone was of conſiderable ſize, weighing about 20 pounds.—Mr Wilcke gives in the Swediſh Commentaries ſeveral inſtances of the ſame kind.

But ſhould this always be the caſe? By no means. There are many circumſtances which may give the magnetiſm of a loadſtone a very different direction. We have found, that ſimple juxtapoſition to a magnet will ſometimes give a ſucceſſion of poles to a long bar of hard ſteel. The ſame thing may happen to an extenſive vein of magnetiſable matter. The loadſtone taken out of this vein may have been placed like that of a ſoft bar placed in the magnetic line, if lying in one part of the vein; if taken from another part of it, its polarity may be the very reverſe; and in another part it may have no magnetiſm, although completely fitted for acquiring it. It may have its poles placed in a direction different from all theſe, in conſequence of the vicinity of a greater loadſtone. As loadſtones poſſeſſed of vigorous magnetiſm are always found only in ſmall pieces, and in pieces of various ſizes and force, we muſt expect every poſition of their poles. The only thing that we can expect by theory is, that adjoining loadſtones will have their friendly poles turned toward each other, and a general prevalence of or tendency to a polarity ſymmetrical with that of the earth. The reader will find ſome more obſervations to this purpoſe in the article Variation, *Encycl.* p. 623. as alſo in Gilbert's treatiſe, B. III. c. 2. p. 121.

Nor ſhould all ſtrata or maſſes of iron ore be magnetical. We know that none are ſuſceptible of induced magnetiſm, but ſuch as are, to a certain degree, in the metallic ſtate. Such ores are not abundant. Nay, even all of ſuch ſtrata do not neceſſarily acquire magnetiſm by the action of the great magnet. If their principal dimenſions lie nearly perpendicular to the magnetic direction, they will not acquire any ſenſible quantity. A ſtratum in this country, riſing about 17 degrees to the N. N. W. will ſcarcely acquire magnetiſm. It may alſo happen, that the influence of the great magnet is counteracted by that of ſome extenſive ſtratum inacceſſible to man, by reaſon of its great depth.

72 Probable cauſe of their great natural vigour.

Thus we ſee, that all the appearances of the original magnetiſm of loadſtones are perfectly conſiſtent with the notion that they are effects of one general coſmical cauſe, the action of the great magnet contained in the earth, and that there is no occaſion to ſuppoſe this great magnet to differ, in its conſtitution or manner of action, from the ſmall maſſes of ſimilar matter called loadſtone. The only difficulty that preſents itſelf is the great ſuperiority of magnetic force obſervable in ſome loadſtones over other maſſes of ores circumjacent, which are not diſtinguiſhable by us by any other circumſtance. We acknowledge ourſelves unable to ſolve this difficulty; for the magnetiſm of ſuch pieces is ſometimes incomparably ſtronger than what a bar of iron acquires by poſition; yet this bar is much more ſuſceptible than the ores which are fit for becoming loadſtones. Perhaps there is ſome chemical change which obtains gradually in certain maſſes, which aids the impregnation, in the ſame way that we know that being red hot deſtroys all magnetiſm, whether in a metal bar or in an ore. This ſeems to be confirmed by what we ſee in ſome old iron ſtanchions, which acquire the ſtrongeſt magnetiſm in thoſe parts of their ſubſtance which are combining themſelves with ingredients floating in the atmoſphere. That part which is caſed in the ſtone, and exfoliates and ſplits with ruſt, being converted into ſomething like what is called finery-cinder, becomes highly and permanently magnetic. Such peculiarities as theſe, operating for ages, may allow a degree of magnetical impregnation (in whatever this may conſiſt) to take place, to which we can ſee no reſemblance in our experiments. It would be worth while to place iron wires in a tube in the magnetic direction, which could be kept of a proper red heat, while it is converted into æthiops by ſteam. It is not unlikely that it would acquire a ſenſible and permanent magnetiſm in this way. It may be, that the little atoms, as they arrange themſelves in a ſort of cryſtaline or ſymmetrical form, may alſo arrange ſo as to favour magnetiſm. Were this tried in the vicinity of a ſtrong magnet, the effect might be more remarkable and preciſe. Perhaps, too, while iron is precipitated in a metallic form from its ſolutions by another metal, ſomething of the ſame kind may happen. We know, that proper ores of iron, expoſed to cementation in a low red heat, in the magnetic direction, becomes magnetic.

73 Natural cauſes of the changes of the magnetic direction.

Notice has been taken in the *Encycl.* art. Variation, of the attempts of ingenious men to explain the change which is obſerved in all parts of the globe, on the direction of the mariner's needle, the gradual change of the variation. The hypotheſis of Dr Halley, that the globe which we inhabit is hollow, and incloſes a magnetic nucleus, moving round another axis, is not inconſiſtent with any natural law, if he did not ſuppoſe the interval filled up with ſome fluid. The action of the nucleus and ſhell on the intervening fluid would gradually bring the two to one common motion of rotation, as may be inferred from the reaſonings employed by Newton in his remarks on the Carteſian vortices.

Leaving out this circumſtance, there is only another cauſe which can affect, and muſt affect, the rotation of both; namely, the mutual action of the magnetic nucleus, and the maſſes of magnetic matter in the ſhell. If the axis of rotation of this nucleus be different from the line joining its magnetic poles, theſe poles will have a motion relative to the ſhell; and this motion may eaſily be conceived ſuch as will produce the changes of magnetic direction which we obſerve. It may even produce a motion of the northern magnetic pole in one direction, and of the ſouthern pole in the oppoſite direction, and this with the appearance of different periods of rotation, as ſuppoſed by Mr Churchman. We may here obſerve, by the way, that the change of magnetic direction in this country is not nearly ſo great as is commonly

commonly imagined. The horizontal needle has shifted its position about 35° at London since 1585; but the point of the dipping needle has not changed 10°. We may also observe, that when the pole of the central magnet changes its place, the magnetism of an extensive stratum, influenced by it, may so alter its disposition, as to change the position of the compass needle in the opposite direction to that of the change which the central magnet alone would induce on it.

But as motions have not yet been assigned to this nucleus, which quadrate with the observed positions of the needle, and as the very existence of it is hypothetical, it may not be amiss to examine, whether such a change of variation may not be explained by what we know of the laws of magnetism, and of the internal constitution of this earth?

1. It is pretty certain, that the veins in which loadstones are found are not parts of the great magnet. This appears from their having two poles while in the mine, and also from the very small depth to which man has been able to penetrate. When we compare the positions of the dipping needle with those of a small needle near a magnet, we must infer, that the poles are very far below the surface.

Yet we know, that there are magnetisable strata of very great extent occupying a very considerable portion of the external covering. Though their bulk and absolute power may be small, when compared with those of the great magnet, yet their greater vicinity to the needles on which observations are made, may give them a very sensible influence. In this way may a great deal of the observed irregularities of the positions of the needle be accounted for. In the Lagoon at Teneriffe, *Feuillée* observed the variation 13° 30′ west in 1724, while at the head of the island it was only 5°. The dip at the Lagoon was 63° 30′, greatly surpassing what was observed in the neighbourhood. Muller found, in the mountains of Bohemia, great and desultory differences of declination, amounting sometimes to 50°. At Mantua, the variation in 1758 was 12°; while at Bononia and Brixia it was nearly 18°. Great irregularities were observed by Goëte in the Gulph of Finland, especially near the island of Suffari, among some rocks: on one of these, the needle shewed no polarity. Captain Cook and Captain Phipps observed differences of 10°, extending to a considerable distance, on the west coasts of North America. In the neighbourhood of the island Elba in the Mediterranean, the position of the needle is greatly affected by the iron strata, in which that island so much abounds. In this country, there are also observed small deviations, which extend over considerable tracts of country, indicating a great extent of strata that are weakly magnetic. Since such strata receive their magnetism by induction, in a manner similar to a bar of hard steel, and since we know that this receives it gradually, it may very probably happen, that a long series of years may elapse before the magnetism attains its ultimate disposition.

Here, then, is a necessary change of the magnetic direction; and although it may be very different in different places, according to the disposition and the power of these strata, there must be a general vergency of it one way.

2. It is well known that all metals, and particularly iron, are in a progress of continual production and demetallization. The veins of metals, and more particularly those of iron, are evidently of posterior date to that of the rocks in which they are lodged. Chemistry teaches us, by the very nature of the substances which compose them, that they are in a state of continual change. This is another cause of change in the magnetic direction. Nay, we know that some of them have suddenly changed their situation by earthquakes and volcanoes. Some of the streams of lava from Vesuvius and Ætna abound in iron. This has greatly changed its situation; and if the strata from which it proceeded were magnetical, the needle in its neighbourhood must be affected. Nay, subterranean heat alone will effect a change, by changing the magnetism of the strata. Mr Lievog, royal astronomer at Bessestedt in Iceland, writes, that the great eruption from Hecla in 1783, changed the direction of the needle nine degrees in the immediate neighbourhood. This change was produced at a mile's distance from the frozen lava; and it diminished to two degrees at the distance of 2½ miles. He could not approach any nearer, on account of the heat still remaining in the lava, after an interval of 14 months.

All these causes of change in the direction of the mariner's needle must be partial and irregular. But there is another cause, which is cosmical and universal. Dr Halley's supposition of four poles, or, at least, the supposition of irregular and diffused poles, seems the only thing that will agree with the observations of declination. We know that all magnetism of this kind (that is, disposed in this manner) has a natural tendency to change. The two northern poles may have the same or opposite polarities. If they are the same, their action on each other tends to diminish the general magnetism, and to cause the centre of effort to approach the centre of the magnet. If they have opposite polarities, the contrary effect will be produced. The general magnetism of each will increase, and the pole (or its centre of effort) will approach to the surface. In either of these cases, the compound magnetism of the whole may change exceedingly, by a change by no means considerable in the magnetism of each pair of poles. It is difficult to subject this to calculation; but the reader may have very convincing proof of it, by taking a strong and a weaker magnet of the same length, and one of them, at least, of steel not harder than spring temper. Lay them across each other like an acute letter X; and then place a compass needle, so that its plane of rotation may be perpendicular to the plane of the X. Note exactly the position in which the needle settles. In a few minutes after, it will be found to change considerably, although no remarkable change has yet happened to the magnets themselves.

We flatter ourselves, that our readers will grant that the preceding pages contain what may justly be called a theory of magnetism, in as much as we have been able to include every phenomenon in one general fact, the induction of magnetism; and have given such a description of that fact and its modifications, that we can accurately predict what will be the appearances of magnets and iron put into any desired situation with respect to each other. If our notions of philosophical disquisition (delivered in article Philosophy, *Encycl.*) be just, we have explained the subordinate phenomena, or have given a theory of magnetism. 74

74 Speculations about the origin of magnetism. Hypothesis of Æpinus.

But

But it is not easy to satisfy human curiosity. Men have even investigated, or sought for causes of the perseverance of matter in its present condition. We have not been contented with Newton's theory of the celestial motions, and have sought for the cause of that mutual tendency which he called gravitation, and of which all the motions are particular instances.

Philosophers have been no less inquisitive after what may be the cause of that mutual attraction of the dissimilar poles, and the repulsion of the similar poles, and that faculty of mutual impregnation, or excitement, which so remarkably distinguish iron, in its various states, from all other substances. The action of bodies on each other at a distance, has appeared to them an absurdity, and all have had recourse to some material intermedium. The phenomenon of the arrangement of iron filings is extremely curious, and naturally engages the attention. It is hardly possible to look at it without the thought arising in the mind of a stream issuing from one pole of the magnet, moving round it, entering by the other pole, and again issuing from the former outlet. Accordingly, this notion has been entertained from the earliest times, and different speculatists have had different ways of conceiving how this stream operated the effects which we observe.

The simplest and most obvious was just to make it act like any other stream of fluid matter, by impulsion. Impulsion is the thing aimed at by all the speculatists. They have a notion, that we conceive this way of communicating motion with intuitive clearness, and that a thing is fully explained when it can be shewn that it is a case of impulsion. We have considered the authority of these explanations in the article Impulsion of this *Supplement*, and need not repeat our reasons for refusing it any pre-eminence. But even when we have shewn the phenomena to be cases of impulsion by such a stream, the greatest difficulty, the most curious and the most embarrassing, is to ascertain the sources of this impulsive motion of the fluid—How, and from what cause does it begin? What forces bend it in curves round the magnet? Those philosophers, whose principle obliges them to explain gravitation also by impulse, must have another stream to impel this into its curves. Acting by impulsion, this magnetic stream must lose a quantity of motion equal to what it communicates. What is to restore this? What directs it in a particular course thro' the magnet! And what is it that can totally alter that course—in a moment—in all the phenomena of induced magnetism? How does it impel? Lucretius, either of himself, or speaking after the Greek philosophers, makes it impel, not the iron, but the surrounding air, sweeping it out of the way; and thus giving occasion for the surrounding air to rush around the magnet, and to hurry the bits of iron toward it. There is, perhaps, more ingenious refinement in this thought than in any of the impulsive theories adopted since his day by Des Cartes, Euler, and other great philosophers: But it is sagaciously remarked by D. Gregory, in his MS. notes on Newton, that this theory of Lucretius falls to the ground; because the experiments succeed just as well under water as in the air. As to the explanations, or descriptions, of the canals and their dock gates, opening in one direction, and shutting in the other, constructions that are changed in an instant in a bar of iron, by changing the position of the magnet, we only wonder that men, who have a reputation to lose, should ever hazard such crude and unmechanical dreams before the public eye. The mind of man cannot conceive the possibility of their formation; and if they are really formed, the effects should be the very opposite of those that are observed: the stream should move those bodies least which afford ready channels for its passage. If a rag of iron filings be arranged by the impulsion of such a stream, it should be carried along by it; and if it is *impelled toward* one end of the magnet, it should be impelled *from* the other end. Since we now know, that each particle of filings is a momentary magnet, we must allow a similar stream whirling round each. Is that an explanation which exceeds all power of conception?

But has it ever been shewn, that there is any impulsion at all in these phenomena? Where is the impelling substance? The only argument ever offered for its existence is, that we are resolved that the phenomena of magnetism shall be produced by impulsion, and the arrangement of iron filings looks somewhat like a stream. But enough of this. We trust that we have shewn the way in which this arrangement obtains in the clearest manner. Every particle becomes magnetic by induction. This is a fact, which sets all reasoning at defiance. The polarity of each rag is so disposed, that their adjoining ends turn to each other. This is another uncontrovertible fact. And these two facts explain the whole. The arrangement of iron filings, therefore, is a secondary fact, depending on principles more general; and therefore cannot, consistently with just logic, be assumed as the foundation of a theory.

Had magnetism exhibited no phenomena besides the attraction and repulsion of magnets, it is likely that we should not have proceeded very far in our theories, and would have contented ourselves with reducing these phenomena to their most general laws. But the communication of magnetism seems a great mystery. The simple approach of a magnet communicates these powers to a piece of iron; and this without any diminution of its own powers. On the contrary, beginning with magnets which have hardly any sensible power, we can, by a proper alternation of the manipulations, communicate the strongest magnetism to as many hard steel bars as we please; and the original magnets shall be brought to their highest degree of magnetism. We have no notion of powers or faculties, but as qualities of some substances in which they are inherent. Yet here is no appearance of something abstracted from one body, and communicated to, or shared with another. The process is like kindling a great fire by a simple spark; here is no communication, but only *occasion* given to the exertion of powers inherent in the combustible matter. It appears probable, that the case is the same in magnetism; and that all that is performed in making a magnet is the excitement of powers already in the steel, or the giving occasion for their exertion; as burning the thread which ties together the two ends of a bow, allows it to unbend. This notion did not escape the sagacity of Dr Gilbert; and he is at much pains to shew, that the *coitio magnetica* is a quality inherent in all magnetical bodies, and only requires the proper circumstance for its exertion. He is not very fortunate in his attempts to explain *how* it is developed by the vicinity of a magnet, and how this faculty, or actual exertion of this power, becomes permanent in one body, while in another it requires the constant presence of the magnet.

74 Magnetical hypothesis of Æpinus. It is to Mr Æpinus, of the Imperial Academy of St Petersburg, that we are indebted for the first really philosophical attempt to explain all these mysteries. We mentioned, in the article Electricity, *Suppl.* the circumstance which suggested the first hint of this theory to Æpinus, *viz.* the resemblance between the attractions and repulsions of the tourmaline and of a magnet. A material cause of the electric phenomena had long been thought familiar to the philosophers. They had attributed them to a fluid which they called an electric fluid, and which they conceived to be shared among bodies in different proportions, and to be transferable from one to another. Dr Franklin's theory of the Leyden phial, which led him to think that the faculty of producing the electrical phenomena depended on the deficiency as well as the redundancy of this fluid, combined with the phenomena of induced electricity, suggested to Æpinus a very perspicuous method of stating the analogy of the tourmaline and the magnet; which he published in 1758 in a paper read to the academy.

Reflecting more deeply on these things, Mr Æpinus came by degrees to perceive the perfect similarity between all the phenomena of electricity by position and those of magnetism; and this led him to account for them in the same manner. As the phenomena of the Leyden phial, explained in Franklin's manner, shews that a body may appear electrical all over, by having less than its natural quantity of the electric fluid, as well as by having more, it seemed to follow, that it may also be so in respect to different parts of the same body; and therefore a body may become electrified in opposite ways at its two extremities, merely by abstracting the fluid from one end, and condensing it in the other; and thus may be explained the phenomena of induced electricity, where nothing appears to have been communicated from one body to the other. If this be the case, the two ends of a body rendered electric by induction should exhibit the same distinctions of phenomena that are exhibited by bodies wholly redundant and wholly deficient. The redundant ends should repel each other; so should the deficient ends; and a redundant part should attract a deficient. All these results of the conjecture tally exactly with observation, and give a high degree of probability to the conjecture. The similarity of these phenomena to the attractions of the dissimilar poles of a magnet, and the repulsions of the similar poles, is so striking, that the same mode of explanation forces itself on the mind, and led Mr Æpinus to think, that the faculty of producing the magnetical phenomena belonged to a magnetical fluid, residing in all bodies susceptible of magnetism; and that the exertion of this faculty required nothing but the abstraction of the fluid from one end of the magnetic bar, and its constipation in the other. And this conjecture was confirmed by observing, that in the induction of magnetism on a piece of iron, the power of the magnet is not diminished.

All these circumstances led Mr Æpinus to frame the following hypothesis:

1. There exists a substance in all magnetic bodies, which may be called the magnetic fluid; the particles of which repel each other with a force decreasing as the distance increases.

2. The particles of magnetic fluid attract, and are attracted by the particles of iron, with a force that varies according to the same law.

3. The particles of iron repel each other according to the same law.

4. The magnetic fluid moves, without any considerable obstruction, through the pores of iron and soft steel; but is more and more obstructed in its motion as the steel is tempered harder; and in hard tempered steel, and in the ores of iron, it is moved with the greatest difficulty.

In consequence of this supposed attraction for iron, the fluid may be contained in it in a certain determinate quantity. This quantity will be such, that the accumulated attraction of a particle for all the iron balances, or is equal to, the repulsion of all the fluid which the iron contains. The quantity of fluid competent to a particle of iron is supposed to be such, that the repulsion exerted between it and the fluid competent to another particle of iron is also equal to its attraction for that particle of iron: And therefore the attraction between the fluid in an iron bar A for the iron of another bar B, is just equal to its repulsion for the fluid in B; it is also equal to the repulsion of the iron in A for the iron in B. This quantity of fluid residing in the iron may be called its natural quantity.

In consequence of the mobility through the pores of the iron, the magnetic fluid may be abstracted from one end of a bar, and condensed in the other, by the agency of a proper external force. But this is a violent state. The mutual repulsion of the particles of condensed fluid, and the attraction of the iron which it has quitted, tend to produce a more uniform distribution. If we reflect on the law of action, we shall clearly perceive, that somewhat of this tendency must obtain in every state of condensation and rarefaction, and that there can be a perfect equilibrium only when the fluid is diffused with perfect uniformity. This, therefore, may be called the natural state of the iron.

If the resistance opposed by the iron to the motion of the magnetic fluid be like that of perfect fluids to the motion of solid bodies, arising entirely from the communication of motion, there is no tendency to uniform diffusion so weak as not to overcome such resistance, and finally to produce this uniform distribution. But (as is more probable) if the obstruction resembles that of a clammy fluid, or of a soft plastic body like clay, some of the accumulation, produced by the agency of an external force, may remain when the force is removed; the diffusion will cease whenever the equalising force is just in equilibrio with the obstruction.

All the preceding circumstances of the hypothesis are so perfectly analogous to the hypothesis of Mr Æpinus for explaining the electrical phenomena, which is given in detail in the article Electricity of this *Supplement*, that it would be superfluous to enter into a minute discussion of their immediate results. We therefore beg the reader to peruse that part of the article Electricity where the elements of Æpinus's hypothesis are delivered, and the phenomena of induced electricity explained (*viz.* from n° 11. to 60. inclusive), and to suppose the discourse to relate to the *magnetical* fluid. Let N, S, *n*, *s*, be considered as the overcharged and undercharged parts of a magnetical body, or the poles of a magnet, and of iron rendered magnetical by induction. We shall confine our observations in this place to to those circumstances in which the mechanical phenomena of magnetism are limited by the circumstance, that magnets always contain their natural quantity of fluid; so that their action on iron, and on each other, depends entirely on its unequable distribution; as is the case with induced electricity.

75 Magnetism how induced on iron by juxtaposition.

Let the magnet NAS (fig. 26.), having its north pole NA overcharged, be set near to the bar *n* B *s* of common iron, and let their axes form one straight line. Then (as in the case of electrics) the overcharged pole NA acts on the bar B only by means of the redundant fluid which it contains. For that portion of its fluid, which is just sufficient for saturating the iron, will repel the fluid in B, just as much as the iron in NA attracts it; and therefore the fluid in B sustains no change from this portion of the fluid in NA. In like manner, the pole SA acts on B only in consequence of the iron in SA, which is not saturated or attended by its equivalent fluid.

If the fluid in B is immoveable, even the redundant fluid in NA, and redundant iron in SA, will produce no *sensible* effect on it: For every particle of iron in B is accompanied by as much fluid as will balance, by its repulsions and attractions, the attractions and repulsions of the equidistant particle of iron. But as the magnetical fluid in B is supposed to be easily moveable, it will be repelled by the redundant fluid in AN toward the remote extremity *n*, till the resistance that it meets with, joined to its own tendency to uniform diffusion, just balances the repulsion of AN. This tendency to uniform diffusion obtains as soon as any fluid quits its place; as has been sufficiently explained in the Supplementary article ELECTRICITY, n° 16. 17. &c.

But, at the same time, the redundant iron in AS attracts the fluid in B, and would abstract it from B *n*, and condense it into B *s*. This attraction opposes the repulsion now mentioned. But, because AS is more remote from every point of B than AN is from the same point, the repulsions of the redundant fluid in AN will prevail; and, on the whole, fluid will be propelled toward *n*, and will be rarefied on the part B *s*. But as to what will be the law of distribution, both in the redundant and deficient parts of B, it is plain that nothing can be said with precision. This must depend on the distribution of the fluid in the magnet NAS. The more diffused that we suppose the redundant fluid and matter in the magnet, the farther removed will the centres of effort of its poles be from their extremities; the smaller will be the action of AN and AS, the smaller will be their difference of action; and therefore the smaller will be the condensation in B *n*, and the rarefaction in B *s*. Hence we learn, in the outset of this attempt to explanation, that the action of a magnet will be so much the greater as its poles are more concentrated. This is agreeable to observation, and gives some credit to the hypothesis. We can just see, in a very general manner, that the fluid will be rarer than its natural state in *s*, and denser in *n*; and that the change of density is gradual, and that the density may be represented by the ordinates of some line *c b d* (fig. 27), while the natural density is represented by the ordinates to the line C *b* D, parallel to *s n*. There will be some point B of the iron bar, where the fluid will be of its natural density, and the ordinate B *b* will meet the line *c b d* in the point of its intersection with CD.

All this action is internal and imperceptible. Let us inquire what will be the *sensible* external action. There is a superiority of attraction towards the magnet: For since the magnetic action is supposed to diminish continually by an increase of distance, the curve, whose ordinates represent the forces, has its convexity toward the axis. Also, the force of the poles AN, AS are equal at equal distances: For, by the hypothesis, the attraction and repulsion of an individual particle are equal at equal distances; and the condensation in AN is equal to the deficiency in AS, by the same hypothesis; because NAS still contains its natural quantity of fluid. Therefore the action of both poles may be expressed by the ordinates of the same curve, and they will differ only by reason of their distances. We may therefore express the actions by the four ordinates M *m*, P *p*, N *n*, Q *q*, of fig. 2.; of which the property (deduced from the single circumstance of its being convex toward the axis) is, that M *m* + Q *q* is greater than P *p* + N *n*. There is therefore a surplus of attraction. It is only this surplus that is perceived. The fluid, moveable in B, but retained by it so as not to be allowed to escape, is pressed towards its remote end *n* by the excess P *p*—Q *q* of the repulsion of the redundant fluid in AN, above the attraction of the redundant iron in AS. This excess on every particle of the fluid is transmitted, by the common laws of hydrostatics, to the stratum immediately incumbent on the extremity *n*, and B is thus pressed away from A. But every particle of the solid matter in B is attracted towards A by the excess M *m* — N *n* of the attraction of the redundant fluid in AN above the repulsion of the redundant iron in AS: and this excess is greater that the other; for *m* + *q* is greater than *p* + *n*.

The piece of common iron *n* B *s* is therefore attracted, *in consequence* of the fluid in it having been propelled towards its remote extremity, and distributed in a manner somewhat resembling its distribution in NAS. Now, in this hypothesis, magnetism is held to depend entirely on the distribution of the fluid. B has therefore become a magnet, has magnetism induced on it, and, only in consequence of this induction, is attracted by A.

Had we supposed the deficient, or south pole of A, to have been nearest to B, the redundant matter in AN would have attracted the moveable fluid in B more than the remoter redundant fluid in AS repels it; and, on this account, the magnetic fluid would have been constipated in B *s*, and rarefied in B *n*. It would, in this case also, have been distributed in a manner similar to its situation in the magnet. And B would therefore have been a momentary magnet, having its redundant pole fronting the deficient or dissimilar pole of A. It is plain, that there would be the same surplus of attraction in this as in the former instance, and B would (on the whole) be attracted in consequence, and only in consequence, of having had a properly disposed magnetism induced on it by juxtaposition. The sensible attraction, in this case, is a *consequence* of the distribution now described; because, since the fluid constipated in the end next to A cannot quit B, the tendency of this fluid toward A must press the solid matter of B in this direction (by hydrostatical laws) more than this solid matter is repelled in the opposite direction.

Thus it appears, that the hypothesis tallies precisely with

with the induction of magnetism. We do not call this an explanation of the phenomenon; for the fact is, that it is the hypothesis that is explained by the phenomenon: That is, if any person be told that induced magnetism is produced by the action of a fluid, in consequence of its situation being changed, he will find, that in order to agree with the attraction of dissimilar, and the repulsion of similar poles, he must accommodate the fluid to the phenomena, by giving it the properties assigned to it by Æpinus.

76 Conformity of the hypothesis with a vast variety of phenomena.

But the agreement with this simplest possible case of the most simple example of induced magnetism, is not enough to make us adopt the hypothesis as adequate to the explanation of all the magnetic phenomena. We must confront the hypothesis with a variety of observations, to see whether the coincidence will be without exception.

When the key CB, in fig. 8. is brought below the constipated north pole N of the magnet SAN, its own moveable fluid is propelled from C towards B, and is disposed in CB nearly after the same manner as in SAN. Therefore the redundant fluid in the lower end of the key repels the moveable fluid in the wire BD more than the redundant matter in the upper end C attracts it; and thus the fluid is rarefied in the upper end of the wire BD, and condensed in its lower end D. CB and BD therefore are two temporary magnets, having their dissimilar poles in contact, or nearest to each other. This is all that is required for their attraction. This effect is promoted by the action of N on the wire BD, also propelling the fluid toward D; and thus increasing the mutual attraction of CB and BD. In like manner, when the key CB is held above the magnet, the moveable fluid in it is more attracted by the redundant matter in SA than it is repelled by the more remote redundant fluid in AN. The same thing happens to the fluid in the wire BD. Therefore CB and BD must attract each other; and the key will carry the wire, although the magnet is below it, and also attracts it. This singularity proceeds from the almost perfect mobility of the fluid in the two pieces of common iron, which renders their poles extremely constipated; whereas the hardness required for the fixed magnetism of the magnet prevents this complete constipation and rarefaction. This can be strictly demonstrated in the case of slender rods of iron; but we can shew, and experience confirms it, that in other cases, depending on the shape and the temper of the pieces, the wire will not adhere to the key, but to the magnet.

In the various situations and positions of the key and wire represented in fig. 7. the actions of some of the poles on the moveable fluid in the iron are oblique in regard to the length of the pieces; but, since the moveable matter is supposed to be a fluid, it will still be propelled along the pieces, notwithstanding their obliquity, in the same manner as gravity makes water occupy the lower end of a pipe lying obliquely. If indeed the magnetic fluid could escape from the iron without any obstruction by the propulsion of the magnet, it could produce no attraction, or sensible motion, any more than light does in a transparent body. What is demonstrated of the electric fluid in the Supplemental article Electricity, n° 133. is equally true here. Why the fluid does not escape when it is so perfectly moveable, is a question of another kind, and will be considered afterwards; at present, the *hypothesis* is, that it does not escape.

If the key and wire have the position fig. 10. n° 1. the fluid is expelled from the parts in contact, and is condensed in the remote ends. So far from attracting each other, the key and wire must repel. They are temporary magnets, having their similar poles fronting each other. They must repel each other, if presented in a similar manner to the south pole of the magnet.

If they be presented as in n° 2. fig. 10. where the actions of both poles of the magnet are equal, the state of the fluid in them will not be affected. The redundant pole of the magnet repels the moveable fluid in both the key and the wire toward the upper ends; but the deficient pole acts equally on it in the opposite direction. It therefore remains uniformly distributed through their substance; and therefore they can exhibit no appearance of magnetism.

But if the key and wire be presented to the *same* part of the magnet, but in another position, as shewn in fig. 8. n° 3. the fluid of the key will be abstracted from C, and condensed in B, by the joint action of both poles of the magnet. The same thing will happen in the wire BD. Here, therefore, we have two magnets, with their dissimilar poles touching. They will attract each other strongly; and if carried gradually toward the upper or lower end of the magnet, they will separate before the point B arrives abreast of N or S. For similar reasons, the pieces of iron presented to the middle of the magnet, as in fig. 10. will have one side a weak north pole, and the other side a weak south pole; but this will not be conspicuous, unless the pieces be broad.

This experiment shews, in a very perspicuous manner, the competency of the hypothesis to the explanation of the phenomena. When the fluid is not moved, magnetism is not induced, even on the most susceptible substance.

When a piece of iron A (fig. 10.), nearly as large as the magnet can carry, hangs at either pole, a large piece of iron B, brought near to the pole on the other side, should cause it immediately to fall. If S be the deficient pole, it causes the fluid in A to ascend to the top, and A is attracted: but, for the same reason, it causes the fluid in B to accumulate in its lower end. This redundant fluid must evidently counteract the redundant matter in S, in the induction of the magnetic state on A. Being more remote from A than S is, it cannot wholly prevent the accumulation in the upper end on A; but it renders it so trifling, that the remaining attraction thence arising cannot support the weight of A. This is a very instructive experiment.

But if, on the contrary, we bring a large piece of iron C below the heavy key A, this piece C will have its fluid accumulated in its upper end, both by the action of A on it, and by the action of the magnet. The attraction of the magnet for A should therefore be augmented; and a magnet should carry a heavier lump of iron when a great lump is beyond it. And it is clear (we think), for similar reasons, that the magnetism of the magnet itself in fig. 11. should be increased by bringing a great lump of iron near its opposite pole: for the magnet differs from common iron only in the *degree* of the mobility of its fluid.

When a compass needle is placed opposite to the redundant

dundant pole N of a magnet AN (fig. 28.), it arranges itſelf magnetically. If a piece of common iron be now preſented laterally to the near point of the needle, the redundant matter in the adjoining parts of the needle and the iron ſhould make them repel; but if preſented to the remote end, the redundant matter in the iron ſhould attract the redundant fluid in that end of the needle, and that end ſhould turn toward the iron.

A parcel of ſlender iron wires, carried by the pole of a magnet, as in fig. 29. ſhould avoid each other. If N be the redundant pole, the fluid in each wire will be driven to the remote end, where it muſt repel the ſimilarly ſituated fluid of its neighbour. The ſame external appearance muſt be exhibited by pieces of wire hanging at the deficient pole of the magnet.

The redundant pole of a magnet A (fig. 30.) being held vertically above the centre of two pieces of common iron, moveable round a ſlender pin, renders the middle of each deficient, and their extremities redundant; therefore they ſhould repel each other, and ſpread out. The ſame effect ſhould be produced by the under charged pole of A.

The redundant pole of a magnet A being applied to one branch of the piece of forked iron NCS (fig. 31.), ſhould drive the fluid into its remote parts C, and then the branch NC ſhould be able to induce the magnetic ſtate on a bit of iron D. But if the deficient pole S of another magnet B be applied to the other branch, theſe two actions ſhould counteract each other at C, and the iron ſhould remain indifferent, and fall.—Yet the magnet B alone would equally cauſe C to carry the piece of iron.

It is ſurely unneceſſary to demonſtrate, that the conſequence of this hypotheſis muſt be, that when a magnet puts any piece of iron into the magnetic ſtate, its own magnetiſm is improved. For the induced magnetiſm of the iron is always ſo diſpoſed as to give the fluid in the magnet a greater conſtipation where already condenſed, and to abſtract more fluid from the parts already deficient. If magnetiſm be produced by ſuch a fluid, a magnet muſt always improve by lying any how among pieces of iron.

But the caſe may be very different when magnets are kept in each others neighbourhood. When the overcharged poles of two magnets are placed fronting each other, the redundant fluid in each repels that in the other more than it attracts the remoter redundant iron. The magnets muſt therefore repel each other. Moreover, in rendering them magnetical, the repulſion of redundant fluid, or the attraction of redundant matter of ſome other magnet, had been employed; and when the magnet was removed, ſome of the conſtipated fluid overcame the obſtruction to its uniform diffuſion, and eſcaped into the deficient pole; what remains is withheld by the obſtruction, and the reſtoring forces are juſt in equilibrio with this obſtruction. If we now add to them the repulſion of redundant fluid, directed toward the deficient pole, ſome more of the conſtipated fluid muſt be driven that way, and the magnet muſt be weakened. Nay, it may be deſtroyed, and even reverſed, if one of the magnets be very powerful, and have its own magnetiſm very fixed; that is, if its fluid be very redundant, and meet with very great obſtruction to its motion. Hence it alſo ſhould follow, that the repulſion obſerved between two magnets ſhould be weaker at the ſame diſtance than their attraction, and ſhould follow a different law. For, in the courſe of the experiments, the ſituation of the fluid in the magnets is continually changing, and approaching to a ſtate of uniform diffuſion.

77 Let us now examine into the ſenſible effect of this fluid on a magnet which cannot move from its place, but can turn on its centre like a compaſs needle. This ſcarcely requires any diſcuſſion. We ſhould only be repeating, with regard to the redundant fluid and redundant matter, what we formerly ſaid in regard of north pole and ſouth pole; the little magnet muſt arrange itſelf nearly in the tangent of a magnetic curve. But it requires a more minute inveſtigation to determine what the ſenſible phenomenon ſhould be when the fluid of the little magnet is perfectly moveable.

Explanation of the directive power, and of polarity.

Suppoſe therefore a particle C (fig. 32.) of magnetic fluid, at perfect liberty to move in every direction, and acted on by the redundant and deficient poles of a magnet NAS. The redundant iron in S attracts C in the direction and with the force CF, while the redundant fluid in N repels it in the direction and with the force CD. By their joint action it muſt be urged in the direction and with the force CE, the diagonal of the parallelogram CDEF, which muſt be accurately a tangent to a magnetic curve. If this particle of fluid belong to the piece of iron n C s, which lies in that very direction, it will unqueſtionably be puſhed towards the extremity n. The ſame muſt happen to other particles. Hence it appears that a piece of common iron in this ſituation and poſition muſt become a magnet, and muſt retain this poſition; only the mechanical energy of the lever may change the equilibrium of the magnetic forces a little; becauſe when the piece of iron n C s has any ſenſible magnitude, the action on its different points will be a little unequal, and may compoſe diagonals which divide a little from the tangent.

Should the iron needle chance not to have the exact poſition, but not deviate very far from it, it is alſo clear that the fluid, not being able to eſcape, will preſs on the ſide toward which it is impelled; and thus will cauſe the needle to turn on its pivot, and finally arrange itſelf in magnetical and mechanical equilibrium, deviating ſo much the leſs from a tangent to a magnetic curve as the piece of iron is ſmaller. Any piece of common iron, held in the neighbourhood of a magnet, will become more overcharged at one end and undercharged at the other, in proportion as the poſition of its length comes nearer to the tangent of a magnetic curve. A ſlender wire held perpendicular to this poſition, that is, perpendicular to the curve, ſhould not acquire any ſenſible magnetiſm, either attractive or directive.

78 We ſurely need not now employ many words to ſhew that a parcel of iron filings, ſtrewed round a magnet, ſhould arrange themſelves in the primary magnetic curves, or that when ſtrewed round two magnets they ſhould form the ſecondary or compoſite curves.

Explanation of the curves formed by iron filings.

79 Let us now enquire more particularly into the modifications of this accumulation of magnetic fluid which may reſult from the nature of the piece of iron, as it is put into the magnetic ſtate. The propelling force of A acts againſt the mutual repulſion of the particles of fluid in B, and alſo againſt the obſtruction to its motion through the pores of B. The greater this obſtruction, the ſmaller will be the accumulation which ſuffices, in conjunction

Explanation of transitory and of permanent magnetiſm, and of indifferent and determinate magnetiſm.

conjunction with the obſtruction and the attraction of the deſerted iron, to balance the propulſive force of the redundant fluid in the overcharged pole of A. This circumſtance therefore muſt limit the accumulation that can be produced in a given time. Therefore the magnetiſm produced on ſoft ſteel or iron ſhould be greater than that produced in hard ſteel at the ſame diſtance. Hence the great advantage of ſoft poles, or of armour, or of capping, to a loadſtone, or to a bundle of hard bars. The beſt form and dimenſions of this armour is certainly determinable by mathematical principles, if we knew the law of magnetical action, and the diſpoſition of the magnetiſm in our loadſtone; but theſe are too imperfectly known in all caſes for us to pretend to give any exact rules. We muſt decide experimentally by making the caps large at firſt, and reducing them till we find the loadſtone carry leſs; then make them a ſmall matter larger. The chief things to be minded are the purity, the uniformity, and the ſoftneſs of the iron, and the cloſeſt poſſible contact.

If the obſtruction reſemble that to motion through a clammy fluid, the final accumulation in hard ſteel may be nearly equal to that in iron, but will require much longer time. Alſo, becauſe ſuch obſtruction to the motion of the fluid will nearly balance the propelling force in parts that are far removed from the magnet, the accumulation will begin thereabouts, while the bar beyond is not yet affected. A redundant pole will be formed in that place. This will operate on what is *immediately* beyond it, driving the fluid farther on, and occaſioning another accumulation at a ſmall diſtance. This may produce a ſimilar effect in a ſtill ſmaller degree farther on. Thus the ſteel bar will have the fluid alternately condenſed and rarefied, and contain alternate north and ſouth poles. This ſtate of diſtribution will not be permanent; fluid will be gradually changing its place; theſe poles will gradually advance along the bar, the remoter poles becoming gradually more diffuſe and faint; and it will not be till after a very long time that a regular magnetiſm with two poles will be produced. To ſtate mathematically the procedure of this mechaniſm would require many pages. Yet it may be done in ſome ſimple caſes, as Newton has ſtated the proceſs of aerial undulation. But we cannot enter upon the taſk in this limited diſſertation. What is ſaid in the Supplementary article Electricity (n° 217, 218.) on the diſtribution of the electric fluid in an imperfect inſulator, will aſſiſt the reader to form a notion of the ſtate of magnetiſm during its induction. That ſuch alternations proceed from ſuch mechaniſm, we have ſufficient proof in the inſtances mentioned in the former part of this article. The wave, or curl, produced on the ſurface of a clammy fluid, is a phenomenon of the ſame kind, and owing to ſimilar cauſes.

When the magnet which has produced all theſe changes is removed, it is evident that a part of this accumulation will be undone again. The repulſion of the condenſed fluid, and the attraction of the deſerted iron, will bring back ſome of the fluid. But it is very evident, that a part of the accumulation will remain, by reaſon of the obſtruction to its motion in returning: and this remainder muſt be ſo much the greater as the obſtruction to the change of ſituation is greater. In ſhort, we cannot doubt but that the magnetiſm which remains will be greater in hard than in ſpring tempered ſteel.

Thus have we traced the hypotheſis in a great variety of circumſtances and ſituations, and pointed out what ſhould be the external appearance in each. We did not, in each inſtance, mention the perfect coincidence of theſe conſequences with what is really obſerved, but left it to the recollection of the reader. The coincidence is indeed ſo complete, that it ſeems hardly poſſible to refuſe granting that nature operates in this or ſome very ſimilar manner. We get ſome confidence in the conjecture, and may even proceed to explain complicated phenomena by this hypothetical theory. We might proceed to ſhew, that the effects of all the methods practiſed by the artiſts in making artificial magnets are eaſy conſequences of the hypotheſis; but this is hardly neceſſary. We ſhall juſt mention ſome facts in thoſe proceſſes which have puzzled the naturaliſts. 80 Rationale of the proceſs for making magnets.

1. A ſtrong magnet is known to communicate the greateſt magnetiſm to a bar of hard ſteel; but Muſchenbroek frequently found, that a weak magnet would communicate more to a ſoft than to a hard bar.

Explanation. When the magnet is ſtrong enough to impregnate both as highly as they are capable of, the hard bar muſt be the ſtrongeſt; but if it can ſaturate neither, the ſpring-tempered bar muſt be left the moſt magnetical.

2. A ſtrong magnet has ſometimes communicated no higher magnetiſm than a weaker one; both have been able to ſaturate the bar.

3. A weak magnet has often impaired a ſtrong one by ſimply paſſing along it two or three times; but a piece of iron always improves a magnet by the ſame treatment.

Explanation. When the north pole of a weak but hard magnet is ſet on the north pole of a ſtrong one, it muſt certainly repel part of the fluid towards the other end, and thus it muſt weaken the magnet. When it is carried forward, it cannot repel this back again, becauſe it is not of itſelf ſuppoſed capable of making the magnet ſo ſtrong. But the end of a piece of iron, always acquiring a magnetiſm oppoſite to that of the part which it touches, muſt increaſe the accumulation of fluid where it is already condenſed, and muſt expel more from thoſe parts which are already deficient.

4. All the parts of the proceſs of the double touch, as practiſed by Meſſrs Mitchell and Canton, are eaſily explained by this hypotheſis. A particle of fluid p (fig. 33.), ſituated in the middle between the two magnets, is repelled in the direction pe by the redundant pole of the magnet AN, whoſe centre of effort is ſuppoſed to be at C. It is attracted with an equal force in the direction pd toward the centre of effort of the deficient pole of AS. By theſe combined actions it is impelled in the direction pf. Now it is plain that, although by increaſing the diſtance between N and S, the forces with which theſe poles act on p are diminiſhed, yet the compound force pf may increaſe by the diminution of the angle dpe. If the action is as $\frac{1}{x^2}$, pf will be greateſt when $\frac{\text{Coſ.}\, dpf}{dp^2}$ is a maximum, or (nearly) when $\text{Sin.}^2\, dpf \times \text{Coſ.}\, dpf$ is a maximum: but this depends on

on the place of the centre of effort. We can, however, gather from this obſervation, that the nearer we ſuppoſe the centres of effort of the poles N and S to the extremities of the magnets, the nearer muſt they be placed to each other. But we muſt alſo attend to another circumſtance; that by bringing the poles nearer together, although we produce a greater action on the intervening fluid, this action is exerted on a ſmaller quantity of it, and therefore a leſs effect may be produced. This makes a wider poſition preferable; but we have too imperfect a knowledge of the circumſtances to be able to determine this with accuracy. The unfavourable action on the fluid beyond the magnets muſt alſo be conſidered. Yet all this may be aſcertained with preciſion in ſome very ſimple inſtances, and the determination might be of ſervice, if we had not a better method, independent of all hypotheſes or theory; namely, to place the magnets at the diſtance where they are *obſerved* to lift the heavieſt bar of iron; then we are certain that their action is moſt favourable, all circumſtances being combined.

We alſo ſee a ſufficient reaſon for preferring the poſition of the magnets employed by Mr Antheaume (and before him by Mr Servington Savery), in his proceſs for making artificial magnets. The form of the parallelogram $d\,p\,e\,f$ is then much more favourable, the diagonal $p\,f$ being much longer.

We alſo ſee, in general, that, by the method of double touch, a much greater accumulation of fluid may be produced than by any other known proceſs.

And, laſtly, ſince no appearances indicate any difference between natural and artificial magnetiſm, this hypotheſis is equally applicable to the explanation of the phenomena of natural magnetiſm; ſuch as the poſition of the horizontal, and of the dipping needle, and the impregnation of natural loadſtones.

Having ſuch a body of evidence for the aptitude of this hypotheſis for the explanation of phenomena, it will ſurely be agreeable to meet with any circumſtances which render the hypotheſis itſelf more probable. Theſe are not wanting; although it muſt be acknowledged that nothing has yet appeared, beſides the phenomena of magnetiſm, to give us any indication of the exiſtence of ſuch a fluid; but there are many particulars in their appearance which greatly reſemble the mechanical properties of a fluid.

81 Probability of the exiſtence of a magnetical fluid.

Heating a rod of iron, and allowing it to cool in a poſition perpendicular to the magnetic direction, deſtroys its magnetiſm. Iron is expanded by heat. If the particles of the magnetic fluid are retained between thoſe of the iron, notwithſtanding the forces which tend to diffuſe them uniformly, they may thus eſcape from between the ferrugineous particles which withheld them. For ſimilar reaſons, magnetiſm ſhould be acquired by heating a bar and letting it cool in the magnetic direction. But, beſides this evident mechanical *opportunity* of motion, the union of fire (or whatever name the neologiſts may chooſe to give to the cauſe of expanſion and of heat) with the particles of iron may totally change the action of thoſe particles on the particles of fluid in immediate contact with them; nay, it may even change the ſenſible law of action between magnet and magnet. Of this no one can doubt who underſtands the application of mathematical ſcience to corpuſcular attraction (See Boscovich, *Suppl.*) A change may be produced in the action between magnets without any remarkable change happening in the actions within the magnet, and it may be juſt the reverſe. The union of fire with the magnetic fluid may increaſe the mutual repulſion of its parts, as it does in all aerial fluids or gaſes. This alone would produce a diſſipation of ſome magnetiſm. It may increaſe the attraction (at inſenſible diſtances) between the fluid and the iron, as it does in numberleſs caſes in chemiſtry.

82 Farther grounds of belief.

It is well known that violently knocking or hammering a magnet weakens its force, and that hammering a piece of iron in the magnetic direction will give it ſome magnetiſm. By this treatment the parts of the iron are put into a tremulous motion, alternately approaching and receding from each other. In the inſtants of their receſs, the pent-up particles of the fluid may make their eſcape. A quantity of ſmall ſhot may be uniformly mixed with a quantity of wheat, and will remain ſo for ever, if nothing diſturb the veſſel; but continue to tap it ſmartly with a ſtick for a long time, and the grains of ſmall ſhot will eſcape from their confinements, and will all go to the bottom. We may conceive the particles of magnetic fluid to be affected in the ſame way. The ſame effect is produced by grinding or filing magnets and loadſtones. The latter are frequently made worthleſs by grinding them into the proper ſhape. This ſhould be avoided as much as poſſible, and it ſhould always be done in moulds made of ſoft iron and very maſſive; but this will not always prevent the diſſipation of *ſtrong* magnetiſm. As a farther reaſon for aſſigning this cauſe for the diſſipation in ſuch caſes, it muſt be obſerved (Muſchenbroek takes notice of it), that a magnet or loadſtone may be ground at its neutral point without much damage. But we had the following moſt diſtinct example of the proceſs. A very fine artificial magnet was ſuſpended by a thread, with its ſouth pole down. A perſon was employed to knock it inceſſantly with a piece of pebble, in ſuch a manner as to make it ring very clearly, being extremely hard and elaſtic. Its magnetiſm was examined from time to time with a very ſmall compaſs needle. In three quarters of an hour, its magnetiſm was not only deſtroyed, but the lower end ſhewed ſigns of a north pole. The ſame magnet was again touched, and made as ſtrong as before, and was then wound about very tight with wetted whipcord, leaving a ſmall part bare in the middle. It was again knocked with the pebble, but could no longer ring. At the end of three quarters of an hour its magnetiſm was ſtill vigorous, and was not near gone after two hours and a quarter. We diſcharged a Leyden jar (coated with gold leaf) in the ſame way. It ſtood on the top of an axis; and while this was turned round, the edge was rubbed with a very dry cork filled with roſin, and faſtened to the end of a glaſs rod. This made the jar ſound like the glaſs of a harmonica. One of them was ſplit in this operation.

A ſmall bar of ſteel was heated red hot and tempered hard between two ſtrong magnets lying in ſhallow boxes filled with water, and was more ſtrongly impregnated in this way than in any other that we could think of for a bar of that ſhape. It has not yet been aſcertained in what temperature it is moſt ſuſceptible of magnetiſm, but it was conſiderably hotter than to be juſt viſible in a dark place. It is no objection to our way of conceiving magnetiſm, that the fluid is in moveable

or

or inactive when the iron is red hot. Either of theſe, or both of them, may reſult from the union with the cauſe of heat. Even a particular degree of expanſion may ſo change the law of action as to make it *immoveable*; or the union with caloric may render it *inactive* at all ſenſible diſtances. We cannot but think, that ſome very inſtructive facts might be obtained by experiments made on iron in the moment of its production, and changes in various chemical proceſſes. All magnetiſm is gone when it is united with ſulphur and arſenic in the greateſt number of ores; and when it is in the ſtate of an ochre, ruſt, æthiops, or ſolution in acids; and when united with aſtringent ſubſtances, ſuch as galls. When, and in what ſtate, does it become magnetic? And whence comes the fluid of Æpinus? It were worth while to try, whether magnets have any influence in the formation or cryſtallization of the martial ſalts; and what will be their effect on iron when precipitated from its ſolutions by another metal, &c. &c.

83 Why magnets have always more than one pole.

There remains one remarkable fact to be taken notice of, which, in one point of view, is a confirmation of the hypotheſis, but in another preſents conſiderable difficulties. It is well known, that no magnet has ever been ſeen which has but one pole; that is, on the hypotheſis of Æpinus, which is wholly redundant, or wholly deficient. If all magnetiſm be either the immediate or the remote effect of the great magnet contained in the earth, and if it be produced by induction, without any communication of ſubſtance, but only by changing the diſpoſition of the fluid already in the iron, we never ſhould ſee a magnet with only one pole. It muſt be owned, that we never can make ſuch a magnet by any of the proceſſes hitherto deſcribed; but the exiſtence of ſuch does not ſeem impoſſible. Suppoſing a magnet of the moſt regular magnetiſm, having only two poles; and that we cut it through at the neutral point, or that we cut or break off any part of it—the fact is, (for the experiment has been tried ever ſince men began to ſpeculate about magnetiſm), that each part becomes an ordinary magnet, with two poles, one of which is of the ſame kind as before the ſeparation. The queſtion now is, What ſhould happen according to the theory maintained by Æpinus?—*Tentam. Theor. Elect. et Magnetiſmi*, p. 104, &c.

Let NAS (fig. 34.) be a magnet, of which N is the overcharged pole. Let the ordinates of the curve DAE expreſs the difference between the natural denſity of the fluid, in a ſtate of uniform diffuſion, and its denſity as it is really diſpoſed in the magnet. The area *p n* ND will there expreſs the quantity of redundant fluid in the part *n* N, and the area *q* ES *m* expreſſes the fluid wanting in the part S *m*. The interſection A marks that part of the magnet where the fluid is of its natural denſity. Suppoſe the part N *n* to be ſeparated from the reſt, containing the redundant fluid ND *p n*. The tendency of this fluid to eſcape from the iron with which it is connected will be greater (Mr Æpinus thinks) than before; becauſe its tendency to quit the magnet formerly was repreſſed by the attractions of the redundant matter contained in AS. This is certainly true of the extremity N; nay, perhaps of all the old external ſurface. Fluid will therefore eſcape. Suppoſe that ſo much has quitted the iron that the point *n* has the fluid of its natural denſity, as is repreſented in nº 3. there is ſtill a force operating at *n*, tending to eſcape, ariſing from the repulſion of all the redundant fluid *n* DN. If this be ſufficient for overcoming the obſtruction, it will really eſcape, and the iron will be left in the ſtate repreſented by nº 4. with an overcharged part *f* N, and an undercharged part *f n*.

In like manner, the tendency of the magnetic fluid ſurrounding the magnet to enter into its deficient pole, will be greater when it is ſeparated from the other, not being checked by the repulſion of the redundant fluid in that other.

Mr Æpinus relates ſome experiments which he made on this ſubject. The general reſult of them was, that the moment the parts were ſeparated, each had two poles, and that the neutral point of each magnet was much nearer to the place of their former union than to their other ends. In a quarter of an hour afterward, the neutral points had advanced nearer to their middle, and continued to do ſo, by very ſmall ſteps, for ſome hours, and ſometimes days, and finally were ſtationary in their middles.

84 Defects of this reaſoning.

We acknowledge, that this reaſoning does not altogether ſatisfy us, and that the gradual progreſs of the neutral point toward the middle of each piece, although agreeable to what ſhould reſult from an eſcape of fluid, is not a proof of it. We know already, that the induction of magnetiſm is a progreſſive thing; and we ſhould have expected this change of the ſituation of the neutral point, whatever be the nature of magnetiſm. There is ſomething ſimilar to this, and perhaps equally puzzling, in the immediate recovery of magnetiſm which has been weakened by heat; it is partly recovered on cooling.

But our chief difficulty is this: At the point A (fig. 34.) every thing is in equilibrium before the fracture. The particle A is repelled by the redundant fluid in AN, and attracted by the redundant matter in AS, yet it does not move, for the magnetiſm is ſuppoſed to have permanency. Therefore the obſtruction at A cannot be overcome by the united repulſion of AN and attraction of AS. Nor can the obſtruction at N be overcome by the difference of theſe two forces. Now ſuppoſe AS annihilated. The change made on the ſtate of things at A is ſurely greater than that at N, becauſe the force abſtracted is greater, the diſtance being leſs. It does not clearly appear, therefore, that the removal of AS ſhould occaſion an efflux at N. This, however is not impoſſible; becauſe the fluid may be ſo diſpoſed, by great conſtipation near N, and no great exceſs of denſity near A, that a ſmaller change at N may produce an efflux there. But ſurely the tendency to eſcape at A muſt now be diminiſhed, inſtead of being greater after the fracture. And if any eſcape from N, this will ſtill more diminiſh that tendency to eſcape from A. It does not therefore appear a clear conſequence of the general theory, that the conſtipated fluid ſhould eſcape; and more particularly, that A ſhould become deficient. And with reſpect to the entry of fluid into the other fragment, and its becoming overcharged at *m*, the reaſoning ſeems ſtill leſs convincing. The ſteps of the phyſical proceſs in the two parts of the original magnet are by no means convertible or counterparts of each other. There is nothing in the part AS to reſemble the force of repulſion really exerting itſelf in the correſponding point of AN. There would be, if there were a particle of fluid in that place; but

but there is not. The tendency therefore of external fluid to enter there, does not resemble the tendency of the internal fluid to expand and dissipate. It is true, indeed, the discourse should be confined to points of the surface. But the internal motion must also be considered; and the great objection always remains, namely, that the obstruction at A (n° 1.) or at *n* (n° 3.) is sufficient to prevent the passage of a particle of fluid from the pole AN into the pole AS, when urged by the repulsion of the fluid in the one and the attraction of the iron in the other; and yet will not prevent the escape of a particle when one of those causes of motion is removed. Add to this, that the whole hypothesis assumes as a principle, that the resistance to escape from any point is greater than the obstruction to motion through the pores. This is readily granted; for however great we suppose the attraction, in the limits of physical contact, it will be no obstruction to motion through the pores, because the particle is equally affected by the opposite sides of the pores; whereas, in quitting the body altogether, there is nothing beyond the body to counteract the attraction by which it is retained.

There seems something wanting to accommodate this beautiful hypothesis of Mr Æpinus to this remarkable phenomenon; and the coincidence is otherwise so complete, that we are almost obliged to conclude that it is merely a deficiency, arising from our not having a sufficient knowledge of the law of magnetic action. This is quite sufficient: For it may be strictly demonstrated, that if the magnetic action decreases in higher ratio than that of the squares of the distances, the permanency of the fluid in any particular disposition has scarcely any dependence on the particles at any sensible distance, and is affected only by the *variations* of its density (See Electricity, *Suppl.* n° 217. for a case somewhat similar). Therefore, if the fluid be so disposed, that its density may be represented by the ordinates of such a curve as is drawn in fig. 34. having its two extremities concave toward the axis, and a point of contrary flexure at A, the tendency to escape at A will be the greatest possible; and when the magnet is broken at A (n° 1.), or when the fluid has taken the arrangement represented by n° 3. it *cannot* stop there, and *must* become deficient in that part. Now, it must be acknowledged, that we are not absolutely certain that the magnetic action is in the precise inverse duplicate ratio of the distance. All that we are certain of is, that it is much nearer to it than to either the inverse simple or inverse triplicate ratio. We own ourselves rather disposed to ascribe the present difficulty to our ignorance of some circumstance, purely mathematical, overlooked, or mistaken, than to think a conjecture unfounded, which tallies so accurately with such a variety of phenomena.

We may here observe, that we are not altogether satisfied with Æpinus's form of the experiment. He did not break a magnet; he set two steel bars end to end, and touched them as one bar, making the magnetism perfectly regular; he then separated them, and found that each had two poles. But was he certain that, when joined, they made but one magnet? We have sometimes succeeded in doing this, as we thought, by the curves of iron filings; but on putting the needle with which we were examining their polarity into proper situations, we sometimes found it in the second intersection of the secondary curves, shewing that the bars were really two magnets, and not one.

On the other hand, when a piece is broken off from a magnet, the succession and elastic tremor into which the parts are thrown, and even the bending previous to the fracture, may give opportunity to a dissipation, which could not otherwise happen. The parts should be separated by corrosion in an acid, and the gradual change of magnetism should be carefully noted. The writer of this article has made some experiments of this nature, the results of which present some curious observations: but they are not yet brought to a conclusion that is fit to be laid before the public.

Mr Prevôt of Geneva, in a dissertation on the origin of magnetic forces, endeavours to give a theory which obviates the only difficulty in that of Æpinus; but it is incomparably more complex, employing two fluids, which by their union compose a third, which he calls combined fluid. There is much ingenuity, and even mathematical address, in adjusting the relative properties of those fluids. But some of them are palpably incompatible; *ex. gr.* the particles of each attract each other, but those of the other kind most strongly; yet they are both elastic like air. This is surely inconceivable.—Granting this, however, he suits his different attractions, so that a strong elective attraction of the combined fluid for iron decompeses part of the fluid in the iron, and each of its ingredients occupies opposite ends of the bar: then will the bars approach or recede, according as the near ends contain a different or the same ingredient. All this is operated without repulsion. 84 Hypothesis of Prevôt.

But the whole of this is mere accommodation, like Æpinus's, but so much more complex, that it requires very intense contemplation to follow the author through the consequences. Add to this, that his attractions are operated by another fluid, infinitely more subtle than either of those already mentioned, every particle of these being, as it were, a world in comparison of those of the other. In short, he adopts all the extravagant suppositions of Le Sage of Geneva, and every thing is ultimately impulsion. Nor is the contrivance for obviating the difficulty (so often mentioned) at all clear and convincing; and it is equally gratuitous with the rest. We cannot think this hypothesis at all intitled to the name of *explanation*.

This must serve for an account of the hypothesis of Æpinus. The philosophical reader will see, that however exactly it may tally with every phenomenon, it cannot be called an explanation of the phenomena; because it is the phenomena which explain the hypothesis, or give us the characters of the magnetic fluid, if such fluid exists. But we are not obliged to admit this existence, as we admit that to be the true decyphering of a letter which makes sense of it. In that case we know both parts of the subject—the characters and the sounds; but are ignorant which corresponds to which. Did we see a fluid abstracted from one part of a bar and constipated in another, and perceive the abstraction and constipation always accompanied by the observed attractions and repulsions, the rules of philosophical discussion, nay, the constitution of our own mind, would oblige us to assign the one as the cause or occasion of the other. But this important circumstance is wanting in the present case. We think, however, that 85 Remarks on hypotheses.

that it merits a close attention; and we entertain great hopes of its being one day completed, by including this single exception.

At the same time, it must be owned, that it gives no extension of knowledge; for it can have no greater extension than the phenomena on which it is founded, and cannot, without risk of error, be applied to an untried case, of a kind dissimilar in its nature to the phenomena on which it is founded. We doubt not but that its ingenious author would have said, that a bit broken off from the north pole of a magnet would be wholly a north pole, if he had not known that the fact was otherwise.

But this hypothesis greatly aids the imagination in conceiving the process of the magnetical phenomena. The more we study them, the more do they appear to resemble the protrusion of a fluid through the parts of an obstructing body. It proceeds gradually. It may be, as it were, overdone, and regorges when the propelling cause is removed. The motion is aided by what we know to aid other obstructed motions. As a fluid would be constipated in all protuberances, so the faculty of producing the phenomena is greater in all such situations, &c. &c. This, joined to the impossibility of speaking, with clearness of conception, of the propagation of powers without the protrusion of something in which they inhere, gives it a hold of the imagination which is not easily shaken off.

To say that nothing is explained when the attraction of the fluid is not explained, and that this is the main question, gives us little concern. We offer no explanation of this attraction, more than of the attraction of gravity. There is nothing contrary to the laws of human intellect, nothing inconsistent with the rules of reasoning, in saying, that things are so constituted, that when two particles are together, they separate, although we are ignorant of the immediate cause of their separation. Those who think that all motion is performed by impulsion, and who explain magnetism by a stream of fluid circulating round the magnet, must have another fluid to impel this fluid into its curvilineal path; for they insist, that the planets are so impelled. Then they must have a third fluid to deflect the vertical motions of the second, and so on without end. This is evident, and it is absurd. But we have said enough in the article IMPULSION, *Suppl.* to shew that all *hypotheses* framed on purpose to explain action *e distanti* by impulsion are illogical; because impulsion requires explanation as much as the other, and neither the one nor the other will ever be resolved into any thing but the FIAT of the Allwise Author of the universe.

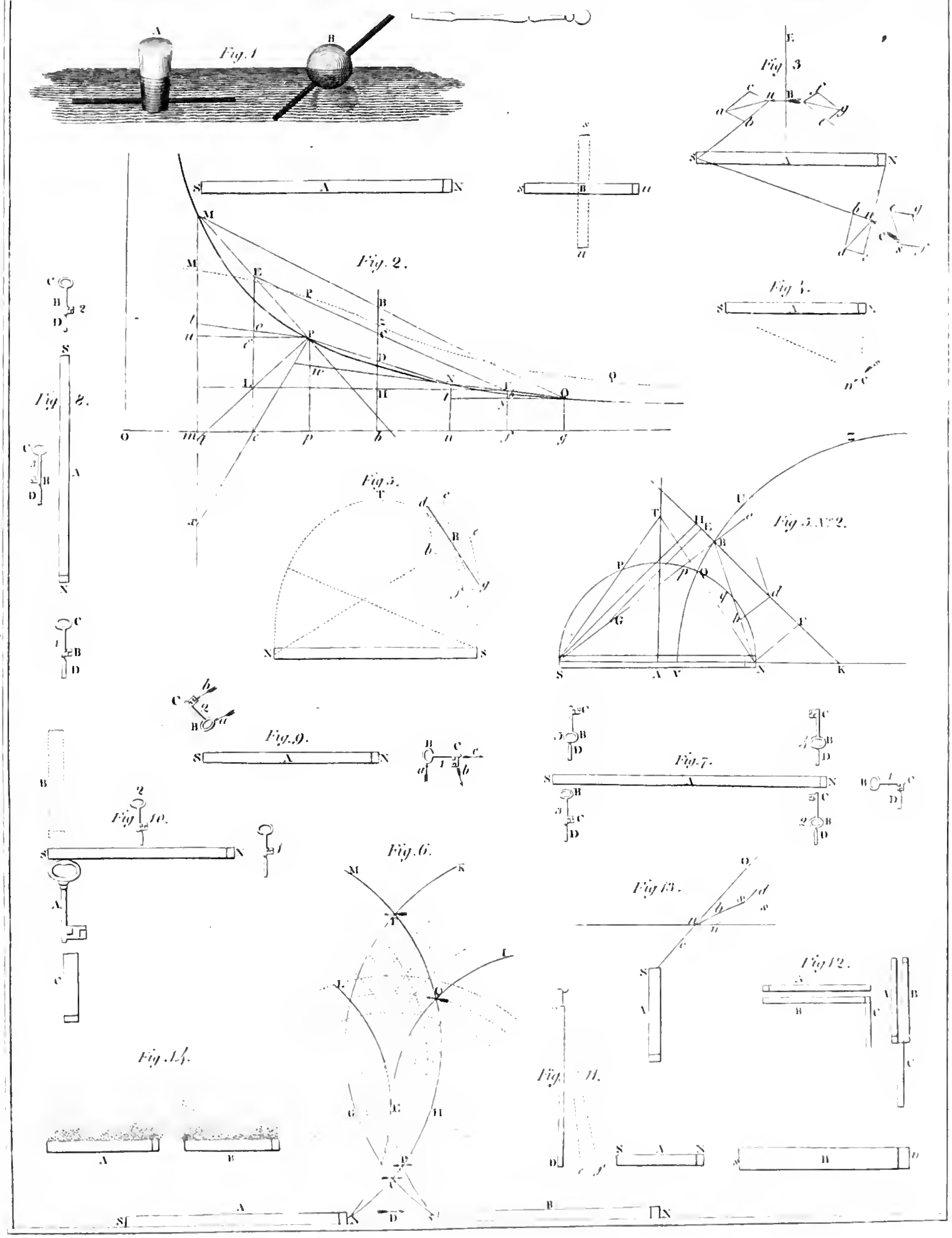
87 The preceding theory is not a hypothesis.

We conclude with desiring the reader to remark, that the explanation which we have given of the magnetical phenomena is independent of the hypothesis of Æpinus, or any hypothesis whatever. We have narrated a variety of very distinguishable facts, and have marked their distinctions. We have been able to reduce them to general classes; and even to groupe those classes into others still more general; and at last, to point out one which is discoverable in them all. This is giving a philosophical theory, in the strictest sense of the word; because we shew, in every case, the modification of the general fact which allots it this or that particular place in the classification. Thus we have shewn that the polarity or directive power of magnets is only a modification of the general fact of attraction and repulsion. Dr Gilbert's theory of *terrestrial* magnetism is indeed a hypothesis, and we enounced it as such. It only claims probability, and we apprehend that a very high degree of credit will be given to it.

We hope that many of our readers will have their curiosity excited by the account we have given of Æpinus's theory. To such we earnestly recommend the serious perusal of his book *Tentamen Theoriæ Electricitatis et Magnetismi, Auct. F. Æpino, Petropoli*, 1759. Van Swinden has included a very good abstract of it in his 2d volume *Sur l'Electricité*, written by Professor Steiglehner of Ratisbon or Ingolstadt. The mathematical part is greatly simplified, and the whole is presented in a very clear and accurate manner. Mr Van Swinden is a professed foe to all hypotheses; but he is not moderate, and we wish that we could say that he is candid. He attacks every thing; and takes the opportunity of every analogy pointed out by Æpinus between magnetism and electricity to repeat the first sentence of his dissertation, namely, that magnetism and electricity are not the same; a thing that Æpinus also maintains. But he even charges Æpinus with a mistake in his fundamental equations, which invalidates his whole theory. He says that Æpinus has omitted one of the acting forces assumed in his hypothesis. This is a most groundless charge: and we own that we cannot conceive how Van Swinden could fall into such a mistake. We are unwilling to call it intentional, for the mere purpose of raising a man of straw to knock him down again. Abbé Haüy of the French Academy has also published an abridgment of Æpinus's theory, with many excellent remarks, tending to clear the theory of the only defect that has been found in it. This work was much approved of, and recommended by the Academy. We have not had the good fortune to see a copy of it.

The reader cannot but have remarked the close analogy between the magnetical phenomena and those of induced electricity; indeed, all the phenomena of attraction and repulsion are the same in both. The mechanical composition of those actions produces a directive power and a polarity, in electrical as well as in magnetical bodies. We can make an electrical needle which will arrange itself, with respect to the overcharged and undercharged ends of a body electrified by mere position, just as a compass needle is arranged by a magnet. We can touch a stick of sealing wax in the manner of the double touch, so as to give it poles of considerable force and durability. As a red hot steel bar acquires permanent poles by quenching it near a magnet, so melted wax acquires them by freezing in the neighbourhood of a positive and negative electric. Some have inferred a sameness of origin of these two species of powers from those various circumstances of resemblance; but the original causes seem to be distinct on many accounts. Electricity is common to all bodies. The cause of magnetism can operate only on iron. Although lightning or an electrical shock gives polarity to a needle, we need not infer the identity of the cause, because the polarity which it gives is always the same with that given by great heat; and there is always intense heat in this operation. The phenomenon which looks the most like an indication of identity of the origin of electricity and magnetism is the direction of the rays of the aurora borealis—

88 Analogy of magnetism and electricity.



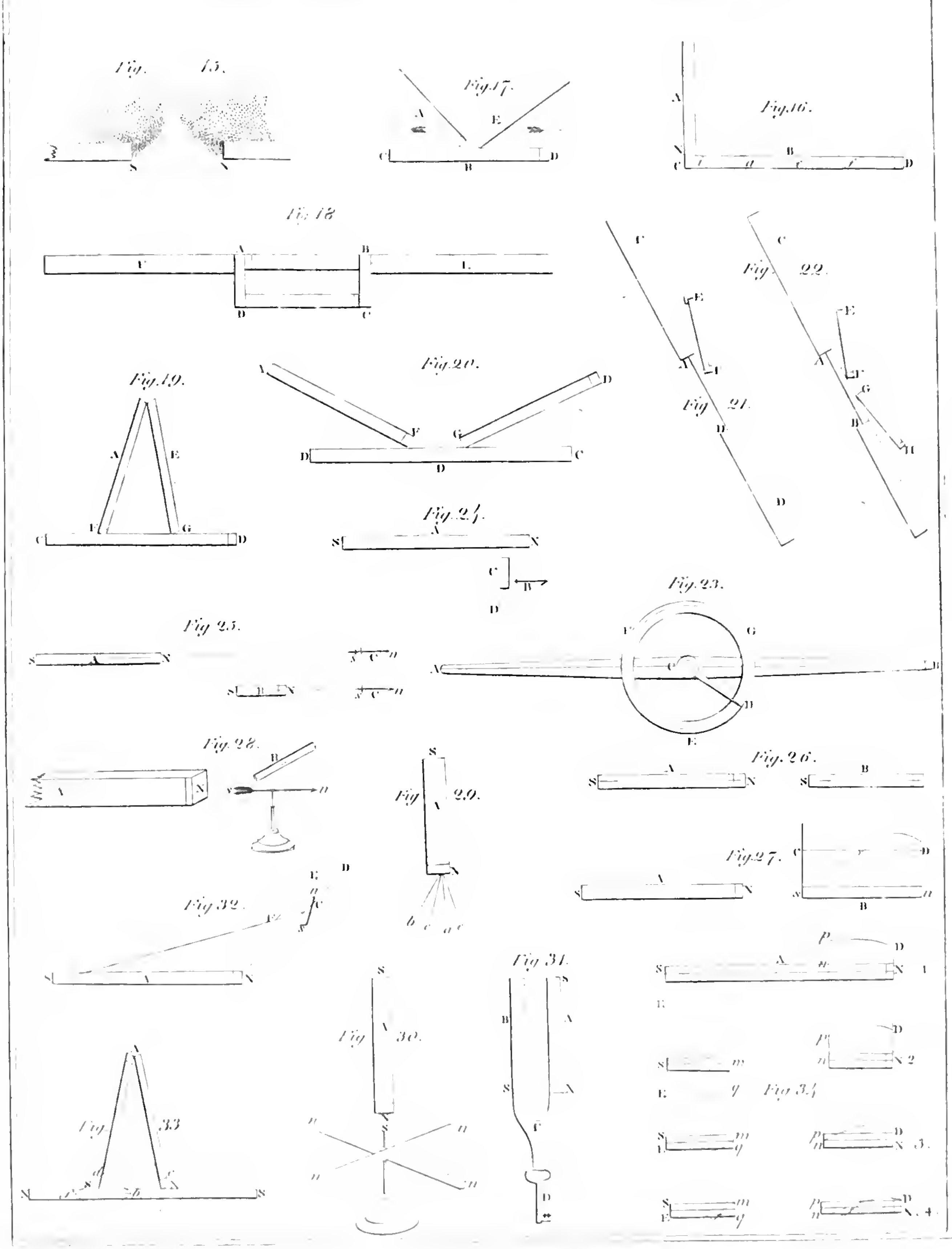


Fig. 15.
Fig. 17.
Fig. 16.
Fig. 18
Fig. 21.
Fig. 22.
Fig. 19.
Fig. 20.
Fig. 24.
Fig. 23.
Fig. 25.
Fig. 28.
Fig. 29.
Fig. 26.
Fig. 27.
Fig. 32.
Fig. 31.
Fig. 30.
Fig. 33
Fig. 34

borealis—they converge to the ſame point of the heavens to which the elevated pole of the dipping needle directs itſelf. But this is by no means a ſufficient foundation for eſtabliſhing a ſameneſs. Electricity and magnetiſm may, however, be related by means of ſome powers hitherto unknown. But we are decidedly of opinion, that the electric and magnetic fluid are totally different, although their mechanical actions are ſo like that there is hardly a phenomenon in the one which has not an exact counterpart in the other. But we ſee them both operating, with all their marks of diſtinction, in the ſame body; for iron and loadſtones may be electrified, like any other body, and their magnetiſm ſuffers no change or modification. We can ſet theſe two forces in oppoſition or compoſition, juſt as we can oppoſe or compound gravity with either. While the iron filings are arranging themſelves round a magnet, the mechanical action of electricity may be employed either to promote or hinder the arrangement. They are therefore diſtinct powers, inherent in different ſubjects.

89 They are not, however, effects of the ſame cauſe.

But there are abundance of other phenomena which ſhew this diverſity. There is nothing in magnetiſm like a body overcharged or undercharged *in toto*. There is nothing which indicates the preſence of the fluid to the other ſenſes—nothing like the ſpark, the ſnap, the viſible diſſipation; becauſe the magnetic fluid enters into no union with air, or any thing but iron. There is nothing reſembling that inconceivably rapid motion which we ſee in electricity; the quickeſt motion of magnetiſm ſeems inferior (even beyond compariſon) with the ſloweſt motion along any electric conductor. Therefore there is no poſſibility of diſcharging a magnet as we diſcharge a coated plate. Indeed, the reſemblance between a magnet and a coated plate of glaſs is exceedingly ſlight. The only reſemblance is between the magnet and an inconceivably thin ſtratum of the glaſs, which ſtratum is poſitive in one ſide and negative in the other. The only perfect reſemblance is between the induced magnetiſm of common iron, and the induced electricity of a conductor.

The following ſeem the moſt inſtructive diſſertations on magnetiſm, either as valuable collections of obſervations, or as judicious reaſonings from them, or as the ſpeculations of eminent or ingenious men concerning the nature of magnetiſm.

Gilbertus de Magnete, Lond. 1600, fol.

Æpini Tentamen Theoriæ Magn. et Electr.

Eberhard's Tentam. Theor. Magnetiſmi, 1720.

Diſſertations ſur l'aimant, par du Fay, 1728.

Muſchenbrock Diſſert. Phyſico Experimentalis de Magnete.

Pieces qui ont emporté le prix de l'Acad. des Sciences à Paris ſur la meilleure conſtruction des Bouſſoles de declination. Recueil des pieces couronnées, tom. v.

Euleri opuſcula, tom. iii. continens Theoriam Magnetis, Berlin, 1751.

Æpini Oratio Academica, 1758.

Æpini item Comment. Petrop. nov. tom. x.

Anton. Brugmanni tentam. Phil. de materia Magnetica, Francqueræ, 1765.

There is a German tranſlation of this work by Eiſenbach, with many very valuable additions.

Scarella de Magnete, 2 tom. fol.

Van Swinden Tentamina Magnetica, 4to.

Van Swinden ſur l'Analogie entre les phenomenes Electriques et Magnetiques, 3 tom. 8vo.

Diſſertation ſur les Aimans artificielles par Antheaume.

Experiences ſur les Aimans artificielles par Nicholas, Fuſs, 1782.

Eſſai ſur l'Origine des Forces Magnetiques par Mr Prevoſt.

Sur les Aimans artificielles par Rivoir, Paris 1752.

Diſſertatio de Magnetiſmo par Sam. Klingenſtier et Jo. Brander, Holm. 1752.

Deſcription des Courants Magnetiques, Straſbourg, 1753.

Traité de l'Aiman par Dalancé, Amſt. 1687.

Beſides theſe original works, we have ſeveral diſſertations on magnetical vortices by Des Cartes, Bernoulli, Euler, Du Tour, &c. publiſhed in the collections of the works of thoſe authors, and many diſſertations in the memoirs of different academies; and there are many popular treatiſes by the traders in experimental philoſophy in London and Paris. Dr Gown Knight, the perſon in Europe who was moſt eminently ſkilled in the knowledge of the phenomena, alſo publiſhed a diſſertation intitled, *An attempt to explain the Phenomena of Nature by two principles, Attraction and Repulſion*, Lond. 1748, 4to, in which he has included a theory of magnetiſm. It is a very curious work, and ſhould be ſtudied by all thoſe who have recourſe without ſcruple to the agency of inviſible fluids, when they are tired of patient thinking. They would there ſee what thought and combination are neceſſary before an inviſible fluid can be really fitted for performing any office we chooſe to aſſign it. And they will get real inſtruction as to what ſervices we may expect of ſuch agents, and from what taſks they muſt be excluded. The Doctor's theory of magnetiſm is very unlike the reſt of the performance; for he does not avail himſelf of the vaſt apparatus of propoſitions which he had eſtabliſhed, and adopts without any nice adjuſtment the moſt common notions of an impulſive vortex. Both the production and maintenance of this vortex, and its mode of operation, are irreconcileable with the acknowledged laws of impulſion.

Si quid noviſti rectius iſtis, candidus imperti—ſi non—his utere mecum.

APPENDIX.

We have been favoured with the following inveſtigation of the curves, to which a needle of indefinite minuteneſs will be a tangent, by Mr Playfair, Profeſſor of Mathematics in the Univerſity of Edinburgh. Inveſtigation of the magnetic curve.

Two magnetical poles being given in poſition, the force of each of which is ſuppoſed to be as the *m*th power of the diſtance from it reciprocally, it is required to find a curve, in any point of which a needle (indefinitely ſhort) being placed, its direction, when at reſt, may be a tangent to the curve?

1. Let A and B (fig. 35.) be the poles of a magnet, C any point in the curve required; then we may ſuppoſe the one of theſe poles to act on the needle only by repulſion, and the other only by attraction, and the direction of the needle, when at reſt, will be the diagonal

of

of a parallelogram, the ſides of which repreſent theſe forces. Therefore, having joined AC and BC, let AD be drawn parallel to BC, and make $\frac{1}{AC^m} : \frac{1}{BC^m} :: AC : AD$; join CD, then CDF will touch the curve in C.

2. Hence an expreſſion for AF may be obtained. For, by the conſtruction, $AD = \frac{AC^{m+1}}{BC^m}$, and ſince $BC : AD :: BF : FA$, and $BC - AD : AD :: AB : AF$, we have $AF = \frac{AB \times AC^{m+1}}{BC^{m+1} - AC^{m+1}}$.

3. A fluxionary expreſſion for AF may alſo be found in terms of the angles CAB, ABC. In CF take the indefinitely ſmall part CH, draw AH, BH, and from C draw CL perpendicular to AH and CK to BH. Draw alſo BC and AM at right angles to FH. Let the angles CAB $= \varphi$, and CBA $= \psi$; then CAH $= \dot\varphi$, and CBH $= -\dot\psi$; alſo $CL = AC \times \dot\varphi$, and $CK = -BC \times \dot\psi$. Now $HC : CL :: AC : AM = \frac{AC^2 \times \dot\varphi}{HC}$; and for the ſame reaſon $BC = -\frac{BC^2 \times \dot\psi}{HC}$. Therefore ſince $AF : FB :: AM : BC$, $AF : FB :: \frac{AC^2 \times \dot\varphi}{HC} - \frac{BC^2 \times \dot\psi}{HC}$, and $AF : AB :: \text{ſin.}\,\psi^2\,\dot\varphi : -\text{ſin.}\,\psi^2\,\dot\varphi - \text{ſin.}\,\varphi^2\,\dot\psi$; wherefore if $AB = a$, $AF = \frac{-a\dot\varphi\,\text{ſin.}\,\psi^2}{\dot\psi\,\text{ſin.}\,\varphi^2 + \dot\varphi\,\text{ſin.}\,\psi^2}$.

4. If this value of AF be put equal to that already found, a fluxionary equation will be obtained, by the integration of which the curve may be conſtructed. Becauſe $AF = \frac{AB \times AC^{m+1}}{Be^{m+1} - Ae^{m+1}}$; and ſince $AC = \frac{a\,\text{ſin.}\,\psi}{\text{ſin.}\,(\varphi+\psi)}$, and $BC = \frac{a\,\text{ſin.}\,\varphi}{\text{ſin.}\,(\varphi+\psi)}$, we have by ſubſtitution $AF = \frac{a\,\text{ſin.}\,\psi^{m+1}}{\text{ſin.}\,\varphi^{m+1} - \text{ſin.}\,\psi^{m+1}} = -\frac{a\dot\varphi\,\text{ſin.}\,\psi^2}{\dot\psi\,\text{ſin.}\,\varphi^2 + \dot\varphi\,\text{ſin.}\,\psi^2}$. Hence, $\text{ſin.}\,\varphi^2 \times \dot\psi\,\text{ſin.}\,\psi^{m+1} + \dot\varphi\,\text{ſin.}\,\psi^{m+3} = -\text{ſin.}\,\psi^2 \times \dot\varphi\,\text{ſin.}\,\varphi^{m+1} + \dot\varphi\,\text{ſin.}\,\psi^{m+2}$, and therefore $\dot\psi\,\text{ſin.}\,\psi^{m-1} = -\dot\varphi\,\text{ſin.}\,\varphi^{m-1}$; and alſo, $\int\dot\psi\,\text{ſin.}\,\psi^{m-1} + \int\dot\varphi\,\text{ſin.}\,\varphi^{m-1} = C$.

5. Theſe fluents are eaſily found when m is any whole poſitive number.

If $m = 1$, we have $\dot\psi + \dot\varphi = o$.
$m = 2$, $\dot\psi\,\text{ſin.}\,\psi + \dot\varphi\,\text{ſin.}\,\varphi = o$.
$m = 3$, $\dot\psi\,\text{ſin.}\,\psi^2 + \dot\varphi\,\text{ſin.}\,\varphi^2 = o$.
$m = 4$, $\dot\psi\,\text{ſin.}\,\psi^3 + \dot\varphi\,\text{ſin.}\,\varphi^3 = o$, &c.
Therefore, &c.

Alſo if $m = 1$, $\varphi + \psi = C$.
$m = 2$, $\text{coſ.}\,\varphi = \text{coſ.}\,\psi = C$.
$m = 3$, $-\text{ſin.}\,2\varphi + 2\varphi - \text{ſin.}\,2\psi + 2\psi = C$.
$m = 4$, $\text{coſ.}\,3\varphi - 9\,\text{coſ.}\,\varphi + \text{coſ.}\,3\psi - 9\,\text{coſ.}\,\psi = C$, &c. &c.

The firſt of the above equations belongs to a ſegment of a circle deſcribed upon AB, which therefore would be the curve required if the magnetical force were inverſely as the diſtances.

If the magnetical force be inverſely as the ſquare of the diſtance, that is, if $m = 2$, $\text{coſ.}\,\varphi + \text{coſ.}\,\psi$ is equal to a conſtant quantity. Hence if, beſide the points A and B, any other point be given in the curve, the whole may be deſcribed. For inſtance, let the point E (fig. 36.) be given in the curve, and in the line DE which biſects AB at right angles. Deſcribe from the centre A a circle through E, viz. QER; then AD being the coſine of DAE to the radius AE, the ſum of the coſines of $\varphi \times \psi$ will be everywhere (to the ſame radius) $= 2\,AD = AB$. Therefore to find E′, the point in which any other line AN, making a given angle with AB, meets the curve, draw from N, the point in which it meets the circumference of the circle QER, NO, perpendicular to AB, ſo that AO may be the coſine of NAO, and from O toward A take OP = AB, then AP will be the coſine of the angle ABE′; ſo to find BE′, draw PQ perpendicular to AP, meeting the circle in Q; join AQ, and draw BE′ parallel to AQ, meeting AE′ in E′, the point E′ is in the curve. In this way the other points of the curve may be found.

The curve will paſs through B, and will cut AB at an angle of which the coſine = RB. If then E be ſuch, that AE = AB, the curve will cut AB at right angles. If E″ be more remote from A, the curve will make with AB an obtuſe angle toward D; in other caſes it will make with it an acute angle.

A conſtruction ſomewhat more expeditious may be had by deſcribing the ſemicircle AFB, cutting AE in F, and AE′ in N, and deſcribing a circle round A, with the diſtance AL = 2 AF, cutting AE′ in *b*. If AG be applied in the ſemicircle AFB = N*b*, AG muſt cut AN in a point E′ of the curve, becauſe AN + BG = 2 AF, and AN and GB are coſines of the angles at A and B.

As the lines AN and BG may be applied either above or below AB, there is another ſituation of their interſection E′. Thus A*n* being applied above, and B*g* below, the interſection is in *e*′. The curve has a branch extending below A; and if D*e* be made = DE, and B*e* be drawn, it will be an aſſymptote to this branch. There is a ſimilar branch below B. But theſe portions of the curve evidently ſuppoſe an oppoſite direction of one of the two magnetic forces, and therefore have no connection with the poſition of the needle.

We omitted the inſerting in its proper place, nº 65. a hypotheſis of the celebrated aſtronomer Tobias Mayer of Gottingen, by which the direction of the mariner's needle in all parts of the earth may be determined. He ſuppoſes that the earth contains a very powerful magnet of inconſiderable dimenſions, which arranges the needle according to the known laws of magnetiſm. The centre of this magnet was diſtant from the centre of the earth about 480 Engliſh miles in 1756, and a line joining theſe centres interſected the earth's ſurface in a point ſituated in 17° N. Lat. and 183° E. Long. from London. The axis of the magnet is perpendicular to this line, and the plane in which it lies is inclined about 11° to the plane of the meridian, the north end of the axis lying on the eaſt ſide of that meridian. From theſe data, it will be found that the axis of this magnet cuts the ſurface of the earth about the middle of the eaſtern ſhore of Baffin's Bay, and in another point about 800 miles S. S. W. of the ſouthern point of New Zealand. Profeſſor Lichtenberg of Gottingen, who gives this extract from the manuſcript, ſays, that the

Addition to nº 65.

the hypothesis is accompanied by a considerable list of variations and dips calculated by it, and compared with observations, and that the agreement is very remarkable. He gives indeed a dozen instances in very different regions of the earth. But we suspect that there is some error or defect in the data given by him, because the annual changes, which he also gives, are such as are inconsistent with the data, and even with each other. He says, that the distance from the centre increases about four miles annually, and that *thence* arises an annual diminution of 8 minutes in the latitude and 14 in the longitude of that point where the straight line joining the centres meets the surface. It can have no such consequence. He says also, that the above mentioned inclination of the planes increases 8 minutes annually. The compound force of the magnet is said to be as the square root of the distance inversely. We are at a loss to understand the meaning of this circumstance; because Mayer's hypothesis concerning the law of magnetic action is exceedingly different, as related by Mr Lichtenberg from the same manuscript. But it was our duty to communicate this notice, though imperfect, of the speculations of this celebrated mathematician. See *Exliben's Elem. of Nat. Phil.* published by Lichtenberg 1784, p. 645.

Addition to n° 64.

Addition to n°. 64.

Let HZOF (fig. 37.) be the plane of a magnetic meridian, H n' O the plane of the horizon, and NS the position of the magnetic needle in any place, when it is at liberty to settle in the true magnetic direction. The angle HON is the inclination or dip of the needle. Let Z n F be a vertical circle, in which a well constructed dipping needle can freely play up and down. This needle cannot place itself in the magnetic direction, because it can only move in a vertical plane. Its north point is impelled in the direction $n\,o$, and its south point in the direction $s\,p$, both of which are parallel to NS. By the laws of mechanical equilibrium, it cannot rest, except in such a position that the forces $n\,o$ and $s\,p$ are in a plane perpendicular to the plane Z n F. In any other position, there would be a force impelling the needle toward that side on which $n\,o$ makes an acute angle with the tangent $r\,n\,t$ of the vertical circle. Therefore the spherical triangle N n F is right angled in n, and Cos. NF n : R = Tan. n F : Tan. NF, = Tan. HN : Tan. $n'\,n$. Therefore

$$\text{Tan. } n'\,n = \frac{\text{Tan. HN}}{\text{Cos. H } n'}, = \text{Tan. HN} \times \text{Sec. H } n'.$$

Therefore, in any place, the real inclination of the magnetical direction to the horizon is different from what is pointed out by a dipping needle when it is in a plane which declines from the magnetic meridian; and the tangent of the observed dip of the needle exceeds that of the inclination of the magnetic direction in the proportion of radius to the cosine of the deviation HC n', or the proportion of the secant of this angle to the radius. If therefore the dipping needle play in a magnetic east and west circle, it will stand perpendicular to the horizon.

Maguana, || Maine.

MAGUANA, *St John of*, a canton and town on the S. side of the island of St Domingo, is situated on the left side of the river Neybe. The capital of the ancient Indian kingdom of Maguana, stood where the town St John of Maguana is situated. The ancient capital disappeared with the unfortunate prince Anacoana. This canton was pillaged by the English privateers, in 1543. In 1764 the district of the new parish contained 3600 persons, of whom 300 were capable of bearing arms. Its population amounts now to more than 5000 souls.—*Morse.*

MAHACKAMACK, a river which falls into the Delaware from the N. E. at the N. W. corner of the State of New-Jersey.—*ib.*

MAHONE BAY, on the coast of Nova-Scotia, is separated from Margaret's bay by the promontory on which is the high land of Aspotagoen.—*ib.*

MAHONING, a township on Susquehannah river, in Pennsylvania.—*ib.*

MAHONOY, a township on Susquehannah river, in Pennsylvania.—*ib.*

MAIDENHEAD, a small neat village in Hunterdon county, New Jersey, having a Presbyterian church, half way between Princeton and Trenton, on the great post-road from New-York to Philadelphia; six miles from each. The township of Maidenhead contains 1032 inhabitants, including 160 slaves —*ib.*

MAIDSTONE, a township in Essex county, in Vermont, on Connecticut river, containing 125 inhabitants.—*ib.*

Maine.

MAINE, District of, belonging to Massachusetts, is situated between lat. 43° and 48° 15′ north, and between long. 64° 53′ and 70° 39′ west; bounded north by Lower Canada, east by the province of New-Brunswick, south by the Atlantic Ocean, west by New-Hampshire. The District of Maine is in length, on an average, 200 miles, and its average breadth 200 miles: containing 40,000 square miles, or 25,600,000 acres. It is divided into 5 counties, viz. York, Cumberland, Lincoln, Hancock, and Washington; these are subdivided into near 200 incorporated townships and plantations; inhabited by 96,540 free people. The chief towns are Portland the metropolis of the District of Maine, York, Pownalborough and Wiscasset. Hallowell, Bath, Waldoborough, Penobscot, and Machias. The last mentioned is the only incorporated town in Washington county, the other settlements being only plantations. The chief rivers are Penobscot, Kennebeck, Saco, Androscoggin, St Croix, &c. besides a vast number of small rivers. The most noted lakes are Moosehead, Scoodic, Sebacook, and Umbagog. The chief bays are those of Casco, Penobscot, Machias, Saco, and Passamaquoddy. The most remarkable capes are those of Neddock, Porpoise, Elizabeth, Small Point, Pemaquid, and Petit Manan. The District of Maine, though an elevated tract of county, cannot be called mountainous. A great proportion of the lands are arable and exceedingly fertile, particularly between Penobscot and Kennebeck rivers. On some parts of the sea-coast, the lands are but indifferent.

ent. The lands in this District may be considered in three divisions: the *first* comprehending the tract lying E. of Penobscot river, of about 4,500,000 acres; the *second*, and best tract, of about 4,000,000 acres, lying between Penobscot and Kennebeck rivers; the *third*, first settled and most populous at present, west of Kennebeck river, containing also about 4,000,000 acres. The soil of this country, in general, where it is properly fitted to receive the seed, appears to be very friendly to the growth of wheat, rye, barley, oats, peas, hemp, and flax, as well as for the production of almost all kinds of culinary roots and plants, and for English grass; and also for Indian corn, especially if the seed be procured from a more northern climate. Hops are the spontaneous growth of this country; and it also uncommonly good for grazing, and large flocks of neat cattle may be fed both summer and winter. The natural growth of this District consists of white pine and spruce trees in large quantities, suitable for masts, boards, and shingles; maple, beech, white and grey oak, and yellow birch. The low lands produce fir, which is neither fit for timber nor fuel, but yields a balsam that is highly prized. Almost the whole coast N. E. of Portland is lined with islands, among which vessels may generally anchor with safety. The principal exports of this country are various kinds of lumber, as pine boards, ship timber, and every species of split lumber manufactured from pine and oak; these are exported from the various ports in immense quantities. A spirit of improvement is increasing here. A charter for a college has been granted by the legislature, and five academies incorporated and endowed with handsome grants of public lands. Town schools are generally maintained in most of the towns. The Commonwealth of Massachusetts possess between eight and nine million acres in this District, independent of what they have sold or contracted to sell, which brings into the treasury the neat sum of £269,005 : 8 : 7 currency; and besides about two million acres between St Croix and Passamaquoddy in dispute between the U. States and the British nation. Exclusive of the lands sold, about 385,000 acres have been granted for the encouragement of literature and other useful and humane purposes. Attempts were made to settle this country as early as 1607, on the W. side of Kennebeck river; but they proved unsuccessful, and were not repeated till between 1620 and 1630. In 1635, the western part of it was granted to Ferdinando Gorges, by the Plymouth Company, and he first instituted government in this province. In 1652, this province came under the jurisdiction of Massachusetts, and was, by charter, incorporated with it, in 1691. It has since increased to upwards of 100,000 inhabitants, and will, it is expected, shortly be erected into a separate State.—*ib.*

MAIRE, *Le*, a strait between Terra del Fuego and Staten-Island, in S. America.—*ib.*

MAISY, *Cape*, is the easternmost point of the island of Cuba.—*ib.*

MAJABAGADUCE, in the District of Maine, at the mouth of Penobscot river, on the east side.—*ib.*

MAKEFIELD, *Upper* and *Lower*, townships in Buck's county, Pennsylvania.—*ib.*

MALABAR, *Cape*, or *Sandy Point*, a narrow strip of land projecting out from the south-east part of Cape Cod, in Massachusetts, about 8 miles S. by W. N. lat. 41° 33′, W. long. from Greenwich 70° 3′.—*ib.*

MALAMBITO, a town in the province of Carthagena, in Terra Firma, about 60 miles easterly of Carthagena, and on the W. side of the river Magdalena. —*ib.*

MALDEN, a town in Middlesex county, Massachusetts, on the eastern post-road, 4 miles north of Boston, containing 1,033 inhabitants. It is connected with Charlestown by a bridge over Mystic river, built in 1787.—*ib.*

MALDONADO, a bay in the river La Plata, eastward of Buenos Ayres, in S. America, and 9 leagues from Cape Santa Maria.—*ib.*

MALESHERBES (Christian William de Lamoignon) was born December the 6th 1721. At the age of 24 he became a counsellor of Parliament, and six years afterwards chief president of the *cour des aides*. He remained in that important situation during a period of 25 years, and displayed on many occasions proofs of firmness, eloquence, and wisdom.

When the prince of Condé was sent by the king in 1768 to silence the magistrates who opposed the taxes, Malesherbes replied to him, "Truth, Sir, must indeed be formidable, since so many efforts are made to prevent its approach to the throne." About the same time that he became president of the *cour des aides*, he was appointed by his father, then chancellor of France, superintendant of the press; an office of the greatest importance, of which the principles which Malesherbes had imbibed from D'Alembert rendered him very ill qualified to discharge the duties. He was what the French called a *philosopher*; a term with them of the same import with a naturalist, who openly denies revealed religion, and has no adequate notions of the moral attributes of God. The consequence was, that when the authors of impious and immoral books were brought before him in his official capacity to undergo examination, he appeared to them as advising, assisting, and protecting them, against that very power which was vested in himself; and they were commonly dismissed with this senseless observation, that all books of whatever tendency should be considered merely as *objects of commerce*. Had it not been for the protecting influence of Malesherbes, the *Encyclopedie*, of which the publication was frequently suspended (see DIDEROT in this *Supplement*), would probably have been altogether suppressed; and the works of Rousseau and Raynal, which so powerfully contributed to that revolution in which he was overwhelmed, would certainly not have spread so rapidly over the kingdom of France. It was he, said D'Alembert, who *broke the shackles of literature*.

In vain will it be replied, that he left the same liberty to the religious as to the impious writers; for that was not always strictly true. The Abbé Barruel has brought the testimony of D'Alembert himself to prove, that it was much against his will that Malesherbes suffered works refuting the sophisters to appear; and, as he very properly observes, what a minister allows with reluctance, he finds abundant means of preventing.

In 1775 he resigned the office of chief president of the *cour des aides*, and was appointed minister and secretary of state in the place of La Vrillière. Thus placed in the centre of a frivolous yet brilliant court, Malesherbes.

Malesherbes did not in the least deviate from his former simplicity of life and manners; but, in lieu of complying with the established etiquette which required magistrates, when they became ministers of state, to exchange their sable habit and head dress for a coloured suit, bag-wig, and sword, he retained his black coat and magisterial *peruke!* This is recorded by a panegyrist to his honour; but we perceive not the honour which it reflects on him. It surely requires no great powers of abstraction to discover, that a colonred coat, bag-wig, and sword, are not in themselves more frivolous or contrary to nature, than a black coat and enormous peruke; and if the manners of a country have appropriated these different dresses to different stations in life, the individual must be actuated by a very absurd kind of pride, who sets up his own caprice against the public opinion.

As, when invested with the power to restrain within just limits the freedom of the press, it was his chief aim to encourage and extend that freedom; so, when raised to an office which gave him the unlimited power of issuing *lettres de cachet*, it was their total suppression that became the earliest object of his *most ardent* zeal. Till that time *lettres de cachet*, being considered as a part of the general police, as well as of the royal prerogative, were issued not only at the will of the minister, but even at the pleasure of a common clerk, or persons still more insignificant. Malesherbes began by relinquishing himself this absurd and iniquitous privilege. He delegated the right to a kind of tribunal, composed of the most upright magistrates, whose opinion was to be unanimous, and founded upon open and well established facts. He had but one more object to attain, and that was to substitute a legal tribunal in the place of that which he had established; and this object he was upon the point of accomplishing, when the intrigues of the court procured the dismission of Turgot; and Malesherbes, in consequence, resigned on the 12th of May 1776. For this part of his conduct he is intitled to praise, which we feel not ourselves inclined to withhold from his memory. Even M. Barruel admits, that he had many moral virtues, and that he displayed real benevolence when alleviating the rigours of imprisonment, and remedying the abuse of *lettres de cachet;* but France, says he, shall nevertheless demand of him her temples that have been destroyed: for it was he who, above all other ministers, abused his authority to establish in that kingdom the reign of impiety.

After this epoch he undertook several journeys into different parts of France, Holland, and Switzerland, where he collected with zeal and taste objects of every kind interesting to arts and sciences. As he travelled with the simplicity and economy of a man of letters, who had emerged from obscurity for the purpose of making observations and acquiring knowledge, he by that means was enabled to reserve his fortune for important occasions, in which it might procure him information on interesting subjects. He travelled slowly, and frequently on foot, that his observations might be the more minute; and employed part of his time in suitably arranging them. These observations formed a valuable collection of interesting matter relative to the arts and sciences, but which has been almost totally destroyed by the fury of revolutionists, who have done as much prejudice to the interests of science as of humanity.

Returning from his travels, Malesherbes for several years enjoyed a philosophic leisure, which he well knew how to direct to useful and important objects. The two treatises which he composed in the years 1785 and 1786 on the civil state of the protestants in France are well known. The law which he proposed in these, was only preparatory to a more extensive reform; and these treatises were to have been followed up by another work, the plan of which he had already laid down, when affairs growing too difficult to be managed by those who held the reins of government, they were compelled to call him to their councils. They did not, however, assign him the direction of any department, and introduced him merely (as subsequent events have shewn) to cover their transactions under a popular name, and pass them on the world as acts in which he had taken part. Malesherbes accepted their overtures merely to satisfy the desire he felt to reveal some useful truths; but it was not for that purpose that they had invited him to their councils. Those who presided at them took umbrage at his first efforts to call their attention to the voice of truth and wisdom; and succeeded so well in their opposition, that he was reduced to the necessity of delivering in writing the counsel which he wished to offer. Such was the origin of two treatises relative to the calamities of France, and the means of repairing them. He transmitted these treatises to the king, who never read them; nor was he ever able to obtain a private audience although a minister of state.

Such is the account of his last conduct in office which is given by his friends; and as we have not read his treatises on the calamities of France, we have no right to controvert it. From his known principles, however, we are intitled to conclude, that his plans of reformation were similar to those of Neckar, the offspring rather of a head teeming with visionary theories, than of the enlightened mind of a practical statesman, or the corrupt heart of a Jacobin conspirator.

Perceiving the inutility of his endeavours, disgusted with what he thought the repeated errors of the government, and deprived of every means of exposing them, or preventing their fatal effects; after frequent solicitations, he at length obtained leave to retire. He repaired to his estate at Malesherbes, and from that moment entirely devoted his time to those occupations that had ever formed the chief pleasure of his life. He passed the evenings and a great part of the night in reading and study.

In this tranquil state he was passing the evening of his days amidst his woods and fields, when the horrors of the Revolution brought him again to Paris. During the whole of its progress, he had his eyes constantly fixed on his unhappy sovereign, and, subduing his natural fondness of retirement, went regularly to court every Sunday, to give him proofs of his respect and attachment. He imposed it as a duty on himself to give the ministers regular information of the designs of the regicide faction*; and when it was determined to bring the king to trial, he voluntarily offered to be the defender of his master, in his memorable letter of the 11th of December 1792, that eternal monument of his loyalty and affection. His offer was accepted; and he pleaded

* Bertrand's Memoirs, vol iii. chap. 31.

Malesherbes. pleaded the cause of the monarch with a strength of argument that nothing could have resisted but the bloodthirsty minds of a den of Jacobins. "What Frenchman (says a valuable writer), what virtuous man, of any country, can ever forget that affecting scene, when the respectable old man, penetrating, for the first time, into the prison of the Temple, melted into tears, on finding himself pressed in the arms of his king; and that still more affecting scene, when, entrusted with the most agonizing commission that a subject could possibly have to his sovereign, he threw himself at the feet of the innocent victim, while, suffocated with his sobs, his voice, till re-animated by the courage of the virtuous Louis, was inadequate to announce the fatal sentence of death*.

Having discharged this painful and hazardous duty he once more returned to his country residence, and resumed his tranquil course of life. But this tranquillity was of short duration. About a twelvemonth afterwards, in the month of December 1793, three worthy members of the Revolutionary Committee of Paris came to reside with him, his son in-law, and his daughter, and apprehended the two latter as criminals. Left alone with his grandchildren, Malesherbes endeavoured to console the rest of his unfortunate family with the hopes which he himself was far from entertaining, when, the next day, the new formed guards arrived to apprehend him, and the whole of his family, even the youngest infants. This circumstance spread a general consternation throughout the whole department; for there was hardly a man in France, a few ex-jesuits excepted, who did not revere the mild virtues of the last friend of the unfortunate king.

In this calamity Malesherbes preserved the undisturbed equanimity of virtue. His affability and good humour never forsook him, and his conversation was as usual; so that to have beheld him (without noticing his wretched guards), it seemed that he was travelling for his pleasure with his neighbours and friends. He was conducted the same night to the prison of the Madelonette with his grandson Louis Lepelletier, at the same time that his other grandchildren were separated into different prisons. This separation proving extremely afflicting to him, he earnestly solicited against it; and at length, on his repeated entreaties, they all met together once more at Port Libre. They remained there but a short period. The son-in-law of Malesherbes, the virtuous Lepelletier Rasambo, the first of them who was arrested, was ordered into another prison, and sacrificed a few days after. Malesherbes himself, his daughter, his grand-daughter, and her husband, were soon after all brought to the gullotine. They approached it with fortitude and serenity. It was then that his daughter addressed these pathetic words to Mademoiselle Sombreuil, who had saved the life of her own father on the 2d of September: "You have had the exalted honour to preserve *your* father—I have, at least, the consolation to die with *mine*."

Malesherbes, still the same, even to his last moments exhibited to his relations an example of fortitude. He conversed with the persons that were near him without bestowing the least attention on the brutalities of the wretches who tied his hands. As he was leaving the prison to ascend the fatal cart, he stumbled against a stone, and made a false step. "See (said he smiling), how bad an omen! A Roman in my situation would have been sent back again." He passed through Paris, ascended the scaffold, and submitted to death with the same unshaken courage. He died at the age of 72 years, 4 months, and 15 days. He had only two daughters, and the son of one of them alone remains to succeed. From this account of Malesherbes's behaviour at his last moments, we are inclined to believe that his intentions were better than some parts of his practical conduct; and we know, that having dispelled the vain illusions of philosophism, he acknowledged his past errors; exclaiming, in the accents of grief, "That false philosophy (to which I confess I was myself a dupe) has plunged us into the gulph of destruction, and, by an inconceivable magic, has fascinated the eyes of the nation, and made us sacrifice reality to a mere phantom. For the simple words *political liberty*, France has lost that *social freedom* which she possessed in every respect, in a higher degree, than any other nation! How truly great did the king appear in his last moments! All their efforts to degrade him were vain; his unshaken virtue triumphed over their wickedness. It is true, then, that religion alone transfuses sufficient courage into the mind of man, to enable him to support, with so much dignity, such dreadful trials."†

* Clery's Journal, p. 158—196.

† Bertrand's Memoirs, chap. 40.

Malguzzary, Malphaghino.

MALGUZZARY, in the language of Bengal, *payment* of revenue; the *revenue* itself.

MALPHAGHINO (John), otherwise called John de Ravenna, from the place of his birth, was born in the year 1352, of a family distinguished neither by riches nor nobility. His father, however, committed him to the care of Donatus the grammarian, an intimate friend of Petrarch, who at that time taught the Latin tongue with great applause at Venice. Donatus thought he discovered such happy dispositions in young Malphaghino, that he recommended him to Petrarch, not only as an excellent assistant to facilitate his labours, by reading or transcribing for him, but as a youth of the most promising talents, and worthy of being formed under the inspection of the greatest man of the fourteenth century.

It appears from some of Petrarch's letters, for it is from these chiefly we can obtain information respecting John de Ravenna, that he fully answered the expectations formed of him; and that he even gained the favour and affection of his patron so much, that he loved him and treated him as if he had been his own son. In a letter to John de Certaldo (A), Petrarch highly extols him, not only for his genius and talents, but also for his prudent and virtuous conduct. "He possesses (says he) what is very rare in our times, a great turn for poetry, and a noble desire to become acquainted with every useful and ornamental part of knowledge. He is favoured by the Muses, and already attempts verses of his own; from which one can foretel, that, if his life be spared, and if he goes on as hitherto, something great may be expected from him."

Not long, however, after this panegyric was written, young Malphaghino conceived an insuperable desire to see the world; and, notwithstanding all Petrarch's remonstrances, persisted in his resolution of quitting him.

Petrarch's

(A) Better known under the name of *Boccaccio* or *Boccace*. Certaldo was the place of his birth.

Malphaghino.

Petrarch's paternal care and regard for his pupil appear, on this occasion, in the most favourable light, as may be seen in his letters to Donatus; and his whole behaviour, though the young man insisted on leaving him, without assigning a sufficient reason for his precipitate and ungrateful conduct, does as much honour to his head as to his heart.

The precipitation with which John de Ravenna carried his plan into execution was not likely to make it answer his expectations. He departed without taking with him letters of recommendation which Petrarch offered him to his friends. He, however, pursued his journey over the Appenines, amidst continual rain, giving out that he had been dismissed by Petrarch; but, though he experienced from many a compassion to which he was not entitled by his conduct, he now began to awaken from his dream. He proceeded therefore to Pisa, in order to procure a vessel to carry him back towards Pavia; but being disappointed, while his money wasted as much as his patience decreased, he suddenly resolved to travel back across the Appenines. When he descended into the Ligurian plains, he attempted to wade through a river in the district of Parma, which was much swelled by the rains; and being carried by the force of the stream into a whirpool, he would have lost his life, had he not been saved by some people who were accidentally passing that way. After escaping this danger, he arrived, pennyless and famished, at the house of his former patron, who happened then not to be at home; but he was received and kindly entertained by his servants till their master returned.

Petrarch, by his intreaties and paternal admonitions, retained the young man at his house for about a year, and prevented him from engaging in any more romantic adventures; but, at the end of that period, his desire for rambling again returned, and as Petrarch found that all attempts to check him would be fruitless, he gave him letters of recommendation to two of his friends, Hugo de St Severino and Franciscus Brunus, at Rome. To the former of these, Petrarch says, "This youth of rare talents, but still a youth, after proposing to himself various plans, has at length embraced the noblest; and as he once travelled, he is now desirous of doing so again, in order to gratify his thirst of knowledge. He has, in particular, a strong inclination for the Greek language; and entertains a wish which Cato first conceived in his old age. This wish I have endeavoured for some years to subdue; sometimes by intreaties, at other times by admonition; sometimes by representing how much he is still deficient in the Roman language; and sometimes by laying before him the difficulties which must attend him in his journey, especially as he once before left me, and by want was obliged to return. As long as that unfortunate excursion was fresh in his memory he remained quiet, and gave me hopes that his restless spirit could be overcome and restrained. But now, since the remembrance of his misfortunes is almost obliterated, he again sighs after the world; and can be retained neither by force nor persuasion. Excited by a desire which betrays more ardour than prudence, he is resolved to leave his country, friends, and relations, his aged father, and me whom he loved as a father, and whose company he preferred to a residence at home, and to hasten to you whom he knows only by name. This precipitation even has an appearance of prudence. The young man first wished to visit Constantinople; but when I told him that Greece, at present, is as poor as it was formerly rich in learning, he gave credit to my assertion, and at any rate altered his plan, which he could not carry into execution. He is now desirous of traversing Calabria, and the whole coast of Italy, distinguished formerly by the name of Magna Græcia, because I once told him that there were in that quarter several men well skilled in the Greek language, particularly a monk, Barlaam, and one Leo, or Leontius, with whom I was intimately acquainted, and of whom the first had been some time my scholar. In consequence of this proposal, he begged me to give him a recommendatory letter to you, as you have considerable influence in that part of the country. This request I granted, in hopes that the young man, by his genius and talents, will afford you satisfaction equal to the service which you may render to him." In his letter to Brunus, Petrarch expresses himself as follows: "He is a young man who wishes to see the world as I formerly did; but I never reflect on it without horror. He is desirous of seeing Rome; and this desire I cannot condemn, as I myself have so often visited that city, and could still revisit it with pleasure. I suspect, however, that he will venture on a more extensive ocean, and that he imagines to find a fortune where he will, perhaps, meet with a shipwreck. At any rate, he is desirous he says, of putting his fortune to a trial. I wish it may be favourable; should it be adverse, he is still at liberty to return to my peaceful, though small, haven; for I hang out a light, during the day as well as the night, to guide those who quit me through youthful folly, and to enable them to find their way back. The ardour by which he is impelled must not be ascribed so much to him as to his age, and is in itself commendable. If I am not much deceived, the young man loves me and virtue in general. He is unsteady, but modest; and deserves that all good men should contribute to his prosperity as far as they can."

From the letters of Petrarch, there is reason to believe, that John de Ravenna lived with him only about three years in all; and that he had not attained to the full age of manhood when he left him. It appears also, for this circumstance is very obscure, that after he quitted him, he wandered about a considerable time before he was so fortunate as to meet with a protector and patron, at whose house, as he wrote to Petrarch, he at last found a permanent asylum. How long he remained with his patron, whom some believe to have been Cardinal Philip, and what happened to him till the death of Petrarch in 1374, and for some years after, is unknown. The literary monuments of the fourteenth and fifteenth centuries say nothing farther of him till his appearance at Padua; where, according to the testimony of Sicco (B), one of the most celebrated of his scholars,

(B) Adolescens tum ego poetas, et instituta Tullii audiebam. Legebat tunc hac in civitate Padua, literarum nutrice, *Johannes Ravennas* vir et sanctimonia morum, et studio isto excellens, atque si potest sine invidia, dici ceteris, qui magistri artis hujus in terra Italia usquam degerent et doctissimi haberentur, quantum recordari videor, Malphaghino.

he not only taught the Roman Eloquence, but also the science of moral philosophy, with such success and applause, and improved his scholars so much by his life and example, that, according to universal opinion, he far excelled all the professors of those sciences who had ever before appeared. That he was here of considerable service in reviving the study of the Latin language, and of the works of the ancient Romans, was acknowledged by all his scholars, and is confirmed by the following testimony of Blondus (c).

"About the same period, Ravenna produced that learned grammarian and rhetorician Johannes, of whom Leonardus Aretinus used to say, that he first introduced into Italy, after a long period of barbarism, the study of the Latin language and eloquence, now so flourishing; a circumstance which deserves to be enlarged on in the present work. Those well acquainted with Roman literature know, that after the periods of Ambrose, Jerom, and Augustine, there were none, or very few, who wrote with any elegance, unless we add to these good writers, St Gregory, the venerable Bede, and St Bernard. Francis Petrarch was the first who, with much genius, and still greater care, recalled from the dust the true art of poetry and of eloquence. He did not attain to the flowers of Ciceronian eloquence, with which many are adorned in the present century; but this was owing rather to a want of books than of talents. Though he boasted of having found at Vercelli Cicero's letters to Lentulus, he was unacquainted with the books of that great Roman *De Oratore*, Quintilian's Institutes, the *Orator*, the *Brutus*, and other writings of Cicero. John de Ravenna was known to Petrarch both in his youth and in his old age. He was not more conversant with the ancients than Petrarch; and, as far as I know, left no works behind him. By his excellent genius, however, and, as Leonardus Aretinus says, by the particular dispensation of God, he was the preceptor of this Leonardus, of Petrus Paulus Vergerius, of Annebonus de Padua, of Robert Rossi, of James Angeli of Florence, of Poggius and Guarino of Verona, of Victorinus, Sicco, and other men of less note, whom he incited to the study of better knowledge, and to imitate Cicero, if he could not form them or instruct them completely.

"About the same time, Manuel Chrysoloras, a man as virtuous as learned, came from Constantinople to Italy, and instructed in the Greek language, partly at Venice and partly at Florence and Rome, all the before mentioned scholars of John de Ravenna. After he had continued this instruction for some years, those unacquainted with the Greek language, and the ancient Greek writers, were considered in Italy as more ignorant than those unacquainted with the Latin. A great many young men and youths were inflamed with an enthusiastic desire for the works of the ancient Greeks and Romans. At the time of the council of Constance, in the beginning of the fifteenth century, many of my countrymen endeavoured, by searching the neighbouring cities and convents, to discover some of the Roman manuscripts which had been lost. Poggius first discovered a complete copy of Quintilian, which was soon followed by the letters of Cicero to Atticus. As our youth applied to the study of these works with the utmost diligence, that celebrated grammarian and rhetorician Casparinus de Bergamo, opened a school at Venice, superior to the former, and in which young persons were encouraged to study the ancient languages and writers. About the same time flourished Petrus Paulus Vergerius, Leonardus Aretinus, Robert Rossi, James Angeli, Poggius, and Nicolaus de Medici, whom Aretin had long instructed. Guarinus also had begun to instruct many at Venice, and Victorinus at Mantua, when Philip III. Duke of Milan, recalled Casparinus as his subject, from Venice to Padua and Milan. The increasing study of ancient literature was much promoted by Gerard Landriano bishop of Lodi, discovering under some ruins an old copy of Cicero, written in characters scarcely legible, which, among other rhetorical writings of that great Roman, contained the whole books *De Oratore*, with his *Brutus* and *Orator*. This saved Casparinus the trouble of supplying the books of Cicero *De Oratore*, as he had attempted to supply the works of Quintilian. As no one was found in all Milan who could read this old manuscript of Cicero, an ingenious young man of Verona, named Casmus, was so fortunate as first to transcribe the books *De Oratore*, and to fill all Italy with copies of a work which was universally sought for with the utmost avidity. I myself, in my youth, when I went to Milan on the business of my native city, transcribed, with as much ardour as speed, the *Brutus* of Cicero, and sent copies of my transcription to Guarinus at Verona, and to Leonard Justiniani at Venice; by which means this work was soon dispersed all over Italy. By these new works eloquence acquired new fire; and hence it happens, that in our age people speak and write better than in the time of Petrarch. The study of the Greek language, besides the abundance of new and useful knowledge which it disclosed, was attended with this great advantage, that many attempted to translate Greek works into Latin, and thereby improved their style much more than they could have done without that practice. After this period, schools for teaching the ancient languages increased in Italy, and flourished more and more. Most cities had schools of this kind; and it gives one pleasure to observe, that the scholars excelled their masters, not only when they left them, but even while they were under their tuition. Of the scholars of John de Ravenna, two of the oldest, Guarinus and Victorinus, the former at Venice, and the latter at Mantua, Verona, Florence, and Ferrara, instructed an immense number of pupils; and among these, the Princes of Ferrara and Mantua. George of Trebisonde, when he lectured at Rome, had for his auditors, besides Italians, many French, Spaniards, and Germans, among whom sometimes there were men of rank and eminence. Franciscus

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omnium judicio præferendus. Hoc namque a præceptore non eloquentia modo, quam ex ordine legerit, sed mores etiam, ac quædam bene honesteque vivendi ratio cum doctrina tum exemplis discebatur.—*Sicco Polentonus*, Ap. Mehus, l. c. p. 139.

(c) Blondi Flavii Forliviensis Italia illustrata. Bas. 1559. fol. p. 346.

Malphag-hino, ‖ Malt.

nus Philelphus, who had been taught at Conſtantinople by Chryſoloras himſelf, inſtructed a great many young men and youths in the Greek and Latin languages at Venice, Florence, Siena, Bologna, and, laſt of all, at Milan." In the above quotation, the ſhare which John de Ravenna had in reviſing and diffuſing a knowledge, not only of the Roman, but alſo of the Grecian literature, is ſo clearly repreſented, that no farther teſtimony is neceſſary to eſtabliſh his claim to celebrity.

After John de Ravenna had taught at Padua, he removed for the like purpoſe to Florence; where, as appears, he inſtructed young people for ſome time, without being expreſsly invited by the government, and without being publicly paid for his labours. In the beginning of his reſidence at Florence, he ſeems to have been recommended by Colucius to the learned Charles de Malateſta. "There lives here at preſent (ſays Colucius, in one of his letters) a teacher of great merit, John de Ravenna.—He is (continues he) of mature age; irreproachable in his manners, and ſo diſpoſed in general, that if you receive him, as I hope and wiſh, among the number of your intimate friends, you will find him an agreeable and incomparable aſſiſtant to you in your labours and ſtudies. What can be more deſirable to you than to poſſeſs a man who will lucubrate and labour for you? and who, in a ſhort time, can communicate to you what you could not obtain by your own exertions without great difficulty. I do not know whether you will find his like in all Italy: and I therefore wiſh, that, if you confide in my judgment, you will receive John de Ravenna in the room of your late learned friend James de Alegretti." It is not known whether John de Ravenna went to reſide with Malateſta or not. It is, however, certain, that the former, in 1397 (the ſame year in which Manuel Chryſoloras came to Florence), was invited thither by the magiſtrates of that city, with the promiſe of an annual ſalary, to inſtruct young people in the Roman language and eloquence: that John de Ravenna, at the period when he entered into this honourable engagement, was 45 years of age; and that the ſcholars of John de Ravenna were, at the ſame time, ſcholars of Chryſoloras. Saluratus Colucius, in all probability, was the cauſe of this invitation, as he was acquainted with the ſervices of John de Ravenna, and knew how to appreciate them. "We know (ſays he, in one of his letters to John de Ravenna), and all who reſpect you know alſo, that none of the moderns, or even ancients, approached ſo near to Cicero as you; and that to the moſt wonderful beauty and powers of ſpeech, you join the deepeſt knowledge." John de Ravenna, like Chryſoloras, and moſt of the teachers of the Greek and Roman languages in the beginning of the fifteenth century, was, no doubt, engaged at firſt only for a few years; when theſe were elapſed, the engagement was renewed, perhaps for the laſt time, in 1412, and he was bound, beſides teaching the Roman eloquence, to read publicly, and explain in the cathedral, on feſtivals, the poems of Dante. John de Ravenna did not long ſurvive the above renewal of his engagement; for an anonymous writer, who, in 1420, finiſhed *A Guide to Letter-writing, according to the Principles of John de Ravenna*," ſpeaks of his preceptor as of a man not then in exiſtence.

MALT. See BREWING (*Encycl.*), where a full account is given of Sir Robert Murray's method of malt-making, together with ſome valuable obſervations on malt by Mr Richardſon of Hull. In a late edition of this latter gentleman's *Theoretic Hints on Brewing*, we are told, that Mr Edward Rigby of Norwich is of opinion, that the mere exſiccation of corn is not the only object obtainable by drying it on the kiln, but that ſome portion of the ſaccharum of malt is the effect of that proceſs. "The operation of kiln drying the malt (ſays Mr Rigby) is as follows:—The grain is ſpread thick upon a floor made of flat bricks *(tiles)*, or iron plates, which are full of perforations; immediately under this floor is the oven or furnace, in which is a large fire made of *coaks*, cinders, or, in ſome places, billet wood; a current of air, at the mouth of the furnace, keeps up the combuſtion of the coaks, and the air which is phlogiſticated by their burning, and which, in a common fire place, riſes up the chimney, paſſes, in this inſtance, through the apertures in the floor, and penetrates the whole ſtratum of malt before it can paſs into the external air. Under theſe circumſtances, it is evident, that the interſtices of the malt muſt be filled with phlogiſtic air: and as the grain uſually remains in this ſituation about two days, it is obvious, that if it have the power of abſorbing phlogiſton, it certainly muſt do it when ſo long in contact with it. And that the malt does really imbibe ſome of this principle, is not only probable on the general ground of the truth of the preceding theory, but, I believe, it will be found, that the phlogiſticated air which riſes from the burning ſubſtances underneath, is corrected in paſſing through the malt; for without its being meliorated by this or ſome other cauſe, it is evident that the air in the kiln-chamber, more eſpecially the lower ſtrata of it, muſt be noxious, and probably even ſo much ſo as to be unfit for reſpiration and combuſtion. But ſo far from this being the caſe, I am informed, that workmen will lie and ſleep many hours on the malt in this ſituation without ſuffering any inconvenience. And after mentioning this, it is ſcarcely neceſſary to add, that I find alſo, by experiment, that a candle will burn perfectly well in the air which is immediately on the ſurface of the malt.

"Were heat alone ſufficient for the purpoſe of completing the operation of malting, it certainly might be applied in a much more cheap way than is at preſent done; for the floor on which the grain is laid might, unqueſtionably, be heated equally without there being perforations in it, as with them. In which caſe, one kind of fuel would be as good as another; and, conſequently, the preſent expence of previouſly burning the coals, to convert them into coaks or cinders, might be ſaved.

"But, admitting that the application of phlogiſton to the malt, as well as heat, is requiſite in this operation, the neceſſity of theſe perforations becomes evident, and alſo the propriety of previouſly burning the coals in ſuch a way, that all the water, and thoſe other heterogeneous particles which compoſe ſmoke and ſoot, may be diſſipated; for theſe, merely as ſuch, would obviouſly contribute little to the phlogiſtication of the malt, and would evidently impart ſome offenſive flavour, if not ſome obnoxious quality to it.

"Reaſoning from the above premiſes (Mr Rigby concludes), it would ſeem, that as all the farinaceous parts of the barley are ſeldom diſſolved in brewing, and the grains which are left have uſually the diſpoſition to

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become four, thereby manifesting some of the acid principle to be still existing in them, it is not improbable but some further saccharine matter might be obtained from the grain by another exposure to phlogisticated air, or, in other words, by being once more laid on the kiln."

This is indeed so far from being improbable, that we think it must infallibly be the case. Sugar, it is well known, consists of oxygen, hydrogen, and carbon (see CHEMISTRY in this *Supplement*, n° 466.); but from the disposition of the grains to become sour, it is plain, that after the process of brewing they still retain much oxygen; and the azotic gas, which is here called phlogisticated air, there is every reason to believe contains both hydrogen and carbon. These, therefore, uniting with the oxygen of the grains, must make an addition to the saccharine matter. This has, indeed, been found to be the fact by Mr Richardson, who, in consequence of Mr Rigby's suggestion, was induced to brew a small brewing of malt, of ten quarters only, and stopping the process when, according to his general practice, one extract was still due, he ordered the grains to be laid upon one of his malt kilns, and cinders to be applied the same as for drying of malt. This was continued for two days and a half, when the grains, being perfectly dried, were put into sacks, and, when cold, returned again into the mash tun. The event, in some measure, justified Mr Rigby's expectation; for the produce of fermentable matter was considerably more than he had reason to conclude would have been the case, had the extract been made in immediate succession, as it would have been in the ordinary course of his practice. He attempts, indeed, to account for it in a way very different from ours; but though we have the highest confidence in Mr Richardson as an experienced brewer, we must sometimes beg leave to think for ourselves as chemists. Like a man of sense, however, and a man of science, he says, "I am so well satisfied with the event of this experiment, that I shall probably be inclined, on some future occasion, to repeat it, in various stages of the process. The fine lively froth on the surface of the wort, in the underback, added to its transparency and good flavour, are circumstances which induce me to thank Mr Rigby for the hint, which, it is not improbable, may be applied to some useful purpose, in certain situations which sometimes occur in the brewing trade."

MAMA KATING, a township in Ulster county, New York, W. of Montgomery and Wallkill, on Delaware river. It contains 1,763 inhabitants, including 232 electors, and 51 slaves.—*Morse.*

MAMARONECK, a township in West-Chester county, New-York, containing 452 inhabitants, including 57 slaves. It is bounded southerly by New Rochelle, and easterly by the Sound.—*ib.*

MAMARUMI, a place on the road from Guayaquil to Quito, in S. America, where there is a very beautiful cascade. The rock from which the water precipitates itself, is nearly perpendicular, and 50 fathoms high; and on both sides edged with lofty and spreading trees. The clearness of the water dazzles the sight, which is delighted, at the same time, with the large volume of water formed in its fall; after which it continues its course in a bed, along a small descent, and is crossed over by a bridge.—*ib.*

MAMMALUKES, MAMALUCS, *Mameloucs*, or *Mamluks*, were a dynasty that reigned for a considerable time in EGYPT, and of which some account has been given in that article *(Encycl.)*. A fuller account of them must, however, be acceptable to our readers, as, since the expedition of Buonaparte, they have attracted the attention of all Europe.

Mammalukes.

They were first introduced into Egypt, as we have already observed, by Saladine, who, when he had it in contemplation to besiege Jerusalem, very naturally endeavoured to collect the most forcible means to accomplish so desirable an end; and, in consequence, observing that the ancient inhabitants of Egypt were, from their effeminate mode of education, and the quiet and tranquil habits of their lives, much fitter for those occupations in which they delighted, namely, the arts, merchandize, and mechanics, than military tactics and military toil, he resolved, as little as possible, to employ or depend upon them.

Antijacobin Review, n° 12 and *Brown's Travels.*

This resolution stimulating him to procure a hardier race of soldiers, he therefore commissioned agents to treat with the Circassians, by the Lake of Mæotis, near Taurica Chersonesus, whence, about the year 1176, they purchased more than a thousand slaves. Men inured to hardship, nurtured in the lap of toil and danger, and bred from their infancy to war, which was to them rather an instinct than a science, as the continual incursions of the Tartars rendered self-defence, in their situation, absolutely necessary.

These slaves Saladine trained to military discipline, and, at the same time that he made them renounce Christianity, had them instructed in the Mahometan religion; and although he prohibited them from marrying, he allowed them an unbounded licence with respect to desultory gallantry. What progress they made in the doctrines of the Alcoran, whether the tenets of that sacred volume effectually eradicated all their first principles, is uncertain; but it is certain, that in time they became excellent soldiers, and that the military glory of Saladine, which was feebly supported by the native Egyptians, expanded in the hands of the Mameloucs, who extended their conquests on every side, until, pervading the Holy Land, they entered in the plain of Askelon.

These Mameloucs, who were continually adding to their numbers, in process of time became naturalized to the country; and, as it has been observed, they excelled the Egyptians in strength of body, in military discipline, in their skill in horsemanship, and in courage; so they, by the liberality of their generals, and the plunder of cities and provinces, also excelled them in wealth. In fact, their mode of education fitted them for the most dangerous and adventurous enterprises, and, from being the slaves, enabled them in time to become the masters of even the Turks, by whom they had originally been purchased.

After the death of Saladine, who left the kingdom to his brother, they rose to still greater importance than they had acquired during his reign, and continued, if not absolutely to govern, yet, like the Roman soldiers in the time of Pertinax, Alexander, and Valerian, to awe the monarch.

This influence continued through the reigns of five successive Caliphs, until that of Melachsala, the last of the posterity of Saladine, who being at war with the Arristians, and at the same time, wishing to repress the enormous

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enormous power of the Mameloucs, purchased slaves from all the surrounding countries, whom, in imitation of his ancestor, he armed and appointed to defend his dominions. The event of this measure was exactly what might have been expected. Melachsala was, in consequence of a conspiracy betwixt his new and his old soldiers, slain; and Turquemenus, the leader of this mutiny and rebellion, hailed by the title of Great Sultan of Egypt. With him began the government of the Mameloucs, about the year 1250; which had the next year gathered such strength, that it was thought necessary, in order to repress those exuberances to which new formed governments are liable, and bring it nearer to a system, to cause the following articles, in the form of a charter, to be subscribed to by their principal leaders, as an act of the whole people:—"1st, That the Sultan should be chosen from the body of Mameloucs: 2dly, That none should be admitted into the order that were by birth either Jews or Turks, but only Christian captives; 3dly, That the native Egyptians should not be permitted to use, or have, any weapons, except the instruments of agriculture."

Turquemenus, as is frequently the practice with those that experience a sudden elevation, endeavoured to kick down the ladder by which he had been raised; or, in other words, his carriage was so haughty and disdainful to his former companions, that he was by them, or rather by one of them named Ciotho, suddenly slain; for which the murderer was rewarded with his sceptre. After him succeeded a long race of princes, many of whom were as eminent for their talents as for their valour; among whom, the name of Caitbeius has been transmitted to us as that of the greatest statesman and general of his age; but, as every one who considers the *materials* of which the government was composed, must rather wonder that it existed so long, than that it should, through almost the whole course of its operation, be exposed to all the various evils and distresses arising from a long train of sedition and tumults, so he must lament that it should expire in the reign of one of their wisest and best monarchs: yet it is some consolation to reflect, that Campson, the last Sultan of the Mameloucs, was not *murdered by his own subjects*, but having for many years governed the kingdoms of Egypt, Judea, and Syria, in a manner that has excited the praise of the historic pen, he, oppressed with age and disease, and encumbered with his armour, sunk upon the field of battle, and, with his last breath, yielded the victory to the fortunate Selim.

With this monarch, who expired January 20, 1516, ended the government of the Mameloucs, after it had continued 276 years; for although an attempt was made by Tomumby to get himself declared Sultan, in which attempt he actually succeeded so far as to be invested with the title, yet he was soon after defeated by the victorious Selim. He was then forsaken by his troops, taken and executed; while the Mameloucs, broken and dispersed, it was the policy of Selim to rally, and, by offers too tempting to be by them refused, engage in his service. The use of these soldiers soon became sufficiently apparent to the Turkish Emperors, to stimulate them to augment their number, enlarge their sphere of action, and combine them closer to the state, by the allowance of still greater privileges and advantages than they had before enjoyed.

The Beys were ordained to be chosen from among them; and the Pasha, or chief governor for the Porte, was to share his power with those Beys, and even to continue in office no longer than should be agreeable to their collective will. At first the power of the Pasha was very extensive; but, by the intrigues and ambition of the Beys, it has been reduced almost to a cypher. It was rather of a civil than military nature. He was always president of the Divan, which was held in the castle where he resided. But that council now commonly meets in the palace of one of the chief Beys, except when a firman or mandate is received from Constantinople, when the Beys are summoned to the castle, to hear the commands of the Porte. The few who attend, as soon as the reading is finished answer, as is usual, "*Esmana wa taana*" "We have heard, and we obey." On leaving the castle, their general voice is "*Esmana wa asysina*," We have heard, and shall disobey."

In the year 1791, Salah Aga, a slave of Murad Bey, was deputed from the government of Egypt to negociate their peace with the Porte. He carried presents of horses, rich stuffs, &c. A spontaneous tribute, which the Porte was in no condition to enforce, implied obligation on the part of the latter. He was well received, and afterwards was appointed *Waquil es Sultan*, agent or attorney to the Sultan in Cairo. It is probable, this office was given him to incline him to second the efforts of the Court in disuniting the Beys; but it was ineffectual. These had formerly experienced the evils of division, and now were united by common interest, grown rich, and well provided with slaves; so that no tribute has since that time found its way to Constantinople.

The Mameloucs remain, as they have ever been, military slaves, imported from Georgia, Circassia, and Mingrelia. A few have been prisoners, taken from the Austrians and Russians, who have exchanged their religion for an establishment. The Beys give general orders to their agents at Constantinople, to purchase a certain number every year; and many are brought to Egypt by private merchants on speculation. When the supply proves insufficient, or many have been expended, black slaves from the interior of Africa are substituted, and, if found docile, are armed and accoutred like the rest.

Particular attention is paid to the education of these favoured slaves. They are instructed in every exercise of agility or strength, and are, in general, distinguished by the grace and beauty of their persons. The gratitude of the disciples is equal to the favour of their masters, whom they never quit in the hour of danger. If they have a disposition for learning, they are taught the use of letters, and some of them are excellent scribes; but the greater part neither can read nor write. A striking example of which deficiency is observable in Murad Bey himself.

The inferior Mameloucs constantly appear in the military dress, and are commonly armed with a pair of pistols, a sabre, and a dagger. They wear a peculiar cap of a greenish hue, around which is wreathed a turban. The rest of their dress resembles that of other Mohamedan citizens, and is restricted to no particular colour; but another singularity is, their large drawers of thick Venetian cloth, of a crimson colour, to which are attached their slippers of red leather. On horse-

back

back they add to their arms a pair of large horse pistols, and the dubbus or battle axe. In battle, many of them wear an open helmet, and the ancient ring armour of interwoven links of steel, worn under part of their dress, and thus concealed. These are dear; sometimes costing 500 piastres, or about L. 40. Some of them are made at Constantinople, others in Persia. Their horses are of the finest Arabian breed, and are often purchased at three or four purses, L. 150 to L. 200 sterling.

They have no pay, as they eat at a table in the house of their master the Bey, Cashef, or other officer. Any military officer may purchase a slave, who becomes, *ipso facto*, a Mameluke. The name, from *malek*, to possess, implies merely a person who is the property of another. After a proper education, the candidate thus constituted a Mameluke, receives a present of a horse and arms from his master, together with a suit of clothes; which is renewed every year in the month Ramadan. The generosity of their masters, and rewards or extortions from others, afford them supplies of money, either for avarice or debauchery. Some of them, admitted to peculiar favour by the Beys, as chasnadars, or purse-bearers, &c. acquire great wealth. They are rather gay and thoughtless than insolent, fond of show, and unprincipled in their means of acquiring it. They seldom marry till they acquire some office.

Though born of Christian parents, they seem highly satisfied with their condition, which they have been known to refuse to exchange for freedom. The majority are regarded by the Arabs as little strict in the principles or duties of Mohamedism. It is worthy of remark, that though the Mamelukes, in general, be strong and personable men, yet the few who marry very seldom have children. As the son, even of a Bey, is not honoured with any particular consideration, the women, perhaps, procure abortions. Of eighteen Beys, with whose history Mr Browne was well acquainted, two only had any children living.

Hardy, capable of every fatigue, of undaunted courage, and eminent skill in horsemanship and the use of the sabre, the Mamelukes may be regarded as by far the best troops in the East. But in a regular battle, conducted by manœuvres, and large or rapid movements, they are equally inferior to European troops.

Being distinguished by favouritism or merit, the Mameluke becomes a Cashef, and in time a Bey. The chief cause of preference arises from political adherence to some powerful leader.

The government of Cairo, and Egypt, in general, is vested in 24 Beys; each of whom is nominally chosen by the remaining 23, but, in fact, appointed by one of the most powerful. The Yenk-tchery, Aga, and several other officers, are enumerated among the 24 Beys.

Besides being governors of certain districts of Egypt, several of the Beys receive other dignities from the Porte: Such are the Shech el Bellad or governor of the city; the Defterdar, or accountant-general; the Emir el Hadj, or leader of the sacred caravan; and the Emir es Said, or governor of the Upper Egypt. These two last offices are annual. These officers have also revenues allotted them by the Porte, ill defined, and liable to much abuse.

Of the other Beys, each appoints all officers and governors within his district, putting into it some slave of his own, who is compelled to render an account of the receipts, of which a great part passes to support the grandeur of his master. An opulent Bey may have from 600 to 1000 purses annually; the revenue of Murad Bey more than doubles that sum. The inferior Beys may have 300 purses, or L. 15,000.

Every Bey sits in judgment on cases of equity. These personages are very observant of their respective jurisdictions; and no Bey will imprison a man liberated by another. Though sometimes too impetuous, they nevertheless display great acuteness and knowledge of characters. This government, at least, possesses every advantage of publicity, as every Bey is a magistrate.

MAN, has been considered in a great number of particulars under the title MAN *(Encycl.)*; but a reference was made from that article to the article *VARIETIES of the Human Species*, which was, after all, omitted entirely.

Perhaps enough has been said on the varieties of the human species in the articles COMPLEXION and NEGRO *(Encycl.)*; but as infidel ignorance is perpetually pretending, that the diminutive Icelanders, the ugly Esquimaux, the woolly-headed Negro, and the copper-coloured American, could not have descended from one original pair either of European complexion or of Hindoo symmetry—it may not be improper, in this place, to shew the weakness of this popular objection to the Mosaic history of the origin of man. This has been done in so satisfactory a manner by Professor Blumenbach, that we have nothing to do but lay his observations before our readers, convinced, as we are, that they are intelligible to every capacity, and that they will carry conviction to all who are not the slaves of prejudice.

"Some late writers on natural history (says the Professor) seem doubtful whether the numerous distinct races of men ought to be considered as mere varieties, which have arisen from degeneration, or as so many species altogether different. The cause of this seems chiefly to be, that they took too narrow a view in their researches; selected, perhaps, two races the most different from each other possible, and, overlooking the intermediate races that formed the connecting links between them, compared these two together; or, they fixed their attention too much on man, without examining other species of animals, and comparing their varieties and degeneration with those of the human species. The first fault is, when one, for example, places together a Senegal negro and an European Adonis, and at the same time forgets that there is not one of the bodily differences of these two beings, whether hair, colour, features, &c. which does not gradually run into the same thing of the other, by such a variety of shades, that no physiologist or naturalist is able to establish a certain boundary between those gradations, and consequently between the extremes themselves.

Phil. Mag. vol. iii. p. 284.

"The second fault is, when people reason as if man were the only organised being in nature, and consider the varieties in his species to be strange and problematical, without reflecting that all these varieties are not more striking or more uncommon than those with which so many thousands of other species of organised beings degenerate, as it were, before our eyes."

As what we have said under the articles COMPLEXION and NEGRO may be sufficient to warn mankind against the

the first error, and at the same time to refute it, we hasten to refute the second by our author's comparison between the human race and that of swine.

"More reasons (says he) than one have induced me to make choice of swine for this comparison; but, in particular, because they have a great similarity, in many respects, to man: not, however, in the form of their entrails, as people formerly believed, and therefore studied the anatomy of the human body purposely in swine; so that, even in the last century, a celebrated dispute, which arose between the physicians of Heidelberg and those of Durlach, respecting the position of the heart in man, was determined, in consequence of orders from government, by inspecting a sow, to the great triumph of the party which really was in the wrong. Nor is it because in the time of Galen, according to repeated assertions, human flesh was said to have a taste perfectly similar to that of swine; nor because the fat, and the tanned hides of both, are very like to each other; but because both, in regard to the economy of their bodily structure, taken on the whole, shew unexpectedly, on the first view, as well as on closer examination, a very striking similitude.

"Both, for example, are domestic animals; both *omnivora;* both are dispersed throughout all the four quarters of the world; and both consequently are exposed, in numerous ways, to the principal causes of degeneration arising from climate, mode of life, nourishment, &c.; both, for the same reason, are subject to many diseases, and, what is particularly worthy of remark, to diseases rarely found among other animals than men and swine, such as the stone in the bladder; or to diseases exclusively peculiar to these two, such as the worms found in measled swine.

"Another reason (continues he) why I have made choice of swine for the present comparison is, because the degeneration and descent from the original race are far more certain in these animals, and can be better traced, than in the varieties of other domestic animals. For no naturalist, I believe, has carried his scepticism so far as to doubt the descent of the domestic swine from the wild boar; which is so much the more evident, as it is well known that wild pigs, when caught, may be easily rendered as tame and familiar as domestic swine: and the contrary also is the case; for if the latter by any accident get into the woods, they as readily become wild again; so that there are instances of such animals being shot for wild swine; and it has not been till they were opened, and found castrated, that people were led to a discovery of their origin, and how, and at what time, they ran away. It is well ascertained, that, before the discovery of America by the Spaniards, swine were unknown in that quarter of the world, and that they were afterwards carried thither from Europe. All the varieties, therefore, through which this animal has since degenerated, belong, with the original European race, to one and the same species; and since no bodily difference is found in the human race, as will presently appear, either in regard to stature, colour, the form of the cranium, &c. which is not observed in the same proportion among the swine race, while no one, on that account, ever doubts that all these different kinds are merely varieties that have arisen from degeneration through the influence of climate, &c. this comparison, it is to be hoped, will silence those sceptics who have thought proper, on account of these varieties in the human race, to admit more than one species.

"With regard to stature, the Patagonians, as is well known, have afforded the greatest employment to anthropologists. The romantic tales, however, of the old travellers, who give to these inhabitants of the southern extremity of America a stature of ten feet and more, are scarcely worth notice; and even the more modest relations of later English navigators, who make their height from six to seven feet, have been doubted by other travellers, who, on the same coast, sought for such children of Enoch in vain. But we shall admit every thing said of the extraordinary size of these Patagonians by Byron, Wallis, and Carteret; the first of whom assigns to their chief, and several of his attendants, a height of not less than seven feet, as far as could be determined by the eye; the second, who asserts that he actually measured them, gives to the greater part of them from 5 feet 10 inches to 6 feet; to some 6 feet 5 inches, and 6 feet 6; but to the tallest, 6 feet 7 inches: and this account is confirmed by the last-mentioned of the above circumnavigators. Now, allowing this to be the case, it is not near such an excess of stature as that observed in many parts of America among the swine, originally carried thither from Europe; and of these I shall mention in particular those of Cuba, which are more than double the size of the original stock in Europe.

"The natives of Guinea, Madagascar, New Holland, New Guinea, &c. are black; many American tribes are reddish brown, and the Europeans are white. An equal difference is observed among swine in different countries. In Piedmont, for example, they are black. When I passed (says our author) through that country, during the great fair for swine at Salenge, I did not see a single one of any other colour. In Bavaria, they are reddish brown; in Normandy, they are all white.

"Human hair is, indeed, somewhat different from swines bristles; yet, in the present point of view, they may be compared with each other. Fair hair is soft, and of a silky texture; black hair is coarser, and among several tribes, such as the Abyssinians, Negroes, and the inhabitants of New Holland, it is woolly, and most so among the Hottentots. In the like manner, among the white swine in Normandy, as I was assured by an incomparable observer, Sulzer of Ronneburg, the hair on the whole body is longer and softer than among other swine; and even the bristles on the back are very little different, but lie flat, and are only longer than the hair on the other parts of the body. They cannot, therefore, be employed by the brush makers. The difference between the hair of the wild boar and the domestic swine, particularly in regard to the softer part between the strong bristles, is, as is well known, still greater.

"The whole difference between the cranium of a Negro and that of an European, is not in the least degree greater than that equally striking difference which exists between the cranium of the wild boar and that of the domestic swine. Those who have not observed this in the animals themselves, need only to cast their eye on the figure which Daubenton has given of both.

"I shall pass over (says our author) less national varieties which may be found among swine as well as among men, and only mention, that I have been assured

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by Mr Sulzer, that the peculiarity of having the bone of the leg remarkably long, as is the case among the Hindoos, has been remarked with regard to the swine in Normandy. 'They stand very long on their hind legs (says he, in one of his letters); their back, therefore, is highest at the rump, forming a kind of inclined plane; and the head proceeds in the same direction, so that the snout is not far from the ground.' I shall here add, that the swine, in some countries, have degenerated into races which in singularity far exceed every thing that has been found strange in bodily variety among the human race. Swine with solid hoofs were known to the ancients, and large herds of them are found in Hungary, Sweden, &c. In the like manner, the European Swine, first carried by the Spaniards, in 1509, to the island of Cuba, at that time celebrated for its pearl fishery, degenerated into a monstrous race, with hoofs which were half a span in length."

From these facts, our author concludes, that it is absurd to allow the vast variety of swine to have descended from one original pair, and to contend that the varieties of men are so many distinct species.

MANALLIN, a township in York county, Pennsylvania.—*Morse.*

MANCA, a town of West-Florida, on the E. bank of the Mississippi, at the mouth of Hona Chitto river. —*ib.*

MANCENILLA, a large bay on the N. side of the island of St Domingo; about 4,000 fathoms long from W. to E. and 2,800 broad from N. to S. The S. E. part of the bay is very wide, and affords excellent anchorage, even for vessels of the first size. In other parts it is too shallow. The river Massacre, which was the point of separation of the French and Spanish colonies on the N. of the island, runs a N. course, towards its mouth N. W. and enters the eastern part of the bay. The bay of Mancenilla, though a very fine one, is not so useful as it might be, if its bottom were well known. There are several shallows in it, owing to the overflowings of the Massacre, which rolls into it, wood, sand, and stones, in great quantities, so that it seems necessary to sound the bay annually, after they are over. In general, it is prudent, on entering, to keep closer to the point of Yeaque, than to the S. side of the bay; because the sandy point has no rocks. The bottom of the bay is muddy. The river Massacre is, during a league, from 5 to 12 feet deep, and pretty wide; but its bed is often full of the wood which the current brings down. It swarms with fish; and here are found those enormous mullets which are the pride of the table at Cape Francois. In the times of the floods, these fish are driven towards the bay, where negroes, well practised in the business, fish for them. Fishing in the bay is difficult enough, on account of the drifted wood; but the negroes are good divers, and are often obliged to go to the bottom and disengage the seine; but when it gets near the beach, it is a singular and striking spectacle, to see the negroes, the fish, and the alligators, all flouncing about in the water together. The negroes kill the alligators, knock out their teeth, and sell them to make corals, the garniture of which serves to mark the degree of luxury or pride of those who hang them to the necks of their children. The plenty of fish often attracts ships of war to this bay. The mouth of Massacre river lies in N. lat. 19° 44′, W. long. from Paris 74° 9′.—*ib.*

MANCHAC, a town on the Mississippi, two miles below the Indian town of Alabama. The banks of the river at Manchac, though frequently overflowed by the vernal inundations, are 50 feet perpendicular height above the surface of the water; and the river, at its lowest ebb, is not less than 40 fathoms deep, and nearly a mile in width. The Spanish fortress on the point of land below the Ibberville, close by the banks of the river, has a communication with Manchac, by a slender, narrow, wooden bridge, across the channel of Ibberville, and not a bow-shot from the habitations of Manchac.—*ib.*

MANCHESTER, a small fishing-town, situated on the sea-coast between Cape Anne and Beverly, in Essex county, Massachusetts. The fishery is carried on from this port chiefly in the vessels, and for the account of the merchants in Boston, and other places. The township lies S. E. of Wenham, and 30 miles N. E. of Boston. It was incorporated in 1645, and contains 965 inhabitants.—*ib.*

Manchester, a post-town of Vermont, in Bennington county, on Battenkill. It is 22 miles N. by E. of Bennington, and 59 N. E. of Albany in New-York. This township contains 1276 inhabitants. In the S. part of the town, in a hill a little W. of the Battenkill, is a deep stratum of friable calcareous earth, of the whiteness of chalk; and apparently composed of shells, which requires but little burning to produce good lime. —*ib.*

Manchester, a township in York county, Pennsylvania.—*ib.*

Manchester, a small town of Virginia, situated on the S. side of James river, opposite to Richmond, with which it is connected by a bridge. In 1781 this town suffered much during Arnold's destructive expedition. —*ib.*

Manchester, a town of Nova-Scotia, 10 leagues N. W. of Cape Canso. It contained 250 families in 1783.—*ib.*

Manchester House, one of the Hudson Bay Company's factories, lies 100 miles W. of Hudson's House, and 75 S. E. of Buckingham House. It stands on the S. W. side of Saskashawan river, in the N. W. part of N. America. N. lat. 53° 14′ 18″, W. long. 109° 20′. —*ib.*

MANCORA, a place on the road from Guayaquil to Truxilla, in Peru, situated on the sea-coast. Through it, during winter, runs a rivulet of fresh water, to the great relief of the mules that travel this way. In summer, the little remaining in its channel is so brackish, as to be hardly tolerable.—*ib.*

MANDING, a large state in the interior of Africa, of which the only satisfactory account that we have is by Mr Park, who, for several months, was hospitably entertained in Kamalia, one of its towns, situated in 12° 40′ N. Lat. and 6° 40′ W. Long. The government of Manding appeared to our author to be a sort of republic, or rather an oligarchy. Every town is indeed governed by a chief magistrate called Mansa, which usually signifies king; but the chief power of the state, in the last resort, is lodged in the assembly of these mansas

Manding.

manſas (A). The caſe, however, is different in other countries, which are occupied by people who have emigrated from Manding; for in all the Mandingo ſtates near the Gambia, the government is monarchical, though the power of the ſovereign is by no means unlimited.

As Mr Park's route was confined to a tract of country, bounded nearly by the 12th and 15th parallels of latitude, the climate throughout the whole was nearly the ſame as that of Manding, and extremely hot: Yet, where the country aſcended into hills, he found it comparatively cool and pleaſant; though none of the diſtricts which he traverſed could be called mountainous. About the middle of June, the hot and ſultry atmoſphere is agitated by violent guſts of wind (called *tornadoes*), accompanied with thunder and rain. Theſe uſher in what is denominated *the rainy ſeaſon;* which continues until the month of November. During this time, the diurnal rains are very heavy; and the prevailing winds are from the ſouth-weſt. The termination of the rainy ſeaſon is likewiſe attended with violent tornadoes; after which the wind ſhifts to the north-eaſt, and continues to blow from that quarter during the reſt of the year.

When the wind ſets in from the north-eaſt, it produces a wonderful change in the face of the country. The graſs ſoon becomes dry and withered; the rivers ſubſide very rapidly, and many of the trees ſhed their leaves. About this period is commonly felt the *harmattan*, a dry and parching wind, blowing from the north-eaſt, and accompanied by a thick ſmoky haze; through which the ſun appears of a dull red colour. This wind, in paſſing over the great deſert of Sahara, acquires a very ſtrong attraction for humidity, and parches up every thing expoſed to its current. It is, however, reckoned very ſalutary, particularly to Europeans, who generally recover their health during its continuance. The truth of this our author experienced both at Kamalia and Piſania, when he had been brought to the very brink of the grave by ſickneſs.

Whenever the graſs is ſufficiently dry, the negroes ſet it on fire; but in Ludamar, and other Mooriſh countries, this practice is not allowed; for it is upon the withered ſtubble that the Moors feed their cattle until the return of the rains. The burning of the graſs in Manding exhibits a ſcene of terrific grandeur. "In the middle of the night (ſays Mr Park), I could ſee the plains and mountains, as far as my eye could reach, variegated with lines of fire; and the light reflected on the ſky, made the heavens appear in a blaze. In the day time, pillars of ſmoke were ſeen in every direction; while the birds of prey were obſerved hovering round the conflagration, and pouncing down upon the ſnakes, lizards, and other reptiles, which attempted to eſcape from the flames." This annual burning is ſoon followed by a freſh and ſweet verdure, and the country is thereby rendered more healthful and pleaſant.

Though many ſpecies of the edible roots, which grow in the Weſt India iſlands, are found in Africa, yet our traveller never ſaw, in any part of his journey, either the ſugar-cane, the coffee, or the cocoa-tree; nor could he learn, on inquiry, that they were known to the natives. The pine-apple, and the thouſand other delicious fruits which the induſtry of civilized man (improving the bounties of nature), has brought to ſo great perfection in the tropical climates of America, are here equally unknown. He obſerved, indeed, a few orange and banana trees, near the mouth of the Gambia; but whether they were indigenous, or were formerly planted there by ſome of the white traders, he could not poſitively learn.

Concerning property in the ſoil, it appeared to Mr Park, that the lands in native woods were conſidered as belonging to the king, or (where the government was not monarchical) to the ſtate. When any individual of free condition had the means of cultivating more land than he actually poſſeſſed, he applied to the chief man of the diſtrict, who allowed him an extenſion of territory, on condition of forfeiture if the lands were not brought into cultivation by a given period. The condition being fulfilled, the ſoil became veſted in the poſſeſſor; and, for aught that appeared, deſcended to his heirs.

The Mandingoes are a very gentle race of people; cheerful in their diſpoſitions, inquiſitive, credulous, ſimple, and fond of flattery. The men are commonly above the middle ſize, well ſhaped, ſtrong, and capable of enduring great labour; the women are good natured, ſprightly, and agreeable. The dreſs of both ſexes is compoſed of cotton cloth of their own manufacture; that of the men is a looſe frock, not unlike a ſurplice, with drawers which reach half way down the leg; and they wear ſandals on their feet, and white cotton caps on their heads. The women's dreſs conſiſts of two pieces of cloth, each of which is about ſix feet long and three broad; one of theſe they wrap round the waiſt, which, hanging down to the ancles, anſwers the purpoſe of a petticoat; the other is thrown negligently over the boſom and ſhoulders. Both men and women among the Mandingoes ſeem to have an invincible propenſity to commit depredations on the property of unprotected ſtrangers; whilſt ſuch is the good nature of theſe poor heathens, that they will readily ſympathiſe in the ſufferings, relieve the diſtreſſes, and contribute to the perſonal ſafety, of the very ſtrangers whom they are bent upon plundering.

Among the Mandingoes, the parental and filial affection is remarkably ſtrong between the mother and her child; but not ſo between the father and his children. This, as Mr Park obſerves, is eaſily accounted for. The ſyſtem of polygamy, while it weakens the father's attachment, by dividing it among the children of different wives, concentrates all the mother's jealous tenderneſs to one point, the protection of her own offspring. He perceived, with great ſatiſfaction too, that the maternal ſolicitude extended, not only to the growth and ſecurity of the perſon, but alſo, in a certain degree, to the improvement of the mind of the infant; for one of the

(A) Mr Park, for the moſt part, writes with remarkable perſpicuity; but we are not ſure that here we have not miſtaken his meaning. He ſays, that the chief power of the ſtate is lodged in the aſſembly of that *whole body*; but we think, that by the whole body muſt be meant the body of *Manſas*, otherwiſe the government could not be called an oligarchy.

Manding. first lessons, in which the Mandingo women instruct their children, is *the practice of truth.*

The Mandingo women suckle their children until they are able to walk of themselves. Three years nursing is not uncommon; and during this period, the husband devotes his whole attention to his other wives. To this practice it is owing, that the family of each wife is seldom very numerous. Few women have more than five or six children. As soon as an infant is able to walk, it is permitted to run about with great freedom. The mother is not over solicitous to preserve it from slight falls, and other trifling accidents. A little practice soon enables a child to take care of itself, and experience acts the part of a nurse. As they advance in life, the girls are taught to spin cotton, and to beat corn, and are instructed in other domestic duties; and the boys are employed in the labours of the field. Both sexes, whether Bushreens or Kafirs, on attaining the age of puberty, are circumcised. This painful operation is not considered by the Kafirs so much in the light of a religious ceremony, as a matter of convenience and utility. They have, indeed, a superstitious notion, that it contributes to render the marriage state prolific.

When a young man takes a fancy to a young girl, and wishes to marry her, it is by no means considered as necessary that he should make an overture to the girl herself. The first object is to agree with the parents, concerning the recompence to be given them for the loss of the company and services of their daughter. The value of two slaves is a common price, unless the girl is thought very handsome; in which case, the parents will raise their demand very considerably. If the lover is rich enough, and willing to give the sum demanded, he then communicates his wishes to the damsel: but her consent is by no means necessary to the match; for if the parents agree to it, and eat a few *kolla-nuts*, which are presented by the suitor as an earnest of the bargain, the young lady must either have the man of their choice, or continue unmarried, for she cannot afterwards be given to another. If the parents should attempt it, the lover is then authorised, by the laws of the country, to seize upon the girl as his slave. At the celebration of a marriage, no religious ceremony seems to be practised. A select number of people are indeed invited to the wedding, and feasted; but consummation constitutes the marriage; for towards the morning, the new married couple are always disturbed by the women, who assemble to inspect the nuptial sheet (according to the manners of the ancient Hebrews, as recorded in Scripture), and dance round it. This ceremony is thought indispensably necessary; nor is the marriage considered as valid without it.

The Mandingoes, and indeed all the negro states, whether Mahomedan or Pagan, allow a plurality of wives. The consequence is, that the wives frequently quarrel among themselves. When this happens, the husband decides between them; and sometimes finds it necessary to administer a little corporal chastisement before tranquility can be restored. But if any one of the ladies complains to the chief of the town, that her husband has unjustly punished her, and shewn an undue partiality to some other of his wives, the affair is brought to a public trial. In these *palavers*, however, which are conducted chiefly by married men, our author was informed, that the complaint of the wife is not always considered in a very serious light; and the complainant herself is sometimes convicted of strife and contention, and left without remedy. If she murmurs at the decision of the court, the magic rod of *Mumbo Jumbo* soon puts an end to the business. See Mumbo Jumbo in this *Suppl.* Manding.

A child, among them, is named when it is seven or eight days old. The ceremony commences by shaving the infant's head; and a dish called *dega*, made of pounded corn and sour milk, is prepared for the guests. If the parents are rich, a sheep or a goat is commonly added. This feast is called *ding koon lee*, "the child's head shaving." During Mr Park's stay at Kamalia, he was present at four different feasts of this kind, and the ceremony was the same in each, whether the child belonged to a Bushreen or a Kafir. The schoolmaster, who officiated as priest on those occasions, and who is necessarily a Bushreen, first said a long prayer over the *dega*; during which, every person present took hold of the brim of the calabash with his right hand. After this, the schoolmaster took the child in his arms, and said a second prayer; in which he repeatedly solicited the blessing of God upon the child, and upon all the company. When this prayer was ended, he whispered a few sentences in the child's ear, and spit three times in its face; after which he pronounced its name aloud, and returned the infant to the mother. This part of the ceremony being ended, the father of the child divided the *dega* into a number of balls, one of which he distributed to every person present. And inquiry was then made, if any person in the town was dangerously sick; it being usual, in such cases, to send the party a large portion of the *dega*, which is thought to possess great medical virtues.

The Mandingoes have no artificial method of dividing time. They calculate the years by the number of *rainy seasons*. They portion the year into *moons*, and reckon the days by so many *suns*. The day they divide into morning, mid day, and evening; and further subdivide it, when necessary, by pointing to the sun's place in the heavens. Our author frequently inquired of some of them, what became of the sun during the night, and whether we should see the same sun, or a different one, in the morning? But that subject appeared to them as placed beyond the reach of human investigation; they had never indulged a conjecture, nor formed any hypothesis, about the matter. The moon, by varying her form, has more attracted their attention. On the first appearance of the new moon, which they look upon to be newly created, the Pagan natives, as well as Mahomedans, say a short prayer; and this seems to be the only visible adoration which the Kafirs offer up to the Supreme Being. This prayer is pronounced in a whisper; the party holding up his hands before his face: its purport is to return thanks to God for his kindness through the existence of the past moon, and to solicit a continuation of his favour during that of the new one. At the conclusion, they spit upon their hands, and rub them over their faces. Great attention is paid to the changes of this luminary in its monthly course; and it is thought very unlucky to begin a journey, or any other work of consequence, in the last quarter. An eclipse, whether of the sun or moon, is supposed to be effected by witchcraft. The stars ftars are very little regarded; and the whole ftudy of aftronomy appears to them as a ufelefs purfuit, and attended to by fuch perfons only as deal in magic.

Their notions of geography are equally puerile. They imagine that the word is an extended plain, the termination of which no eye has difcovered; it being, they fay, overhung with clouds and darknefs. They defcribe the fea as a large river of falt water, on the farther fhore of which is fituated a country called *Tobaubo doo;* "the land of the white people." At a diftance from Tobaubo doo, they defcribe another country, which they allege is inhabited by cannibals of gigantic fize, called *Koomi*.

Mr Park fays he has converfed with all ranks and conditions of negroes on the fubject of their faith, and that he can pronounce, without the fmalleft fhadow of doubt, that the belief of one God, and of a future ftate of reward and punifhment, is entire and univerfal among them. It is remarkable, however, that, except on the appearance of a new moon, as before related, the Pagan natives do not think it neceffary to offer up prayers and fupplications to the Almighty. They reprefent the Deity, indeed, as the creator and preferver of all things; but in general they confider him as a being fo remote, and of fo exalted a nature, that it is idle to imagine the feeble fupplications of wretched mortals can reverfe the decrees, and change the purpofes, of unerring wifdom. The concerns of this world, they believe, are committed by the Almighty to the fuperintendance and direction of fubordinate fpirits, over whom they fuppofe that certain magical ceremonies have great influence. A white fowl, fufpended to the branch of a particular tree, a fnake's head, or a few handfuls of fruit, are offerings which ignorance and fuperftition frequently prefent, to deprecate the wrath, or to conciliate the favour, of thefe tutelary agents.

The Mandingoes feldom attain extreme old age. At forty, moft of them become grey haired, and covered with wrinkles; and but few of them furvive the age of fifty-five, or fixty. Yet their difeafes appeared but few; fevers and fluxes being the moft common, and the moft fatal. For thefe they generally apply *faphies*, i. e. charms, to different parts of the body; though fometimes, on the firft attack of a fever, the patient is, with great fuccefs, placed in a fort of vapour bath. The other difeafes which prevail among the negroes, are the *yaws*, the *elephantiafis*, and a *leprofy* of the very worft kind, together with the *Guinea worm*, which they attribute to bad water.

When a perfon of confequence dies, the relations and neighbours meet together, and manifeft their forrow by loud and difmal howlings. A bullock or goat is killed for fuch perfons as come to affift at the funeral; which generally takes place in the evening of the fame day on which the party died. The negroes have no appropriate burial places, and frequently dig the grave in the floor of the deceafed's hut, or in the fhade of a favourite tree. The body is dreffed in white cotton, and wrapped up in a mat. It is carried to the grave, in the dufk of the evening, by the relations. If the grave is without the walls of the town, a number of prickly bufhes are laid upon it, to prevent the wolves from digging up the body; but our author never obferved that any ftone was placed over the grave as a monument or memorial.

With refpect to employment, the men cultivate the ground, or catch fifh in large rivers; while the women manufacture cotton cloth. It is only the fpinning and the dying, however, that are performed by the women; for the web, which is feldom more than four inches broad, is wove by the men in a loom made exactly upon the fame principle as that of Europe. As the arts of weaving, dyeing, fewing, &c. may eafily be acquired, thofe who exercife them are not confidered in Africa as following any particular profeffion; for almoft every flave can weave, and every boy can few. The only artifts which are diftinctly acknowledged as fuch by the negroes, and who value themfelves on exercifing appropriate and peculiar trades, are the manufacturers of leather and of iron. The firft of thefe are called *Karrankea* (or as the word is fometimes pronounced *Gaungay)*. They are to be found in almoft every town, and they frequently travel through the country in the exercife of their calling. They tan and drefs leather with very great expedition, by fteeping the hide firft in a mixture of wood afhes and water, until it parts with the hair; and afterwards by ufing the pounded leaves of a tree, called *goo*, as an aftringent.

The manufacturers in iron are not fo numerous as the *Karrankeas;* but they appear to have ftudied their bufinefs with equal diligence. The negroes on the coaft being cheaply fupplied with iron from the European traders, never attempt the manufacturing of this article themfelves; but in the inland parts, the natives fmelt this ufeful metal in fuch quantities, as not only to fupply themfelves from it with all neceffary weapons and inftruments, but even to make it an article of commerce with fome of the neighbouring ftates. During our author's ftay at Kamalia, there was a fmelting furnace at a fhort diftance from the hut where he lodged, and the owner and his workmen made no fecret about the manner of conducting the operation; and readily allowed him to examine the furnace, and affift them in breaking the iron-ftone. The procefs it is needlefs to defcribe; though it be proper to obferve, that the mafs of metal obtained by it was rather fteel than iron. Moft of the African blackfmiths are acquainted alfo with the method of fmelting gold, in which procefs they ufe an alkaline falt, obtained from a ley of burnt corn-ftalks evaporated to drynefs. They likewife draw the gold into wire, and form it into a variety of ornaments, fome of which are executed with a great deal of tafte and ingenuity.

The reader will obferve, that in the extracts which we have made from Mr Park's interefting travels, the terms African and Negro are frequently ufed as if all Africans and Negroes were Mandingoes. The reafon is, that the Mandingoes were not only the moft numerous tribe which he vifited, but were alfo fpread over all that tract of country which he traverfed.

MANGEEA, an ifland of the S. Seas, vifited by Captain Cook in the beginning of his laft voyage. The coaft is guarded by a reef of coral rocks, againft which a heavy furf is continually breaking. The ifland is about 15 miles in circumference. The inhabitants appear of a warlike difpofition. S. lat. 21° 27', W. long. 158° 7'.—*Morse*.

MANHEIM, a town of Pennfylvania, in the county of Lancafter. It contains about 60 houfes, and a

Dutch church. Glass works were erected here previous to the revolution, but they are fallen to decay. It is 11 miles N. by W. of Lancaster, and 77 W. by N. of Philadelphia.—Also the name of a town in Lincoln county, Maine. There is another of the same name in York county, Pensylvania.—*ib.*

MANIANA, a small negro kingdom lying between 12° and 14° North Lat. and between the meridian of Greenwich and 1° and 30′ West Long. Its inhabitants, as Mr Park was informed by a variety of people in many different kingdoms, are remarkable for cruelty and ferocity; carrying their resentment to their enemies so far as never to give quarter, and even indulging themselves with banquets of human flesh. Hence the inhabitants of Bambarra, who carried on with them a long and bloody war, and must of course be well ascertained of the fact, called them *Ma dummulo*, which signifies men-eaters.

MANICOUAGAN, or *Black River*, rises from a lake of its name, in Lower Canada; runs a southern course, and falls into the St Lawrence 85 miles N. E. of Tadousac.—*Morse.*

MANIEL, or rather *Bahoruco*, mountains in the island of Hispaniola or St Domingo, 20 miles in circumference, and almost inaccessible. They have been for 80 years past the place of refuge of the fugitive Spanish and French negroes. These brigands have as yet always defied their pursuers. The soil of these mountains is fertile, the air temperate, and the streams in them abound with gold dust.—*ib.*

MANILLON, a township in Fayette county, Pennsylvania.—*ib.*

MANITOUALIN, a cluster of islands near the northern shore of Lake Huron, considered as sacred by the Indians.—*ib.*

MANLIUS, a township in Onondago county, New-York, incorporated in 1794, and is the seat of the county courts. It is well watered by Butternut, Limestone, and Chittenengo creeks, which unite at the N. E. corner of the town; and the stream, assuming the latter name, runs north to Oneida lake, which is 10 miles northerly of the centre of the town. It comprehends that part of the Onondago reservation bounded southerly by the Genessee road, and westerly by Onondago creek and the Salt lake. Of its inhabitants 96 are electors, according to the State census of 1796.—*ib.*

MANMIC. Indian villages on the Picaway fork of the Manmic, or Miami of the lake, and St Mary's river.—*ib.*

MANNINGTON, a township in Salem county, New-Jersey.—*ib.*

MANOR, a township in Lancaster county, Pennsylvania.—*ib.*

MANSEL, an island in the N. E. part of Hudson's bay, between Southampton island and the coast of Labrador. N. lat. 62° 38′.

MANSFIELD, a township in Sussex county, New-Jersey, containing 1482 inhabitants, including 35 slaves. It is situated on Musconecunk river, about 7 miles south-easterly of Oxford, and as far northerly of Greenwich.—*ib.*

MANSFIELD, a township in Bristol county, Massachusetts, situated 30 miles southerly of Boston. It was incorporated in 1770, and contains 983 inhabitants.—*ib.*

MANSFIELD, a township in Chittenden county, Vermont, between La Moille and Onion rivers, about 7 miles distance from each, and 113 miles N. by E. of Bennington.—*ib.*

MANSFIELD, a township in Burlington county, New-Jersey, on the S. side of Black's creek, consisting of 19,000 acres, of an excellent soil, noted for its fine pastures and large dairies. It is 8 miles W by N. of Burlington, and 12 S. by E. of Trenton. The inhabitants are mostly Friends.—*ib.*

MANSFIELD, a township in Windham county, Connecticut, about 30 miles north of New-London, and as far east of Hartford.—*ib.*

MANTA, a bay of Guayaquil, in South-America, formerly famous for a considerable pearl fishery; but it has been totally discontinued for some years. There is also a point of this name on the coast near it. The bay has its name from the great numbers of large fish, called *mantas*, the catching of which is the common employment of the inhabitants. The method of carrying on this fishery is as follows: they throw into the water a log of wood, about 18 feet long, and near a foot in diameter; on one end they place their net, and on the other an Indian stands in an erect position, and with a single oar rows his tottering bark to the distance of half a league from the shore, where he shoots his net; another Indian follows on a similar log, takes hold of the rope fastened to one end of the net, and when fully extended, they both make towards the land, hauling the net after them. It is astonishing to observe with what agility the Indians maintain an equilibrium on these round logs, notwithstanding the continual agitations of the sea, and their being obliged to mind the oar and the net at the same. They are indeed excellent swimmers; so that if they slip off they are immediately on the log again, and in their former position.—*ib.*

MANURE is so essential to agriculture, that the want of it, or an improper manner of using it, is the principal cause of the sterility of a country. We have therefore treated of manures and their action at some length in the article AGRICULTURE in the *Encyclopædia*; but as the theoretical part of that disquisition rests in a great measure on the doctrine of phlogiston, which is now exploded, it may not be improper to resume the subject here. Experience however being, after all, the only guide which the farmer can safely and confidently follow, instead of amusing our readers with theories of our own, we shall lay before them the observations of a man who seems to have united theory with practice.

"The use of manures (says M. Parmentier*) has been known in all ages, but we are yet far from having any clear and precise ideas of the nature of the juices which are destined for the nourishment of vegetables, and of the manner in which they are transmitted to their organs. The writers on agriculture, who have endeavoured to explain these matters, perceiving salts in most plants, were persuaded that these salts, by the help of water and heat, passed, in a saline form, through the vegetable filter. These first philosophers did not hesitate to consider every thing that has been done by the industry of man, to improve the nature of land, and its productions,

* *Memoirs of the Royal Society of Agriculture, Paris.*

productions, as merely forming reſervoirs of theſe ſalts, which they conſidered as the principle of fertility. This opinion was ſo well eſtabliſhed among the improvers of land, that, to this day, many of them have no object in view, in their operations, but to diſengage ſalts; and, when they attempt to explain certain phenomena which take place in their fields or orchards, they talk confidently about the *nitre of the air*, *of rain*, *of ſnow*, *of dew*, *and fogs*; of the *ſalts of the earth*, *of dung*, *of marle*, *of lime*, *of chalk*, &c. and make uſe of thoſe vague terms, *oil*, *ſulphur*, *ſpirit*, &c. which ought henceforward to be baniſhed from our elementary books on agriculture.

"Among the authors who have attacked, and combated with moſt ſucceſs, the opinion that the fruitfulneſs of ſoils, and the aliment of vegetables, reſide in ſaline ſubſtances, muſt be reckoned Elier and Wallerius. Theſe philoſophers examined, by every means which chemiſtry at that time could furniſh, the various kinds of earth proper for cultivation, and alſo thoſe ſubſtances which have always been conſidered as the moſt powerful manures, without being able to obtain, from any of them, any thing more than mere atoms of ſalt.

"Animated with the ſame zeal, and taking advantage of the inſtructions found in their writings, I thought it neceſſary to determine, by experience, whether, as has been aſſerted, there really exiſt neutral ſalts in earths; and alſo, whether thoſe earths are more fertile in proportion to the quantity of ſuch ſalts they contain. With this view, I lixiviated, by means of diſtilled water, many ſpecies of cultivated earths, taken in various ſtates, from freſh earth to that which had been impoveriſhed by the growth of ſeveral crops; I alſo tried dung, reduced more or leſs into the ſtate of mould; and likewiſe the moſt active manures, ſuch as the offal of animal ſubſtances rotted by putrefaction; but in none of theſe, however carefully analyzed, were found any ſalts in a free ſtate. They contain indeed the materials proper for forming ſalts, but if they contain any ready formed, it is merely by accident.

"The reſearches of Kraft, and thoſe of Alſton, were not attended with different reſults. Having ſown ſome oats in aſhes, not lixiviated, and in ſand ſtrongly impregnated with potaſh and with ſaltpetre, and having found that the oats did not grow, they concluded that neutral ſalts, and alkalies, not only retarded the growth of vegetables, but that they abſolutely prevented it. It is well known that in Egypt there are diſtricts where the earth is entirely covered with ſea-ſalt, and theſe diſtricts are quite barren. It is probably owing to this property of ſea-ſalt, that the Romans were accuſtomed to ſcatter large quantities of it over fields where any great crime had been committed, and of which they wiſhed to perpetuate the remembrance, by rendering the part barren for a certain time.

"The idea that ſalts had great influence in vegetation, ought to have been greatly weakened by the following ſimple reflection. Suppoſing that ſalts exiſted in garden mould, they would be very ſoon diſſolved by the rain, and carried away, towards the lower ſtrata of the earth, to a depth to which the longeſt roots would not reach. Indeed the famous experiment of Vanhelmont would have been ſufficient to have deſtroyed the above opinion, if it did not generally happen that we are no ſooner ſet free from one error than we fall into another not leſs extraordinary. The ſurpriſing effects of vegetation brought about by the overflowing of water, and in the neighbourhood of ſalt marſhes, and the infinite number of inhaling capillary tubes obſerved upon the ſurface of vegetables, led to an opinion that the air and water, abſorbed by the roots and leaves of plants, were only vehicles loaded with ſaline matter, analogous to the vegetables nouriſhed by them.

"To the experiment of Vanhelmont, which was repeated by many accurate obſervers, ſucceeded thoſe of modern philoſophers; from which it clearly appeared, that plants could grow, and produce fruit, in the air of the atmoſphere, and in diſtilled water, alſo in pure ſand, in powdered glaſs, in wet moſs or ſponge, in the cavity of fleſhy roots, &c. and that plants which had nothing but the above mentioned fluids for their nouriſhment, gave, when ſubmitted to chemical analyſis, the ſame products as thoſe which had undergone their proceſs of vegetation in a ſoil perfectly well manured. It was alſo obſerved, that the moſt barren ſoils were rendered fertile when they were properly ſupplied with water by canals; and the efficacy of irrigation was repeatedly evinced in different ways: from theſe obſervations was formed the following ſyſtem, that water riſes in plants in the form of vapour, as in diſtillation; that air introduces itſelf into their pores; and that, if ſalts contribute to the fruitfulneſs of ſoils, it is only in conſequence of their containing the two fluids above-mentioned in great abundance."

Our author, after making many experiments upon various ſoils and ſalts, and after attending minutely to the proceſs of vegetation, thinks himſelf warranted to maintain, "that ſaline ſubſtances have no ſenſible effects in promoting vegetation, except inaſmuch as they are of a deliqueſcent nature, have an earthy baſis eaſily decompoſed, and are uſed only in ſmall quantity. In thoſe circumſtances they have the power of attracting, from the immenſe reſervoir of the atmoſphere, the vapours which circulate in it; theſe vapours they retain, along with the moiſture that is produced from rain, ſnow, dew, fog, &c. which moiſture they prevent from running together in a maſs, or from being loſt, either by exhaling into the air of the atmoſphere, or by filtering itſelf through the inferior ſtrata of the earth, and thereby leaving the roots of vegetables dry; they diſtribute that moiſture uniformly, and tranſmit it, in a ſtate of great diviſion, to the orifices of the tubes deſtined to carry it into the texture of the plant, where it is afterwards to undergo the laws of aſſimilation. As every kind of vegetable manure poſſeſſes a viſcous kind of moiſture, it thereby partakes of the property of deliqueſcent ſalts. In ſhort, the preparation of land for vegetation has no other object in view but to divide the earthy particles, to ſoften them, and to give them a form capable of producing the above mentioned effects. It is ſufficient, therefore, that water, by its mixture with the earth and the manure, be divided, and ſpread out ſo as to be applied only by its ſurface, and that it keep the roots of the plant always wet, without drowning it, in order to become the eſſential principle of vegetation. But as plants which grow in the ſhade, even in the beſt ſoil, are weakly, and as the greater part of thoſe which are made to grow in a place that is perfectly dark neither give fruit nor flowers, it cannot be denied that the influence of the ſun is of great importance in vegetable economy."

Such was the opinion which our author gave of the manner in which ſalts act in vegetation, at a time when it was not known that air and water (which had been ſo long conſidered as elements), far from being ſimple ſubſtances, are capable of being decompoſed by a great variety of operations both of nature and art; and nothing was wanting to complete his theory, but to know that air and water act their part in vegetation only in a ſtate of decompoſition; and that if earth well manured is a better matrix than water itſelf, it is becauſe ſuch earth has the power of converting the water into gaſes which are eaſily abſorbed, and which, while their abſorption takes place, communicate to the plants a motion and heat which they received when taking the form of gas, and which they loſe when they enter again into combination; whence it is natural to conclude, that this motion and this heat muſt neceſſarily develope themſelves in ſeeds, and maintain the vital action in plants.

What is a vegetable, conſidered chemically, according to the preſent ſtate of our knowledge? It is, ſay the chemiſts, a compound of hydrogen, oxygen, and carbon, the proportions of which vary according to the agents which have concurred to its developement, and according to the matrix which received and aſſimilated them, in order to create thoſe combinations which are varied to infinity, by their forms and properties, and known by the generic terms of ſalt, oil, and mucilage. It appears, therefore, needleſs to ſeek theſe combinations in the different ſubſtances which are uſed for manure, when we wiſh to determine the nature of them, and explain their manner of acting in vegetation; becauſe, ſuppoſing it true that theſe ſalts, theſe oils, or theſe mucilages, exiſt in their combined ſtate, nothing but their conſtituent elements, namely, hydrogen, oxygen, and carbon, can poſſibly have any action.

The ſuperiority of animal ſubſtances, as manures, and the remarkable luxuriance of thoſe plants which are watered with putrid water, prove inconteſtibly, that the putrid ſtate is favourable to vegetation, and that every ſubſtance which is liable to enter, to a certain degree, into that ſtate, contributes very powerfully thereto. The moſt aerated waters are, in this caſe, the moſt beneficial. It is obſerved that rain, particularly in ſtormy weather, quickens vegetation ſo much, that the gardeners in the neighbourhood of Paris are often obliged to drench their plants with water taken from their wells, which, in conſequence of its rawneſs, or its want of air, retards the vegetation of the plants; either becauſe it precipitates the meteoriſed or electrified water, or becauſe, by being mixed with the other water, it diminiſhes its fertilizing quality; whereas, in ſummer, this ſame well-water, by being expoſed to the ſun for ſome days, acquires a ſmell like that of ſtale eggs, loſes its rawneſs, and becomes very fit for accelerating vegetation. An atom of vegetable or animal matter is, at that time, ſufficient to bring about more quickly this ſtate of putrefaction; while theſe ſame ſubſtances, by being employed in certain proportions, far from acting as a leaven on the liquids which hold them in ſolution, preſerve thoſe liquids, or at leaſt make them more ſlow to change.

Salts and dung, therefore, are not merely decompoſed by the power of vegetation; by furniſhing the reſults of their decompoſition, they alſo act in the manner of leavens, the action of which is ſcarcely perceptible in cold or dry weather; but when they are heated by the ſun, and ſufficiently penetrated with moiſture, they very ſoon enter into a ſort of fermentation, ſuffering the various gaſes with which they are provided to eſcape. Thus manures may be conſidered as decompoſing inſtruments, provided by nature, and prepared by art, to act upon water ſo as to bring it to a proper ſtate of attenuation. The ſubſtances which enter into the compoſition of plants are, therefore, nothing but products of the decompoſition of air and water, and combinations of the conſtituent principles of theſe two fluids, determined by the power which preſides in the ſeed, and which thence has paſſed into the plant.

It is now eaſy to account for the effects of charcoal-powder, ſtraw, &c. which are made uſe of to cover ground during long droughts with undoubted benefit: they are mechanical means of preventing the diſſipation of moiſture, and of determining it to take the form of thoſe gaſeous fluids which have ſuch powerful effect in vegetation. As water is compoſed of hydrogen and oxygen, it is not ſurpriſing that, when aſſiſted by the influence of the ſun, and that of electricity, it is capable of forming, almoſt by itſelf, the ſolids and fluids of vegetables; taking from the atmoſphere the carbon it ſtands in need of, to give them their moſt eſſential characters. We ſay their moſt eſſential characters; for thoſe terreſtrial plants which have grown in air and water do not abound in principles, and their offspring, when they have any, is by no means vigorous. We ſee alſo, that plants which are naturally of an aquatic nature, have in general but little ſmell, becauſe the medium in which they live and grow furniſhes only a ſmall quantity of carbon, in proportion to the hydrogen and oxygen, which are the conſtituent principles of water. This is the reaſon why, in cold and wet years, flowers are leſs odoriferous, fruit leſs full of flavour, and more difficult to be preſerved. The germ of their reproduction is weak; and they are, if the expreſſion may be uſed, in a ſort of dropſy; that is to ſay, they are loaded with the principles which conſtitute water, and even with water itſelf.

Theſe obſervations, to which more might be added, may ſerve to explain why vegetation is ſlow and weak in a ſoil which is too much charged with ſaline matter, while it is rendered quick and vigorous by a ſmall quantity of this ſame matter; and why earth, which is perfectly lixiviated, and watered, from time to time, with diſtilled water only, is capable of giving to bitter plants their bitterneſs, to ſweet ones their ſweetneſs, to acid ones their acidity, to aromatic ones their ſpicineſs, and to poiſonous ones their deleterious qualities; in ſhort, why the inherent characters of plants are more ſtrongly marked, in proportion as the ſoil in which they grow is furniſhed with natural or mechanical means to produce a quantity of gas neceſſary to the formation of the ſubſtances on which theſe characters depend.

If a nitrous or marine plant can, even when growing in a ſoil deſtitute of nitre or ſea-ſalt, occaſion the production of theſe ſalts, it muſt be allowed that ſuch plants would vegetate more ſtrongly, and contain more of ſuch ſalts, if they grew in ſoils more abounding in

materials

materials proper to form them. Thus, the different species of samphire, glasswort, sea wrack, &c. flourish on the borders of the sea, such soils being strongly impregnated with the fluids necessary to form the muriatic gas and sea salt which enter into the composition of those plants; while the sun flower, pellitory, &c. succeed best in earth which is mixed with the ruins of old buildings, in which the materials for the production of nitrous gas, and even of nitre itself, are very abundant. In short, the organization of these plants is a real elaboratory for forming the forementioned salts.

Those plants which, for their vegetation, require the most assistance from the soil and manure, are very apt to contract a disagreeable taste, if either the soil or manure are capable of supplying the principles from which it is acquired. The class *tetradynamia*, particularly all sorts of cabbages (which contain sulphur ready formed), contract a bad taste in a soil composed of mud and dung, because these substances, as they are decomposed, furnish a great quantity of hepatic gas, or of sulphurised hydrogen gas; yet plants of another class may grow in the same soil, close by the cabbages, without partaking even in the smallest degree of the bad taste of the latter. The plants last mentioned, when growing in hepatic gas, retain only so much of it as is sufficient for the production of the substances of which they are formed; the overplus, which could not be assimilated, is thrown out by the excretory vessels, after undergoing those modifications which the digestive juices and organization of the plant, and the state of the atmosphere, have produced.

Thus we see that those plants which abound most in oily, saline, and mucilaginous principles, are generally such as require a soil well manured. Tobacco, for instance, gives forty pounds of alkaline salt or potash from every hundred weight of ashes: this plant may, by being buried in the ground, be converted into a very powerful manure; while other plants, which thrive in a middling soil, and appear as vigorous, are, in general, such as have not so great a quantity of principles in their composition, and when thrown on the dunghill, and left to rot, furnish very little manure. From such observations, it may perhaps not be impossible hereafter to judge, by the analysis of a plant, not only whether it requires a large or a small quantity of manure, but likewise what kinds of soil and manure are most fit to promote its vegetation: wild plants also may serve to shew the nature of the soil which they seem most to flourish in.

Besides the physical action of manures, they have a very evident mechanical action. When mixed with earth, in a certain proportion, they not only render it more permeable to water, but the roots of plants can, with greater ease, acquire their proper size and form in it: in other cases, manures tend to unite that earth which is too loose, and, by rendering it more tenacious, they prevent the water from being lost, and the roots from becoming dry. Those manures which are called *warm* are suited to cold lands, not only because they render them less compact, but also because they take off a part of that moisture which such lands always have in too great quantity. Cold manures, on the other hand, by their viscid quality, give tenacity to dry and hot soils, attracting and retaining, for a longer time, the moisture which comes in their way. The nature of the soil must therefore determine what kind of manure it stands in need of, and also whether cultivating it by means of oxen or by horses is preferable; for the manures produced from these two animals have those opposite qualities which we have above described. By such observations, we shall perhaps be able to resolve a question, respecting which the sentiments of cultivators in many parts of the kingdom are much divided.

It cannot, however, be denied, that the earth is able of itself to serve as a basis and support to plants, and that it has an action more or less evident upon air, upon water, and upon dung. There is a well-known method of distinguishing clay from other earths; by merely breathing upon it, a smell is immediately perceived, sufficiently strong to shew that a decomposition and fresh combination have taken place. In summer, after a drought of some days continuance, there always arises in the fields a particular smell during a shower of rain; and there is no kind of vegetable manure which, when mixed with earth, does not send forth a smell. This proves that the nature of the soil must have an influence, not only upon air and upon water, but also upon the effect of manures; and that before we speak of their power, we should always specify what kind of earth they were applied to; because when manures and earth are mixed together, there ensues an action and reaction more or less favourable to vegetation.

Having examined to what degree air and water enter, in substance, into the vessels of plants, and having shewn that the principal action of earth, of salts, and of manures, consists in preparing, elaborating, and decomposing these two fluids, and in giving to the products of their decomposition the forms they require, to accomplish the purpose of nature in vegetation, our author makes some observations upon the particular effects of certain substances used for improving land, such as marl, lime, chalk, and wood ashes; which are usually applied either to an exhausted soil, in order to restore it, or to a drooping plant, with a view to give it strength. Of the efficacy of these substances no one doubts, but it does not appear that we are equally agreed respecting their manner of acting.

Marl (a manure whose effects are well known, and which is found to be of the greatest benefit in those districts where it can be procured in sufficient quantity) is capable of acting in the same manner as the most fertile soil, when the principles of which it is composed, namely, clay, sand, calcareous earth, and magnesian earth, are justly proportioned to each other. But it is sometimes compact and tenacious, because it contains a superabundant portion of clay, and at other times porous and friable, because it contains too much sand, and therefore is not in general fit for vegetation by itself. These considerations ought always to be our guide when we mean to employ marl as a manure.

It has been supposed that *to marl* was a sort of technical expression, intended to denote the bringing together or dividing the earthy particles by means of clay or sand. It appears to our author, that neither of the above operations can properly be called *marling*; because, in either case, all we do is, to put the earth into a situation to receive and to profit by the influence of the atmosphere, and that of the manures made use of. The peculiar principle of marl is, that part of it which, like

lime,

lime, acts very powerfully upon the different aeriform fluids, is easily reduced to powder, effervesces with acids, and sends forth a quantity of air-bubbles when water is poured upon it. Now this matter, which in a particular manner does the office of manure, resides neither in clay nor in sand. Upon the proportion of it depends the duration of the fertility it produces; consequently it is of importance, when we make use of marl, to know which of its constituent parts it contains in the greatest proportion, otherwise in some cases we should only add one common kind of earth to another. Hence our author infers, that for a chalky soil clay is the proper manure, and that in such a soil a clay bottom is of more value than a gold mine.

"Wood-ashes, as a manure, may be, in some respects, compared to marl; at least they contain the same earths as those which generally enter into the composition of marl, but they contain a greater quantity of saline substances, proceeding from the vegetables of which they are the residue, and from the process made use of in their combustion; a process which increases their activity, and should render us careful in what manner and for what purposes we employ them. Wood-ashes, when scattered over fields, at proper times and in proper quantities, destroy weeds, and encourage the vegetation of good plants. But do the ashes produce this effect by a sort of corrosive power? I cannot (says our author) think it; for in that case all kinds of plants would indiscriminately be acted upon by them, and to a certain degree destroyed.

"Besides, the ashes of fresh wood are seldom employed until they have been lixiviated, in which state they are deprived of their caustic principle; those ashes which are most commonly made use of for manure are produced either from wood that has been floated in water, or from turf, or from pit-coal, and contain little or no alkaline salt.

"It appears much more probable that ashes, when laid upon ground, destroy the weeds by a well known effect, namely, by seizing with eagerness that moisture which served to produce those weeds, and which in a superabundant quantity is necessary to their existence and support. Whereas those plants which have a firmer texture and a longer root, which are rendered strong by age and by having withstood the rigour of winter, and which are in fact the plants of which the fields are composed, do not suffer any damage from the application of the ashes; but, on the contrary, by being freed from the superfluous weeds which stifled them, and robbed them of a part of their sustenance, they receive a quantity of nourishment proportioned to their wants. The state of relaxation and languor to which they were reduced by a superabundance of water, leaves them, the soil gets its proper consistence, and the grass, corn, &c. acquiring the strength and vigour which is natural to them, soon overcome the moss, rushes, and other weeds; thus a good crop, of whatever the field consists of, is produced. It is in the above manner that wood ashes act, whenever in the spring it is necessary to apply them to meadows, corn fields, &c. the plants of which are stifled and weakened by a luxuriant vegetation of weeds, the usual consequence of mild and wet winters.

"When wood ashes produce an effect different from what is above described, it is either because they happen to contain too much alkaline salt, or that they are laid on the ground in too great quantity, or that the fields to which they are applied were not sufficiently wet to restrain their action; for when they are scattered upon cold soils, and buried by the plough before the time of sowing, they are, like lime, of great service. The last-mentioned substance is very efficacious in other circumstances; and there is a well-known method of using it, practised by the Germans, as follows: A heap of lime is formed by the side of a heap of poor earth, and water is poured upon the lime: the earth is then thrown over it, and becomes impregnated with the vapours which escape from the lime while it is slaked. The earth, after being thus aerated, may be separated; and although no lime remains mixed with it, is, by the operation just described, rendered capable of giving a luxuriant vegetation to whatever plants may be put into it.

"It is possible, therefore, to aerate earth as well as fluids; for this purpose, by mixing it with certain substances, during their decomposition, we must attach to it the principles of which these substances are composed; from which there results a matter so loaded with gas, as to form a more compound substance, and one which has acquired new properties. The Arabians, for example, who take great pains to improve their land, are accustomed to make large pits, which they fill with animals which happen to die: these pits they afterwards cover with calcareous or clayey earth; and after some time these earths, which of themselves are sterile, acquire the properties of the richest manures.

"The foregoing observations may at least be considered as proving, that those substances which, when employed fresh and in too great quantity, are most prejudicial to vegetation, have, on the contrary, an advantageous effect, when they are previously made to undergo a fermentation; or when they are mixed with earth or water, in a proportion adapted to the end proposed. The grass of fields in which cattle or poultry go to feed, after the first or second crop of hay, appears to be dried by the urine and dung of those animals; as if fire had been applied to it; whereas these same excrementitious substances, when combined with earth, or diluted with water, are capable, without any other preparation of performing the office of good manure.

"But if animal secretions, when applied in substance to plants, were capable of acting upon them, as is affirmed, in such a way as to corrode or burn them, how could seed which has been swallowed, and escaped the action of the digestive powers, be prolific when thrown out by the animal, after having remained so long in its dung? yet we often see oats, so circumstanced, grow and produce seed. Is it not more consistent with experience and observation to suppose, that these excrementitious substances, being still endowed with animal heat, and with an organic motion, diffuse round plants in vegetation a deleterious principle or inflammable gas, which destroys them; for soon after their application, the foliage of the plant grows yellow, dries up, and the plant withers, unless there happens a shower of rain which revives it. When these substances are diluted, by being mixed with water and earth, they lose that principle which is so destructive to vegetable life, and an incipient fermentation augments their power as a manure, so that they may be immediately made use of without any apprehension of injury from their effects.

"It appears, therefore, that any operation upon excrementitious

Manure.

crementitious subſtances, by which they are dried and reduced to powder, cannot be practiſed without depriving thoſe ſubſtances of a great part of ſuch of their principles as are eaſily evaporated, and upon which their fluidity depends; theſe principles, when diluted with water, and confined by being mixed with earth, are capable of increaſing the produce of the ſoil. Such is the way in which the huſbandmen in Flanders make uſe of this kind of manure, in the cultivation of a kind of rape or cole ſeed, which is to them a very important branch of agricultural induſtry and commerce; and they never obſerve that the ſap carries up any of thoſe principles which give ſuch manure its offenſive ſmell; nor do they obſerve, that the fodder produced from fields ſo manured, whether eaten freſh or dry, is diſagreeable to their cattle. The excrements of all animals would be injurious to plants, if applied too freſh, or in too great quantity; and a gardener could not commit a greater fault, than to put more than a certain quantity of them into the water he means to make uſe of to water his young plants; in ſhort, this kind of manure is to be uſed in a very ſparing manner; and he that is too prodigal of it will find, to his coſt, that exceſs, even of that which is otherwiſe beneficial, becomes an evil.

"It muſt certainly be allowed, that excrementitious ſubſtances are a very advantageous manure for cold ſoils, and ſuited to moſt vegetable productions; a long experience of their effects over a large tract of country, and the acknowledged intelligence of the Flemiſh farmers, ought to be conſidered as ſufficient to overcome the prejudice that has been raiſed againſt this ſort of manure. Suppoſing that the bad effects which have been attributed to it, when uſed in the ſtate in which it is taken out of privies, &c. are not the offspring of a prejudiced imagination, they may have ariſen from its having been made uſe of at an improper time, or in too great quantity; or from its having been applied to a ſoil and for the cultivation of plants to which it was not adapted; for we know that the exceſs of any kind of manure changes the ſmell and taſte of plants, and the ſame effect is produced by watering them too frequently. Striking examples of this change are ſeen in the ſtrawberry and in the violet, when ſuch as have grown in the woods are compared to thoſe produced from ſome of our over-manured gardens; alſo in the lettuce, and ſome other plants, when thoſe raiſed for ſale by the gardeners about Paris are compared to thoſe of ſome particular kitchen gardens. In the markets of ſome cities, the carrots, turnips, and potatoes of the fields, are preferred to the ſame kind of roots cultivated by the gardeners (A); for though the laſt are of a larger ſize, they have not ſo good a flavour. Some vegetables, therefore, are like certain wild ſpecies of the animal kingdom; they reſiſt every kind of culture, as thoſe animals reſiſt every effort to tame them.

"Although experience has taught the Flemiſh farmers, that excrementitious ſubſtances are more active in their natural ſtate than when dried, yet it cannot be denied that drying them, and reducing them into powder, is ſometimes very advantageous, becauſe in that ſtate they are much leſs offenſive, are eaſily tranſported to any diſtance, and may be uſed when moſt convenient or moſt proper. In many cities the inhabitants pay to have their privies emptied: in other places, thoſe who empty them pay for their contents; and it would aſtoniſh any one to be told how great a revenue is produced in the city of Liſle in Flanders by the ſale of this kind of manure. I am, however (ſays our author), far from thinking that it is right, in all caſes, to employ it in the above mentioned ſtate of concentration; it would be better, in my opinion, to follow the example of the Flemiſh farmers, who uſe it the firſt year for the cultivation of plants for oil, or for hemp or flax; and the ſecond year for the beſt kinds of grain: thus obtaining two crops, inſtead of one, without any farther preparation of the land. What is ſaid above may be applied alſo to the manures produced from the dung of cattle, poultry, &c. (particularly to pigeons dung, the moſt powerful manure of its kind), all which, by being dried and powdered before they are uſed, loſe a great portion of their activity. From theſe obſervations another fact may be deduced, namely, that manure ſhould not be taken from the place where it has been thrown together until the ſeaſon of the year and the ſtate of the land are ſuch that it may be put into the ground as ſoon as it is brought to it. In ſome diſtricts a very injurious cuſtom prevails of carrying the manure into the fields, and leaving it there formed into ſmall heaps, expoſed for ſome days to the elements; during which time, either the ſun and wind dry up its natural moiſture, leaving a maſs which is much leſs active; or the rain diſſolves and carries away the extractive part impregnated with the ſalt. This kind of brine, which is the moſt powerful part of the manure, penetrates the earth to a conſiderable depth, and ſhews (by the thick tufts which ariſe in thoſe places, and which produce more ſtraw than grain) that manure ought to be put into the ground as ſoon as it is brought to it, becauſe it then poſſeſſes its full force and effect, and conſequently would be then uſed to the greateſt advantage.

"We have always at hand the means of compoſing, from a great variety of vegetable and animal ſubſtances, ſuch manures as, when brought into a proper ſtate, and mixed with land, contribute to its fertility. Chemiſtry alſo offers to us a number of ſubſtances, which, although when uſed ſeparately they tend to diminiſh the fertiliſing quality of the earth, are yet capable, by being combined, of forming excellent manures; ſuch, for inſtance, is that ſaponaceous combination which is produced from a mixture of potaſh, oil, and earth. What an advantage it would be, if, inſtead of being ſparing of manure, the inhabitants of the country would endeavour to increaſe the number of theſe reſources, and to render them more beneficial, by employing them in a more effectual manner. How many years had paſſed before it was known that the refuſe of apples and pears, after they are preſſed (and which uſed to be thrown away as uſeleſs), is capable of forming as valuable a manure, in cyder and perry countries, as the refuſe of grapes does in wine countries."

From what has been obſerved, our author concludes, that

(A) We believe they are univerſally preferable.

that manures act, in many circumstances, like medicines, and consequently that the same sort of manure cannot be adapted to every situation, and every kind of soil; we must therefore take care to make proper distinctions between them. Whoever shall pretend that any particular kind of manure may be used, with equal benefit, in grass land, corn-fields, vineyards, orchards, kitchen-gardens, &c. ought to be classed amongst those quacks who undertake to cure all persons with the same remedy, without any regard to their age, constitution, &c. It is probably from not having paid sufficient attention to the forementioned distinctions, that some authors have found fault with particular manures, while others have spoken too highly in their favour. He thinks, however, and we agree with him, that we are still in want of a course of comparative experiments upon the various kinds of manures, considered according to their influence with respect to different soils, situations, and productions. If this part of rural economy were better understood, we should perhaps see many places in a state of cultivation, which, on account of the bad quality of their soil, have hitherto resisted all our endeavours to render them fertile.

Perhaps it would not be proper to dismiss this subject without noticing Mr Middleton's observations on various kinds of manure, which were published in the Transactions of the Society of Arts for the year 1799. This gentleman agrees with Mr Parmentier in recommending the *excrementitious matter of privies* as the most powerful of all manures on some kinds of soil; but he differs from him, and we believe from most writers on agriculture, when he affirms, that *wood ashes*, when spread on the grass in February or March, are of very little service, and that the ashes of *coal* and even of *peat* are of none upon any kind of land. He likewise affirms *soot* to be of very little value as a manure, *soapmakers waste* to be of none, or rather to be hurtful; and he seems to consider *malt-dust*, including the dust from the malt-kilns, to be, after the soil of privies, one of the most powerful manures. He affirms, from his own experience, that, with respect to fertilising power, the soil of privies, compared with farm-yard dung, is in the proportion of five to one.

MAOUANA, one of that cluster of islands in the South Sea which were discovered by M. Bougainville, and by him named Navigator's Islands. It was visited by La Perouse in 1787, who describes it as exceedingly rich in every animal and vegetable production necessary to the sustenance of man. The two frigates which he commanded had no sooner approached the shore than he discovered at the bottom of each creek a number of villages, from whence came innumerable canoes, laden with hogs, cocoa nuts, and other fruits, which were purchased for glass ware. This was in the evening; and next morning the commerce was renewed in the most friendly manner. As early as the dawn of day, the islanders had surrounded the two frigates with 200 canoes full of different kinds of provision, which they would exchange only for beads—in their estimation diamonds of the first water. Axes, cloth, and all other articles of commerce, they disdained. Abounding in real blessings, they were desirous of obtaining superfluities alone.

Two boats, filled with empty casks, were sent ashore for fresh water; and Perouse himself accompanied them in his pinnace. A line of soldiers was posted between the beach and the Indians, who amounted to about 200, including a great many women and children. The French commander prevailed upon them all to sit down under cocoa trees, that were not more than eight toises distant from the ships boats. Each of them had by him fowls, hogs, parrots, pigeons, or fruit, and all wished to sell them at once, which occasioned some confusion.

The women, some of whom were very pretty, offered their favours, as well as their fowls and fruit, to all those who had beads to give them; and soon tried to pass through the line of soldiers, who opposed but a feeble resistance to their attempts. Europeans who have made a voyage round the world, especially Frenchmen, have no arms to ward off similar attacks. Accordingly the fair savages found little difficulty in breaking the ranks; the men then approached; and the confusion was growing general; when Indians, who seemed to be chiefs, made their appearance with sticks in their hands, and restored order, every one returning to his post, and the traffic beginning anew, to the great satisfaction of both buyers and sellers.

While all this was passing with the greatest tranquillity, and the casks were filling with water, Perouse thought he might venture to the distance of 200 yards to visit a charming village, situated in the midst of a wood, or rather of an orchard, all the trees of which were loaded with fruit. The houses were placed upon the circumference of a circle, of about 150 toises in diameter, the interior forming a vast open space, covered with the most beautiful verdure, and shaded by trees, which kept the air delightfully cool. Women, children, and old men, accompanied him, and invited him into their houses. They spread the finest and freshest mats upon a floor formed of little chosen pebbles, and raised about two feet above the ground, in order to guard against humidity. He went into the handsomest of these huts, which probably belonged to a chief; and great was his surprise to see a large cabin of lattice-work, as well executed as any of these in the environs of Paris. The best architect could not have given a more elegant curve to the extremities of the ellipsis that terminated the building; while a row of pillars, at five feet distance from each other, formed a complete colonnade round the whole. The pillars were made of trunks of trees very neatly wrought, and between them were fine mats laid over one another with great art, like the scales of a fish, and drawing up and down with cords, like our Venetian blinds. The rest of the house was covered with leaves of the cocoa palm.

This charming country combines the advantages of a soil fruitful without culture, and of a climate which renders clothing unnecessary. The trees that produce the bread fruit, the cocoa-nut, the banana, the guava, and the orange, hold out to these fortunate people an abundance of wholesome food; while the fowls, hogs, and dogs, which live upon the surplus of these fruits, afford them an agreeable variety of viands. What cold imagination could separate the idea of happiness from so enchanting a place! But Maouana is not the abode of innocence. No arms were indeed perceived; but the bodies of the Indians, covered over with scars, proved that they were often at war, or else quarrelling among themselves; while their features announced a ferocity that was not perceptible in the countenances of the women.

women. Nature had, no doubt, ſtamped this character on their faces, by way of ſhewing, that the half ſavage, living in a ſtate of anarchy, is a more miſchievous being than the moſt ferocious of the brute creation.

Of their ferocity and their treachery, Perouſe had too ſoon the moſt complete evidence. M. de Langle, the ſecond in command, went aſhore for freſh water, accompanied by ſixty Frenchmen, officers, ſailors, and ſoldiers. They were received with an air of good humour by crowds of people waiting on the beach with immenſe quantities of fruit and hogs; but this calm was of ſhort duration. The Indians picked a quarrel with them, pelted them with ſtones, thrown with great dexterity and with equal force; and it was with difficulty that, of the ſixty-one, forty-nine reached the ſhips, many of whom were ſeverely wounded. Among the killed were De Langle, and Lamanon the naturaliſt (ſee Lamanon in this *Suppl.*). Perouſe deſcribes the men of Maouana as of gigantic ſtature and of great muſcular ſtrength. See *Navigators Iſlands* in this *Suppl.*

MAPLETON, a name given to a pleaſant range of excellent farms, 3 miles eaſt of Princeton, in New-Jerſey.—*Morſe.*

MAQUOIT, a bay of ſhoal waters in Caſco-Bay, in the Diſtrict of Main, about 20 miles north of Cape Elizabeth, frequently mentioned in the hiſtory of Maine; where the Indians were uſed to land with their canoes, and from thence carry them to *Pejepſcot Falls*, on Androſcoggin river. This was done with the toil of only 4 hours walk. From theſe falls they went down into Kennebeck river; and from thence continued their route up that river to Weſſerunſett, and thence over to St Lawrence; or turned and went down through Monſeag bay, towards Penobſcot; or from the falls they continued their progreſs up Androſcoggin river, beyond the White Mountains, and over to Connecticut river, and from thence to Lake Memphremagog, and down to the limits of Canada.—*ib.*

MARACAIBO, *Maracaybo*, or *Maracaya*, a ſmall but rich city of Venezuelo, a province of Terra Firma in South-America, ſituated on the weſtern bank of the lake of the ſame name, about 18 miles from its mouth and 73 S. W. of Coro. It is well built, has ſeveral ſtately houſes, very regular, and adorned with balconies, from which there is a proſpect of the lake, which has the appearance of a ſea. Here are about 4000 inhabitants, of whom 800 are able to bear arms. It has a governor ſubordinate to the governor of Terra Firma. Here is a large parochial church, an hoſpital, and 4 convents. Veſſels from 25 to 30 tons frequent this port, with manufactures and merchandize from the places near the lake, which are afterwards put on board Spaniſh ſhips that come hither to buy them. Ships are built at Maracaibo, which trade all over America, and even into Spain, this place being very commodious for ſhip-building. It lies 338 miles eaſt of Rio de la Hacha. N. lat. 10° 51′, W. long. 70° 15′.—*ib.*

Maracaibo *Lake*, or rather *Gulf*, a large collection of waters, on which the town above mentioned is ſituated. It is near 208 miles long, and in ſome parts, 50 in breadth, running from S. to N. and emptying itſelf into the N. Sea; the entrance of which is well defended by ſtrong forts; but Sir Henry Morgan paſſed by them, plundered ſeveral Spaniſh towns on the coaſt, and defeated a ſquadron which had been ſent to intercept him. As the tide flows into the lake, its water is ſomewhat brackiſh, notwithſtanding the many rivers it receives. It abounds with all ſorts of fiſh, ſome of which are very large. By the navigation of this lake, the inhabitants of Venezuela carry on a trade with thoſe of New Granada. The lake becomes narrower towards the middle, where the town is erected.—*ib.*

MARANHAO, a ſmall iſland at the mouth of the noted rivers Maracu, Topocoru, and Mony, on the N. ſide of the province of Maranhao, or Maranon in Brazil. The iſland is oblong, 45 miles in circuit, very fertile, and well inhabited. The French, who ſeized on it in 1612, built a town here, called St Louis de Maragnan; but it is now in the hands of the Portugueſe, and is a biſhop's ſee. It is very ſtrong, and has a ſtout caſtle built on a rock, towards the ſea, which commands a very convenient harbour. The iſland itſelf is very difficult of acceſs, by reaſon of the rapidity of the three rivers which form it: ſo that veſſels muſt wait for proper winds and ſeaſons to viſit it. Beſides the town mentioned here, are two ſmaller ones, viz. St Andero, on the moſt northern point, and St Jago, on the ſouthern. The natives have about 27 hamlets, each conſiſting of four large huts, forming a ſquare in the middle; all being built of large timber, and covered from top to bottom with leaves: ſo that each may contain 200 or 300 perſons. The inhabitants are ſtrong and healthy, and live to a great age; bows and arrows are their only weapons, with which they are very dextrous: but they are fierce and cruel, eſpecially to their enemies. The continent, 3 or 4 leagues from the iſland, is inhabited by the Taponytapare, and Toupinambois nations, who are wild and fierce, and divided into 15 or 20 ſuch hamlets, as have been deſcribed above. Contiguous to theſe are the territories of Cuma and Gayeta, inhabited by nearly the ſame ſort of people. The capital, Maragnan, has a harbour at the mouth of the river St Mary, on the Atlantic ocean; 495 miles N. W. of Cape St Roque. S. lat. 2° 27′, W. long. 44° 36′.—*ib.*

MARBLEHEAD, a port of entry and poſt-town in Eſſex county, Maſſachuſetts, 4 miles S. E. of Salem, 19 N. E. of Boſton; containing 1 Epiſcopal and 2 Congregational churches, and 5,661 inhabitants. The harbour lies in front of the town S. E. extending from S. W. to N. E. about one mile and a half in length, and half a mile broad. It is formed by Marblehead neck on the S. and E. and is protected by a ſea wall which, before its late repairs, was in imminent danger of giving way, to the great detriment, if not ruin of the port. A battery and citadel were erected here in 1795, for the defence of the place, by order of Congreſs. The bank fiſhery employs the principal attention of the inhabitants, and more is done of this buſineſs, in this place, than in any other in the State. The exports of the year 1794, amounted to 184,532 dollars. Marblehead was incorporated in 1649, and lies in N. lat. 42° 30′, W. long. 69° 49′.—*ib.*

MARBLETOWN, a townſhip in Ulſter county, New-York, ſituated on the W. ſide of Hudſon's river, and ſome diſtance from it; 8 miles S. W. by S. of Eſopus, and near 80 N. of New-York city. It contains 2,190 inhabitants, including 374 ſlaves. By the State cenſus of 1796, 374 of the inhabitants are electors.—*ib.*

MARCELLUS, a military townſhip in Onondago county, New-York, ſituated on Skaneatetes lake, 11 miles W. of Onondago Caſtle. Marcellus, as incorporated in 1794, comprehends alſo the townſhip of Camillus, part of the Onondago reſervation, and part of the reſerved lands lying S. W. of the Salt Lake. In 1796, 65 of its inhabitants were electors.—*ib.*

MARCUS HOOK, a town in Cheſter county, Pennſylvania, on the weſt ſide of Delaware river, 20 miles below Philadelphia. It contains about 30 families. Here are two rows of piers, or long wharves, to defend veſſels from the driving of ice in winter.—*ib.*

MARECHAUX, *Cape*, forms the N. E. ſide of the bay of Jacmel, in the iſland of St Domingo. N. lat. 18° 18'.—*ib.*

MARECHITES *Indians* inhabit the banks of the river St John, and around Paſſamaquoddy bay. They are eſtimated at 140 fighting men.—*ib.*

MARGALLAWAY, a river which riſes in the Diſtrict of Maine, and croſſes the New-Hampſhire line between Lake Umbagog and a mountain on the north, and runs ſouth-weſtward to Amariſcoggin river. Its mouth is 10 rods wide.—*ib.*

MARGARET's *Bay*, *St*, a port on the ſouth coaſt of Nova-Scotia, between Proſpect Harbour and Mahone Bay; from which laſt it is ſeparated by a promontory, on which is the high land of Aſpotagoen.—*ib.*

Margaret's *Iſlands*, in the N. Pacific ocean, were diſcovered by Capt. James Magee, in the ſhip Margaret, of Boſton, in his voyage from Kamſchatka in 1780. Their latitude is 24° 40' N. long. 141° 12' E. —*ib.*

MARGARETTSVILLE, a village in Waſhington county, Maryland, about 10 miles S. by E. of Elizabeth-Town and 6 N. E. of William's Port.—*ib.*

MARGOT, the river and heights of Margot are on the E. ſide of the Miſſiſſippi. The river has a weſterly courſe, and is ſaid to be navigable for batteaux a number of miles. The ground below its junction with the Miſſiſſippi, in lat. 35° 28' N. affords a commanding, airy, pleaſant, and extenſive ſituation for ſettlements; the ſoil is remarkably fertile. About 3 miles below this, the French built Aſſumption Fort in 1736, when at war with the Chickaſaws, but the year after it was demoliſhed, when a peace was concluded. It is 70 miles from the river St Francis, and 104 from the Chickaſaw river.—*ib.*

Margot Port, a maritime village on the N. ſide of the iſland of St Domingo, in 19° 48' N. lat. 9 leagues weſtward of Cape Francois —*ib.*

MARIA, *Cape Santa*, is the northern cape at the mouth of La Plata river, in S. America; 9 leagues from the bay of Maldonade, and 20 from Montevideo, a bay ſo called from a mountain which overlooks it. —*ib.*

MARIA SANTA, a town of the audience of Panama, in S. America. It was built by the Spaniards ſoon after they diſcovered the gold mines in its neighbourhood. N. lat. 7° 43', W. long. 78° 12'.

MARIAGALANTE, one of the Caribbee Iſlands in the Atlantic ocean; ſo called from the ſhip's name in which Columbus diſcovered it, in 1493. It is of an elliptical figure, 4½ leagues from N. to S. and 3 from E. to W. It lies 5 or 6 leagues S. eaſterly of Guadaloupe, above half its ſurface is barren mountains. There are only two pariſhes, the principal at the ſouth defended by a fort called Baſſeterre. It is indifferently watered, but produces 800,000lb. of coffee, 100,000lb. cotton, and 1,000,000lb. of ſugar. The French planted a colony here in 1648. It was taken by the Engliſh in 1692, but the French ſoon ſettled there again, and ſtill poſſeſs it. N. lat. 15° 55', W. long. 61° 6'.—*ib.*

MARIANNA, was the name given to the diſtrict granted by the Plymouth Council to Captain John Maſon in 1621. It extended from the river Naumkeag, now Salem, round Cape Ann, to Merrimack river, and from the ſea to the heads of theſe rivers, with the iſlands lying within 3 miles of the coaſt.—*ib.*

MARIE, *Cape Dame*, the weſternmoſt point of the iſland of St Domingo, which, with Cape St Nicholas, forms the entrance of the bay of Leogane. N. lat. 18° 38', W. long. from Paris 76° 51'. The town of this name, ſituated on the cape, is on the north-weſternmoſt part of the ſouth peninſula; 8 leagues weſt of Jeremie, and 60 weſt of Port au Prince. The towns and villages, along the north coaſt of the peninſula, and in the bay or bite of Leogane, between the cape and Port au Prince, are Petit Trou, Anſe a Veau, Maragoane, Petite Goave, Grand Goave, &c.

Marie, *Straits of*, connect Lakes Superior and Huron, which will permit boats to paſs, but not larger veſſels. Near the upper end of theſe ſtraits, which are 40 miles long, is a rapid, which (though it is impoſſible for canoes to aſcend) may be navigated by boats without danger, when conducted by able pilots. The ſtraits afford one of the moſt pleaſing proſpects in the world: on the left, leading to lake Superior, may be ſeen many beautiful little iſlands that extend a conſiderable way before you; and on the right an agreeable ſucceſſion of ſmall points of land, which project a little way into the water, and contribute with the iſlands to render it delightful.—*ib.*

MARIEL, *Port*, a harbour on the north ſide of the iſland of Cuba, which will admit frigates of 30 guns. —*ib.*

MARIETTA, a poſt-town and ſettlement of the N. W. Territory, ſituated on the Ohio at the mouth of the Muſkingum. The Campus Martius in this town is an elevated public ſquare, founded by the Ohio Company, in the year 1788. The fortification is all of hewn timber, and for appearance, convenience, and defence, of ſuperior excellence. It is more than 30 feet above the high banks of the Muſkingum, and only 159 yards diſtant from that river, with a beautiful natural glacis in front. The town conſiſts of 1,000 houſe-lots of 90 by 180 feet; the ſpacious ſtreets interſect each other at right angles, and there are neceſſary ſquares reſerved for uſe, pleaſure, and ornament. There are but few houſes yet erected. It is 19 miles above Bel-Pre, 86 ſouth-weſt of Wheeling, 146 ſouth-weſt of Pittſburg, 240 northeaſt of Lexington in Kentucky, and 460 W. by S. of Philadelphia. The mouth of Muſkingum river lies in lat. 39° 34', long. 82° 9'. —*ib.*

MARK's, *St*, a town of E. Florida, at the head of the bay of Apalachy; 180 miles weſt of St Auguſtine, and 105 from the Alachua Savannah. N. lat. 30° 12', W. long. 85° 45'.—*ib.*

MARK, *St*, a jurisdiction in the west part of the island of St Domingo, containing 4 parishes. Its exports, shipped from the town of its name, from Jan. 1, 1789, to Dec. 31, of the same year, were 3,065,047lb. white sugar, 7,931,710lb. brown sugar, 7,041,852lb. coffee, 3,250,890lb. cotton, 349,819lb. indigo, and various articles to the value of 2,250½ livres: the total value of duties on exportation 116,974 dollars 4 cents. The town of St Mark lies at the head of a bay of its name, which is at the head of the Bay or Bite of Leogane. The bay is formed by Cape St Mark on the south, and Morne au Diable on the north. This town, although small, is reckoned the pleasantest in the island. Its commerce is considerable. It owes a great deal of its embellishments to the attention of M. de Marboi-, during his administration. It is 22 leagues west of Hinche, 19½ north-west of Port au Prince, 14 south by west of Les Gonaives, 30 south of Port de Paix, and 26½ south-west of Cape Francois. N. lat. 19° 5′, W. long. 75° 10′.—*ib.*

MARLBOROUGH, a county in the north-east corner of Cheraws district, on the Great Pedee river, S. Carolina, 25 miles long, and 19 broad.—*ib.*

MARLBOROUGH, *New*, a township in Berkshire county, Massachusetts, containing 1,550 inhabitants. It was incorporated in 1759, and is 135 miles west by south of Boston.—*ib.*

MARLBOROUGH, an ancient and wealthy township in Middlesex county, Massachusetts, (the *Okommakamesit* of the Indians) was incorporated in 1660, and contains 1,554 inhabitants. It is 28 miles west of Boston. A mode of manufacturing Spanish brown, from a kind of earth or loam, said to resemble bed-ore, though not impregnated with particles of iron, has lately been discovered in this town by an ingenious gentleman. He constructed an air furnace, at a trivial expense; and in the year 1794, could calcine and prepare for the mill a ton in 24 hours, 6 days in succession, without great expense of wood. Connoisseurs in paints acknowledge it is good. His first attempts in making spruce yellow were likewise flattering.—*ib.*

MARLBOROUGH, a township in Windham county, Vermont, having Newfane on the north, Halifax south, Brattleborough east, and Wilmington on the west. It contains 629 inhabitants.—*ib.*

MARLBOROUGH, a post-town in Cheshire county, New-Hampshire, six miles from Keene, 20 north of Winchendon, and 26 from Ashburnham in Massachusetts. It was incorporated in 1776, and contains 786 inhabitants.—*ib.*

MARLBOROUGH, *New*, a township in Ulster county, New-York, on the west side of Hudson's river, north of Newburgh. It contains 2,241 inhabitants; of whom 339 are electors, and 58 slaves.—*ib.*

MARLBOROUGH, the name of three townships in Pennsylvania, the one in Montgomery county, and East and West Marlborough in Chester county.—*ib.*

MARLBOROUGH, *Lower*, a town of Maryland, situated in Calvert county on the east side of Patuxent river, 24 miles south-east of Washington city. It contains about 60 houses, and a ware-house for the inspection of tobacco. The river is navigable for ships of burden for some miles above the town.—*ib.*

MARLBOROUGH, *Upper*, the chief town of Prince George's county, Maryland. It is situated on the south-west side of Hatavisit, one of the two principal branches of Patuxent river. It contains about 120 houses, a court-house, and a ware-house for the inspection of tobacco. It is 47 miles S. S. W. of Baltimore, and about 15 easterly of the city of Washington.—*ib.*

MARLOW, a township in Cheshire county, New-Hampshire, settled in 1761. It contains 313 inhabitants.—*ib.*

MARMOSETS, a harbour in the island of St Domingo, which may receive merchantmen, but the entrance of it is rendered difficult by the breakers. It lies between Cape Rouge and Grand Port Berhagne.—*ib.*

MARQUES, a cape on the coast of Old-Mexico, or New-Spain, in the South Sea.—*ib.*

MARSHFIELD, a township in Plymouth county, Massachusetts, bounded S. by Duxborough, and 36 miles S. E. of Boston. It was incorporated in 1640, and contains 1269 inhabitants.—*ib.*

MARSHFIELD, a township in Caledonia county, in Vermont; adjoining to Calais on the N. W. and Peachum N. E.—*ib.*

MARSHPEE, by several writers called *Mashpee*, an ancient Indian town in Barnstable county, Massachusetts, containing 308 inhabitants. There is still an Indian church here, but not more than 40 or 50 persons are pure Indians. The whole consists of about 80 families, principally of a mixed race, being 280 souls in all. They have greatly decreased since 1693, when there were 214 adults, besides stragglers in the plantation and places adjacent; under the care of Mr Rowland Cotton, minister of Sandwich.—*ib.*

MARSHY HOPE, the north-western branch of Nanticoke river in Maryland. Federalsburgh lies on the E. side, 13 or 14 miles from its mouth.—*ib.*

MARTHA BRAE, in Jamaica a small town having a harbour, 7 leagues W. of Montego Point. It is frequented only by such vessels as are particularly destined for this place. There is a bar with 16 or 17 feet water in going in; and the passage in coming out between the Triangle Rocks is not more than 60 feet wide with 6½ or 7 fathoms water.—*ib.*

MARTHA, *St*, a city in the province of the same name, in Terra-firma, South America, with a harbour on the N. Sea, at the mouth of the Guayra; about 124 miles N. E. of Carthagena. It is the residence of a governor and bishop. The houses are built with canes, and are very neat. Its harbour is large, convenient, and safe, and the environs agreeable and fertile. At present it contains about 3000 inhabitants, who carry on an extensive rich trade, and make great quantities of cottons, stuffs, &c. with earthen ware, which is much esteemed. It has a valuable pearl fishery, in which great numbers of slaves are employed, whose dexterity in diving for the oysters is very extraordinary; some of whom will remain for a quarter of an hour under water, and will rise with a basket full. N. lat. 11° 26′, W. long. 73° 59′.—*ib.*

MARTHA'S VINEYARD, an island belonging to Duke's county, Massachusetts, called by the Indians *Nope*, or *Capawock*, is situated between 40° 17′, and 41° 29′ N. lat. and between 70° 22′ and 70° 50′ W. long. about 21 miles long and 6 broad, and lies a little to the W. of Nantucket. Martha's Vineyard, Chabaquiddick, Noman's Island, and the Elizabeth Islands, which contain about 16,500 acres of valuable land, constitute Duke's county, containing 3,265 white inhabitants, and between 400 and 500 Indians and mulattoes; who subsist by agriculture and fishing. Cattle and sheep are raised here in great numbers; and rye, corn and oats are the chief produce of the island. White pipe-clay, and yellow and red ochre are found in Martha's Vineyard. The ravages of war were severely felt in this industrious spot. In September, 1778, the British made a requisition of their militia arms, 300 oxen, and 2000 sheep, which were delivered up.—*ib.*

MARTICK, a township in Lancaster county, Pennsylvania.—*ib.*

MARTIN, a county of Halifax district, N. Carolina, adjoining Tyrrel, Halifax, Bertie, and Pitt counties. It contains 6,080 inhabitants, of whom 1,889 are slaves.—*ib.*

MARTIN'S, *St*, one of the northernmost of the Caribbee islands; situated in the Atlantic ocean, between Anguilla on the north, from whence it is distant a league and a half, and St Bartholomew on the south-east, 15 miles. It is about 15 leagues in circumference, with commodious bays and roads on the N. W. side. Here are good salt-pits, and lakes of salt water, which run a great way within the land; but has no fresh water but what falls from the clouds, and is saved by the inhabitants in cisterns. The salt lakes abound in good fish, particularly turtle; and the salt water pools are frequented by vast numbers of birds. In the woods are wild hogs, turtle-doves, and parrots innumerable. Here are several trees producing gums; and plenty of the candle-tree, splinters of which, when dry and lighted, emit a very fragrant smell. Its tobacco, the chief commodity cultivated, is reckoned the best in the Caribbee islands. The Spaniards abandoned this island in 1650, and blew up a fort which they had erected. The French and Dutch afterwards shared the island between them. But in 1689, were attacked and plundered by Sir Timothy Thornhill, and in July, 1744, were driven out by the British forces, and did not return till after the peace of 1763. They now enjoy about 35,000 acres, out of the 55,000 which the whole island contains. The two colonies breed poultry and sheep, which they sell to the other islands. They also cultivate a little cotton and coffee. About 20 years ago the French part contained 400 white families, and 10,000 slaves. The Dutch part no more than 60 families, and about 200 slaves. N. lat. 18° 6', W. long. 62° 30'.—*ib.*

MARTINSBOROUGH, a town of N. Carolina, situated on the S. side of Tar river, and 20 miles above Washington.—*ib.*

MARTINSBURG, a post-town of Virginia, and capital of Berkeley county, situated about 8 miles south of the Patowmac, in the midst of a fertile and well cultivated country, and 25 miles from the mineral springs at Bath. It contains upwards of 70 houses, a court-house, gaol, and Episcopal church; and contiguous to the town is one for Presbyterians. It is 10 miles from Shepherdstown, 30 from Pittsylvania court-house, 25 from Rocky Mount or Franklin court-house, 22 N. E. of Winchester, 88 N. N. W. of Alexandria, and 244 from Philadelphia.—*ib.*

MARTINVILLE, a post-town, and the capital of Guilford county, in N. Carolina, is agreeably situated on the east side of Buffaloe creek, a branch of Haw river, and contains about 40 houses, a court-house and gaol. It lies N. E. of Bell's Mill, at the head of Deep river; 48 miles north-west of Hillsborough; 27 east of Salem; 50 north-east of Salisbury; 151 west by south of Halifax, and 500 south-west of Philadelphia. N. lat. 36° 5', W. long. 79° 43'.

It was near this town that General Greene and Lord Cornwallis engaged in one of the best fought actions in the late war, on the 15th of March, 1781: and although the Americans were driven off the field, the British suffered so great loss, that they could not pursue the victory. The greatest part of the country in which the action happened, was a wilderness, with a few cleared fields interspersed. The American army, when the action commenced, was posted on a rising ground about a mile and a half from Guilford court-house.—*ib.*

MARYLAND POINT, is formed by a bend in Patowmac river, W. of Port Tobacco.—*ib.*

MARY, *St*, a port on the south side of the Bay of Fundy.—*ib.*

MARY, *Cape St*, is the most southern promontory of Brazil, in South-America.—*ib.*

MARY, *Cape St*, the point of land which forms the northern side of the mouth of La Plata river in Paraguay or La Plata, in South-America. S. lat 35° 14', W. long. 55° 32'.—*ib.*

MARY, *Cape St*, forms the southeastern head land at the mouth of Placentia Bay, Newfoundland Island. —*ib.*

MARY'S RIVER, *St*, a branch of the Miami, which empties into Lake Erie.—*ib.*

MARY'S RIVER, *St*, forms a part of the southern boundary line of the United States. It in part divides Georgia from East-Florida, and is very crooked, with a wide open marsh on each side, from its mouth upwards 30 miles, where the marsh is terminated by thick woods. It is nearly straight for 30 miles farther, up to *Allen's*, an Indian trader at the head of navigation; where it is like a dead creek, 4 fathoms deep, and 10 rods wide. It rises in the great Okafonoka or Ekansanoga swamp, which extends southwardly into East-Florida. It is thought to be what is called May river, discovered by John Ribalt, in 1562. Between this, and Nassau river, lies the low even coast of Amelia Island. The harbours of both rivers are spacious, but St Mary's is the safest. It has 9 feet of water at low spring tides. It runs a course of 150 miles, and enters the ocean between the points of Amelia and Talbert's islands, in lat. 30° 44' and is navigable for vessels of considerable burden for 90 miles. Its banks afford immense quantities of fine timber, suited to the West-India market. Along this river, every 4 or 5 miles, are bluffs convenient for vessels to haul to and load.—*ib.*

MARY'S, *St*, a post-town and port of entry of Georgia, situated on St Mary's river, a few miles from its mouth. It is a small place, and has little trade. It is 129 miles south of Savannah. N. lat. 30° 45', W. long. 79° 12'.—*ib.*

MARY'S, *St*, a county of Maryland on the peninsula between Patowmac and Patuxent rivers, 39 miles in length,

length, and 15 in breadth. It contains 15,544 inhabitants; of whom 6,985 are slaves.—*ib.*

MASCOMY, a considerable pond in New-Hampshire, in the south-western part of Grafton county, lying partly in Lebanon and partly in Enfield townships. This pond is from 30 to 40 fathoms deep. The surrounding land bears evident marks, that the surface of this pond was once 30 or 40 feet higher than its present level. By what cause the alteration was made, and at what time, is unknown; but appearances indicate a sudden rupture, there being no sign of any margin between its former and present height. About a mile distant from its outlet, there is a declivity of rocks, 40 feet higher than the stream, as it now runs. By the situation of these rocks, it appears that they were once a fall, over which the water flowed; but it has now made for itself a very deep channel, through solid earth, nearly a mile in length, where it seems confined for futurity.—*ib.*

MASCAUTENS, an Indian nation who inhabit on Lake Michigan, and between that and the Mississippi. The number of warriors, 400.—*ib.*

MASON (the Rev. William) was a man of such eminence both as a poet and as a scholar, that a more particular account of his life and of his studies should be published than our scanty materials enable us to give. He was born at Hull, where his father possessed the vicarage of St Trinity; but where he received his school education we have not been able to learn. At the proper time he was admitted into St John's College, Cambridge; where he took the degrees of B. A. and M. A. and in 1747, he obtained a fellowship in Pembroke Hall. It was there that he contracted an intimate friendship with Gray the poet, and with Mr Hurd, now Bishop of Worcester. When the former of these gentlemen died, Mr Mason took upon himself the office of editor of his works and guardian of his fame; and upon the promotion of the latter to the see of Litchfield and Coventry, he expressed his satisfaction in some beautiful verses, which we read at the time, but do not recollect where.

In 1754 he entered into holy orders, and was patronized by the then Earl of Holderness, who obtained for him the appointment of chaplain to the king, and presented him with the valuable rectory of Aston in Yorkshire. He was some time afterwards made precentor of York Cathedral, when he published a small volume of Church music, which has alternately met with opposition and applause. In our opinion some of his anthems are unrivalled.

It was natural for the precentor of a cathedral church, who was likewise a poet, to turn his attention to sacred music; and Mason had been a poet from his early years. His *Elfrida* and *Caractacus*, two tragedies on the Grecian model, were both published before the year 1757. These two dramas, in the opinion of Dr Hurd, do honour to modern poetry, and are, according to him, a sufficient proof of the propriety of reviving the chorus on the British stage. In this sentiment few critics, we believe, will agree with his Lordship; but the tragedies have certainly great merit, and transcend perhaps every poem of the same cast in our own or any other modern tongue. In the first, the language is elegant and sweet; in the latter, it is daring and sublime. The author himself always considered the former as the most perfect; and Johnson, whose critical judgment will not be rashly questioned, seems to have been of the same opinion. Johnson's partiality to Oxford, as is well known, made him embrace every opportunity of turning into ridicule Cambridge men and Cambridge poems; but while he boasted of having spent hours in burlesquing Caractacus for the amusement of his Oxford friends, he confessed that Elfrida was too beautiful to be hurt by ridicule. The voice of the public, however, seems to give the preference to the latter, and to consider it as standing, like Dryden's celebrated ode, without a rival. In both are sentiments and expressions which would do honour to the genius of Shakespeare; and Caractacus, in the Greek version of Mr Glass, would not have disgraced an Athenian theatre.

Besides his two tragedies, Mr Mason published many other poems. His English Garden is universally read and admired, being unquestionably the finest poem of the kind that has appeared since the days of Thomson; though some have affected to consider it as treating the subject rather with professional skill than with poetical genius. That there are in it a few prosaic expressions we shall not controvert; for such seem inseparable from didactic poetry; but, taken as a whole, where shall we find its equal? His elegies particularly that on the death of his wife, and that on the demise of Lady Coventry, have been generally read and extolled, though not more than they deserve, as superior in classic elegance to any thing of the kind in the English tongue, and expressing a manliness and tenderness of the pathetic, rarely found in the most polished elegies of Roman writers. The splendor of genius, and accuracy of judgment, conspicuous in his dramas, are equally displayed in his character as a lyric writer. His quarry was bold and impetuous, and he never swept the ground with an ignominious flight. In his Sappho and Phaon he has happily imitated the style of Dryden and Metastasio; and at his death he was employed on a poem in which he proposed to measure his strength with Dryden.

We have reason to believe that this ingenious man was not only a poet and a musical performer, but the inventor of the fashionable instrument the Piano Forte. We cannot indeed at present bring evidence of this fact; but we have instituted such inquiries as, we hope, shall enable us to ascertain the truth under the article *Piano Forte*.

Poetry and music, and the duties of his office, might be supposed to have employed all his time; but, unfortunately, he caught the alarm which in 1769 was spread over the nation by the expulsion of Mr Wilkes from the House of Commons, and immediately inrolled himself among the supporters of the *Bill of Rights*. The decision of the House, which pronounced Mr Lutteral duly elected in opposition to Mr Wilkes, he considered as a gross violation of the rights of the people; and though he surely did not approve of the conduct of the exiled member, he joined with other freeholders in Yorkshire in a petition to the king that he would dissolve the parliament.

Being now leagued with the opposition, he joined in some violent clamours for a parliamentary reform. In the year 1779, when the city of London, and some other commercial towns, agreed to present their petitions to parliament for a more economical expenditure of the public money, and a more equal representation

Mason.

of the people, Mr Mason came forward, and took an active part in promoting these designs, as one who was convinced of their importance and necessity. When the county of York assembled, on the 30th of December 1779, and resolved unanimously, "that a committee of correspondence should be appointed, for the effectually promoting the object of the petition then agreed to, and also to prepare a plan of *association* to support that laudable reform, and such other measures as may conduce to restore the *freedom of parliament*," he was chosen upon the committee, and was consulted with, or assisted in drawing up those various high-spirited resolutions and addresses to the public, for which the Yorkshire committee was so celebrated; and which was afterwards generally adopted by the other associated bodies of reformers. This part of his conduct is surely entitled to no praise. Thinking as we do of the parliamentary reformers, we cannot but regret that a man of Mr Mason's talents and virtues should have embarked in their dangerous pursuits; and though we perceived less hazard in those pursuits than we do, we should still consider them as unsuitable to the character of a clergyman. Our author, however, was of a different opinion. In reply to a censure passed by a dignified clergyman on the political conduct of himself and some of his reverend brethren, he published, without his name indeed, a spirited defence of their proceedings and designs in some of the country papers. The York committee, too, at its next meeting, resolved, "that a Protestant, by entering into holy orders, does not abandon his civil rights;" they also resolved, "that the thanks of the committee be given to those reverend gentlemen who, thus preferring the public good to their own private emoluments, have stood forth the firm friends to the true interests of their country."

Mr Mason, however, showed, by his subsequent conduct, that however earnestly he might wish for what he doubtless considered as an expedient reform in the commons-house of Parliament, he was firmly attached to the British constitution. He was indeed a whig; but he was a whig of the old school. In the beginning of 1794, when the reformers had betrayed the principles of French democrates, he deserted them, and ranged himself under the banners of the servants of the crown; and for this conduct, which was certainly consistent, he has been plentifully traduced by our Jacobin journalists as an alarmist, who not only deserted his old friends, but ascribed to them a certain degree of guilt and political depravity.

The death of this great and good man, which happened in April 1797, was occasioned neither by age nor by inveterate disease. As he was stepping into his chariot, his foot slipped, and his shin grazed against the step. This accident had taken place several days before he paid the proper attention to it; and on April the 3d a mortification ensued, which, in the space of forty-eight hours, put a period to his life.

That he was a scholar and a poet of high eminence is universally acknowledged; and we are assured, that his posthumous works, when published, will not detract from his living fame. In private life, though he affected perhaps too much the fastidious manners of Mr Gray, whose genius he estimated with a degree of enthusiasm amounting almost to idolatry, his character was distinguished by philanthropy and the most fervid friendships; and he may be considered as a man who merits to be ranked with the ablest supporters of British liberty and British morals.

Mason, ‖ Masonry.

MASON, a county of Kentucky, on the southern side of Ohio river. It contains 2,267 inhabitants, of whom 208 are slaves.—*Morse.*

MASON, a township in Hillsborough county, New-Hampshire, on the Massachusetts line, about 70 miles west of Portsmouth, and 50 N. W. of Boston. It was incorporated in 1768, and contains 922 inhabitants.—*ib.*

FREE-MASONRY, is a subject which, after the copious detail given in the *Encyclopædia* of its lodges, and wardens, and grand masters, we should not have resumed in this place, but to warn our countrymen against the pernicious superstructures which have been raised by the French and Germans on the simple system of British masonry.

Much falsehood is current respecting the origin and antiquity of the masonic associations. That the Dionysiacs of Asia Minor were a society of architects and engineers, who had the exclusive privilege of building temples, stadia, and theatres, under the mysterious tutelage of Bacchus, seems to be unquestionable. "We are also certain, that there was a similar trading association during the dark ages in Christian Europe, which monopolized the building of great churches and castles, and enjoyed many privileges under the patronage of the various sovereigns. Circumstances (says Dr Robison), which it would be tedious to enumerate and discuss, continued this association longer in Britain than on the continent;" but there is no good evidence, that, anterior to the year 1648, any man sought admission into it, who was not either a builder by profession, or at least skilled in the science of architecture. At that period, indeed, Mr Ashmole, the famous antiquary (see ASHMOLE, *Encycl.*), was admitted into a lodge at Warrington, together with his father-in-law Colonel Mainwaring; and these are the first distinct and unequivocal instances that we have in Britain of men unconnected with the operative masons being received into their mysterious fraternity. The secrecy, however, of the lodges, made them fit places for the meetings of the royalists; and accordingly many royalists became free-masons. "Nay, the ritual of the master's degree seems to have been formed, or perhaps twisted from its original institution, so as to give an opportunity of sounding the political principles of the candidate, and of the whole brethren present. For it bears so easy an adaption to the death of the king, to the overturning of the venerable constitution of the English government of three orders by a mean democracy, and its re-establishment by the efforts of the loyalists, that this would start into every person's mind during the ceremonial, and could hardly fail to shew, by the countenances and behaviour of the brethren, how they were affected."

This supposition receives much countenance from the well known fact, that "Charles II. was made a mason, and frequented the lodges. It is not unlikely, that besides the amusement of a vacant hour, which was always agreeable to him, he had pleasure in meeting with his loyal friends, and in the occupations of the lodge, which recalled to his mind their attachment and services. His brother and successor James II. was of a more serious and manly cast of mind, and had little pleasure in the

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the frivolous ceremonies of masonry. He did not frequent the lodges. But, by this time, they were the resort of many persons who were not of the profession, or members of the trading corporation. This circumstance, in all probability, produced the denominations of *free* and *accepted* masons. A person who has the privilege of working at any incorporated trade, is said to be a *freeman* of that trade. Others were *accepted* as brethren, and admitted to a kind of honorary freedom; as is the case in many other trades and incorporations, without having (as far as we can learn for certain) a legal title to earn a livelihood by the exercise of it."

It was not till some years after this period that the lodges made open profession of the cultivation of general benevolence, and that the grand aim of the fraternity was to enforce the exercise of all the social virtues. The establishment of a fund for the relief of unfortunate brethren did not take place till the very end of the 17th century; and we may presume, that it was brought about by the warm recommendations of some benevolent members, who would naturally enforce it by addresses to their assembled brethren. Hence the probable origin of those philanthropic discourses, which are occasionally delivered in the lodges by one of the brethren as an official task.

The boasted philanthropy of masons serves, however, another purpose. The inquisitive are always prying and teazing, eager to discover the secrets of their neighbours; and hence the brethren are induced to say, that universal beneficence is the great aim of the order, for it is the only point on which they are at liberty to speak. They forget, that universal beneficence and philanthropy are inconsistent with the exclusive and monopolizing spirit of an association, which not only confines its benevolence to its own members (like any other charitable association), but hoards up in its bosom inestimable secrets, whose natural tendency, they say, is to form the heart to this generous and kind conduct, and inspire us with love to all mankind. The profane world cannot see the beneficence of concealing from public view a principle or a motive which so powerfully induces a mason to be good and kind. The brother says, that publicity would rob it of its force; and we must take him at his word: and our curiosity is so much the more excited, to learn what are the secrets which have so singular a quality, for they must be totally unlike the principles of science, which produce their effects only when made public.

From this account of masonry, it would appear to have been at first a loyal association, and as such it was carried over from England to the continent; for all the masons abroad profess to have received their mysteries from Great Britain. It was first transported into France by the zealous adherents of King James, who, together with their unfortunate master, took refuge in that country; and it was cultivated by the French in a manner suited to the taste and habits of that highly polished and frivolous people. To the three simple British degrees of *apprentice*, *fellow-craft*, and *master*, they gradually added degrees innumerable, all decorated with stars and ribbons; and into their lodges they introduced the impieties and seditious doctrines of Voltaire and the other philosophists. Indeed, if the account which the Abbé Barruel gives of masonry be just, it must be admitted, that even the secrets of the most ancient lodges, though in one sense harmless and just, are so expressed, that they may be easily twisted to very dangerous purposes. This author was advanced by a few friends to the degree of master, without being obliged to take the oath of secrecy; and being furnished with the signs, he got admission into a lodge, where he heard the secret regularly communicated, with all the ordinary forms, to an apprentice. "It would be useless, says he, to describe the ceremonials and trials on such occasions; for in the first degrees, they are nothing more than the play of children. The grand object was the communication of the famous secret, when the candidate was ordered to approach nearer to the venerable. At that moment, the brethren, who had been armed with swords for the occasion, drawing up in two lines, held their swords elevated, leaning the points towards each other, and formed what in masonry is called the *arch of steel*. The candidate passed under this arch to a sort of altar elevated on two steps, at the farthest end of the lodge. The master, seated in an arm chair, or a sort of throne, behind this altar, pronounced a long discourse on the inviolability of the secret which was to be imparted, and on the danger of breaking the oath which the candidate was going to take. He pointed to the naked swords, which were always ready to pierce the breast of the traitor; and declared to him that it was impossible to escape their vengeance. The candidate then swore, "that rather than betray the secret, he consented to have his head cut off, his heart and entrails torn out, and his ashes cast before the winds." Having taken the oath, the master said the following words to him; "My dear brother, the secret of masonry consists in these words, EQUALITY AND LIBERTY; *all men are equal and free; all men are brethren.*" The master did not utter another syllable, and every body embraced the new *brother equal and free*. The lodge broke up, and we gayly adjourned to a masonic repast."

In the British lodges, the author admits, that no other interpretation is given to this famous secret, than that, as all men are children of one common parent, and creatures of the same God, they are in duty bound to love and help each other as brethren; but he contends, that in France it was differently interpreted; and he supports his opinion by the following arguments:

On the 12th of August 1792, Louis XVI. was carried a prisoner to the tower of the *temple*, so called because it formerly belonged to the knights templars. On that day, the rebel assembly decreed, that to the date of *liberty* the date of *equality* should be added in future in all public acts; and the decree itself was dated the fourth year of *liberty*, the first year and first day of *equality*. It was on that day, for the first time, that the secret of free-masonry was made public; that secret so dear to them, and which they preserved with all the solemnity of the most inviolable oath. At the reading of this famous decree, they exclaimed, "We have at length succeeded, and France is no other than an immense lodge. The whole French people are free masons, and the whole universe will soon follow their example."

"I witnessed (says our author) this enthusiasm; I heard the conversations to which it gave rise; I saw masons, till then the most reserved, who freely and openly declared, 'Yes, at length the grand object of free-masonry is accomplished, EQUALITY and LIBERTY; *all*

 men

men are equal and brothers; all men are free. That was the whole substance of our doctrine, the object of our wishes, *the whole of our grand secret!*"

This is a very serious charge against the original secret of masonry, as it was understood in France; and though the author does not bring it directly against the same secret as understood in Britain, he yet seems to say, that in *all* lodges, the following question is put to the candidate before he is entrusted with any secret:—"Brother, are you disposed to execute all the orders of the grand-master, though you were to receive contrary orders from a king, an emperor, or any other sovereign whatever?" And as the brother is obliged to promise this unlimited obedience, it is easy to conceive how much a traiterous conspiracy may be promoted by means of mason lodges. The allegorical story which is told at the conferring of the degree of master, is capable of various and even contrary interpretations; for though in this country it was originally rendered subservient to the purposes of the royalists, in the occult lodges on the continent it has been made the vehicle of treason and impiety.

When the degree of master-mason is to be conferred, the lodge is hung round with black. In the middle is a coffin covered with a pall, the brethren standing round it in attitudes denoting sorrow and revenge. When the new adept is admitted, the master relates to him the following history or fable:

"Adoniram presided over the payment of the workmen who were building the temple by Solomon's orders. They were three thousand workmen. That each one might receive his due, Adoniram divided them into three classes, apprentices, fellow-crafts, and masters. He entrusted each class with a word, signs, and a gripe, by which they might be recognised. Each class was to preserve the greatest secrecy as to these signs and words. Three of the fellow-crafts, wishing to know the word, and by that means obtain the salary, of master, hid themselves in the temple, and each posted himself at a different gate. At the usual time when Adoniram came to shut the gates of the temple, the first of the three met him, and demanded the *word of the masters;* Adoniram refused to give it, and received a violent blow with a stick on his head. He flies to another gate, is met, challenged, and treated in a similar manner by the second: flying to the third door, he is killed by the fellow-craft posted there, on his refusing to betray the word. His assassins buried him under a heap of rubbish, and marked the spot with a branch of acacia.

"Adoniram's absence gave great uneasiness to Solomon and the masters. He is sought for everywhere: at length one of the masters discovers the corpse, and, taking it by the finger, the finger parted from the hand; he took it by the wrist, and it parted from the arm; when the master, in astonishment, cried out, *Mac Benac;* which the craft interprets by "*the flesh parts from the bones.*"

"Lest Adoniram should have revealed the *word*, the masters convened and agreed to change it, and to substitute the words *Mac Benac;* sacred words, that freemasons dare not pronounce out of the lodges, and there each only pronounces one syllable, leaving his neighbour to pronounce the other."

The history finished, the adept is informed, that the object of the degree he has just received is to recover the word lost by the death of Adoniram, and to revenge this martyr of the masonic secrecy. The generality of masons, looking upon this history as no more than a fable, and the ceremonies as puerile, give themselves very little trouble to search farther into these mysteries.

These sports, however, assume a more serious aspect when we arrive at the degree of elect *(Elu.)* This degree is subdivided into two parts; the first has the revenging of Adoniram for its object, the other to recover the *word*, or rather the sacred doctrine which it expressed, and which has been lost.

In this degree of elect, all the brethren appear dressed in black, wearing a breast-piece on the left side, on which is embroidered a death's head, a bone, and a poignard, encircled by the motto of *Conquer or die.* The same motto is embroidered on a ribband which they wear in saltier. Every thing breathes death and revenge. The candidate is led into the lodge blindfolded, with bloody gloves on his hands. An adept with a poignard in his hand threatens to run him through the heart for the crime with which he is accused After various frights, he obtains his life, on condition that he will revenge the father of masonry in the death of his assassin. He is shewn to a dark cavern. He is to penetrate into it; and they call to him, Strike all that shall oppose you; enter, defend yourself, and avenge our master; at that price you shall receive the degree of elect. A poignard in his right hand, a lamp in his left, he proceeds; a phantom opposes his passage; he hears the same voice repeat, Strike, avenge Hiram, there is his assassin. He strikes, and the blood flows.—Strike off his head, the voice repeats; and the head of the corpse is lying at his feet. He seizes it by the hair (A), and triumphantly carries it back as a proof of his victory; shows it to each of the brethren, and is judged worthy of the new degree.

Our author says, that he has questioned divers masons whether this apprenticeship to ferocity and murder had never given them the idea, that the head to be cut off was that of kings; but they all affirmed that such an idea had never occurred to them till the French revolution had convinced them of the fact. At this indeed we are not surprised. The assassin of Hiram is no where said to have been a king; and why should the young elect have supposed, that when stabbing that assassin, he was training to be a regicide? The ceremony, however, is certainly ferocious in the highest degree, and obviously calculated to reconcile the masons of the occult lodges to the practice of assassination at the command of their superiors; and when it is remembered, that they are bound to pay obedience to those unseen superiors even against their lawful sovereigns, the atrocities of the revolution would naturally make them interpret this shocking ceremony as it is interpreted by the Abbé.

It was the same with respect to the religious part of this degree, where the adept is at once pontiff and sacrificer

(A) The reader may easily conceive that this corpse is no more than a mannikin containing bladders full of blood.

Masonry. crificer with the rest of the brethren. Vested in the ornaments of the priesthood, they offer bread and wine, according to the order of Melchisedec. The secret object of this ceremony is to re-establish religious equality, and to exhibit all men equally priests and pontiffs, to recal the brethren to natural religion, and to persuade them that the religion of Moses and of Christ had violated religious equality and liberty by the distinction of priests and laity. It was the revolution again which opened the eyes of many of the adepts, who then owned that they had been dupes to this impiety, as they had been to the regicide essay in the former part.

Our author treats the fraternity of the occult lodges through the higher degrees of Scotch masonry, those of the Rosicrucians, and that of the knights Kadosch; and sums up his account in the following terms:

"In the two first degrees, that is to say, in those of *apprentice* and *fellow-craft*, the sect begins by throwing out its equality and liberty. After that, it occupies the attention of its novices with puerile games of fraternity or masonic repasts; but it already trains its adepts to the profoundest secrecy by the most frightful oaths.

"In that of *master*, it relates the allegorical history of Adoniram, who is to be avenged; and of the *word*, which is to be recovered.

"In the degree of *elect*, it trains the adepts to vengeance, without pointing out the person on whom it is to fall. It carries them back to the time of the patriarchs, when, according to them, men knew no religion but that of nature, and when every body was equally priest and pontiff. But it had not as yet declared that all religion revealed since the time of the patriarchs was to be thrown aside.

"This last mystery is only developed in the Scotch degrees. There the brethren are declared free: The word so long sought for is, Deism; it is the worship of Jehovah, such as was known to the philosophers of nature. The true mason becomes the pontiff of Jehovah; and such is the grand mystery by which he is extricated from that darkness in which the prophane are involved.

"In the degree *Rosæ Crucis*, he who wrested the *word*, who destroyed the worship of Jehovah, is Christ himself, the author of Christianity; and it is on the Gospel and on the Son of Man that the adept is to avenge the brethren, the pontiffs of Jehovah.

"At length, on his reception as Kadosch, he learns that the assassin of Adoniram is the king, who is to be killed to avenge the grand master Molay, and the order of the masons successors of the knights templars. The religion which is to be destroyed to recover the *word*, or the true doctrine, is the religion of Christ, founded on revelation. This word in its full extent is *equality* and *liberty*, to be established by the total overthrow of the altar and the throne.

"Such are the incipient degrees, the process, and the whole system of masonry; it is thus that the sect, by its gradual explanation of its twofold principle of *equality* and *liberty*, of its allegory of the founder of masonry to be avenged, of the word to be recovered, leading the adepts from secret to secret, at length initiates them into the whole Jacobinical code of revolution."

If this account of masonry be not greatly exaggerated, what are we to think of those men among ourselves, who, since the publication of the Abbé Barruel's book and Dr Robison's, have displayed a zeal for the propagation of their mysteries, by which they seemed not to be formerly actuated, and to which the importance of the business that, by their own account, is transacted in the lodges, cannot be thought to bear an adequate proportion? It is not enough to say that British masonry is harmless, and that the *equality* and *liberty* taught in our lodges are the equality and liberty taught in the bible. Without directly questioning this assertion, we only beg leave to put our countrymen in remembrance, that French and German masonry, as it was derived from Britain, must have been originally as harmless as our own; and to call their attention to the monstrous superstructures of impiety and rebellion which in these countries have been raised upon our foundation. Have there been no symptoms of sedition and irreligion among us, since the commencement of the French revolution, that we should be so confident that the equality and liberty of our lodges will never degenerate into the equality and liberty of the French Jacobins? This cannot be said; for it has been proved, that there are several occult lodges in Britain; and what security have we, or what security can we receive, that their number will not increase? The legislature indeed has lately laid some salutary restraints on the meetings of masons; but such is the nature of these meetings, that nothing can effectually secure us against the introduction of the higher mysteries, but the voluntary shutting up for a time of all lodges. This has been done by the honest masons in Germany; and why may it not be done by the masons in Britain? The fund for the relief of poor brethren may surely be managed without secrecy; the signs and gripe may be communicated without the *word*, or exacting a promise of implicit obedience; and the relinquishing of the joys of a social hour would be no great sacrifice to the peace of a country.

But is British masonry really so harmless as the younger masons wish us to believe? The writer of these reflections was never initiated in its mysteries, and therefore cannot, from his own knowledge, say what is their tendency; but he has no hesitation to affirm, because he believes himself able to demonstrate, that it is grossly immoral to promise implicit obedience to unknown superiors, or to swear that one will keep inviolate a secret, to the nature of which he is an absolute stranger. He hopes, indeed, and is inclined to believe, that, in the decent lodges of Britain, the candidate is assured, before he is required to take the oath, that the secret to be communicated, and the obedience which he is to pay, militate in no respect against the civil government or the religion of his country; but still if the secret contain information of value, it is, in his opinion, sinful to keep it a secret; and he cannot conceive upon what principle a native of Britain can promise unlimited obedience to any human being. The mysteries of masonry must relate to something which is either important and laudable; frivolous, though innocent; or dangerous and immoral. To confine to a sect any information which is laudable and important, is surely not to act the part of genuine philanthropists; to administer the most tremendous oaths in the midst of frivolous amusements, is to violate one of the most sacred precepts of our holy religion; and, as no man will pretend to vindicate dangerous and immoral mysteries, masonry

sonry appears, in every point in which it can be placed, an association which no good Christian will think himself at liberty to encourage.

MASQUE PACONA, a jurisdiction of Charcas, in Peru, extending above 30 leagues. Its air is hot, but not too great for vines. The city of the same name, where the bishop of Santa Cruz de la Sierra resides, is very thinly inhabited; but there are in other parts of the jurisdiction, several populous towns. It produces all kinds of grain and fruits; honey and wax constitute a principal part of its trade.—*Morse.*

MASQUES, or *Chilques* and *Masques*, a jurisdiction of Casco, in Peru, which begins about 7 or 8 leagues from Casco, extending about 30 in length.—*ib.*

MASSAC, a fort built by the French, on the northwestern side of the Ohio, about 11 miles below the mouth of Tennessee river. Its remains stand on a high bank, in a healthy agreeable situation.—*ib.*

MASSACHUSETTS, *Fort*, stands on the northwestern corner of the State of its name, in N. lat. 42° 41′ 30″; 19 miles N. E. by N. of Pittsfield, and 20 due E. of Lansingburgh city, in New-York State.—*ib.*

MASSACHUSETTS *Sound*, on the N. W. coast of North-America, is situated on the southern side of the Quadras Isles, and leads from the W. into Nootka Sound along the N. side of Kendrick's Island, whose eastern side forms, with Point Breakfast, the mouth of Nootka Sound.—*ib.*

MASSACRE *River* passes out of the Straits of Magellan S. W. into the supposed channel of St Barbara, which cuts through the island of Terra del Fuego, through which, we are informed, Capt. Mareanille of Marseilles passed in 1713 into the South Pacific Ocean.—*ib.*

MASSACRE *River*, on the N. side of the Island of St Domingo, falls into the bay of *Mancenilla.*—*ib.*

MASSACRE, a small island on the coast of West-Florida, 2 miles to the eastward of Horn Island; 10 miles from the main land, all the way across there is from 2 to 3 fathoms; except the shoal called La Grand Bature, which stretches a league from the main land, with 2 or 3 feet water on it, and in some places not so much. Behind it is a large bay called L'Ance de la Grand Bature, 8 miles E. of Pascagoula bluff.—*ib.*

MASSAFUERO, an island in the S. Pacific Ocean, called by the Spaniards the Lesser Juan Fernandes, 22 leagues W. by S. of the Greater Juan Fernandes. It has always been represented by the Spaniards as a barren rock, without wood, water or provisions. But Lord Anson found this to be a political falsity, asserted to prevent hostile vessels from touching there. There is anchorage on the N. side in deep water, where a single ship may be sheltered close under the shore, but is exposed to all winds except the south. According to Capt. Magee of the ship Jefferson, it is 38 leagues to the westward of Juan Fernandes, and in about 33° 30′ S. lat. and 82° W. long. from Greenwich.—*ib.*

MASSANUTEN'S *River*, a western branch of the Shenandoah.—*ib.*

MASSEDAN *Bay*, on the N. Pacific Ocean, and W. coast of Mexico, is situated between Acapulco and Aquacara, a port near the cape of California, where Sir Thomas Cavendish lay after he had passed the Straits of Magellan.—*ib.*

MASEY'S-TOWN, in the N. W. Territory, stands on the northern bank of Ohio river, between the rivers Little Miami and Sciota.—*ib.*

MASSY'S CROSS ROADS, in Kent county, Maryland, is N. E. of New Market, S. E. of George-Town, and S. by W. of Sassafras-Town, a little more than 5 miles from each.—*ib.*

MAST *Bay*, on the north side of the island of Jamaica, in the N. W. part. It is eastward of Montego Bay, and near the shelf of rocks that lies from the shore, called Catlin's Cliffs.—*ib.*

MASTICK *Gut*, on the S. W. side of the island of St Christopher's in the West-Indies, is between Moline's Gut on the N. W. and Godwin's Gut on the southeast.—*ib.*

MASTIGON, a river which runs westward into lake Michigan about 11 miles north of La Grande Riviere. It is 150 yards wide at its mouth.—*ib.*

MASUAH (See MASSUAH, *Encycl.*) is in latitude 15° 35′ 5″ north, and in longitude 39° 36′ 30″ east of Greenwich. On the 22d of September 1769 Mr Bruce found the variation of the needle at Masuah to be 12° 48′ west.

MATA, *Point*, on the northern side of the island of Cuba, and 9 leagues N. W. of Cape Maisy.—*Morse.*

MATACA, or *Mantaca*, is a commodious bay on the N. coast of the island of Cuba, where the galleons usually come to take in fresh water on their return to Spain, about 12 leagues from the Havannah. It appears to be the same as Matanze, in lat. 23° 12′ N. long. 81° 16′ W. Peter Heyn took a great part of a rich fleet of Spanish galleons here in 1627.—*ib.*

MATAIA, a province of S America, towards the river Amazon, between the mouth of Madeira and Tapaesa rivers.—*ib.*

MATANCA, or *Manances*, a short and broad river of E. Florida which falls into the ocean south of St Augustine.—*ib.*

MATANCHEL, a sea-port on the west coast of New Mexico, about 20 leagues to the N. E. of the rocks of Ponteque, over which, in clear weather, may be seen a very high hill, with a break on the top, called the hill of Xalisco, and may be seen 8 or 9 leagues from the port.—*ib.*

MATANE, a river of Canada, in N. America, the mouth of which is capable of admitting vessels of 200 tons burden. All this coast, especially near this river, for 20 leagues, abounds in cod, which might employ 500 shallops or fishing smacks at a time. The fish is very fine, and fit for exportation to the Straits, Spain, and the Levant. Great numbers of whales have been also seen floating upon the water, which may be struck with a harpoon, and prove a very valuable fishery.—*ib.*

MATANZAS, or *Matance*, a large bay on the north side of the island of Cuba, 14 leagues south-east of the Havannah, but some accounts say 20 leagues. From Cape Quibanico to this bay the coast is west-north-west.—*ib.*

MATAVIA *Bay*, or *Port Royal Bay*, is situated within Point Venus near the north part of the island of Otaheite, but open to the north-west, and in the south Pacific Ocean. The east side of the bay has good anchorage in 14 and 16 fathoms. S. lat. 17° 29′, W. long. 149° 30′, and the variation of the compass 3° 34′ east.—*ib.*

MATCHADOCK *Bay*, in the eafternmoft part of Lake Huron.—*ib.*

MATHANON *Port*, in the fouth-eaft part of the ifland of Cuba, is one of thofe ports on that coaft which afford good anchorage for fhips, but without any ufe for want of them. It is between Cape Cruz and Cape Maizi, at the eaft end of the ifland. —*ib*

MATHEWS, *Fort*, ftands on the eaftern fide of Oconee river, in the S. weftern part of Franklin county, Georgia.—*ib.*

Mathews, a county of Virginia, bounded W. by Gloucefter, from which it was taken fince 1790; lying on the W. fhore of the bay of Chefapeak. It is about 18 miles in length and 6 in breadth.—*ib.*

MATICALOC *River*, on the W. coaft of New Mexico, is 7 leagues from Catalta Strand, or the port of Sanfonate. It is much expofed to northerly winds, and is known by fome fmall but high hills that are oppofite to it. There is another large river to the weftward of it, about 4 leagues, which has 2 fathoms upon the bar; and from thence to the bar of Eftapa it is 15 leagues.—*ib.*

MATILDA, a village of Virginia fituated on the fouth-weft bank of Patowmac river, above Wafhington city, and near the Great Falls.—*ib.*

MATINICUS *Iflands*, on the coaft of Maine. When you pafs to the weft of thefe iflands, the main paffage from the fea to Penobfcot Bay lies about north by weft. Matinicus lies north lat. 43° 56′, weft long. 68° 20′.—*ib.*

MATMAI, or Matsumai, is the largeft of the Kurile iflands; and if it be not independent, is tributary to Japan. The capital town of the fame name, Matmai, is fituated on the fea-fhore, on the fouth-weft fide. It was built and is inhabited by the Japanefe. It is a fortified place, furnifhed with artillery, and defended by a numerous garrifon. The ifland of Matmai is the place of exile for perfons of diftinction at Japan: it is feparated from that empire by only a narrow channel, but which is confidered as dangerous, becaufe the capes, which project on both fides, render the navigation difficult. The people are faid to be fenfible to friendfhip, hofpitable, generous, and humane.

MATTA DE BRAZIL, a town in the captainfhip of Pernambuco, in Brazil; about 9 leagues from Olinda. It is very populous; and quantities of Brazil are fent from this country to Europe.—*Morse.*

MATTAPONY, a navigable river of Virginia, which rifes in Spottfylvania county, and running a S. E. courfe, joins Pamunky river, below the town of De la War, and together form York river. This river will admit loaded floats to Downer's bridge, 70 miles above its mouth.—*ib.*

MATTES, on the eaft coaft of South-America, in the fouth Atlantic Ocean, is in lat. 45° 5′ fouth, and long. 64° 25′ weft —*ib.*

MATTHEO *Ifland*, *St*, or *St Matthew's Ifland*, in the S. Atlantic Ocean. S. lat 1° 24′.—*ib.*

MATTHEW'S *Bay*, *St*, in the Gulf of Mexico, on the W. fhore of Campeachy Gulf, is more than 100 leagues to the N. of Tumbez.—*ib.*

Matthews, *St*, or *Mattheo Bay*, on the coaft of Peru, on the N. Pacific Ocean, is 6 leagues to the N. E. by E. from Point Galera, and 5 or 6 leagues S. S. W. from the river St Jago, between which there is anchorange all the way, if fhips keep at leaft in 6 fathoms water. It is all high land with hollow red crags, and feveral points run out, forming good retreats for fhips driven in by hard fqualls and flaws from the hills, and by the feas running high, which often happen.—*ib.*

MAUGERVILLE, a townfhip in Sunbury county, province of New Brunfwick, fituated on St John's river, oppofite St Annes, and 30 miles above Belifle. —*ib.*

MAUREPAS, an ifland on the north eaft coaft of Lake Superior, and north-eaft of Ponchartrain ifland. —*ib.*

Maurepas, a lake in W. Florida, which communicates weftward with Miffiffippi river, through the Gut of Ibberville, and eaftward with Lake Ponchartrain. It is 10 miles long, 7 broad, and has 10 or 12 feet water in it. The country round it is low, and covered with cyprefs, live-oak, myrtle, &c. Two creeks fall into this lake, one from the north fide, called Nattabanie, the other from the peninfula of Orleans. From the Ibberville at its junction with Maurepas to the river Amit is 39 miles, and from thence, following the Ibberville, to the Miffiffippi at the W. fide of the peninfula of Orleans, 21 miles. From the Ibberville acrofs the lake, it is 7 miles to the paffage leading to Ponchartrain. The length of this paffage is 7 miles, and only 300 yards in width, which is divided into two branches by an ifland that extends from Maurepas to about the diftance of a mile from Ponchartrain. The fouth channel is the deepeft and fhorteft. The paffage thence through Lake Ponchartrain, to the Gulf of Mexico, is above 50 miles.—*ib.*

Maurepas *Ifland*, on the coaft of Cape Breton, the fame as the *Ifle Madame*.—*ib.*

MAURICE *Bay*, on the W. fide of Cape Farewell Ifland, or S. extremity of E. Greenland, and the principal harbour of that fea —*ib.*

Maurice, *Port*, on the E. coaft of Terra del Fuego Ifland, is on the W. fhore of Le Maire Straits, between that ifland and Staten Land on the E. and N. of the bay of Good Succefs. It is a fmall cove, having anchorage before it in 12½ fathoms, about half a mile from the fhore, over coral rocks.—*ib.*

Maurice *River*, the name of a place in Cumberland county, New-Jerfey.—*ib.*

Maurice *River*, in fome maps called corruptly *Morris*, rifes in Gloucefter county, New-Jerfey, and runs fouthwardly about 40 miles, and empties into Delaware Bay; is navigable for veffels of 100 tons 20 miles, and for fmall craft confiderably further.—*ib.*

MAXANTALLA *Ifland*, is near the port of Matanchel on the W. coaft of New-Mexico, and on the North Pacific ocean.—*ib.*

MAY, *Cape*, the moft foutherly point of land of the State of New-Jerfey, and the N. point of the entrance into Delaware Bay and river, in lat. 39°, and long. 74° 56′ W. The time of high water on fpring tide days, is a quarter before nine o'clock.—*ib.*

MAY POINT, on the S. fide of New-Foundland Ifland, a point of the peninfula between Fortune and Placentia Bays.—*ib.*

MAYAGUANA, one of the Bahama iflands in the Weft-Indies, and the fame with Maranella, and in lat. 22° 51′ N. at the N point, and long. 72° 57′ W.—*ib.*

MAYFIELD, a townſhip in Montgomery county, New-York, adjoining Broadabin on the weſtward, taken from Caughnawaga, and incorporated in 1793. In 1796, 126 of its inhabitants were qualified electors.—*ib.*

MAY's *Lick*, in Maſon county, Kentucky, a ſalt ſpring on a branch of Licking river, 9 miles S. S. W. of Waſhington, on the ſouth bank of the Ohio, and 15 northerly of the Blue Licks.—*ib.*

MAYNAS, a government, formerly the eaſtern limit of the juriſdiction of Quito in Peru, and joining on the caſt to the governments of Quixos and Jaen de Bracameros. In its territory are the ſources of thoſe rivers which, after traverſing a vaſt extent, form, by their confluence, the famous river of the Amazons. It is ſeparated from the poſſeſſions of the Portugueſe, by the famous line of demarcation, or the boundary of thoſe countries belonging to Spain and Portugal. Its capital is San Franciſco de Borja, the reſidence of the governor, but the Superior reſides at Santiago de la Laguna. There are ſeveral miſſions in the government of Maynas, and dioceſe of Quito, particularly 12 on the river Napo, and 24 on the Maranon or Amazon; many of them are both large and populous.—*ib.*

MAYO *River*, on the eaſt ſhore of the Gulf of California, and weſt coaſt of New-Biſcay, in the province of that name, forms a ſpacious bay at its mouth, in lat. 27° 40′ N. and long. 114° W.—*ib.*

MAYORGA (Martin de). See *Don Martin*, &c. in this *Suppl.*

MAYOW (John), whoſe diſcoveries in chemiſtry have aſtoniſhed the ſcientific part of the public, deſcended, ſays Wood, from a genteel family living at *Bree* in the county of *Cornwall*. His father was probably a younger ſon, bred to buſineſs; for our author was born in Fleet-ſtreet, London, in the pariſh of St Dunſtan's in the Weſt. At what ſchool he received the rudiments of his education, a circumſtance which the biographers of men eminent in the republic of letters ſhould never omit, we have not been able to learn; but on the 27th of September 1661, when he had juſt completed his 16th year, he was admitted a ſcholar of Wadham college, Oxford. Some time afterwards, on the recommendation of Henry Coventry, Eſq; one of the ſecretaries of ſtate, he was choſen probationer fellow of All ſouls college. As Wood informs us that he had here a *Legiſt's place*, an expreſſion by which we underſtand a law-fellowſhip, it is not wonderful that he took his degrees in the civil law, though phyſic and the phyſical ſciences were the favourite objects of his ſtudy. He was indeed an eminent phyſician, practiſing both in London and in Bath, but in the latter city chiefly in the ſummer months, till the year 1679, when he died, ſome time during the month of September, in the houſe of an apothecary in York-ſtreet, Covent Garden, and was buried in the church of that pariſh. He had been married, ſays Wood, a little before his death, not altogether to his content; and indeed he muſt have been very diſcontented, if he choſe to die in the houſe of a friend rather than in his own. He publiſhed, "Tractatus quinque medico phyſici, 1. De ſalnitro; 2. De reſpiratione; 3. De reſpiratione fœtus in utero et ovo; 4. De motu muſculari et ſpiritibus animalibus; 5. De Rachitide." Theſe were publiſhed together in 8vo at Oxford, in 1674; but there is an edition of two of them, "De reſpiratione," and "De Rachitide," publiſhed together at Leyden in 1671.

The fame of this author has been lately revived and extended by Dr Beddoes, who publiſhed, in 1790, "Chemical Experiments and Opinions, extracted from a work publiſhed in the laſt century," 8vo; in which he gives to Mayow the higheſt credit as a chemiſt, and aſcribes to him ſome of the greateſt modern diſcoveries reſpecting air, giving many extracts from the three firſt of his treatiſes. His chief diſcovery was, that oxygen gas, to which he gave the name of *fire air*, exiſts in the nitrous acid, and in the atmoſphere; which he proved by ſuch deciſive experiments, as to render it impoſſible to explain how Boyle and Hales could avoid availing themſelves, in their reſearches into air, of ſo capital a diſcovery. Mayow alſo relates his manner of paſſing aeriform fluids under water, from veſſel to veſſel, which is generally believed to be a new art. He did not collect dephlogiſticated air in veſſels, and transfer it from one jar to another, but he proved its exiſtence by finding ſubſtances that would burn in vacuo, and in water when mixed with nitre; and after animals had breathed and died in veſſels filled with atmoſpheric air, or after fire had been extinguiſhed in them, there was a reſiduum which was the part of the air unfit for reſpiration, and for ſupporting fire; and he further ſhewed, that nitrous acid cannot be formed, but by expoſing the ſubſtances that generate it to the atmoſphere. Mayow was undoubtedly no common man, eſpecially ſince, if the above dates are right, he was only 34 at the time of his death. But he was not ſo unknown as Dr Beddoes ſuppoſed; for ſince the repetition of the ſame diſcovery by Prieſtley and Scheele, reference has frequently been made by Chemiſts to Mayow as the original inventor; thus allowing to him a ſpecies of merit, to which he has perhaps but a doubtful claim, and which, if that claim be well founded, muſt certainly be ſhared between him and Dr Hooke. See HOOKE in this *Supplement*.

MAYZI, the eaſtern cape of the iſland of Cuba, and the weſtern point of the windward paſſage. N. lat. 20° 19′ 30″, W. long. from Paris 76° 40′ 30″.—*Morse.*

MAZALTAN, a province of Mexico, or New Spain. It is well watered by the Alvarado, which diſcharges itſelf by 3 navigable mouths, at 30 miles diſtance from Vera Cruz.—*ib.*

MEADOWS, a ſmall river which falls into Caſco Bay, in the Diſtrict of Maine.—*ib.*

MEADS, a place ſituated on a fork of French Creek; a branch of the Alleghany, in Pennſylvania. N. lat. 41° 36′, and about 23 miles N. W. of Fort Franklin, at the mouth of the creek.—*ib.*

MEAN, in general. See *Encycl.*

Arithmetical MEAN, is half the ſum of the extremes. So 4 is an arithmetical mean between 2 and 6, or between 3 and 5, or between 1 and 7; alſo an arithmetical mean between a and b is $\frac{a+b}{2}$, or $\frac{1}{2}a + \frac{1}{2}b$.

Geometrical MEAN, commonly called a mean proportional, is the ſquare root of the product of the two extremes; ſo that, to find a mean proportional between two given extremes, multiply theſe together, and extract the ſquare root of the product. Thus, a mean proportional

portional between 1 and 9, is $\sqrt{1 \times 9} = \sqrt{9} = 3$; a mean between 2 and $4\frac{1}{2}$ is $\sqrt{2 \times 4\frac{1}{2}} = \sqrt{9} = 3$ alfo; the mean between 4 and 6 is $\sqrt{4 \times 6} = \sqrt{24}$; and the mean between a and b is $\sqrt{ab}$.

Harmonical MEAN. See *Harmonical* PROPORTION, Encycl.

MEAN *and Extreme Proportion*, or *Extreme and Mean Proportion*, is when a line or any quantity is fo divided that the lefs part is to the greater, as the greater is to the whole.

MEAN *Anomaly of a Planet*, is an angle which is always proportional to the time of the planet's motion from the aphelion or perihelion, or proportional to the area defcribed by the radius vector; that is, as the whole periodic time in one revolution of the planet, is to the time paft the aphelion or perihelion, fo is 360° to the mean anomaly. See ANOMALY, *Encycl.*

MEAN *Conjunction* or *Oppofition*, is when the mean place of the fun is in conjunction, or oppofition, with the mean place of the moon in the ecliptic.

MEAN *Diftance of a Planet from the Sun*, is an arithmetical mean between the planet's greateft and leaft diftances.

MEAN *Motion*, is that by which a planet is fuppofed to move equably in its orbit; and it is always proportional to the time.

MEAN *Time*, or *Equal Time*, is that which is meafured by an equable motion, as a clock; as diftinguifhed from apparent time, arifing from the unequal motion of the earth or fun.

UNIVERSAL OR PERPETUAL MEASURE, is a kind of meafure unalterable by time or place, to which the meafures of different ages and nations might be reduced, and by which they may be compared and eftimated. Such a meafure would be very ufeful if it could be attained; fince, being ufed at all times, and in all places, a great deal of confufion and error would be avoided.

It has been attempted, at different times and in different countries, more efpecially by the French, who, fince the commencement of their revolutionary government, have laboured hard to obtrude their innovations in arts and fcience, as well as in politics, upon all nations. Propofals, however, have been made by foberer men for a ftandard both of weights and of meafures for all nations: and fome of the moft rational of thefe fhal be noticed under the word WEIGHTS in this *Supplement.*

MECATINA, *Great, Point of*, on the fouth coaft of Labrador, and the north fhore of the Gulf of St Lawrence, in N. America. N. lat. 50° 42′, W. long. 59° 13′.—*Morse.*

MECATINA *Ifland, Little*, on the fame coaft and fhore, lies fouth-weft of Great Mecatina. N. lat. 50° 36′.—*ib.*

MECHANICS.—Our readers will recollect that in the article PHYSICS. *Encycl.* we propofed to diftinguifh by the term *Mechanical Philofophy* that part of natural fcience which treats of the local motions of bodies and the caufes of thofe phenomena. And, although all the changes which we obferve in material nature are accompanied by local motion, and, when completely explained, are the effects (perhaps very remote) of thofe powers of matter which we call *moving forces*, and of thofe alone, yet, in many cafes, this local motion is not obferved, and we only perceive certain ultimate refults of thofe changes of place. This is the cafe (for example) in the folution of a grain of filver in a phial of aquafortis. In the beginning of the experiment, the particles of filver are contained in a fmall fpace at the bottom of the phial; but they are finally raifed from the bottom, and uniformly diffeminated over the whole fluid. If we fix our attention fteadily on one particle, and trace it in its whole progrefs, we contemplate nothing but a particle of matter acted on by moving forces, and yielding to their action. Could we ftate, for every fituation of the particle, the direction and intenfity of the moving force by which it is impelled, we could conftruct a figure, or a formula, which would tell us the precife direction and velocity with which it changes its place, and we could delineate its path, and tell the time when it will arrive at that part of the veffel where it finally refts in perfect equilibrium. Newton having done all this in the cafe of bodies acted on by the moving force called gravity, has given us a complete fyftem of mechanical aftronomy. The philofopher who fhall be as fortunate in afcertaining the paths and motions of the particles of filver, till the end of this experiment, will eftablifh a fyftem of the mechanical folution of filver in aquafortis; and the theorems and formulæ which characterife this particular moving force, or this modification of force, ftating the laws of variation by a change of diftance, will be the complete theory of this chemical fact. It is this modification of moving force which is ufually (but moft vaguely) called the *chemical affinity*, or the *elective attraction of filver and aquafortis.*

But alas! we are, as yet, far from having attained this perfection of chemical knowledge. All that we have yet difcovered is, that the putting the bit of filver into the fpirit of falt will not give occafion to the exertion of this moving force; and we exprefs this obfervation, by calling that unknown force (unknown, becaufe we are ignorant of the law of its action) an *affinity*, an *elective* attraction. And we have obferved many fuch elections, and have been able to clafs them, and to tell on what occafions they will or will not be exerted; and this fcrap of the complete theory becomes a moft valuable acquifition, and the claffification of thofe fcraps a moft curious, and extenfive, and important fcience. The chemical philofopher has alfo the pleafure of feeing gradual approaches made by ingenious men to the complete mechanical explanation of thefe unfeen motions and their caufes, of which he has arranged the ultimate refults.

The ordinary chemift, however, and even many moft acute and penetrating enquirers, do not think of all thefe motions. Familiarly converfant with the refults, they confider them as principles, and as topics to reafon from. They think a chemical phenomenon fufficiently explained, when they have pointed out the affinity under which it is arranged. Thus they afcribe the propagation of heat to the expanfive nature of fire, and imagine that they conceive clearly how the effect is produced. But if a mathematical philofopher fhould fay, "What is this which you call an expanfive fluid? Explain to me diftinctly, in what manner this property which you call expanfivenefs operates in producing the propagation of heat."—We imagine that the chemift would

would find himself put to a stand. He will then, perhaps for the first time, try to form a distinct conception of an expansive fluid, and its manner of operation. He will naturally think of air, and will reflect on the manner in which air actually expands or occupies more room; and he will thus contemplate local motion and mechanical pressure. He will find, too late, that this gives him no assistance; because the phenomena which he has been accustomed to explain by the expansiveness of fluids have no resemblance whatever to what we see result from the actual expansion of air. Experience has made him acquainted with many effects which the air produces during its expansion; but they are of a totally different kind from those which he thought that he had sufficiently explained by the expansiveness of fire. The only resemblance he observes is, that the air and the heat, which were formerly perceived only in a small space, now appear in a much larger space. The mathematician now desires him to tell in what manner he conceives this expansiveness, or this actual expansion of air or gas. The chemist is then obliged to consider the air or gas as consisting of atoms or particles, which must be kept in their present situation by an external force, the most familiar of all to his imagination, namely, pressure; and all pressures are equally fit. Pressure is a moving force, and can only be opposed to such another moving force; therefore expansiveness supposes, that the particles are under the influence of something which would separate them from each other, if it were not opposed by something *perfectly of the same kind.* It cannot be opposed by greenness, nor by loudness, nor by fear, but only by what is competent to the production of motion; and it may be opposed by any *such* natural power; therefore by gravity, or by magnetism, or electricity, or corpuscular attraction, or by an elective attraction. The chemist, being thus led to the contemplation of the phenomenon in its most simple state, can now judge with some distinctness, what is the nature of those powers with which expansiveness can be brought to co-operate or combine. And only now will he be able to speculate on the means for explaining the propagation of heat; and he will perceive, that the general laws of motion, and of the action of moving forces (doctrines which we comprehended under the title of DYNAMICS, *Suppl.)* must be resorted to for a *complete* explanation of all chemical phenomena. The same may be said of the phenomena perceived in the growth of vegetables and animals. All of them lead us ultimately to the contemplation of an atom, which is characterised by being susceptible of local motion, and requires for this purpose the agency of what we call a moving force.

We would distinguish this particular OBJECT of our CONTEMPLATION (consisting of two constituent parts, the atom and the force, related, in fact, to each other by constant conjunction) by the term MECHANISM. We conceive it to be the characteristic of what we call MATTER; and we would consider it as the most simple MECHANICAL PHENOMENON. We are disposed to think, that this moving force is as simple and uniform as the atom to which it is related; and we would ascribe the inconceivable diversity of the moving forces which we see around us to combinations of this universal force exerted by many atoms at once; and therefore modified by this combination, in the very same manner as we frequently see those seemingly different moving forces combine their influence on a sensible mass of tangible matter, giving it a sensible local motion. Having formed such notions, we would say that we do not conceive either the atom or the force as being matter, but the two thus related. And we would then say, that whatever object of contemplation does not ultimately lead us to this complex notion is IMMATERIAL; meaning by the epithet nothing more than the negation of this particular character of the object. It is equivalent to saying, that the phenomenon does not lead the mind to the consideration of an atom actuated by a moving force; that is, moved, or prevented from moving, by an opposite pressure or force.

Such is the extension which the discoveries of last century have enabled us to give to the use of the term mechanism, mechanical action, mechanical cause, &c.

The Greeks, from whom we have borrowed the term, gave it a much more limited meaning; confining it to those motions which are produced by the intervention of machines. Even many of the naturalists of the present day limit the term to those motions which are the *immediate* consequences of impulse, and which are cases of sensible motion. Thus the chemist says, that printers ink is a mechanical fluid, but that ink for writing is a chemical fluid. We make no objection to the distinction, because chemistry is really a vast body of real and important science, although we have, as yet, been able to class only very complicated phenomena, and are far from the knowledge of its elements. This distinction made by the chemists is very clear, and very proper to be kept in view; but we should be at a loss for a term to express the analogy which is perceivable between these sensible motions and the hidden motions which obtain even in the chemical phenomena, unless we give mechanism a still greater extension than the effects of percussion or impulsion.

Mechanics, in the ancient sense of the word, considers only the energy of *organa*, machines. The authors who have treated the subject systematically, have observed, that all machines derive their efficacy from a few simple forms and dispositions, which may be given to that piece of matter called the tool, Ὄργανον, or *machine*, which is interposed between the workman or natural agent, and the task to be performed, which is always something to be moved, in opposition to resisting pressures. To those simple forms they have given the name of MECHANICAL POWERS, simple powers, simple machines.

The machine is interposed for various reasons.

1. In order to enable a natural power, having a certain determinate intensity, which cannot be increased, to balance or overcome another natural power, acting with a greater intensity. For this purpose, a piece of solid matter is interposed, connected in such a manner with firm supports, that the pressure exerted on the impelled point by the power occasions the excitement of a pressure at the working point, which is equal or superior to the resistance, arising from the work, to the motion of that point. Thus, if a rod three feet long be supported at one foot from the end to which the resistance of two pounds is applied, and if a pressure of one pound be applied to the other end of the rod, perpendicular to its length, the cohesive forces which connect the particles of the rod will all be excited, in certain

Mechanics.

tain proportions, according to their ſituation, and the ſupported point will be made to preſs on its ſupport as much as three pounds would preſs on it; and a preſſure in the oppoſite direction will be excited at the working point, equal to the preſſure of two pounds. The reſiſtance will therefore be balanced, and it will be overcome by increaſing the natural power acting on the long diviſion of the rod. This is called a LEVER. Toothed wheels and pinions are a perpetual ſucceſſion of levers in one machine or mechanical power.

2. The natural power may act with a certain velocity which cannot be changed, and the work requires to be performed with a greater velocity. A machine is interpoſed, moveable round a fixed ſupport, and the diſtances of the impelled and working points are taken in the proportion of the two velocities. Then are we certain, that when the power acts with its natural velocity, the working point is moving with the velocity we deſire.

3. The power may act only in one unchangeable direction, and the reſiſtance muſt be overcome in another direction. As when a quantity of coals muſt be brought from the bottom of a pit, and we have no power at command but the weight of a quantity of water. We let the water pull down one end of a lever, either immediately or by a rope, and we hang the coals on the other end, while the middle point is firmly ſupported. This lever may be made perpetual, by lapping the ropes round a cylinder which turns round an axis firmly ſupported. This is a FIXED PULLEY. We can ſet unequal powers in oppoſition, by lapping each rope round a different cylinder, having the ſame axis. This is a WINDLASS or GIN. All theſe forms derive their energy from the lever virtually contained in them.

Any of theſe three purpoſes may be gained by the interpoſition of a ſolid body in another way. Inſtead of being ſupported in one point, round which it is moveable, it may be ſupported by a ſolid path, along which it is impelled, and by its ſhape it thruſts the reſiſting body out of its way. This is the caſe with the WEDGE when it is employed to force up a ſwagging joiſt, or preſs things ſtrongly together. If this wedge be lapped or formed round an axis, it becomes a SCREW or a SPIRAL WIPER. This is alſo the operation of the balance wheel of a horizontal or cylinder watch. The oblique face of the tooth is a wedge, which thruſts the edge of the cylinder out of its way. The pallet of a clock or watch is alſo a wedge, acted on in the oppoſite direction.

Theſe are the different forms in which a ſolid body is interpoſed as a mechanic power. All are reducible to the lever and the wedge.

But there are other mechanic powers beſides thoſe now mentioned. The carmen have a way of lowering a caſk of liquor into a cellar, by paſſing a rope under it, making the end faſt to ſome ſtake cloſe to the ground, and bringing the other end of the rope round the caſk, and thus letting it ſlip down in the bight of the rope. In this proceſs they feel but half of its weight, the other half being ſupported by the end of the rope that is faſtened to the ſtake. This is called a PARBUCKLE by the ſeamen. A hanging pulley is quite the ſame with this more artleſs method. The weight hangs by the axis of the pulley, and each half of the hanging rope carries half of the weight, and the perſon who pulls one of them upwards acts only againſt half of the weight, the other being carried by the hook to which the ſtanding rope is faſtened. This mechanical power does not (as is commonly imagined) derive its efficacy from the pulley's turning round an axis. If it were made faſt, or if the tackle rope merely paſſed through a loop of the rope which carries the weight, it would ſtill require only half of the weight acting on the running rope to balance it. The uſe of the motion round an axis is merely to avoid a very great friction. When the two hanging parts of the rope are not parallel, but inclined in any angle, the force neceſſary for balancing the weight is to the weight as the ſide is to the diagonal of the parallelogram formed by the directions of the three ropes. Varignon calls this the FUNICULAR MACHINE or power. Our ſailors call it the SWIGG.

Mechanics, ‖ Mecklenburg.

We may employ the *quaqua verſum* preſſure of fluidity with great effect as a mechanic power. Thus, in the hydroſtatic bellows deſcribed by Graveſande, § 1451, and by Deſaguilliers, the weight of a few ounces of water is made to raiſe ſeveral hundred pounds. In like manner, Dr Wallis of Oxford, by blowing with a pipe into a bladder, raiſed 64 pounds lying on it. Otto Guericke of Magdeburgh made a child balance, and even overcome, the pull exerted by the emperor's ſix coach horſes, by merely ſucking the air from below a piſton. Mr Bramah, ironmonger in Piccadilly, London, has lately obtained a patent for a machine acting on this principle as a preſs.* A piſton of one fourth of an inch in diameter, forces water into a cylinder of 12 inches diameter, and by this intervention raiſes the piſton of the cylinder. A boy, acting with the fourth part of his ſtrength on the ſmall piſton by means of a lever, raiſes 42 tons, or 94,080 libs, preſſing on the great piſton. It is very ſurpriſing, that this application of the *quaqua verſum* preſſure of fluids has been overlooked for more than a century, although the principle has been inculcated and lectured on by every itinerant teacher, and illuſtrated by the above mentioned experiments of Graveſande and Wallis: nay, it has been expreſsly taught as a mechanic power of great efficacy by the Profeſſor of Natural Philoſophy at Edinburgh every ſeſſion of the college for theſe twenty years paſt, but he never thought of putting it in practice. It forms a moſt compendious machine of prodigious power, and is ſuſceptible of the greateſt ſtrength. If the ſame multiplication of power be attempted by toothed wheels, pinions, and racks, it is ſcarcely poſſible to give ſtrength enough to the teeth of the racks, and the machine becomes very cumberſome and of great expence. But Mr Bramah's machine may be made abundantly ſtrong in very ſmall compaſs. It only requires very accurate execution. We give it all praiſe: but Mr Bramah is miſtaken when he publiſhes it as the invention or diſcovery of a new mechanic power: for it has been familiar to every ſtudent of mechanics and hydroſtatics ever ſince Boyle's firſt publication of his hydroſtatic paradoxes.

* See MACHINERY in this Suppl.

MECHOACAN, an Epiſcopal city and capital of the province of its name, ſituated on a large river, well ſtored with fiſh, near the weſt ſide of a lake, about 120 miles weſt of Mexico. It is a large place, having a fine cathedral and handſome houſes belonging to rich Spaniards, who own the ſilver mines at Guanaxoato or Guaxaſiata.—*Morſe.*

MECKLENBURG, a county of Virginia, bounded south by the State of N. Carolina. It contains 14,733 inhabitants, of whom 6,762 are slaves.—*ib.*

MECKLENBURG, a county of North Carolina, in Salisbury district, bounded south by the State of S. Carolina. It contains 11,395 inhabitants, of whom 1,603 are slaves. Chief town, Charlotte.—*ib.*

MECOWBANISH, a lake in N. America, in 49° N lat.—*ib.*

MEDFIELD, a township in Norfolk county, Massachusetts, 20 miles south-westerly of Boston. It was incorporated in 1650, and contains 731 inhabitants. —*ib.*

MEDFORD, a pleasant, thriving, compact town in Middlesex county, Massachusetts, 4 miles north of Boston, situated on Mystick river, 3 miles from its mouth. Here are several distilleries and brick works which give employment to a considerable number of people. The river is navigable for small vessels to this place. The township was incorporated in 1630, and contains 1,029 inhabitants, who are noted for their industry.—*ib.*

MEDICAL JURISPRUDENCE. See *MEDICINA Forensis* in this *Suppl.*

MEDICI, is the name of an illustrious family in Florence, which contributed more than perhaps any other family whatever to the revival of letters in Europe. To trace this family from its origin, or even to give biographical sketches of all the great men whom it produced, would occupy by far too great a part of our work; for, during some centuries, almost every individual of the house of Medici was distinguished among his contemporaries. That house, after having rendered itself memorable in the annals of Florence, for opposing the encroachments of the nobles on the liberties of the people, had lost much of its influence under the aristocratic government of the Albizi, when it was raised to a rank superior to what it had ever held, by

Giovanni de MEDICI, who was born in the year 1360. This man determined to restore his family to splendour; but, conscious of his critical situation, surrounded as he was by powerful rivals and enemies, he affected rather a secure privacy than a dangerous popularity. Even when raised to the office of gonfalonier, or generalissimo of the republic, he carefully avoided any desire of partaking in the magistracy, and seemed to be entirely engrossed by merchandize, which he extended from the East throughout Europe. This conduct, as on one hand it threw his enemies off their guard, on the other, enabled him to acquire an immense fortune, of which he made a proper disposition amongst all ranks of people.

Many, even of the ruling party, either gained by his liberality, or pleased with his amiable and retired conduct, proposed to the seigniory to admit him into the magistracy; and though the proposal met with great opposition, it was carried in the affirmative.

It was by rashly declaring for the plebeians against the nobles that an ancestor of Giovanni's had lost to his family their rank in the state. Giovanni, resolving not to split on the same rock, continued to affect privacy and retirement, accepting any office in the state with the utmost appearance of reluctance, and never attending at the Palazzo, unless particularly sent for by the seigniory. Rising by these means in the esteem of the people, his enemies became, of course, unpopular; and having obtained a decided superiority over his opponents, he now ventured to procure, that those taxes which the nobles had exacted with the utmost severity and partiality from the people alone, should be levied upon the two first orders, in common with the plebeians: and that a law should be ordained, by which personal property might be taxed.

The nobles seeing, with the deepest concern, their consequence so sensibly wounded, and their power so much diminished, held several consultations in private how they might effect his ruin; but their want of unanimity prevented any thing decisive from being carried into execution. The people, alarmed for the safety of their leader and patron, offered him the sovereignty, which his relations and friends urged him to accept; but this his prudence forbad him to take, as with the title of lord he would have gained also that of tyrant. Thus, by his singular prudence, he died possessed of all the power of the state, with the affectation of being the most disinterested citizen in the commonwealth. His death happened in the year 1428.

Giovanni was graceful in his person, and his affability to all established his character for moderation. His extensive knowledge and pleasantry made his company eagerly sought. As all his actions were placid and serene, he was not in want of that trumpet of sedition, popular declamation, which he never attempted. Much to his honour, his elevation was not procured even by the banishment of a single individual; a circumstance until then unknown in Florence, where every new administration was marked with the ruin of families, and by scaffolds stained with blood.

"The maxims (says Mr Roscoe) which, uniformly pursued, raised the house of Medici to the splendour which it afterwards enjoyed, are to be found in the charge given by this venerable old man, on his deathbed, to his two sons Cosmo and Lorenzo. 'I feel (said he) that I have lived the time prescribed me. I die content, leaving you, my sons, in affluence and in health, and in such a station, that, whilst you follow my example, you may live in your native place honoured and respected. Nothing affords me more pleasure than the reflection, that my conduct has given offence to no one; but that, on the contrary, I have endeavoured to serve all persons to the best of my abilities. I advise you to do the same. With respect to the honours of the state, if you would live with security, accept only such as are bestowed on you by the laws, and the favour of your fellow-citizens; for it is the exercise of that power which is obtained by violence, and not of that which is voluntarily given, that occasions hatred and contention."

MEDICI (Cosmo de), the eldest son of the preceding, was born in 1389. During the life-time of his father, he had engaged himself deeply, not only in the extensive commerce by which the family had acquired its wealth, but in the weightier matters of government. When Giovanni died he was in the prime of life; and though his complexion was swarthy, he had an agreeable person, was well made, of a proper stature, and in conversation united a happy intermixture of gravity with occasional sallies of pleasantry and repartee. His conduct was uniformly marked by urbanity and kind-

Medici. nefs to the fuperior ranks of his fellow-citizens, and by a conftant attention to the interefts and the wants of the lower clafs, whom he relieved with unbounded generofity. By thefe means he acquired numerous and zealous partizans of every denomination; but he rather confidered them as pledges for the continuance of the power which he poffeffed, than as inftruments to be employed in extending it to the ruin and fubjugation of the ftate. An interchange of reciprocal good offices was the only tie by which the Florentines and the Medici were bound; and perhaps the long continuance of this connection may be attributed to the very circumftance of its being in the power of either of the parties at any time to have diffolved it.

But the prudence and moderation of Cofmo could not reprefs the ambitious defigns of thofe rival families, who wifhed to poffefs or to fhare his authority. In the year 1433, Rinaldo de Albizi, at the head of a powerful party, carried the appointment of the magiftracy. At that time Cofmo had withdrawn to his feat in the country, to avoid the difturbances which he faw likely to enfue; but at the requeft of his friends he returned to Florence, where he was led to expect fuch a union of parties, as might at leaft preferve the peace of the city. No fooner did he make his appearance in the palace, where his prefence had been requefted, on pretence of his being intended to fhare in the adminiftration of the republic, than he was feized upon by his adverfaries, and committed to prifon.

The confpirators were divided in their opinions as to the difpofal of their prifoner. Moft of them inclined to follow the advice of Peruzzi, who recommended taking him off by poifon. Cofmo, confined in the Alberzettino, a room in one of the turrets of the Palazzo, could hear this dreadful confultation, which was determining, not in what manner he fhould be tried, but in what manner he fhould be put to death; and finding that he was to die by an infufion of poifon fecretly adminiftered to him, a fmall portion of bread was the only food which he thought proper to take.

Cofmo lived in this manner four days; and, fhut up from all his kindred and friends, he foon expected to be numbered with the dead; but here, as it fometimes happens, he found relief where leaft expected, from the man who had been engaged to take him off. Malavolta, the keeper of the prifon, either from compunction, diffatisfaction, or the youth and misfortunes of the illuftrious fufferer, relented; and inftead of purfuing any criminal intentions againft the life of Cofmo, after upbraiding him with entertaining fo unworthy an opinion of him, declared that his fears were entirely groundlefs. To convince him of this, he fat down, and partook of every thing the prifoner chofe to eat of. The expreffions of gratitude, together with his moft engaging manners, and great promifes, entirely won Malavolta, who, to ingratiate himfelf ftill farther in the good opinion of Cofmo, invited Fargaccio, the moft celebrated wit in Florence, to dine with him the next day, from the idea that his fprightly mirth would contribute to lighten his misfortunes.

In the mean time, his brother Lorenzo, and his coufin Averardo, having raifed a confiderable body of men in Romagna and other neighbouring diftricts, and being joined by the commander of the troops of the republic, approached towards Florence to his relief. The apprehenfion, however, that the life of Cofmo might be endangered, if they fhould proceed to open violence, induced them to abandon their enterprife. At length Rinaldo and his adherents obtained a decree of the magiftracy, by which Cofmo was banifhed to Padua for ten years, his brother to Venice for five years; and feveral of their relations and adherents fhared the fame fate.

Cofmo received this determination of his judges with a compofure that gained him the compaffion and the admiration of many of his moft inveterate enemies. He would gladly have left the city purfuant to his fentence; but he was detained by his enemies till their authority fhould be eftablifhed: and it was not till he thought of bribing the gonfalonier, and another creature of Rinaldo's, that he was privately taken from his confinement, and conducted out of Florence.

Padua, to which he was confined by his fentence, was in the dominions of Venice; but before he could reach that place, he received a deputation from the fenate, the purport of which was to condole with him for his misfortunes, and to promife him their protection and affiftance in whatever he fhould defire. He experienced the treatment of a prince rather than that of an exile. Nor were that wife people without good reafons for fuch a conduct. Venice had long regarded Florence as her rival in commerce, and hoped, by conferring upon Cofmo the moft flattering diftinctions, to prevail upon him to refide there in future; prudently fuppofing, that the manufactories of Florence, and the great commerce the Medici had carried on throughout Italy, and extended far beyond it to the wealthieft kingdoms in Europe, would become their own by enrolling him amongft their fubjects.

The readinefs with which Cofmo had given way to the temporary clamour raifed againft him, and the reluctance which he had fhewn to renew thofe rencounters which had fo often deluged the ftreets of Florence with blood, gained him new friends, even during his exile. The utmoft exertions of his antagonifts could not long prevent the choice of fuch magiftrates as were known to be attached to the caufe of the Medici; and no fooner did they enter on their office, than Cofmo and his brother were recalled, and Rinaldo with his adherents were compelled to quit the city. This event took place about a year after the banifhment of Cofmo.

The fubfequent conduct of this great man (for great all allow him to have been) has been painted in different colours by different writers. Mr Noble, after Machiavel, compares his cruelties to his fallen foes with thofe of Sylla and Octavius to the partizans of Marius and Brutus; whilft Rofcoe reprefents his conduct as in a high degree amiable and generous. It appears to us evident, from his own words, that he had exercifed fome cruelties on his exiled enemies; for when one of them wrote to him, that "the hen was hatching," he replied "She will have but a bad time of it, fo far from her neft." When fome other exiles acquainted him that "they were not afleep," he anfwered, "he could eafily believe that, for he thought he had fpoiled their fleeping." At another time, fome of the citizens remonftrated with him upon the odioufnefs of his conduct in banifhing fo many perfons; telling him, "the republic would be extremely weakened, and God offended, by the expulfion of fo many good and pious men as he was

 fend-

fending into banishment." His answer was, "It would be better for the republic to be weakened than utterly ruined; that two or three yards of fine cloth made many a one look like a good man; but that states were not to be governed or maintained by counting a string of beads, and mumbling over a few *Pater nosters*."

From this time the life of Cosmo de Medici was an almost uninterrupted series of prosperity. His misfortunes had taught him, that the affectation of grandeur is more dangerous in a free state than usurpation. He adopted, therefore, the dress, behaviour, and manners, of a private citizen. His clothes were of the same fashion and materials as the rest of the Florentines. In the streets he walked alone and unguarded. His table was supplied from what his estate of Mugello produced, nor had he one servant more than was absolutely necessary; thus endeavouring to unite the character of a prince with that of a merchant, and a private person in a republic.

Whilst he rejected all offices in the magistracy, no business was transacted without its being first settled at Mugello: nor did he contract any alliances but with the sons and daughters of the citizens of Florence; yet all foreign princes and courts paid his children the respect due only to those of sovereigns; and the family of Cosmo received educations equal to those of the greatest potentates.

A proper judgment may be formed of his immense traffic, and the prodigious advantages accruing from it: For though a private citizen of Florence only, yet he possessed at one time more money than what was in all the treasuries of the different sovereigns in Europe. When Alfonso king of Naples leagued with the Venetians against Florence, Cosmo called in such immense debts from those places, as deprived them of resources for carrying on the war. During the contest between the houses of York and Lancaster, he furnished Edward IV. with a sum of money so great, that it might almost be considered as the means of supporting that monarch on the throne.

In his public and private charities, in the number and grandeur of the edifices he erected, not only in Florence, but in the most distant parts of the world, and in the foundations which he endowed, he seemed to more than vie with majesty. He supplied most of the exigencies of the state from his private purse; and there were few citizens that had not experienced his liberality, and many without the least application, particularly the nobles.

But in nothing did his munificence produce so much good to the world, or acquire such honour to himself, as when it was exerted for the promotion of science, and the encouragement of learned men; and upon nothing did Cosmo delight so much to exert it. The study of the Greek language had been introduced into Italy towards the latter part of the preceding century; but it had again fallen into neglect. After a short interval, an attempt was made to revive it, by the intervention of Emanuel Chrysoloras, a noble Greek, who taught that language at Florence, and other cities of Italy, about the beginning of the 15th century. His disciples, who were numerous and respectable, kept the flame alive till it received new aid from other learned Greeks, who were driven from Constantinople by the dread of the Turks, or by the total overthrow of the Eastern Empire. To these illustrious foreigners, as well as to the learned Italians, who shortly became their successful rivals, even in the knowledge of their national history and language, Cosmo afforded the most liberal support and protection. The very titles of the works of ancient authors, which were brought to light by his munificence, would extend this article beyond its proper limits. Such, indeed, was the estimation in which these works were then held in Italy, that a manuscript of the history of Livy, sent by Cosmo de Medici to Alfonso king of Naples, with whom he was at variance, conciliated the breach between them.

As the natural disposition of Cosmo led him to take an active part in collecting the remains of the ancient Greek and Roman writers, so he was enabled by his wealth, and by his extensive mercantile intercourse with different parts of Europe and of Asia, to gratify a passion of this kind beyond any other individual. To this end he laid injunctions on all his friends and correspondents, as well as on the missionaries and preachers who travelled into the remotest countries, to search for and procure ancient manuscripts, in every language, and on every subject. The situation of the Eastern Empire, then falling into ruins, afforded him an opportunity of obtaining many inestimable works in the Hebrew, Greek, Chaldaic, Arabic, and other eastern languages. From these beginnings arose the celebrated library of the Medici; which, after various vicissitudes of fortune, and frequent and considerable additions, has been preserved to the present times under the name of the *Bibliotheca Mediceo Laurentiana*.

Nor was Cosmo a mere collector of books, he was himself, even in old age, a laborious student. Having been struck with the sublime speculations of Plato, which he had heard detailed in lectures by a Greek monk, who had come from Constantinople to the council of Florence, he determined to found an academy for the cultivation of that philosophy. For this purpose he selected Marsilio Ficino, the son of his favourite physician, and destined him, though very young, to be the support of his future establishment. The education of Ficino was entirely directed to the Platonic philosophy; nor were the expectations which Cosmo had formed of him disappointed. The Florentine academy was some years afterwards established with great credit, and was the first institution in Europe for the pursuit of science, detached from the scholastic method then universally adopted. It is true, the fanciful doctrines of Plato are as remote from the purposes of life as the subtleties of Aristotle; but, by dividing the attention of the learned between them, the dogmas of the Stagyrite were deprived of that servile respect which had so long been paid to them, and men learned by degrees to think for themselves.

The fostering hand of Cosmo was held out to art as well as to science; and architecture, sculpture, and painting, all flourished under his powerful protection. The countenance shewn by him to these arts was not such as their professors generally receive from the great. It was not conceded as a bounty, nor received as a favour, but appeared in the friendship and equality that subsisted between the artist and his patron; and the sums of money, which Cosmo expended on pictures, statues, and public buildings, appear almost incredible.

Cosmo now approached the period of his mortal existence:

Medici.

istence: but the faculties of his mind remained unimpaired. About twenty days before he died, he sent for Ficino, and enjoined him to translate from the Greek the treatise of Xenocrates on death. Calling into his chamber his wife and his son Piero, he entered into a narrative of all his public transactions; in which he gave a full account of his extensive mercantile connections, and adverted to the state of his domestic concerns. To Piero he recommended a strict attention to the education of his sons; and requested, that his funeral might be conducted with as much privacy as possible. He died on the first of August 1464, at the age of 75 years, deeply lamented by a great majority of the citizens of Florence. Their esteem and gratitude had indeed been fully shewn some time before, when, by a public decree, he was honoured with the title of *Pater Patriæ*, an appellation which was inscribed on his tomb; and which, as it was founded, says Roscoe, on real merit, has ever since been attached to the name of Cosmo de Medici.

Medici (Lorenzo de), justly styled the *magnificent*, was the grandson of Cosmo, and about 16 years of age when his grandfather died. His father Piero de Medici, though possessed of more than ordinary talents, as well as of a very considerable share of worth, was, from various circumstances, little qualified to maintain the influence which his family had gained in the republic of Florence. From very early life he had been tortured by the gout; and almost uninterrupted pain had made him peevish. Such a disposition was not calculated to retain the affections of the giddy Florentines, or to persuade republicans that they were free, while they submitted to the government of a single individual. All this Cosmo had foreseen, and had done what wisdom could do to preserve to his family that ascendency in the republic which he had himself acquired. He exhorted Piero to bestow the utmost care on the education of his sons, of whose capacity he expressed a high opinion; he recommended to him Diotisalvo Neroni, a man whom he had himself raised from obscurity to an eminent rank, as a counsellor, in whose wisdom and fidelity he might place the utmost confidence: and to bind the inhabitants of Florence to the house of Medici by the strongest of all ties, he had distributed among them, under the denomination of loans, immense sums, which he knew they would not soon be able to repay.

Piero paid the utmost deference to the dying injunctions of his father. He had himself an ardent love of letters; and under the eye of the venerable Cosmo, he had given his two sons, Lorenzo and Juliano, the best possible domestic education. In the Greek language, in ethics, and in the principles of the Aristotelian philosophy, Lorenzo, the eldest, had the advantage of the precepts of the learned Argyropylus (A), and in those of the Platonic sect he was sedulously instructed by Marsilio Ficino (see Ficinus, *Encycl.*); but for his most valuable accomplishments he was not indebted to any preceptor. To complete his education, however, it was judged expedient that he should visit some of the principal courts of Italy; and very soon after the death of his grandfather, he repaired to Rome, Bologna, Ferrara, Venice, and Milan, where he gained the esteem of all whose esteem was of value.

Thus attentive was Piero to the advice of his father with respect to the education of his eldest son; nor was he less attentive to it in the choice of his principal counsellor. He intrusted the whole of his affairs into the hands of Neroni, and gave him Cosmo's accounts to peruse and settle. That ambition, which perhaps had lain lurking in this man's mind, was now called forth, and he basely formed the scheme of ruining the son of his patron, by building upon his misfortunes his own future grandeur. For this purpose, he lamented the absolute necessity there was for an immediate call upon those who were indebted to Piero as Cosmo's representative; telling him, that a delay might subject him to the greatest inconveniences. Piero consented, though with reluctance, to his supposed friend's advice. The result was such as Neroni expected. Those who were friends of the father became enemies of the son; and had not Piero discovered the snare, and desisted from such rigorous proceedings, he might have found, when too late, that in supporting the character of the merchant, he had forgotten that of the statesman; for all the citizens of Florence were his debtors.

Soon after this, an attempt was made to assassinate Piero, by a powerful party which had always been inimical to the house of Medici; but it was defeated by Lorenzo, who displayed on that occasion a sagacity and promptitude of mind which would have done honour to the oldest statesman. A few of the conspirators were declared enemies to the state, and condemned to banishment; but by far the greater part of them were pardoned on the solicitation of Lorenzo, who declared, that "he only knows how to conqner, who knows how to forgive."

In the year 1469 Piero de Medici died; and Lorenzo succeed to his authority as if it had been a part of his patrimony, being requested by the principal inhabitants of Florence, that he would take upon himself the administration of the republic in the same manner that his grandfather and father had done.

In the month of December 1470, a league was solemnly concluded between the pope, the king of Naples, the duke of Milan, and the Florentines, against Mahomet II. who had vowed not to lay down his arms till he had abolished the religion of Christ, and extirpated all his followers. The pope, however (Paul II.), died on the 26th of July 1471; and Sixtus IV. succeeding to the chair of St Peter, Lorenzo was deputed from Florence to congratulate him on his elevation. Two more opposite characters can hardly be conceived than those of Sixtus and Lorenzo. The former was cruel, treacherous, and sordid; the latter was merciful, candid, and generous. Yet such instances of mutual good will took place between them on this occasion, that Lorenzo, who, under the direction of his agents, had a bank established at Rome, was formally invested with the office of treasurer of the Holy See.

Pisa had been under the dominion of Florence from the

(A) This man had fled from Constantinople, when it was taken by the Turks, to Florence, where he was protected by Cosmo de Medici.

Medici.

the year 1406, and it had acquired some celebrity on account of its academy, which had existed almost two centuries. That academy, however, had fallen into decay; and, in the year 1472, the Florentines resolved to restore it to its pristine splendour. Five citizens, of whom Lorenzo de Medici was one, were appointed to superintend the execution of their purpose; but Lorenzo, who was the projector of the plan, undertook the chief management of it; and, in addition to 6000 florins annually granted by the state, expended, in effecting his purpose, a large sum of money from his private fortune. In doing this, he only imitated the example of his father and grandfather; for in the course of 37 years, reckoning from the return of Cosmo from banishment, this illustrious family had expended on works of charity or public utility upwards of 660,000 florins. "Some persons (said Lorenzo) would perhaps be better pleased to have a part of it in their purse; but I conceive that it has been of great advantage to the public, and well laid out, and am therefore perfectly satisfied."

In the year 1474, Lorenzo incurred the displeasure of the pope for opposing some of his encroachments on the petty princes of Italy; and the revenge planned by Sixtus was of such a nature as would have disgraced, we do not say a Christian bishop, but the rudest savage. He began by depriving Lorenzo of the office of treasurer of the Roman See, which he gave to the Pazzi, a Florentine family, who as well as the Medici, had a public bank at Rome. By this step he secured the interest of the Pazzi, who, it is probable, were to govern Florence under the pope, when Lorenzo and Juliano de Medici should be cut off, and their friends and adherents driven from the republic. The principal agent engaged in the undertaking was Fransesco Salviati archbishop of Pisa, to which rank he had lately been promoted by Sixtus, in opposition to the wishes of the Medici. The other conspirators were Giacopo Salviati, brother to the archbishop; Giacopo Poggio, one of the sons of the celebrated Poggio Bracciolini (see POGGIUS, *Encycl.*); Barnardo Bandini, a daring libertine, rendered desperate by the consequence of his excesses; Giovanni Battisti Montesicco, who had distinguished himself as general of the pope's armies; Antonio Maffei, a priest of Volterra; and Stephano de Bagnona, one of the apostolic scribes; with several others of inferior note. The cardinal Riario, then at Pisa, was likewise an instrument in the conspiracy; but he can hardly be considered as an agent, for he was kept ignorant of what was going on, and enjoined only to obey whatever directions he might receive from the archbishop of Pisa.

The assassination of the illustrious youths was fixed for Sunday, April 26. 1478; the place the cathedral of Florence, at the moment the host was to be elevated; and their murder was to be the signal for seizing and expelling from the walls of the city all their relations and friends. What a transaction this for one who presumed to style himself the vicar of Christ, the common father of Christendom, to patronize!

The fatal day arrived, and Lorenzo was already in the church; but Juliano remained at home, occasioned by a slight indisposition. The conspirators, determining not to lose one of their victims, went to invite, to intreat him, to go. They embraced (B), and led him, by a tender violence, to the cathedral. The signal was given by the elevation of the consecrated wafer; and whilst the people fell upon their knees to adore, the assassins rose, and, as was concerted, two of them, Francisco Pazzi and Barnardo Bandini, fell upon Juliano. The latter directed his poignard so truly, that it entered into the bosom of the unoffending youth, and he fell mortally wounded at his feet.

In a moment, as must be supposed, all was confusion. Lorenzo, alarmed, put himself in a posture of defence, when, in an instant, Antonio of Volterra, and Stephano a priest, the dependant of the archbishop, who, upon Giovanni Battisti's declining the infamous task, undertook his destruction, rushed upon him as their destined prey. The contest continued some time. Lorenzo had received a wound in his neck, and seemed to contend for his life in vain; but a servant, whom he had lately relieved from prison, inspired by gratitude, heroically threw himself between his beloved lord and his assassins receiving in his body those weapons that were aimed at the breast of Lorenzo. This fidelity saved him; for by one vigorous effort he broke from Antonio and Stephano, and with a few friends rushed into the sacristy, shutting the doors behind them, which were of brass. Apprehensions being entertained, that the weapon which had wounded him was poisoned, a young man sucked the wound, endangering his own life to save that of Lorenzo.

The rage of the people to see one of their favourites expiring, and the other covered with blood, was inexpressible. The cardinal Riario found it difficult to save his life at that altar which he had stained by so horrid a deed, and to which he then fled for protection.

Whilst this infamous scene was acting in the cathedral, others of the conspirators were attempting to seize the Palazzo; but with no better success. The archbishop Salviatti, who had undertaken to head them, gave the magistrates suspicion by those violent emotions which agitated his whole frame. The nine senators who composed the magistracy, including the gonfalonier, who had been appointed by, and were, in other words, the privy council of the Medici, immediately attacked those who intended to have surprised them; and Salviatti and his followers had no sooner gained the second floor, than they found themselves prisoners.

Jacobo Pazzi soon appeared in the street, proclaiming, with exultation, the murder of Juliano; and inviting the Florentines to free themselves from the Medicean slavery; but perceiving that he was not joined by the people, the magistrates sent off 100 horse to the rescue of Lorenzo. This was the more to be commended, because they continued to be assaulted by the conspirators, who, finding their situation desperate, forced themselves to the ground floor, determining, if possible, to seize the Palazzo. The magistrates, with their attendants, acted with such resolution and valour, that as often

(B) The assassins embraced Juliano, to discover whether he wore any secret armour, that they might know where to strike with the surest aim.

ten as they gained an entrance, they drove them back, killing some of the assailants upon the spot, others they threw out of the windows upon the pavement; and to strike an awe into those that were without, they had the boldness and virtue to hang the archbishop from one of the windows, dressed as he was in his pontifical robes, with Poggio, another of the chief conspirators. Florence resounded in every part with the exclamation—Medici, Medici! down with their enemies!

Lorenzo was liberated from that part of the cathedral to which he had fled, and conveyed home in triumph, where his wounds were attended to, and where he found himself surrounded by his most valuable friends, to whom he was endeared by the shocking occurrences of the day. His partizans, however, did not spend their time only in lamentations for the death of one of the brothers, and exultations for the preservation of the other; they united in pursuing the conspirators, sparing none that fell into their hands. Jacobo Pazzi was taken flying with his forces into Romania, and immediately hung. An officer of the pope's, who commanded a brigade under count Hirronimo, had alone the favour of decapitation. Bandini fled privately to Pisa, thence to Naples, and, lastly, to Constantinople; but Mahomet, to oblige Lorenzo, seized, and sent him back; and he was hung out of the same window from which the archbishop had suffered. An embassy was sent from Florence to thank the sultan in the name of the republic.

Throughout the whole of this just but dreadful retribution, Lorenzo had exerted all his influence to restrain the indignation of the populace. He entreated that they would resign to the magistrates the task of ascertaining and of punishing the guilty, lest the innocent should be incautiously involved in destruction; and his appearance and admonitions had an instantaneous effect. By his moderation, and even kindness to the relatives of the conspirators, he sought to obliterate the remembrance of past disturbances; and by his interference, even the survivors of the Pazzi were restored to their honours, of which they had been deprived by a decree of the state.

The generosity and moderation of Lorenzo had no effect on the temper of Sixtus, who solemnly excommunicated him, the gonfalonier, the magistrates, and their immediate successors; and in the bull which he issued on this occasion, he styles Lorenzo de Medici "the child of iniquity, and the nursling of perdition!" Not content with this ebullition of resentment, he suspended the bishops and clergy of the Florentine territories from the exercise of their spiritual functions; thus laying the whole republic under an interdict. This had been a formidable weapon in the hands of his predecessors, who had, by means of it, overawed the most powerful monarchs; but the general character of Sixtus was so infamous, and his present injustice so manifest, that by the exertions of the bishop of Arezzo, a convocation was held in the cathedral church of Florence, in which Sixtus was accused of *fornication* and *adultery*, with other infamous vices; declared to be the principal instigator of the conspiracy against the Medici, and the sentence of excommunication which he had fulminated against Lorenzo and the Florentine magistrates was called in direct terms, the "execrable malediction of a damned judge *(maledictam maledictionem damnatissimi judicis)*!

How such language could be reconciled to the notions which then prevailed of the sanctity of the pope, and the plentitude of his power, it is needless to inquire; but the reader will not be surprised that the prelates, who made use of it, paid no regard to the interdict of Sixtus. The pontiff, however, did not relax from his purpose. Whilst he brandished with one hand the spiritual weapon, which the Florentines treated with such contempt, in the other, he grasped a temporal sword, which he now openly, as he had before secretly, aimed at the breast of Lorenzo. At his instigation the king of Naples dispatched an envoy to Florence, to require the citizens to banish Lorenzo from the Tuscan territories, if they would not incur the vengeance both of him and of the pope. These threats produced not the intended effect; for the Florentines avowed their firm resolution to suffer every extremity, rather than betray the man whom they considered as guardian of the republic. War therefore was commenced; and the republic was on the point of being ruined, when Lorenzo taking advantage of a truce, threw himself, with a resolution not to be equalled, into the hands of the king of Naples. He judged, perhaps, that any stipulations for his personal safety would be useless with a prince who had sported with honour, justice, mercy, and the most solemn treaties. But, whilst all viewed him as a victim who had devoted himself to save his country, he, by persuasive eloquence, obtained of this crafty perfidious monarch a separate peace, and returned to Florence crowned with a success that no one thought possible, and where he was received as its tutelar deity. The pope, however, continued inflexible, till a descent of the Turks upon Italy restored him to his senses, and made him willing to receive the submission of Florence, and reconcile its inhabitants to the church.

Soon after the termination of the hostilities between Sixtus and the republic of Florence, Lorenzo began to unfold plans for securing the peace of Italy, which confer the highest honour on his political life. To counterpoise all the jarring interests of the petty states of which that country was composed, to restrain the powerful, succour the weak, and to unite the whole in one firm body which might be able, on the one hand, successfully to oppose the formidable power of the Turks, and, on the other, to repel the incursions of the French and Germans, were the important ends which this great man proposed to accomplish. But before he engaged in these momentous undertakings, he had further personal dangers to encounter. By the instigation of Cardinal Riario, and some Florentine exiles, one Battista Frescobaldi, with only two assistants, undertook to assassinate him in the church of the Carmeli, on the festival of the ascension 1481; but the plot was discovered, the conspirators executed, and Lorenzo henceforth seldom went abroad without being surrounded by a number of tried friends.

Lorenzo was now at liberty to prosecute his benevolent purposes; and after contributing to the expulsion of the Turks from Italy, he set himself in good earnest to support the weak states against the encroachments of the more powerful. This necessarily embroiled the republic at one time with the pope, at another with the king of Naples; now with the Venetians, and then with the Duke of Milan; but when some exclaimed against him as being too precipitate in involving the republic in dangerous and expensive wars, he explained

to

to them the neceſſity of maintaining the balance of power, if they would preſerve the independence of their own ſtate; and ſo completely had he made himſelf maſter of this ſubject that he convinced the moſt incredulous of the propriety of his meaſures, which, in 1488, introduced general tranquillity into Italy.

At this period, the city of Florence was at its higheſt degree of proſperity. The vigilance of Lorenzo had ſecured it from all apprehenſions of external attack; and his acknowledged diſintereſtedneſs and moderation had almoſt extinguiſhed that ſpirit of internal diſſenſion for which it had been ſo long remarkable. The Florentines gloried in their illuſtrious citizen, and were gratified by numbering in their body a man who wielded in his hands the fate of nations, and attracted the reſpect and admiration of all Europe.

Yet amidſt public affairs ſo intricate and ſo momentous, ſuch was the capacity of this man's mind, and ſuch his verſatility of genius, that for the greater part of his life, he carried on a commerce as extenſive as that of his grandfather, whilſt he afforded ſtill greater encouragement to learning and learned men. Coſmo had greatly promoted the ſtudy of the ancient languages and ancient philoſophy. Lorenzo did the ſame thing: but he did much more; he encouraged the cultivation of his own tongue, which had been neglected ſince the age of Petrarca; and by ſetting a great example himſelf, he produced a race of Italian poets, which have hardly been ſurpaſſed in any age or nation. To enumerate even the names of the elegant ſcholars whom he patroniſed, would extend this article far beyond its limits. In the academy of Piſa, of which mention has been already made, the ſtudies were chiefly confined to the Latin language, and to thoſe ſciences of which it was the principal vehicle. At Florence the Greek tongue was taught under the ſanction of a public inſtitution, either by native Greeks or learned Italians, whoſe ſervices were procured by the diligence of Lorenzo de Medici, and repaid by his bounty. He placed Michael Angelo at the head of an academy, which he erected for painting and ſculpture, furniſhing it with the beſt models of antiquity. He built and endowed a public library, and ſent Laſcaris, of imperial deſcent, to Conſtantinople more than once, to procure Greek manuſcripts. For father Moriano, the orator, a monaſtery was built; and Florence owed many of her fineſt edifices to him. Politiano and Ficino were among his moſt intimate friends; and it is not perhaps too much to ſay, that he did more for letters and ſcience and art than any other individual that ever exiſted. His own acquirements in learning were great; and his poetry, of which the reader will find many ſpecimens in the elegant work of Roſcoe, was exquiſite.

Is it ſurpriſing, when we examine Lorenzo's character, that all Italy, all Chriſtendom, even the Mahometans, gave him the moſt flattering marks of approbation, and ſtrove who ſhould oblige him moſt, by preſenting him with whatever was rare and valuable? His palace was conſtantly filled with men famous in every elegant, every uſeful ſcience, and the neighbouring princes flocked to it as to the temple of wiſdom. The celebrated prince of Mirandola, on his account, choſe Florence for his reſidence, and died there.

To a moſt engaging perſon was added each grace, and every accompliſhment. He was the favourite of the ladies, the envy of the men, and the admiration of both. The ſtateſman of his time; unrivalled in chivalry; one of the moſt eminent orators that the world has produced. His poetic merit, with his judgment in, and patronage of that art, procured him the title of "Father of the Muſes." In liberality to his fellow-citizens, as well as in every other reſpect, except as a general, he exceeded even Cæſar himſelf; and had not peace been his dear delight, his talents would have made him a conſummate commander. Yet with all theſe ſuperior accompliſhments, he did not think it beneath him to indulge in amuſements which perſons, leſs wiſe, would have thought an impeachment of their underſtanding, and he would often ſeek pleaſure in his nurſery, ſpending hours there in all the frivolous pranks of childiſh diverſion. In fine, "the gravity of his life, if compared with its levity, muſt make him appear as a compoſition of two different perſons, incompatible, and, as it were, impoſſible to be joined with the other."

Lorenzo, like moſt other great men, had wiſhed to ſpend his laſt years in the tranquillity of retirement. He therefore at an early period wound up his mercantile concerns, and divided his time between the cares of the republic at Florence, and the cultivation of his eſtates in the country. He wiſhed even to diveſt himſelf of all public concerns, and get his ſecond ſon Giovanni admitted into holy orders at the age of ſeven years, that he might be fit for eccleſiaſtical preferment before he ſhould be deprived of the protection of his father. The young eccleſiaſtic, who afterwards made ſuch a figure as Leo X. was accordingly appointed by Louis XI. of France, abbot of Fonte Dolac, before he was eight years of age; and by Innocent VIII. a cardinal, when he was little more than thirteen. This added much to the influence of the family, not only in the Tuſcan ſtates, but through all Italy; and Lorenzo having introduced his eldeſt ſon into public life, and accompliſhed a marriage between him and the daughter of a noble family at Rome, thought he might commit the affairs of the republic in a great meaſure to Piero, and indulge his own taſte in the converſation of his learned friends. This dream of felicity however was not realized. Early in the year 1492, he was attacked by a diſeaſe, under which he had long laboured, with ſuch violence, that on the 8th of April he died in the midſt of his weeping friends, after having taken of them, one by one, an affectionate farewell, and given to his ſon Piero much ſalutary counſel, which he thought not fit to follow.

The character of this great and good man is developed in the detail which we have given of his conduct through life: But it may not be improper to add, that ſuch was the love and veneration of the citizens to him, that the phyſician, who had attended him on his death-bed, afraid to return to Florence, left the houſe in a ſtate of diſtraction, and plunged himſelf into a well. Throughout the reſt of Italy the death of Lorenzo was regarded as a public calamity of the moſt alarming kind. Of the arch which ſupported the political fabric of that country he had long been conſidered as the centre, and his loſs ſeemed to threaten the whole with immediate deſtruction. When Ferdinand king of Naples was informed of the event, he exclaimed, "This man has lived long enough for his own glory, but too ſhort a time for Italy."

Medicina.

MEDICINA FORENSIS, is a phrase used in Germany to denote those parts of anatomical and physiological knowledge, which enable physicians and surgeons to decide certain causes as judges in courts of justice. In that country it has long been law and custom (if we mistake not, by the Caroline code of Charles V.) to refer cases of *poisoning*, *child-murder*, *rape*, *pregnancy*, *impotency*, *ideotism*, &c. to the medical faculty, which, in the universities and some other great towns, is constituted into a kind of court for the trial of such questions. In this country there are no such courts; but in criminal trials medical gentlemen are often called upon to describe the symptoms of *poisoning*, *child-murder*, *rape*, &c. and therefore it becomes them to obtain an accurate knowledge of these symptoms, and to store their memories with a number of minute facts, to which they may have occasion to appeal when giving their evidence.

The importance of this subject induced the professor of the institutes of physic in the university of Edinburgh to resolve lately to read an annual course of lectures on MEDICAL JURISPRUDENCE. This, we doubt not, will prove a valuable course; for though it is hardly conceivable that, under the head *medical jurisprudence*, any *knowledge* can be communicated which a well educated physician would not necessarily have acquired, without attending such a course; yet it is very obvious, that the recollection of the young physician may receive great aid from his listening to the well arranged lectures of an accurate professor. From these lectures he may store his mind with a collection of aphorisms which shall be always ready on the day of examination; or the lectures themselves may be delivered in questions and answers with all the formalities of a criminal court.

We have heard it observed, that to attend a course of such lectures would be of the utmost advantage to all who may be called upon to serve as jurymen in criminal trials; but of the truth of this observation we are more than doubtful. Persons who are only *half* instructed are always conceited of their own attainments; and men not acquainted with anatomy and physiology cannot be *more* than half instructed by the ablest course possible to be given of medical jurisprudence. Such persons indeed can hardly avoid mistaking the sense of the professor's language, however perspicuous that language may be. Of this we had lately a very striking instance. A gentleman, by no means illiterate, though a stranger to anatomical and physiological science, was expatiating to the writer of this article upon the general importance of medical jurisprudence, a course of which, he said, he had attended for the sole purpose of qualifying himself for discharging the important duties of a juryman. Upon being asked what he had learned? he replied, that he had been taught, among other things which we thought frivolous, to discern, from the symptoms of *hanging*, whether the dead man had been hanged by *himself* or by *another*. We need not surely observe, that no such lesson was ever taught in any university, or by any medical lecturer; but it is worthy of consideration, whether lectures on medical jurisprudence may not have the most pernicious effects on the minds of men so little qualified as this gentleman to profit by them. To the regularly educated physician and surgeon such lectures may prove useful; to the plain citizen, not skilled in anatomy and physiology, they must prove dangerous; as their only tendency is to make him despise the evidence given before him by the regular physician or surgeon; to place implicit confidence in his own superficial knowledge; and thus to decide at random on the life or death of his fellow-creature:

A little learning is a dangerous thing;
Drink deep, or taste not the Pierian spring.

Medina, || Medusa.

MEDINA, the capital of the kingdom of Woolli in Africa, is situated in 13° 40′ N. Lat. and 12° 40′ W. Long. It is a place of considerable extent, and may contain from 800 to 1000 houses. It is fortified in the common African manner, by a surrounding high wall built of clay, and an outward fence of pointed stakes and prickly bushes; but the walls are neglected, and the outward fence has suffered considerably from the active hands of busy housewives, who pluck up the stakes for firewood. Mr Park passed through it on his route eastward, and was treated with much kindness both by the king and the people. The good old sovereign warned him of the dangers he was about to encounter, and endeavoured to persuade him to relinquish all thoughts of his journey eastward; but when he could not prevail, he gave him a guide, who conducted him in safety to Koojar, the frontier town of the kingdom towards Bondou, from which it is separated by an intervening wilderness of two days journey. Here our author was presented, by way of refreshment, with a liquor which tasted so much like the strong beer of his native country (and very good beer too), as to induce him to inquire into its composition; and he learned, with some degree of surprise, that it was actually made from corn which had been previously malted, much in the same manner as barley is malted in Great Britain: a root yielding a grateful bitter was used in lieu of hops, the name of which he forgot; but the corn which yields the wort is the *holcus spicatus* of botanists.

MEDOCTU, a settlement in New-Brunswick, situated on the west side of St John's river, 35 miles above St Annes.—*Morse*.

MEDOROSTA, a lake in the north part of the District of Maine, whose northern point is within 8 miles of the Canada line, in lat. 47° 56′, and long. 68° 22′ W. It gives rise to Spey river, which runs S. S. E. into St John's river.—*ib.*

MEDUNCOOK, a plantation in Lincoln county, District of Maine, 230 miles from Boston, having 322 inhabitants.—*ib.*

MEDUSA. In addition to the different species of this genus of vermes described in the *Encyclopædia*, that which is represented in two different attitudes, fig. 1. and 2. and which strongly resembles a bagpipe in shape, may be worthy of notice. It is merely a white transparent vesicle, furnished with several blue tentacles yellowish at their extremity; its long tail, which is also blue, appears to be composed of a number of small glandulous grains, flattened and united together by a gelatinous membrane. The upper part of the vesicle exhibits a kind of seam with alternate punctures of three different sizes; its elongated part, which may be considered as the head of the animal, is terminated by a single trunk, the exterior edge of which is fringed with 25 or 26 tentacles, much smaller than those which originate from the insertion of its long tail, and the number of which sometimes amounts to 30. By means of these Plate XXXVI.

last,

last, the diameter of which it is capable of increasing at pleasure by forcing in a little of the air from its body, it fixed itself to the side of the vessel, in which it was placed, in such a manner as that the extremity of some of its tentacles occupied a surface of two or three lines from its body. The most moveable part of the vesicle is its elongation, or the head of the animal, as it is by means of this that it performs its different motions. The rounded substance, marked by the letter P, is situated in the centre of the larger tentacles, which are firmly fixed to the body of the animal near its tail; and is only an assemblage of a few minute gelatinous globules, from the middle of which arise other larger globules, with a small peduncle, about the middle of which is fixed a curved bluish coloured body, which is represented magnified in two positions at R. Martiniere, the naturalist, who accompanied Perouse in his voyage round the world, met with this animal in about the 20th degree of lat. and 179° of long. east from Paris.

MEDWAY, a township in Norfolk county, Massachusetts, bounded east and south by Charles river, which separates it from Medfield, and of which it was a part until 1713. It has two parishes of Congregationalists, and contains 1,035 inhabitants. It is 25 miles south-west of Boston, on the middle post-road from thence to Hartford.—*Morse.*

MEDWAY, or *Midway*, a settlement in Liberty county, Georgia, formed by emigrants from Dorchester in S. Carolina, about the year 1750, and whose ancestors migrated from Dorchester and the vicinity of Boston about the year 1700. A handsome Congregational meeting-house, belonging to this settlement, was burnt by the British during the war, and the settlement was destroyed. It has since recovered, in a considerable degree, its former importance. Medway is 30 miles south of Savannah, and 9 west of Sunbury.—*ib.*

MEGAMETER, a name sometimes given to the MICROMETER, which see, *Encycl.*

MEHALL, in the language of Bengal, a place or district.

M'KESSENSBURG, a town of Pennsylvania, York county, on Tom's Creek, 40 miles W. S. W. of York.—*Morse.*

MEHERRIN, a principal branch of Chowan river, in N. Carolina, which rises in Charlotte county, Virginia, and running an east by south course, unites with the Nottaway about 7 miles south of the Virginia line. —*ib*

MELAQUE PORT, on the west coast of New-Mexico, is to the north-west of Port Natividad, or Nativity, and near 3 leagues at south-east from a row of 4 or 5 rocks, or naked islands above water, in the direction of north-west. This port is land locked against all winds from the north-west to the south-west. —*ib.*

MELA, or *Mala*, on the coast of Peru in S. America, lies between Canette and Chelca. It is 3 leagues from Asia Island, whose latitude is about 13° 6′ S.—*ib.*

MELAWASKA, a French settlement of about 70 families, secluded in a singular manner from the rest of mankind, in the north-eastern part of the District of Maine. These people are Roman Catholics, and are industrious, humane, and hospitable.—*ib.*

MELETECUNK *River*, in Monmouth county, New-Jersey, falls eastward into Beaver Dam, which is at the head of the bay which is north of Cranberry New Inlet.—*ib.*

MEMORONCOK, a stream a little west of Byram river. Douglass says the partition line between New-York and Connecticut, as settled Dec. 1, 1664, ran from the mouth of this river N. N. W. and was the ancient limits of New-York, until Nov. 23, 1683, when the line was run nearly the same as it is now settled.—*ib.*

MEMORY ROCKS, amongst the Bahama Islands, are in lat. 27° 20′ N. and long. 79° 40′ W.—*ib.*

MEMPHREMAGOG, a lake chiefly in the province of Canada, 40 miles in length from north to south, and 2 or 3 wide from east to west. The north line of Vermont State passes over the south part of the lake in 45° N. lat. Memphremagog, which has communication, by the river St Francis, with St Lawrence river, is the reservoir of 3 considerable streams, viz. Black, Barton, and Clyde rivers, which rise in Vermont. The soil on its banks is rich, and the country round it is level.—*ib.*

MEMRAMCOOK *River* has been recommended as the most proper boundary between the province of New-Brunswick and Nova-Scotia. It lies a little to the eastward of Petitcodiak, and takes a north-easterly direction.—*ib.*

MENADOU *Bay*, or *Panadou*, is 2 leagues from Port Balene, or Port Nove, on the coast of Cape Breton Island, at the south part of the gulf of St Lawrence, having the island of Scatari, heretofore called Little Cape Breton, opposite to it.—*ib.*

MENDHAM, a township in Morris county, New-Jersey, 3 miles north-westerly of Veal town, and 6 west of Morristown.—*ib.*

MENDOCIN, a cape on the north west coast of America, and N. Pacific ocean. N. lat. 42° 20′, W. long. 130° 5′.—*ib.*

MENDON, a post-town in Worcester county, Massachusetts, 37 miles south west of Boston, and 31 north-east of Pomfret in Connecticut. This township, called *Quansbipauge* by the Indians, was incorporated in 1667, and contains 2 Congregational parishes, a society of Friends, and 1555 inhabitants. It is bounded on the south by the State of Rhode-Island. It is watered by Charles and Mill rivers, and other small streams, which serve 5 grist-mills, 2 saw-mills, 2 clothier's works and a forge. There are 3 hills here, viz. Caleb's, Wigwam, and Miskee, from either of which may be seen, in a clear day, the 4 New-England States.—*ib.*

MENDOZA, a jurisdiction in Chili, in S. America. It has a town of the same name, and lies on the east side of the Cordillera, about 50 leagues from Santiago, in a plain adorned with gardens, well supplied with water by means of canals. The town contains about 100 families, half Spaniards and the other half casts, together with a college founded by the Jesuits, a parochial church, and 3 convents. In the jurisdiction are also the towns of St Juan de la Frontera, situated on the east of the Cordillera, and about 30 leagues north of Mendoza; and St Louis de Loyola, about 50 east of Mendoza; the latter is very small, but has a parish church, a Dominican convent, and a college founded by the Jesuits.—*ib.*

MENDOZA, a river which rises in the Cordillera of the Andes in S. America. Over this river is a natural bridge

Menichlick, || Meninski.

bridge of rocks, from the vaults of which hang several pieces of stone resembling salt, which congeal like isicles, as the water drops from the rock. This bridge is broad enough for 3 or 4 carts to pass a-breast. Near this is another bridge, called the bridge of the Incas, betwixt two rocks; and "so very high from the river, that the stream, which runs with great rapidity, cannot be heard."—*ib.*

MENICHLICK *Lake*, in the north-west part of N. America, lies in lat. 61° N. long. 105° W. North of this is Lake Dobount.—*ib.*

MENINSKI (Franciscus), a most celebrated German orientalist, was born in Lorraine, then subject to the emperor, in the year 1623; and for copiousness of learning, elegance of genius, and profound knowledge of languages, particularly those of the East, proved undoubtedly one of the principal ornaments of the age in which he lived. He studied at Rome under Giattino. When he was about 30, his love of letters induced him to accompany the Polish ambassador to Constantinople, where he studied the Turkish language under Bobovius and Ahmed, two very skilful teachers. So successful was he in this study, that when he had been there only two years, the place of first interpreter to the Polish embassy at the Porte was promised to him. When the place became vacant, he was accordingly appointed to it, and obtained so much credit by his conduct, that, after a time, he was sent for into Poland, and again sent out with full powers as ambassador to the Porte. For his able execution of this office, he was further honoured, by being naturalized in Poland; on which occasion he added the Polish termination of *ski* to his family name, which was Menin. Being desirous afterwards to extend his sphere of action, he went to the court of the emperor as interpreter of oriental languages in 1661. Here also, as in other instances, his talents and behaviour obtained the highest approbation; on which account he was not only sent as interpreter to several imperial ambassadors at the Porte, but was intrusted in many important and confidential services; and, in 1669, having paid a visit to the holy sepulchre at Jerusalem, was made one of the knights of that order. After his return to Vienna he was advanced to further honours; being made one of the counsellors of war to the emperor, and first interpreter of oriental languages. At Vienna he died at the age of 75, in the year 1698. His great work, 1. The "Thesaurus linguarum orientalium," was published at Vienna in 1680, in 4 vols folio; to which was added, in 1687, another volume, intitled, "Complementum Thesauri linguarum orientalium, seu onomasticum Latino-Turcico-Arabico-Persicum." The former volumes having become extremely scarce, partly on account of the destruction of a great part of the impression, in the siege of Vienna by the Turks in 1683, a design was formed some time ago in England of reprinting the work, by a society of learned men, among whom was Sir William Jones. But as this undertaking, probably on account of the vast expence which must have been incurred, did not proceed, the empress queen Maria Theresa, who had heard of the plan, took it upon herself, and with vast liberality furnished every thing necessary for its completion. In consequence of this, it was begun to be spendidly republished at Vienna in 1780, with this title: "Francisci a Mesgnien Meninski Lexicon Arabico-Persico-Turcicum, adjecta ad singulas voces et Phrases interpretatione Latinâ, ad usitatiores, etiam Italica." Of this edition only two vols folio are yet published, extending no farther than *zal*, the ninth letter of the Arabic alphabet, which is about a third of the whole. The delay of the rest is much to be lamented. In this edition, say the editors, the Lexicon of Meninski may be said to be increased, diminished, and amended. *Increased*, because many Arabic and Persian words are added, from Wankuli and Ferhengi, the best Arabic and Persic lexicographers whom the East has produced; and from Herbelot are inserted the names of kingdoms, cities, and rivers, as well as phrases in common use among the Turks, &c. *Diminished*, because many useless synonyma are omitted, which rather puzzled than assisted the student; as well as all the French, Polish, and German interpretations, the Latin being considered as sufficient for all men of learning. *Amended*, with respect to innumerable typographical errors; which, however, from a work of this nature, no care can perhaps altogether exclude. The other works of Meninski were occasioned chiefly by a violent contest between him and a man named J. B. Podesta, in which much acrimony was employed on both sides. These it is hardly worth while to enumerate, but they may all be seen in the account of his life from which this article is taken (A). It should be observed, however, that in 1674, Podesta published a book, intitled, "Prodromus novi linguarum orientalium collegii, jussu Aug. &c. erigendi, in Univ. Viennensi;" to which Meninski opposed, 2. "Meninskii Antidotum in Prodromum novi ling. orient. collegii, &c." 4to. But such was the credit of his antagonist in the university, that soon after there came out a decree in the name of the rector and consistory, in which that antidote of Meninski's is proscribed and prohibited, for six specific reasons, as impious and infamous. Meninski was defended against this formidable attack by a friend, in a small tract, intitled, "Veritas defensa, seu justitia causæ Dn. F. de M. M. [Meninski] contra infame decretum Universitatis Viennensis, Anno 1674, 23 Novembris, &c. ab Amico luci exposita, Anno 1675," in which this friend exposes, article by article, the falsehood of the decree, and exclaims strongly against the arts of Podesta. This tract is in the British Museum. Podesta was oriental secretary to the emperor, and professor of those languages at Vienna; but is described in a very satirical manner by the defender of Meninski. "Podesta, natura Semi-Italus, statura nanus, cæcutiens, balbus, imo bardus repertus, aliisque vitiis ac stultitiis plenus, adeoque ad discendas linguas orientales inhabilis." A list of the works of Podesta is, however, given by the late editors of Meninski.

Meninski, || Menolopen.

MENIOLAGOMEKAH, a Moravian settlement E. of the Great Swamp, at the head of Lehigh river in Pennsylvania, about 33 miles N. W. by N. of Bethlehem.—*Morse.*

MENOLOPEN, a wealthy and pleasant farming

3 O 2 settlement,

(A) We have taken this article from the Biographical Dictionary; the editors of which took it from the life of Meninski prefixed to the new edition of his great work.

settlement, in Monmouth county, New-Jersey; making a part of a rich glade of land, extending from the sea, westward to Delaware river. It is 18 miles south-east of Princeton.—*ib.*

MERCER, a county of Kentucky, adjoining Woodford, Shelby, and Madison counties. Harredsburg is the chief town.—*ib.*

MERCERSBOROUGH, a village of Pennsylvania, S. E. of North Mountain, and about 13 miles S. W. of Chambersburg.—*ib.*

MERCER's *Creek*, in the N. E. part of the island of Antigua, in the W. Indies, is a pretty deep inlet of the coast, the entrance to which is between the islands of Codrington, Crumps, or Pelican. Lavicount's Island is a small island also within it towards the south shore; and in the south-west part of it is Farley's Bay, at the mouth of a river.—*ib.*

MERCHANT's *Careening Place*, within the harbour of Port-Royal in Jamaica, on the N. side of the long peninsula. Along this narrow slip of beach is the only way to pass by land to Port Royal, for 9 or 10 miles, the careening place being almost at midway, but somewhat nearer to the east end of the peninsula. —*ib.*

MERCHETTA, or *Marchetta Mulierum*, is commonly supposed to have been a right which, during the prevalence of the feudal system, the lord had of passing the first night after marriage with his female villain. This opinion has been held by the greater part of our antiquarians; and we have adopted it in our history of Scotland published in the *Encyclopædia*. It appears, however, to be a mistake. That there was a custom called *merchetta mulierum*, which prevailed not only in England, Scotland, Wales, and the isle of Guernsey, but also on the continent, is indeed a fact unquestionable; but Mr Astle has clearly proved, that, instead of being an adulterous connection, the *merchetta* was a compact between the lord and his vassal for the redemption of an *offence* committed by that vassal's *unmarried* daughter. He admits, however, that it denoted likewise a fine paid by a *sokeman* or a *villain* to his lord, for a licence to marry his daughter to a free man; and that if the vassal gave her away without obtaining such a licence, he was liable to pay a heavier fine. He quotes two authorities in support of his opinion from Bracton; one of which we shall transcribe, as being alone complete evidence.

Archæologia, vol. xii.

"Ric. Burre tenet unum mesuagium et debet telliagium factam curiæ, et *merchet*, hoc modo, *quod si maritare voluerit filiam suam cum quodam libero homine, extra villam, faciet pacem domini pro maritagio, et si eam maritaverit alicui custumario villæ, nihil debuit pro maritagio.*"

"The probable reason of the custom (says Mr Astle) appears to have been this. Persons of low rank, residing on an estate, were either *ascripti glebæ*, or were subjected to some species of servitude similar to the *ascripti glebæ*. They were bound to reside on the estate, and to perform several services to the lord. As women necessarily followed the residence of their husbands, the consequence was, that when a woman of low rank married a stranger, the lord was deprived of part of his live stock; he therefore required a fine to indemnify him for the loss of his property." Further particulars on the *merchetta* are to be found in the Appendix to vol. 1st of *Sir David Dalrymple's Annals of Scotland.*

MERCY, *Cape of God's*, the most southerly point of Cumberland's Island, on the N. side of Cumberland's Straits, in lat. about 66° N. and has Cape Walsingham on its N. E. and Exeter Sound on its north.—*Morse.*

MEREDITH, *Cape*, among the Falkland Islands in the S. Atlantic Ocean, is between Port Stephen's and Cape Orford.—*ib.*

MEREDITH, a township in Strafford county, New-Hampshire, situated on the S. W. side of Lake Winipiseogee, 15 miles N. of Gilmantown, 9 S. E. of Plymouth, and 70 N. W. of Portsmouth. It was incorporated in 1768. In 1775 it contained 259 and in 1790, 881 inhabitants. It was first called New-Salem.—*ib.*

MERIDA, the capital of Yucatan, in the audience of Mexico, in N. America. It lies near the N. side of the province, between the gulfs of Mexico and Honduras; 45 miles S. of the Ocean, and 135 N. E. of the city of Campeachy. N. lat. 21° 38′, W. long. 90° 36′.—*ib.*

Merida, a town of New Granada, in S. America, situated near the limits which divide the province from Venezuela. The soil round this place abounds with fruit of all sorts, and there are gold mines near it. It is about 54 miles from Lake Maracaybo, 130 N. E. of Pampeluna, and 260 N. E. of St Fe. The inhabitants send their fruit and merchandize to Truxillo. N. lat. 8° 30′, W. long. 71°.—*ib.*

MERIDIAN Line, an arch, or part of the meridian of the place, terminated each way by the horizon. Or, a meridian line is the intersection of the plane of the meridian of the place with the plane of the horizon, often called a north-and-south line, because its direction is from north to south.

In the article Astronomy *(Encycl.)*, n° 376 and 377, we have given two methods of drawing a meridian line; but it may be proper to add, in this place, the following improvement of the former of these from Dr Hutton's Mathematical Dictionary. "As it is not easy (says the Doctor) to determine precisely the extremity of the shadow, it will be best to make the stile flat at the top, and to drill a small hole through it, noting the lucid point projected by it on the several concentric circles, instead of marking the extremity of the shadow itself on these circles."

We shall give another method of drawing a meridian line from the same valuable dictionary.

"Knowing the south quarter pretty nearly, observe the altitude FE of some star on the east side of it, and not far from the meridian HZRN: then, keeping the quadrant firm on its axis, so as the plummet may still cut the same degree, direct it to the western side of the meridian, and wait till you find the star has the same altitude as before, as *fe*. Lastly, bisect the angle EC*e*, formed by the intersection of the two planes in which the quadrant has been placed at the time of the two observations, by the right line HR, which will be the meridian sought." Plate XXXVI.

Magnetical Meridian, is a great circle passing thro' or by the magnetical poles; to which meridians the magnetical needle conforms itself. See Magnetism, *Suppl.*

MERIM,

MERIM, a large lake in Paraguay in S. America, very near the coast of the S. Atlantic Ocean, where the land is very flat. Fort St Miguel stands at the S. end, and Fort Mangaveira at its north-eastern extremity. There is a very narrow lake, parallel to Lake Merim between it and the ocean, and nearly as long. The forts command the extremities of the peninsula.—*Morse.*

MERIMEG, or *Marameg*, a large river of Louisiana, which emties into the Mississippi, below the mouth of the Missouri, and 50 miles above the settlement of Genivieve. Fine meadows lie between this and the Missouri.—*ib.*

MERION, *Upper* and *Lower*, two townships in Montgomery county, Pennsylvania.—*ib.*

MERO DISTRICT, in the State of Tennessee, on the banks of Cumberland river. It comprehends the counties of Davidson, Sumner, and Tennessee. In 1790 it contained 7,042 inhabitants, including 1,151 slaves. By the State census of 1795 there were 14,390, of which number 2,466 were slaves.—*ib.*

MERO POINT, in the S. Pacific Ocean and coast of Peru, between Cape Blanco to the S. W. and Tumbez river to the N. E. on the S. E. side of Guayaquil Bay, in lat. 3° 40′ S. The coast at the point of Mero is low and flat, but the country within is high and mountainous.—*ib.*

MERRIMACK *River*, has its course southerly through the State of New-Hampshire, till it enters Massachusetts; it then turns easterly, and passes into the ocean at Newbury Port. This river is formed by the confluence of Pemigewasset and Winnipiseogee rivers, in about lat. 43° 26′. This river is navigable for vessels of burden about 20 miles from its mouth, where it is obstructed by the first falls, or rapids, called Mitchell's Eddy, between Bradford and Haverhill. Vast quantities of ship-timber, and various kinds of lumber are brought down in rafts, so constructed as to pass all the falls in the river except those of Amuskeag and Pawtucket. In the spring and summer, considerable quantities of salmon, shad and alewives are caught, which are either used as bait in the codfishery, or pickled, and shipped to the West-Indies. As many as 6 or 7 bridges have been thrown over this fine river at different distances, from New-Concord, downwards; the most elegant and expensive are the one two miles above Newbury-Port, and the one at Haverhill. A canal is now in process to open a communication between the waters of the Merrimack at Chelmsford and the harbour of Boston, through Mystick river. The bar across the mouth of this river is a very great incumbrance to navigation, and is especially terrible to strangers. There are 16 feet of water upon it at common tides. There are two light-houses of wood, removeable at pleasure, according to the shifting of the bar. The lights now bear E. ¼ N. and W. ¼ S. Bringing both the light houses to bear into one, until you are a breast of the lower one, will bring you in over the bar in the deepest water; where is a bold shore and good anchoring ground. The N. point of Plumb-Island which forms the S. side of the entrance into the river, lies in lat. 42° 47′ 40″.—*ib.*

MERRIMACK, a township in Hillsborough county, New-Hampshire, situated on the south side of Souhegan river, which runs eastward into the Merrimack. It is 55 miles westerly of Portsmouth, was incorporated in 1746, and contains 819 inhabitants.—*ib.*

MERRIMICHI *River* falls into the head of a bay of that name on the N. E. coast of the province of New-Brunswick. A little above its confluence with the bay, it forms into two branches, and runs through a fertile tract of choice intervale land; and the land is, in general, well cloathed with timber of all kinds. From this river there is a communication with St John's, partly by land, but principally by water carriage in canoes. The salmon fishery is carried on with success, and the cod fishery is improving near the entrance of the bay.—*ib.*

MERRY-MEETING *Bay*, in Strafford county, New-Hampshire, is the south-easternmost arm of Lake Winnipiseogee. Mount Major stands on its west side.—*ib.*

MERRY-MEETING *Bay*, in the District of Maine, is formed by the junction of Androscoggin and Kennebeck rivers, opposite to the town of Woolwich, 20 miles from the sea. Formerly, from this bay to the sea, the confluent stream was called Sagadahock. The lands here are good. Steven's river heads within a mile of the bay, and a canal has lately been opened which unites these waters. A company has been incorporated to build a bridge over Androscoggin river, at its entrance into the bay, to connect the towns of Brunswick and Topsham; the former on its southern side, the latter on its northern side.—*ib.*

MERTEQUE, a town in the province of Honduras in New-Spain, which produces the cochineal.—*ib.*

MESA, *La*, the southernmost of 4 isles in the Pacific Ocean, near to each other, and E. of the Sandwich Isles. N. lat. 19°, W. long. 137° 30′.—*ib.*

MESOLABE, or MESOLABIUM, a mathematical instrument invented by the ancients, for finding two mean proportionals mechanically, which they could not perform geometrically. It consists of three parallelograms, moving in a groove to certain intersections. Its figure is described by Eutocius, in his Commentary on Archimedes. See also Pappus, lib. 3.

MESO-LOGARITHM, a term used by Kepler to signify the logarithms of the cosines and cotangents.

MESSASAGUES, Indians inhabiting between Lakes Superior and Huron. They have about 1,500 warriors.—*Morse.*

MESSERSBURG, a town in Franklin county, Pennsylvania, 16 miles S. W. of Chambersburg, and 168 W. by S. of Philadelphia.—*ib.*

MESSILLONES, or *Muscle Bay*, on the coast of Chili or Peru, in S. America, is 8 leagues N. by E. of Morrenas bay, and 5 S. by W. of Atacama. It is properly within the bay of Atacama, and is so deep on the S. side that there is no soundings; but at the entrance or anchoring place it is moderate, and ships may ride in 15 fathoms, clean ground, and secured from most winds.—*ib.*

MESTRE *Bay*, *Little*, on the N. E. part of Newfoundland Island, southward of St Julian, and N. by W. of the islands Gros and Belle.—*ib.*

MESUCKAMA *Lake*, in the N. part of N. America. N. lat. 50° 10′, W. long. 80°.—*ib.*

MESURATA, a seaport of the kingdom of Tripoli, in Africa. A caravan proceeds from this place to Fezzan, and other interior parts toward the south of Africa.

Africa. It is 260 miles north of Mourzook. E. lon. 15. 5. N. lat. 31. 3.

METALLIC TRACTORS. See PERKINISM in this *Suppl.*

METCHIGAMIAS, a long narrow lake, or rather dilatation of the northern branch of the river St Francis, in Louisiana, which falls into the Mississippi from the N. W. about 4 miles above Kappas Old Fort.—*Morse.*

METHUEN, the north-westernmost township in Essex county, Massachusetts, situated on the N. bank of Merrimack river, between Dracut and Haverhill. It contains 2 parishes and 1,297 inhabitants. It was incorporated in 1725. Husbandry and the cutting and selling lumber divide the attention of the inhabitants.—*ib.*

METONIC CYCLE, called also the *Golden Number*, and *Lunar Cycle*, or *Cycle of the Moon*, that which was invented by Meton the Athenian; being a period of 19 years. See CYCLE, *Encycl.*

MEW *Islands*, on the coast of the Spanish Main in the West-Indies, between Cape Cameron, and Cape Gracias a Dios, lie across the entrance into the bay of Cotroe, or Crotoe. They are surrounded with rocks, and are very dangerous, especially in case of hard gusts, from the N. and N. E.—*Morse.*

MEXICANO *River*, or *Adayes*, in Louisiana, has a S. E. course and empties into the Gulf of Mexico, at Cabo du Nord; W by S of Ascension bay, and E. by N. of the mouth of Trinity river. On its banks are rich silver mines: Fort Adayes stands on its north-eastern side, in about lat. 30° 31′ north.—*ib.*

MEXICO, a township in Herkemer county, New-York, incorporated in 1796, lying on Canada and Wood Creeks, and Oneida Lake.—*ib.*

MEXICO, or *New-Spain*, bounded north by unknown regions, east by Louisiana and the gulf of Mexico, south by the Isthmus of Darien, which separates it from Terra Firma in South-America, west by the Pacific Ocean. Its length is about 2,100 miles, its breadth 1600; situated between lat. 9° and 40° north, and between long. 83° 8′ and 125° 8′ west. This vast country is divided into *Old Mexico*, which contains the audiences of Galicia, Mexico, and Gautimala, which are subdivided into 22 provinces; *New-Mexico*, divided into two audiences, Apacheria and Sonora; and *California*, on the west, a peninsula. The land is in great part abrupt and mountainous, covered with thick woods, and watered with large rivers. Some of these run into the Gulf of Mexico, and others into the Pacific Ocean. Among the first are Alvarado, Coatzacualco, and Tabasco. Among the latter is the river Guadalaxara or Great river. There are several lakes which do not less embellish the country than give convenience to the commerce of the people. The lakes of Nicaragua, Chapallan, and Pazaquaro, are among the largest. The lakes Tezcuco and Chalco occupy a great part of the vale of Mexico, which is the finest tract of country in New-Spain. The waters of Chalco are sweet, those of Tezcuco are brackish. A canal unites them. The lower lake (Tezcuco) was formerly as much as 20 miles long and 17 broad, and, lying at the bottom of the vale, is the reservoir of all the waters from the surrounding mountains. The city of Mexico stands on an island in this lake.

In this country are interspersed many fountains of different qualities. There are an infinity of nitrous, sulphureous, vitriolic, and alluminous mineral waters, some of which spring out so hot, that in a short time any kind of fruit or animal food is boiled in them. There are also petrifying waters, with which they make little white, smooth stones, not displeasing to the taste; scrapings from which taken in broth, or in gruel, made of Indian corn, are most powerful diaphoretics, and are used with remarkable success in various kinds of fevers.

The climate of this extensive country is various. The maritime parts are hot, and for the most part moist and unhealthy. Lands, which are very high, or very near to high mountains, which are perpetually covered with snow, are cold.

The mountains of Mexico abound in ores of every kind of metal, and a great variety of fossils. There are entire mountains of loadstone, and among others, one very considerable between Coiltytlan and Chilapan, in the country of the Cohuixcas.

However plentiful and rich the mineral kingdom of Mexico may be, the vegetable kingdom is still more various and abundant. Dr Hernandez, describes in his natural history, about 1,200 medicinal plants, natives of that country. The fruits of Mexico are, pine-apples, plums, dates, water-melons, apples, peaches, quinces, apricots, pears, pomegranates, figs, black-cherries, walnuts, almonds, olives, chesnuts, and grapes. The cocoa nut, vanilla, chia, great-pepper, tomati, the pepper of Tabasco, and cotton, are very common with the Mexicans. Wheat, barley, peas, beans and rice have been successfully cultivated in this country. With respect to plants which yield profitable resins, gums, oils or juices, the country of Mexico is singularly fertile. Of quadrupeds, there have been transported into this country horses, asses, bulls, sheep, goats, hogs, dogs and cats, which have all multiplied. Of the ancient quadrupeds, by which is meant those that from time immemorial have been in that country, some are common to both the continents of Europe and America, some peculiar to the new world, others natives only of the kingdom of Mexico. The ancient quadrupeds common to Mexico and the old continents, are lions, tigers, wild-cats, bears, wolves, foxes, the common stags and white stags, bucks, wild-goats, badgers, pole-cats, weazles, martins, squirrels, rabbits, hares, otters and rats. Their prodigious number of birds, their variety, and many valuable qualities, have occasioned some authors to observe, that as Africa is the country of beasts, so Mexico is the country of birds. It is said there are 200 species peculiar to that kingdom.

The civil government of Mexico is administered by tribunals called audiences. In these courts, the viceroy of the king of Spain presides. His employment is the greatest trust and power his Catholic Majesty has at his disposal, and is perhaps the richest government entrusted to any subject in the world. The viceroy continues in office three years. The clergy are extremely numerous in Mexico. The priests, monks and nuns of all orders make a fifth of the white inhabitants, both here and in other parts of Spanish America. The empire of Mexico was subdued by Cortez in 1521.—*ib.*

MEXICO, the capital of the above province, is the oldest

oldeſt city in America, of which we have any account; its foundation being dated as far back as 1325. It is ſituated in the charming vale of Mexico, on ſeveral ſmall iſlands, in Lake Tetzcuco, in N. lat. 19° 26′, and 103° 35′ W. long. from Ferro. This vale is ſurrounded with lofty and verdant mountains, and formerly contained no leſs than 40 eminent cities, beſides villages and hamlets. Concerning the ancient population of this city there are various opinions. The hiſtorians moſt to be relied on ſay, that it was nearly nine miles in circumference; and contained upwards of 60,000 houſes, containing each from 4 to 10 inhabitants. By a late accurate enumeration, made by the magiſtrates and prieſts, it appears that the preſent number of inhabitants exceeds 200,000. The greateſt curioſity in the city of Mexico, is their floating gardens. When the Mexicans, about the year 1325, were ſubdued by the Colhuan and Tepanecan nations, and confined to the ſmall iſlands in the lake, having no land to cultivate, they were taught by neceſſity to form moveable gardens, which floated on the lake. Their conſtruction is very ſimple. They take willows and the roots of marſh plants, and other materials which are light, and twiſt them together, and ſo firmly unite them as to form a ſort of platform, which is capable of ſupporting the earth of the garden. Upon this foundation they lay the light buſhes which float on the lake, and over them ſpread the mud and dirt which they draw up from the bottom of the lake. Their regular figure is quadrangular; their length and breadth various, but generally about 8 rods long and 3 wide; and their elevation from the ſurface of the water is leſs than a foot. Theſe were the firſt fields that the Mexicans owned, after the foundation of Mexico; there they firſt cultivated the maize, great-pepper, and other plants neceſſary for their ſupport. From the induſtry of the people theſe fields ſoon became numerous. At preſent they cultivate flowers and every ſort of garden herbs upon them. Every day of the year at ſunriſe, innumerable veſſels or boats, loaded with various kinds of flowers and herbs, which are cultivated in theſe gardens, are ſeen arriving by the canal, at the great market-place of Mexico. All plants thrive in them ſurpriſingly; the mud of the lake makes a very rich ſoil, which requires no water from the clouds. In the largeſt gardens there is commonly a little tree and a little hut to ſhelter the cultivator and defend him from the rain or the ſun. When the owner of a garden or the *Chinampa* as it is called, wiſhes to change his ſituation, to get out of a bad neighbourhood, or to come nearer to his family, he gets into his little boat, and by his own ſtrength alone, if the garden is ſmall, or with the aſſiſtance of others, if it is large, conducts it wherever he pleaſes, with the little tree and hut upon it. That part of the iſland where theſe floating gardens are, is a place of delightful recreation, where the ſenſes receive the higheſt poſſible gratification. The buildings, which are of ſtone, are convenient, and the public edifices, eſpecially the churches, are magnificent; and the city has the appearance of immenſe wealth. The trade of Mexico conſiſts of 3 great branches, which extend over the whole world. It carries on a traffic with Europe, by La Vera Cruz, ſituated on the Gulf of Mexico, or North Sea; with the Eaſt-Indies, by Acapulco, on the South Sea, 210 miles S. W, of Mexico; and with South-America, by the ſame port. Theſe two ſea-ports, Vera Cruz and Acapulco, are admirably well ſituated for the commercial purpoſes to which they are applied.—*ib.*

MHA Rajah, the higheſt title of Hindoos.

MIAMI *River*, *Little*, in the N. W. Territory, has a ſouth-weſtern courſe, and empties into the Ohio, on the eaſt ſide of the town of Columbia, 20 miles eaſtward of the Great Miami, in a ſtraight line, but 27 taking in the meanders of the Ohio. It is too ſmall for batteaux navigation. Its banks are good land, and ſo high as to prevent in common the overflowing of the water. At the diſtance of 30 miles from the Ohio, the Miamies approximate each other within eight miles and a half. On this river are ſeveral ſaltſprings.—*Morſe.*

Miami *River*, *Great*, or *Great Mineami*, called alſo *Aſſerenict*, or Rocky river, in the N. W. Territory, has a S. by W. courſe, and empties into the Ohio by a mouth 200 yards wide, 32½ miles from Big Bones, 154 miles from the Rapids, and 604 from the mouth of the Ohio. It is one of the moſt beautiful ſtreams in the Territory, and is ſo clear and tranſparent, at its higheſt ſtate, that a pin may very plainly be ſeen at its bottom. It has a very ſtony channel, a ſwift ſtream, but no falls. At the Picque or Pickawee towns, above 75 miles from its mouth, it is not above 50 yards broad, yet loaded batteaux can aſcend 50 miles higher. The portage from the navigable waters of its eaſtern branch to Sanduſky river is 9 miles, and from thoſe of its weſtern branch to the Miami of the Lakes, only 5 miles. It alſo interlocks with the Scioto.—*ib.*

Miami *of the Lakes*, a navigable river of the N. W. Territory, which falls into Lake Erie, at the S. W. corner of the lake. A ſouthern branch of this river communicates with the Great Miami, by a portage of 5 miles. This river is called by ſome writers Mawmee, alſo Omee, and Manmick.—*ib.*

Miami, a village on the Miami of the Lake near the Miami Fort. Large canoes can come from Ouiatanon, a ſmall French ſettlement on the W. ſide of the Wabaſh, 197 miles below the Miami Carrying-place, which laſt is 9 miles from this village.—*ib.*

MIAMIS, an Indian nation who inhabit on the Miami river and the ſouthern ſide of Lake Michigan. They can raiſe about 300 warriors. In conſequence of lands ceded to the United States by the treaty of Greenville, Auguſt 3d 1795, government paid them a ſum in hand, and engaged to pay to them annually, forever, to the value of 1,000 dollars in goods.—*ib.*

Miamis *Bay*, at the mouth of the Miami of the Lakes.—*ib.*

MIATA *Iſland*, one of the Society Iſlands, in the S. Pacific ocean. S. lat. 17° 52′, W. long. 148° 6′.—*ib.*

MICHAEL, *St*, or *St Miguel*, a town in the province of Quito, in Peru, and ſaid to be the firſt town the Spaniards built in that country. It is of conſiderable ſize, ſtanding in a fruitful valley, about 20 leagues from the ſea. The inhabitants call it Chila. Another town, called St Miguel, is the ſecond city in Tucumania, 20 leagues from St Jago del Eſtero, on the road to Charcara or Potoſi, at the foot of a range of rugged mountains, in a well watered place, having the river Quebrada on the one side, and several small streams on the other, 5 or 6 leagues from it. The country produces all kinds of grain, plenty of grapes, cotton and flax, and yields excellent pasturage.—*ib.*

MICHAEL, *St*, a town of N. America, in New-Spain, and in the province of Mechoacan. It is very populous, and 100 miles from Mexico. N. lat. 20° 35', W. long. 102° 55'.—*ib.*

MICHAEL's *Bay*, *St*, on the E. side of the island of Barbadoes, in the West-Indies; a little N. of Foul's Bay; N. E. of which last bay are Cobler's Rocks, in the shape of a horn.—*ib.*

MICHAEL's *Gulf*, *St*, in the S. E. part of Panama Bay, is formed by the outlet of St Maria and other rivers that fall into it.—*ib.*

MICHAEL, *St*, or *St Miguel River*, is also on the S. coast of the isthmus between N. and S. America, and on the N. Pacific ocean, and 18 leagues to the W. of Port Martin Lopez, and 3 E. of Guibaltigue. It has 3 fathoms water at flood. Within the river to the N. E. is the burning mountain of St Miguel, in the midst of an open plain.—*ib.*

MICHAEL's *Bay*, *St*, in Terra Firma, on the S. Sea.—*ib.*

MICHAEL's, *St*, a parish in Charleston district, S. Carolina.—*ib.*

MICHAEL's, *St*, a town in Talbot county, Maryland, 8 miles W. of Easton, and 21 S. E. of Annapolis.—*ib.*

MICHAEL, *St*, or *Fond des Negre*, a town on the S. peninsula of St Domingo island, 10 leagues N. E. of St Louis.—*ib.*

MICHIGAN *Lake*, in the N. W. Territory, is the largest and most considerable lake, which is wholly within the United States, and lies between lat. 42° 10' and 45° 40' N. and between 84° 30' and 87° 30' W. long. Its computed length is 280 miles from north to south; its breadth from 60 to 70 miles, and its circumference nearly 600 miles; and contains, according to Mr Hutchins, 10,368,000 acres. It is navigable for shipping of any burden; and communicates with Lake Huron, at the north-eastern part, through the Straits of Michillimakkinak. The strait is 6 miles broad, and the fort of its name stands on an island at the mouth of the strait. In this lake are several kinds of fish; particularly trout of an excellent quality, weighing from 20 to 60 pounds; and some have been taken in the strait which weighed 90 pounds. On the N. W. parts of this lake, the waters push through a narrow strait, and branch out into two bays; that to the northward is called Noquet's Bay, the other to the southward, Puans, or Green Bay, which last with the lake, forms a long peninsula, called Cape Townsend, or Vermillion Point. About 30 miles S. of Bay de Puans, is Lake Winnebago, which communicates with it: and a very short portage interrupts the water communication, south-westward from Winnebago Lake through Fox river, then through Ouisconsin, into the river Mississippi. Chicago river, also at the S. W. extremity of Lake Michigan, furnishes a communication interrupted by a still shorter portage, with Illinois river. Lake Michigan receives many small rivers from the W. and E. some 150 and even 250 yards broad at their mouths.—*ib.*

MICHILLIMAKKINAK *Straits* connect Lakes Michigan and Huron, in a N. E. and S. W. course.—*ib.*

MICHILLIMAKKINAK, an island, fort, and village on the S. W. side of the straits of the same name. The small isle on which the village, and the fort commanding the strait, stand, is W. N. W. of White Wood Island, in Lake Huron. In addition to the lands round this post to which the Indian title had been extinguished by the French and British governments, the Indians have ceded by the treaty of Greenville, a tract of land on the main, to the north of the island on which the post of Michillimakkinak stands, to measure 6 miles on lakes Huron and Michigan, and to extend 3 miles back from the water of the lake or strait, and also De Bois Blanc, or White Wood Island. This last was the voluntary gift of the Chipewa nation. The island of Michillimakkinak is very barren, but, as it is the grand rendezvous of the Indian traders, a considerable trade is carried on; and its very advantageous situation seems to ensure that it will be, at some future period, a place of great commercial importance. It is within the line of the United States, and was lately delivered up by the British. It is about 200 miles N. N. W. from Detroit, and 974 N. W. of Philadelphia. N. lat. 45° 20', W. long. 84° 30'.—*ib.*

MICHILLIMAKKINAK, *Little*, a river in the N. W. Territory, which enters the south eastern side of Illinois river, by a mouth 50 yards wide, and has between 30 and 40 small islands at its mouth; which at a distance appear like a small village. It runs a N. W. course, and is navigable about 90 miles. On its banks is plenty of good timber, viz. red and white cedar, pine, maple, walnut, &c. as also coal mines. Its mouth is 13 miles below the Old Piorias Fort and village, on the opposite side of the river, at the S. W. end of Illinois Lake, and 195 miles from the Mississippi.—*ib.*

MICHIPICOTEN, a river which empties into Lake Superior, on the north-east side of the lake. It has its source not far distant from Moose river, a water of James's Bay. It forms at its mouth a bay of its own name; and on the W. part of the bay, is a large island so called, close to the land, a small strait only separates it from Otter's Head on the north.—*ib.*

MICHIPICOOTON *House*, in Upper Canada, is situated on the E. side of the mouth of the above river, in lat. 47° 56' N. and belongs to the Hudson Bay Company.—*ib.*

MICHISCOUI is the Indian and present name of the most northerly river in Vermont. It rises in Belvidere, and runs nearly north-east until it has crossed into Canada, were it runs some distance, it turns W. then southerly, re-enters the State of Vermont in Richford, and empties into Lake Champlain, at Michiscoui Bay, at Highgate. It is navigable for the largest boats to the falls at Swantown, 7 miles from its mouth. Michiscoui, La Moelle, and Onion rivers, are nearly of the same magnitude.—*ib.*

MICHISCOUI *Tongue*, or *Bay*, a long point of land which extends southerly into Lake Champlain from the north-east corner of the State of Vermont on the W. side of the bay of this name, and forms the township of Allburg.—*ib.*

MICKMACKS, an Indian nation which inhabit the country between the Shapody Mountains, and the Gulf

Gulf of St Lawrence in Nova-Scotia, oppofite to St John's Ifland. This nation convey their fentiments by hieroglyphics marked on the rind of the birch and on paper, which the Roman miffionaries perfectly underftand. Many of them refide at the heads of the rivers, in King's and Hants counties.—*ib.*

MICOYA *Bay* is fituated on the S. W. coaft of Mexico, or New-Spain, on the North Pacific Ocean. In fome charts it is laid down in lat. 10° 15′ N. and having Cape Blanco and Chira Ifland for its fouth-eaft limit.—*ib.*

MICROCOUSTICS, or MICROPHONES, inftruments contrived to magnify fmall founds, as microfcopes do fmall objects.

MICROCOSMIC SALT. See CHEMISTRY-*Index*, *Suppl.*

MIDDLE BANK, a fifhing ground in the Atlantic Ocean, which lies from north-eaft to fouth-weft, between St Peter's Bank and that of Sable Ifland; and oppofite to, and S. E. of Cape Breton Ifland, laid down in fome charts between lat. 44° 32′, and 45° 34′ N. and between long. 57° 37′, and 59° 32′. —*Morse.*

MIDDLEBOROUGH, the *Namafkett* of the ancient Indians, a townfhip in Plymouth county, Maffachufetts, bounded weft by Freetown and Taunton, eaft by Carver and Warham, and is 40 miles S. by E. of Bofton; was incorporated in 1669, and contains 4,526 inhabitants. This town was formerly thickly inhabited by Indian natives, governed by the noted fachem *Tifpacan*: there are now only 30 or 40 fouls remaining, who, to fupply their immediate neceffities, make and fell brooms and bafkets. The town is remarkable for a large range of ponds, which produce feveral forts of fifh, and large quantities of iron ore. The bottom of Affowamfet Pond may be faid to be an entire mine of iron ore. Men go out with boats, and ufe inftruments like oyfter dredges, to get up the ore from the bottom of the pond. It is now fo much exhaufted, that half a ton is thought a good day's work for one man; but for a number of years one man could take up four times the quantity. In an adjacent pond there is yet great plenty at 20 feet deep, as well as from fhoaler water. Great quantities of nails are made here. In winter, the farmers and young men are employed in this manufacture. Here, and at Milton in Norfolk county, the firft rolling and flitting mills were erected about 40 years ago, but were imperfect and unproductive, in comparifon with thofe of the prefent time. The prints of naked hands and feet are to be feen on feveral rocks in this town, fuppofed to have been done by the Indians. Thefe are probably fimilar to thofe obferved in the States of Tenneffee and Virginia.—*il.*

MIDDLEBOURG *Key*, a fmall iflot feparated from St Martin's in the Weft-Indies on the N. E.—*ib.*

MIDDLEBURG, or *Eooa*, the moft foutherly of all the Friendly Iflands, in the South Pacific Ocean; and is about 10 leagues in circuit.—*ib.*

MIDDLEBURY, a poft-town of Vermont, and capital of Addifon county. It is 33 miles N. by W. of Rutland, 15 from Vergennes, and 37 S. E. of Burlington. Here is a brewery upon a pretty large fcale. The townfhip lies on the E. fide of Otter Creek, and contains 395 inhabitants.—*ib.*

MIDDLE *Cape* is to the S. W. of Cape Anthony, in Staten Land, on the ftrait Le Maire, and the moft wefterly point of that ifland; at the extremity of S. America.—*ib.*

MIDDLEFIELD, a townfhip in Hampfhire county, Maffachufetts, 30 miles N. W. of Springfield, and 125 miles wefterly of Bofton. It was incorporated in 1783, and contains 608 inhabitants.—*ib.*

MIDDLEHOOK, a village in New-Jerfey, 8 miles W. of Brunfwick, on the crofs poft-road from Brunfwick to Flemington, and on the N. bank of Rariton river.—*ib.*

MIDDLE *Iflands*, or *Iblas de en Medio*, on the W. coaft of New-Mexico, and are between the iflands of Chira and St Luke. They are in the North Pacific ocean, in lat. 9° 30′ N. There is only from 6 to 7 fathoms from Chira to thefe iflands, and all veffels fhould keep nearer to them than to the main.—*ib.*

MIDDLE LATITUDE, is half the fum of two given latitudes; or the arithmetical mean, or the middle between two parallels of latitude. Therefore,

If the latitudes be of the fame name, either both north or both fouth, add the one number to the other, and divide the fum by 2; the quotient is the middle latitude, which is of the fame name with the two given latitudes. But

If the latitudes be of different names, the one north and the other fouth; fubtract the lefs from the greater, and divide the remainder by 2, fo fhall the quotient be the middle latitude, of the fame name with the greater of the two.

MIDDLESEX, a county of Maffachufetts, bounded north by the State of New-Hampfhire, E. by Effex county, S. by Suffolk, and W. by Worcefter county. Its figure is nearly equal to a fquare of 40 miles on a fide; its greateft length being 52, and its greateft breadth 42 miles. It has 42 townfhips, which contain 42,737 inhabitants. The religious focieties are 55 of Congregationalifts, 6 of Baptifts, and fome Prefbyterians. It was made a county in 1643. It is watered by five principal rivers, Merrimack, Charles, Concord, Nafhua, and Myftick; befides fmaller ftreams. The chief towns are Charleftown, Cambridge, and Concord. Charleftown is the only fea port in the county; Concord is the moft refpectable inland town, and is near the centre of the county, being 20 miles N. W. of Bofton. There are in the county 24 fulling-mills, about 70 tan-yards, 4 paper mills, 2 fnuff-mills, 6 diftilleries, and about 20 pot and pearl afh houfes. The fouthern and northern fides of the county are hilly, but not mountainous, few of the hills exceeding 100 feet in height, and are covered with wood, or cultivated quite to their fummits. The air is generally ferene, and the temperature mild. The extreme variation of Farenheit's thermometer, may be confidered as 100° in a year; but it is in very few inftances, that in the courfe of a year it reaches either extreme: 92° may be confidered as the extreme fummer heat, and 5 or 6° below 0, as that of the winter cold. In the winter of 1796—1797, it funk to 11° below 0. The foil is various, in fome parts of rich, black loam, and in others it is light and fandy. It produces the timber, grain and fruit which are common throughout the State, either by natural growth or cultivation. —*Morse.*

MIDDLESEX, a maritime county of Connecticut, bounded

bounded north by Hartford county, south by Long-Island Sound, east by New-London county, and west by New-Haven. Its greatest length is about 30 miles, and its greatest breadth 19 miles. It is divided into 6 townships, containing 18,855 inhabitants, of whom 221 are slaves. Connecticut river runs the whole length of the county, and on the streams which flow into it are a number of mills. Middleton is the chief town.—*ib.*

Middlesex, a county of New-Jersey, bounded north by Essex, N. W. and W. by Somerset, S. W. by Burlington, S. E. by Monmouth, east by Rariton Bay and part of Staten Island. It contains 15,956 inhabitants, including 1,318 slaves. From the mouth of Rariton river up to Brunswick, the land on both sides is generally good, both for pasture and tillage, producing considerable quantities of every kind of grain and hay. Chief town, New-Brunswick.—*ib.*

Middlesex, a county of Virginia, on the south side of Rappahannock river, on Chesapeak Bay. It is about 35 miles in length, and 7 in breadth, containing 4,140 inhabitants, including 2,558 slaves. Urbanna is the chief town.—*ib.*

Middlesex, a township in Chittendon county, Vermont, on the north-east side of Onion river. It contains 60 inhabitants.—*ib.*

Middlesex *Canal* (Massachusetts) it is expected will be of great importance to the States of Massachusetts and New-Hampshire. It is now opening at a vast expense by an incorporated company. The design is to open a water communication from the waters of Merrimack river at Chelmsford to the harbour of Boston. The route of the canal will be southerly through the east parts of Chelmsford, and Billerica, the west part of Wilmington, and the middle of Woburn; where it comes to some ponds, from which the waters run by Myslick river into Boston harbour. The distance from the Merrimack to these ponds will be 17 miles. The canal will, without meeting with any large hills or deep vallies, be straighter than the country road near it. The distance from the Merrimack to Medford, as the canal will be made, is 27, and to Boston, 31 miles. The canal is to be 24 feet wide at the bottom, and 32 at the top, and 6 feet deep. The boats are to be 12 feet wide and 70 feet long. The toll is to be 6 cents a mile for every ton weight which shall pass, besides pay for their boats and labour.—*ib.*

MIDDLE STATES, one of the Grand Divisions of the United States, (so denominated in reference to the northern and southern States) comprehending the States of New-York, New-Jersey, Pennsylvania, Delaware, and the Territory N. W. of the Ohio.—*ib.*

MIDDLETON, an interior township in Essex county, Massachusetts, 28 miles northerly of Boston. It was incorporated in 1728, and contains 682 inhabitants.—*ib.*

Middleton, a city and post-town of Connecticut, and the capital of Middlesex county, pleasantly situated on the western bank of Connecticut river, 31 miles from its mouth at Saybrook Bar, according to the course of the river; 14 miles S. of Hartford, 26 N. by E. of New-Haven, 40 N. W. by W. of New-London, and 209 N. E. of Philadelphia. Its public buildings are, a Congregational church, an Episcopalian church, a court-house and naval-office. It contains about 300 houses, and carries on a considerable trade. Here the river has 10 feet water at full tides. N. lat. 41° 35′, W. long. 77° 12′. This place was called *Mattabesick*, by the Indians, and was settled in 1650 or 1651. Two miles from the city is a lead mine which was wrought during the war, and was productive; but it is too expensive to be worked in time of peace.—*ib.*

MIDDLETOWN, a township in Strafford county, New-Hampshire; about 40 miles N by N W. of Portsmouth. It was incorporated in 1778, and contains 617 inhabitants.—*ib.*

Middletown, a township in Rutland county, Vermont. It contains 699 inhabitants, and is 39 miles north of Bennington.—*ib.*

Middletown, a village on Long-Island, New-York State; 12 miles from Smithtown, and 13 from Bridgehampton.—*ib.*

Middletown, a township in Ulster county, New-York, erected from Rochester and Woodstock in 1789, and contains 1,019 inhabitants, including 6 slaves. In 1796 there were 135 of the inhabitants entitled to be electors.—*ib.*

Middletown, a township in Newport county, Rhode-Island State, contains 840 inhabitants, including 15 slaves. In this town which is on the island which gives name to the State, and about 2 miles from Newport, is the large and curious cavity in the rocks, called *Purgatory*.—*ib.*

Middletown, a small post-town in Newcastle county, Delaware, lies on Apoquinimy Creek, 21 miles S. S. W. of Wilmington, and 49 S. W. of Philadelphia.—*ib.*

Middletown, in Monmouth county, New Jersey, a township which contains two places of worship, one for Baptists and one for the Dutch Reformed church, and 3,226 inhabitants, including 491 slaves. The centre of the township is 50 miles E by N. of Trenton, and 30 S. W. by S. of New York city. The light-house built by the citizens of New-York on the point of Sandy Hook, is in this township. The high lands of Navesink, are on the sea-coast, near Sandy Hook. They are 600 feet above the surface of the water, and are the lands first discovered by mariners on this part of the coast.—*ib.*

Middletown *Point*, in the above township, lies on the S. W. side of the bay within Sandy Hook, 9 miles E. by N. of Spotswood, and 14 north west of Shrewsbury. A post-office is kept here.—*ib.*

Middletown, a flourishing town in Dauphin county, Pennsylvania, situated on the N. W. side of Swatara creek, which empties into the Susquehannah, 2 miles below. It contains a German church and above 100 houses, and carries on a brisk trade with the farmers in the vicinity. It is estimated that above 200 000 bushels of wheat are brought down these rivers annually to the landing place, 2 miles from the town. Contiguous to the town is an excellent merchant mill, supplied with a constant stream, by a canal cut from the Swatara. It is 6 miles S. of Hummelston, and 92 W. by N. of Philadelphia. N. lat. 40° 12′, W. long. 76° 44′. There are also two other townships of this name in the State; the one in Delaware county, the other in that of Cumberland.—*ib.*

Middletown, in Frederick county, Maryland, lies nearly 8 miles W. N. W. of Frederickstown.—*ib*

MIDDLETOWN, in Dorchester county, Maryland, is about 5 miles N. of the Cedar Landing Place, on Transquaking Creek; 7 westerly of Vienna, and 8½ N. W. of Cambridge.—*ib.*

MIDSUMMER-DAY, is held on the 24th of June, the same day as the nativity of St John the Baptist is held.

MIDWAY, a village in Liberty county, Georgia, 30 miles south of Savannah, and 10 miles N. W. of Sunbury. Its inhabitants are Congregationalists, and are the descendants of emigrants from Dorchester near Boston, in New-England, who migrated as early as 1700.—*Morse.*

MIDWAY, a township in Rutland county, Vermont, east of and adjoining Rutland.—*ib.*

MIFFLIN, a county of Pennsylvania, surrounded by Lycoming, Franklin, Cumberland, Northumberland, Dauphin, and Huntingdon counties. It contains 1,851 square miles, 1 184,960 acres, and is divided into 8 townships. The mountains in this county abound with iron ore, for the manufacturing of which, several forges have been erected. It is well watered by the Juniatta, and other streams which empty into the Susquehannah. Chief town, Lewistown.—*ib.*

MIFFLIN, a small town lately laid out in the above county, on the east side of the Juniatta; 12 miles east of Lewistown, and 138 from Philadelphia.—*ib.*

MIFFLIN, *Fort*, in Pennsylvania, is situated on a small island, at the mouth of Schuylkill river, about 6 miles south of Philadelphia.—*ib.*

MILFIELD, in Grafton county, New-Hampshire, settled 1774.—*ib.*

MILFORD, a township in Mifflin county, Pennsylvania.—*ib.*

MILFORD, a post-town of the State of Delaware, pleasantly situated on the north side of Muspillion Creek, about 12 miles west of its mouth in Delaware Bay, 19 S. by E. of Dover, 7 south of Frederica, and 95 S. by W. of Philadelphia. It contains nearly 100 houses, all built since the war, except one. The inhabitants are Episcopalians, Quakers and Methodists.—*ib.*

MILFORD, a town of Northampton county, Pennsylvania, lately laid out on the N. W. side of the Delaware, on a lofty situation, at Well's Ferry, 120 miles above Philadelphia. In front of the town, which contains as yet only a few houses, the river forms a cove well fitted for sheltering boats and lumber in storms, or freshes in the river. A saw-mill and paper-mill have been erected here; the latter belongs to Mr Biddis, who has discovered the method of making paper and paste board, by substituting a large proportion of saw-dust in the composition.—*ib.*

MILFORD, a post town of Connecticut, on Long-Island found, and in New-Haven county, 13 miles S. W. of New-Haven, and east of Stratford. The mouth of the creek on which it stands has 3 fathoms water. This town was called *Wopowage* by the Indians, and was settled in 1638. It contains an Episcopal church, and 2 Congregational churches.—*ib.*

MILFORD *Haven*, a deep bay on the coast of Nova Scotia, to the S. W. round the point of the strait of Canso. It receives several rivers from the N. W. and S. W.—*ib.*

MILITARY *Townships*, in the State of New-York. The legislature of the State granted one million and a half acres of land, as a gratuity to the officers and soldiers of the line of this State. This tract, forming the new county of Onondago, is bounded W. by the east shore of the Seneca Lake, and the Massachusetts lands in the new county of Ontario; N. by the part of Lake Ontario near Fort Oswego; S. by a ridge of the Alleghany Mountains and the Pennsylvania line; and E. by the Tuscarora Creek (which falls nearly into the middle of the Oneida Lake) and that part of what was formerly Montgomery county, which has been settling by the New-England people very rapidly since the peace. This pleasant county is divided into 25 townships of 60,000 acres each, which are again subdivided into 100 convenient farms, of 600 acres; making in the whole 2,500 farms. This tract is well watered by a multitude of small lakes and rivers.

The reserved lands embosomed in this tract, are as follow: a tract about 171 miles long, and 10 broad, including the northern part of the lake Cayuga, which lies in the centre of it, to the Cayuga Indians. The Indians have a village on each side of the lake; and the ferry at the north end lies in lat. 42° 54′ 14″ north. Connoga Castle is about 3 miles south of the ferry, on the east side of Lake Cayuga. The Onondago Reservation is uniformly 11 miles long, and 9 broad; bounded north by the Public Reservation, and part of the townships of Manlius and Camillus. A very small part of the south end of Salt Lake is within the Reservation. The Salt Spring, and the Salt Lake, with a small portion of ground on each side, is reserved by the State; its greatest length is 6½ miles, and the greatest breadth of the Reservation 3½.—*ib.*

MILK, or MILKYET, property in Bengal.

MILLER, *Fort*, is on the E. side of Hudson's river, 41 miles north of Albany, consisting of rapids in the river, and several mills thereon. It is so called from a little mud fort formerly built there against the Indians.—*Morse.*

MILLER'S, or *Payquage*, a river of Massachusetts, which runs W. by S. and falls into Connecticut river, between Northfield and Montague. It is a beautiful stream, though in some places very rapid. Its chief source is in Monomenock pond in Rindge, New-Hampshire, and partly in Winchendon; the other in Naukheag pond in Ashburnham. These with various streams unite in Winchendon, and form Miller's river.—*ib.*

MILLERS, a settlement in Kentucky, on a branch of Licking river, 32 miles north-east of Lexington.—*ib.*

MILLER'S-TOWN, in Northampton county, Pennsylvania, is pleasantly situated on a branch of Little Lehigh river; 26 miles S. W. of Easton, and 47 N. W. by N. of Philadelphia. It contains about 40 houses.—*ib.*

MILLER'S TOWN, a small town in Shenandoah county, Virginia, 32 miles south of Winchester. Two or three miles from this place is the narrow pass, formed by the Shenandoah river on one side, and a small brook on the other. It is about a rod and a half wide, and 2 or 3 long; on each side is a bank of about 100 feet high.—*ib.*

MILL *Island*, near the N. W. end of Hudson's

Straits; N. N. W. of Nottingham Island, and S. by E. of Cape Comfort, but nearer to the latter. N. lat. 64° 36'. W. long. 80° 30'.—*ib.*

MILL *Island*, a small island in that branch of Chignecto Bay which runs up due north, whilst the Bay particularly so called, runs in north-east. It is nearly due west 4 miles from the nearest point of land.—*ib.*

MILLS of various kinds are described in the article MECHANICS *(Encycl.)*; and he who shall study that article, together with *Water-Works*, and MACHINERY, in this *Supplement*, will have a sufficient knowledge of the principles upon which mills must be constructed so as that they may produce their proper effects. The subject is introduced into this place merely to put it into the power of our countrymen to adopt, if they shall think fit, the improvements which have been made in the machinery of flour mills in America.

The chief of these consist in a new application of the screw, and the introduction of what are called elevators, the idea of which was evidently borrowed from the chain pump. The screw is made by sticking small thin pieces of board, about three inches long and two wide, into a cylinder, so as to form the spiral line. This screw is placed in a horizontal position, and by turning on its axis it forces wheat or flour from one end of a trough to the other. For instance, in the trough which receives the meal immediately coming from the stones, a screw of this kind is placed, by which the meal is forced on, to the distance of six or eight feet, perhaps, into a reservoir; from thence, without any manual labour, it is conveyed to the very top of the mill by the elevators, which consist of a number of small buckets of the size of tea cups, attached to a long band that goes round a wheel at the top, and another at the bottom of the mill. As the band revolves round the wheels, these buckets dip into the reservoir of wheat or flour below, and take their loads up to the top, where they empty themselves as they turn round the upper wheel. The elevators are inclosed in square wooden tubes, to prevent them from catching in any thing, and also to prevent dust. By means of these two simple contrivances no manual labour is required from the moment the wheat is taken to the mill till it is converted into flour, and ready to be packed, during the various processes of screening, grinding, sifting, &c.

That this is a considerable improvement is obvious; and we are not without hopes that it may be adopted. The licentiousness of an English mob has indeed persecuted an Arkwright, expelled the inventor of the fly-shuttle from his native country, and by such conduct prevented the re-erection of the Albion mills, and the general establishment of saw-mills through the kingdom; but their sovereignty perhaps will not be roused by so easy and simple a contrivance as this to lessen the quantity of manual labour. For an account of the Dutch oil-mill, which was somehow omitted in its proper place in the *Encyclopædia*, see *OIL-MILL* in this *Supplement*.

MILLSTONE, a south branch of Rariton river, in New-Jersey.—*Morse.*

MILLSTONE, a pleasant rural village, situated on the river of its name, 14 miles N. of Princeton, in New-Jersey, containing the seat of General Frelinghuysen, and formerly the county town of Somerset.—*ib.*

MILLTOWN, in the State of Delaware, two miles from Wilmington.—*ib.*

MILLTOWN, in Northumberland county, Pennsylvania, on the E. side of the W. branch of Susquehannah river, containing about 60 houses, and 14 miles N. by W. of Sunbury.—*ib.*

MILTON, a township in Chittenden county, Vermont, situated on the east side of Lake Champlain, opposite to South Hero Island. It is divided into nearly equal parts by La Moille river, which empties into the lake in Colchester, near the S. line of Milton. The township contains 282 inhabitants.—*ib.*

MILTON, the *Uncataquissett*, or Unquety of the ancient Indians, a township in Norfolk county, Massachusetts; adjoining to Dorchester, from which it is partly separated by Naponset river, noted for the excellent quality of its water. It is 7 miles S. of Boston, and contains 1039 inhabitants; 3 paper-mills, and a chocolate-mill. It was incoporated in 1662. Milton hill affords one of the finest prospects in America.—*ib.*

MILTON, a township in the new county of Saratoga in New-York. By the State census of 1796, there were 301 of the inhabitants who were electors.—*ib.*

MILTON, a military township in Onondago county, New-York, situated on the N. E. side of Cayuga Lake, near its southern extremity; 40 miles N. of Tioga river, and 21 S. by E. of the ferry on the N. end of Cayuga Lake. It was incorporated in 1794. By the State census of 1796, 181 of its inhabitants were electors.—*ib.*

MILTON, a small town in Albemarle county, Virginia, situated on the S. W. side of the Rivanna, about 80 miles N. W. by W. of Richmond. It has about 20 houses and a ware-house for the inspection of tobacco.—*ib.*

MINAS, *Basin of*, or *Les Mines Bay*, sometimes also called *Le Grand Praye*; is a gulf on the S. E. side of the Bay of Fundy, into which its waters pass by a narrow strait, and set up into Nova-Scotia in an E. and S. direction. It is about 30 leagues from the entrance of Annapolis, and 10 from the bottom of Bedford Bay. It is 12 leagues in length, and three in breadth.—*ib.*

MINAS, or *De las Minas Hill*, is the middlemost of the three hills, described as marks within land for Bonaventura Bay and river, on the coast of Peru, in S. America: these are S. of Panama Bay, and in N. lat. 3° 20', W. long. 75° 18'.—*ib.*

MINE AU FER, or *Iron Mines*, on the E. side of Mississippi river, is 67¼ miles N. by E. of Chickasaw river, and 15 S. by E. of the Ohio. Here the land is nearly similar in quality to that bordering on the Chickasaw river, interspersed with gradual risings or small eminences. There was a post at this place, near the former S. boundary of Virginia.—*ib.*

MINEHEAD, a township in Essex county, Vermont, on Connecticut river.—*ib.*

1 Definition. **I**S a science, the object of which is the description and arrangement of *inorganic bodies*, or *minerals*; or of *all* the bodies which belong to our globe, excepting *animal* and *vegetable* substances.

Since the publication of the article Mineralogy, *Encycl.* scarcely a single day has passed without the discovery of some new mineralogical fact, or the detection of some old and unsuspected error. These improvements cannot be overlooked in the present *Supplement*. But they are so numerous in every part of the science, that we can hardly notice them without giving a pretty complete view of the present state of mineralogy. This will scarcely occupy more room, and must be much more useful as well as entertaining, than an undigested mass of annotations and remarks. We undertake this task the more readily, because in the article Mineralogy in the *Encyclopædia*, the improvements of Mr Werner and his disciples, to which the science is indebted for a great part of its present accuracy, have been entirely overlooked.

2 Object. The object of mineralogy is twofold. 1. To *describe* every mineral with so much accuracy and precision, that it may be easily distinguished from every other mineral; 2. To *arrange* them into a system in such a manner that every mineral may be easily referred to its proper place, and that a person may be able, merely by the help of the system, to discover the *name* of any mineral whatever. When these two objects are accomplished, mineralogy, strictly so called, is completed. But were we to stop here, the utility of the science, if it would be entitled to the name of science, could hardly be considered as very great. We must therefore apply *chemistry* to discover the ingredients of which minerals are composed, and to detect, if possible, the laws which these ingredients have observed in their combination. Thus we shall really extend our knowledge of inorganic nature, and be enabled to apply that knowledge to the improvement of almost every art and manufacture.

Description of Minerals.

3 Division of the article. Mineralogy naturally divides itself into three parts. The *first* treats of the method of describing minerals; the *second*, of the method of arranging them; and the *third* exhibits them in a system described and arranged according to the rules laid down in the two first parts. These three parts shall be the subjects of the following chapters; and we shall finish the article with a chapter on the chemical analysis of minerals.

Chap. I. Of the Description of Minerals.

Nothing, at first sight, appears easier than to describe a mineral, and yet, in reality, it is attended with a great deal of difficulty. The mineralogical descriptions of the ancients are so loose and inaccurate, that many of the minerals to which they allude cannot be ascertained; and consequently their observations, however valuable in themselves, are often as far as respects us, altogether lost. It is obvious, that to distinguish a mineral from every other, we must either mention some peculiar property, or a collection of properties, which exist together in no other mineral. These properties must be described in terms rigidly accurate, which convey precise ideas of the very properties intended, and of no other properties. The smallest deviation from this would lead to confusion and uncertainty. Now it is impossible to describe minerals in this manner, unless there be a peculiar term for each of their properties; and unless this term be completely understood. Mineralogy therefore must have a language of its own; that is to say, it must have a *term* to denote every mineralogical property, and each of these terms must be accurately defined. The language of mineralogy was invented by the celebrated Werner of Freyberg, and first made known to the world by the publication of his treatise on *the external characters of minerals*. Of this language we shall give a view in the following general description of the properties of minerals (A).

4 Properties of minerals. The properties of minerals may be divided into two classes. *1st*, Properties discoverable without destroying the texture of the mineral; *2d*, Properties resulting from the action of other bodies on it. The first class has, by Werner and his disciples, been called *external* properties, and by some French writers *physical*; the second class has been called *chemical*.

External Characters.

The *external* properties may be arranged under the following heads:

1 Figure.	8 Ductility.	14 Sound.
2 Surface.	9 Fracture.	15 Smell.
3 Transparency.	10 Texture.	16 Taste.
4 Colour.	11 Structure.	17 Gravity.
5 Scratch.	12 Fragments.	18 Magnetism.
6 Lustre.	13 Feel.	19 Electricity.
7 Hardness.		

5 Figure. I. By figure is meant the shape or form which a mineral is observed to have. The *figure* of minerals is either *regular*, *particular*, or *amorphous*. 1. Minerals which assume a regular figure are said to be crystallized.* The *sides* of a crystal are called *faces*; the sharp line formed by the inclination of two faces is called an *edge*; and the corner, or angle, formed by the meeting of several edges in one point, is called a *solid angle*, or simply *an angle*. Thus a cube has six faces, twelve edges, and eight angles. 2. Some minerals, though not crystallized, affect a *particular* figure. These particular figures are the following: *Globular*, like a globe; *oval*, like an oblong spheriod; *ovate*, like an egg; *cheese-shaped*, a very flattened sphere; *almond-shaped*, like an almond; *lenticular*, like a double convex lense, compressed and gradually thinner towards the edges; *cuneiform*, like a wedge; *nodulous*, having depressions and protuberances like a potatoe; *botryoidal*, like grapes closely pressed together; *dentiform*, longish and tortuous, and thicker at the bottom than the top; *wireform*, like a wire; *capillary*, like hair, finer than the preceding; *retiform*, threads interwoven like a net; *dendritic*, like a tree, having branches issuing from a common stem; *shrubiform*, branches not arising from a common stem; *coralloidal*, branched like coral; *stalactitical*, like icicles; *clavated*, like a club, long, and thicker at one end than another; *fasciform*, long straight cylindrical

* See Chemistry, Part III. ch. iv. Suppl.

(A) The fullest account of Werner's external characters which we have seen in the English language, has been given by Dr Townton in his *Philosophy of Mineralogy*. We have availed ourselves of this book, in order to exhibit some of the latest improvements of Werner and his disciples. The reader may also consult *Werner's Treatise*, published at Leipsic in 1774; or the *French translation* published at Dijon in 1790. See also *Rome de Lisle. Des caracters exterieur des mineraux*. And *Hauy Jour. d'hist. Nat.* II. 56.

External Characters. drical bodies, united like a bundle of rods; *tubular*, cylindrical and hollow. 3. When minerals have neither a regular nor particular shape, they are said to be *amorphous*.

6 Surface. II. By SURFACE is meant the appearance of the external surface of minerals. The *surface* is either *uneven*, composed of small unequal elevations and depressions; *scabrous*, having very small *sharp* and rough elevations, more easily felt than seen; *drusy*, covered with very minute crystals; *rough*, composed of very minute *blunt* elevations, easily distinguishable by the feel; *scaly*, composed of very minute thin scale-like leaves; *smooth*, free from all inequality or roughness; *specular*, having a smooth polished surface like a mirror: or *streaked*, having elevated, straight, and parallel lines. This last character is confined to the *surface* of crystals. The *streaks* are either *transverse*; *longitudinal*; *alternate*, in different directions on different faces; *plumose*, running from a middle rib; or *decussated*, crossing each other.

7 Transparency. III. By TRANSPARENCY is meant the proportion of light which minerals are capable of transmitting. They are *transparent* or *pellucid*, when objects can be seen distinctly through them; *diaphanous*, when objects are seen through them indistinctly; *subdiaphanous*, when light passes but in so small a quantity that objects cannot be seen through them (B); *opaque*, when no light is transmitted.

When opaque minerals become transparent in water, they are called *hydrophanous*. When objects are seen double through a transparent mineral, it is said to *refract doubly*.

8 Colour. IV. The colours of minerals may be reduced to eight classes.

1. *Whites*.

Snow white. Pure white.
Reddish white. White with a light tint of red.
Yellowish white. White with a light tint of yellow.
Silver white. Yellowish white with a metallic lustre.
Greyish white. White with a light tint of black.
Greenish white. White with a light tint of green.
Milk white. White with a light tint of blue.
Tin white. Milk white of a metallic lustre.

2. *Greys*.

Bluish grey. Grey with a little blue.
Lead Grey. Bluish grey with a metallic lustre.
Pearl grey. Light grey with a slight mixture of violet blue.
Smoke grey. Dark grey with a little blue and brown.
Greenish grey. Light grey tinged with green.
Yellowish grey. A light grey tinged with yellow.
Steel grey. A dark grey with a light tint of yellow and a metallic lustre.
Black grey. The darkest grey with a tint of yellow.

3. *Blacks*.

Greyish black. Black with a little white.
Brownish black. Black with a tint of brown.
Black. Pure Black.
Iron black. Pure black with a small mixture of white and a metallic lustre.
Bluish black. Black with a tint of blue.

4. *Blues*.

Indigo blue. A dark blackish blue.
Prussian blue. The purest blue.
Azure blue. A bright blue with scarce a tint of red. External Characters.
Smalt blue. A light blue.
Violet blue. A mixture of azure blue and carmine.
Lavender blue. Violet blue mixed with grey.
Sky blue. A light blue with a slight tint of green.

5. *Greens*.

Verdigris green. A bright green of a bluish cast.
Seagreen. A very light green, a mixture of verdigris green and grey.
Beryl Green. The preceding, but of a yellowish cast.
Emerald green. Pure green.
Grass green. Pure green with a tint of yellow.
Apple green. A light green formed of verdigris green and white.
Leek green. A very dark green with a cast of brown.
Blackish green. The darkest green, a mixture of leek green and black.
Pistachio green. Grass green, yellow and a little brown.
Olive green. A pale yellowish green with a tint of brown.
Asparagus green. The lightest green, yellowish with a little brown and grey.

6. *Yellows*.

Sulphur yellow. A light greenish yellow.
Brass yellow. The preceding, with a little less green and a metallic lustre.
Lemon yellow. Pure yellow.
Gold yellow. The preceding with a metallic lustre.
Honey yellow. A deep yellow with a little reddish brown.
Wax yellow. The preceding, but deeper.
Pyritaceous. A pale yellow with grey.
Straw yellow. A pale yellow, a mixture of sulphur yellow and reddish grey.
Wine yellow. A pale yellow with a tint of red.
Ochre yellow. Darker than the preceding, a mixture of lemon yellow with a little brown.
Isabella yellow. A pale brownish yellow, a mixture of pale orange with reddish brown.
Orange yellow. A bright reddish yellow, formed of lemon yellow and red.

7. *Reds*.

Aurora red. A bright yellow red, a mixture of scarlet and lemon yellow.
Hyacinth red. A high red like the preceding, but with a shade of brown.
Brick red Lighter than the preceding; a mixture of aurora red and a little brown.
Scarlet red. A bright and high red with scarce a tint of yellow.
Copper red. A light yellowish red with the metallic lustre.
Blood red. A deep red, a mixture of crimson and scarlet.
Carmine red. Pure red verging towards a cast of blue.
Cochineal red. A deep red; a mixture of carmine with a little blue and a very little grey.
Crimson red. A deep red with a tint of blue.
Flesh red. A very pale red of the crimson kind.
Rose red. A pale red of the cochineal kind.

Peach

(B) After Mr Kirwan, we have denoted these three degrees of transparency by the figures 4, 3, 2. When a mineral is subdiaphanous only at the edges, that is denoted by the figure 1. Opacity is sometimes denoted by 0.

External Characters.

Peach blossom red. A very pale whitish red of the crimson kind.

Mordoré. A dark dirty crimson red; a mixture of crimson and a little brown.

Brownish red. A mixture of blood red and brown.

8. *Browns.*

Reddish brown. A deep brown inclining to red.

Clove brown. A deep brown with a tint of carmine.

Yellowish brown. A light brown verging towards ochre yellow.

Umber brown. A light brown, a mixture of yellowish brown and grey.

Hair brown. Intermediate between yellow brown and clove brown with a tint of grey.

Tombac brown. A light yellowish brown, of a metallic lustre, formed of gold yellow and reddish brown.

Liver brown. A dark brown; blackish brown with a tint of green.

Blackish brown. The darkest brown.

Colours, in respect of intensity, are either *dark, deep, light*, or *pale*. When a colour cannot be referred to any of the preceding, but is a mixture of two, this is expressed, by saying, that the prevailing one *verges* towards the other, if it has only a small tint of it; *passes* into it, if it has a greater.

9 Streak. V. By the SCRATCH or STREAK, is meant the mark left when a mineral is scratched by any hard body, as the point of a knife. It is either *similar*, of the same colour with the mineral; or *dissimilar*, of a different colour.

10 Lustre. VI. LUSTRE, is the gloss or brightness which appears on the external surface of a mineral, or on its internal surface when fresh broken. The first is called *external*, the second *internal* lustre. Lustre is either *common*, that which most minerals possess; *silky*, like that of silk or mother-of-pearl; *waxy*, like that of wax; *greasy*, like that of grease; or *metallic*, like that of metals.

As to the degree, the greatest is called *splendent*, the next *shining*, the third *dullish*; and when only a few scattered particles shine, the lustre is called *dull* (c).

11 Hardness. VII. We have used figures to denote the comparative HARDNESS of bodies; for an explanation of which, we refer to the article CHEMISTRY, Vol. I. p. 272, of this *Supplement*.

12 Ductility and brittleness. VIII. With respect to DUCTILITY and BRITTLENESS, minerals are either *malleable*; *sectile*, capable of being cut without breaking, but not malleable; *flexile*, capable of being bent, and when bent retaining their shape; or *elastic*, capable of being bent, but recovering their former shape. Minerals destitute of these properties are *brittle*. Brittle minerals, with respect to the ease with which they may be broken, are either *very tough, tough, fragile*, or *very fragile*.

13 Fracture. IX. By FRACTURE is meant the fresh surface which a mineral displays when broken. It is either *flat*, without any general elevation or depression; or *conchoidal*, having wide extended roundish hollows and gentle risings. When these are not *very* evident, the fracture is called *flat* conchoidal; when they are small, it is called *small* conchoidal; and when of great extent, *great* conchoidal.

The fracture may also be *even*, free from all asperities; *uneven*, having many small, sharp, abrupt, irregular elevations and inequalities; and from the size of these, this fracture is denominated *coarse, small*, or *fine*; *splintery*, having small, thin, half detached, sharp edged splinters, according to the size of which this fracture is denominated *coarse* or *fine*; or *rugged*, having many very minute sharp hooks, more sensible to the hand than the eye.

14 Texture. X. By TEXTURE is meant the internal structure or disposition of the matter of which a mineral is composed, which may be discovered by breaking it. The texture is either *compact*, without any distinguishable parts, or the appearance of being composed of smaller parts; *earthy*, composed of very minute *almost* imperceptible rough parts; *granular*, composed of small shapeless grains; *globuliform*, composed of small spherical bodies; *fibrous*, composed of fibres which may be *long, short, straight, crooked, parallel, divergent, stellated, fasciculated*, or *decussated*; *radiated*, consisting of long narrow flattish lamellæ; or *lamellar* or *foliated*, consisting of smooth continued plates covering each other: these plates may be either *straight, crooked*, or *undulating*.

15 Structure. XI. The STRUCTURE or COMPOUND TEXTURE is the manner in which the parts that form the texture are disposed. It is either *slaty*, in straight layers like slate; *testaceous*, in incurvated layers; *concentric*, in concentric layers; or *columnar*, in columns.

The *texture* and *structure* may at first view appear the same; but in reality they are very different. Thus common slate has often the *slaty structure* and *earthy texture*. The texture of pitcoal is compact, but its structure is often slaty.

16 Fragments. XII. By FRAGMENTS is meant the shape of the pieces into which a mineral breaks when struck with a hammer. They are either *cubic*; *rhomboidal*; *wedge-shaped*; *splintery*, thin, long, and pointed; *tabular*, thin, and broad, and sharp at the corners, as common slate; or *indeterminate*, without any particular resemblance to any other body. The *edges* of indeterminate fragments are either *very sharp, sharp, sharpish*, or *blunt*.

17 Feel. XIII. By the FEEL of minerals is meant the sensation which their surfaces communicate when handled. The feel of some minerals is *greasy*, of others *dry*, &c.

18 Sound. XIV. Some minerals when struck give a *clear* SOUND, as common slate; others a *dull* sound.

The SMELL, TASTE, SPECIFIC GRAVITY, and MAGNETISM of minerals, require no explanation.

With respect to ELECTRICITY, some minerals become electric when *heated*, others when *rubbed*, others cannot be rendered electric. The electricity of some minerals is *positive* or *vitreous*, of others *negative* or *resinous*.

As for the CHEMICAL properties of minerals, they have been already explained in the article CHEMISTRY, which makes a part of this *Supplement*. And for the description of the blow-pipe, and the manner of using it, we refer the reader to a treatise on that subject prefixed to the article MINERALOGY in the *Encyclopædia*.

CHAP. II. OF THE ARRANGEMENT OF MINERALS.

MINERALS may be arranged two ways, according to their external characters, and according to their chemical composition. The first of these methods has been called an *artificial* classification; the second, a *natural* one.

(c) These four degrees have been denoted by Kirwan by the figures 4, 3, 2, 1, and no lustre by 0. We have imitated him in the present article.

Artificial System.

one. The first is indispensably necessary for the student of nature; the second is no less indispensable for the proficient who means to turn his knowledge to account. Without the first, it is impossible to discover the *names* of minerals; and without the second, we must remain ignorant of their use.

Almost every system of mineralogy hitherto published, at least since the appearance of Werner's *external characters*, has attempted to combine these two arrangements, and to obtain at one and the same time the advantages peculiar to each. But no attempt of this kind has hitherto succeeded. Whether this be owing to any thing impossible in the undertaking, or to the present imperfect state of mineralogy, as is more probable, we do not take upon us to determine. But surely the want of success, which has hitherto attended all attempts to combine the two arrangements, ought to suggest the propriety of separating them. By adhering strictly to one language, the trouble of studying two different systems would be entirely prevented. They would throw mutual light upon each other: the artificial system would enable the student to discover the *names* of minerals; the natural would enable him to arrange them, and to study their properties and uses.

The happy arrangement of Cronstedt, together with the subsequent improvements of Bergman, Werner, Kirwan, Hauy, and other celebrated mineralogists, has brought the *natural* system of mineralogy to a considerable degree of perfection. But an *artificial* system is still a desideratum; for excepting Linnæus, whose success was precluded by the state of the science, no one has hitherto attempted it. Though we are very far from thinking ourselves sufficiently qualified for undertaking such a task, we shall nevertheless venture, in the next chapter, to sketch out the rudiments of an artificial system. The attempt, at least, will be laudable, even though we should fail.

Chap. III. Artificial System.

19 Artificial classes.

Minerals may be divided into six classes:

1. Minerals that cannot be fused by the blow-pipe *per se*.
2. Minerals fusible *per se* by the blow-pipe.
3. Minerals fusible by the blow-pipe *per se* when exposed to the blue flame, but not when exposed to the yellow flame.
4. Minerals fusible *per se* by the blow-pipe; and when in fusion, partly evaporating in a visible smoke.
5. Minerals which totally evaporate before the blow-pipe.
6. Minerals totally soluble in muriatic acid with effervescence, the solution colourless.

Under these heads we shall arrange the subjects of the mineral kingdom.

Class I. INFUSIBLE.

ORDER I. Specific gravity from 16 to 12.
- Genus I. Colour whitish iron grey.
  - *Species* 1. Native platinum.

ORDER II. Sp. gr. 8.5844 to 7.006.
- Genus I. Attracted by the magnet.
  - *Sp.* 1. Native iron.
- Genus II. Not attracted by the magnet.
  - *Sp.* 1. Native copper.
    Flexible and malleable. Colour usually red.
  - *Sp.* 2. Wolfram.
    Brittle. Colour usually brown or black.

ORDER III. Sp. gr. from 6.4509 to 5.8.
- Genus I. Forms a blue glass with microcosmic salt, which becomes colourless in the yellow, but recovers its colour in the blue flame.
  - *Sp.* 1. Tungstat of lime.
- Genus II. Forms with microcosmic salt a permanently coloured bead.
  - *Sp.* 1. Sulphuret of cobalt.

ORDER IV. Sp. gr. from 4.8 to 4.5.
- Genus I. Tinges borax dark green.
  - *Sp.* 1. Common magnetic iron stone.
- Genus II. Tinges borax reddish brown.
  - *Sp.* 1. Grey ore of manganese.

ORDER V. Sp. gr. from 4.4165 to 3.092. Infusible with fixed alkalies.
- Genus I. Hardness 20.
  - *Sp.* 1. Diamond.
- Genus II. Hardness 15 to 17. Causes single refraction.
  - *Sp.* 1. Telesia.
  - *Sp.* 2. Corundum.
- Genus III. Hardness 13. Single refraction.
  - *Sp.* 1. Ruby.
    Crystallizes in octohedrons.
- Genus IV. Hardness 12. Single refraction.
  - *Sp.* 1. Chrysoberyl.
- Genus V. Hardness 12. Causes double refraction. Becomes electric when heated.
  - *Sp.* 1. Topaz.
- Genus VI. Hardness 10 to 16. Double refraction. Sp. gr. 4.2 to 4.165.
  - *Sp.* 1. Zircon.
- Genus VII. Hardness 6 to 9. Feels greasy.
  - *Sp.* 1. Cyanite.
- Genus VIII. Hardness 9 to 10. Feel not greasy. Double refraction. Sp. gr. 3.283 to 3.285.
  - *Sp.* 1. Chrysolite.
- Genus IX. Hardness 12. Infusible with borax. Colour of large masses black, of thin pieces deep green.
  - *Sp.* Ceylanite.

(Phosphat of lime.)

ORDER VI. Sp. gr. from 2.9829 to 1.987. Infusible with fixed alkalies.
- Genus I. Hardness 12.
  - *Sp.* 1. Emerald.
- Genus II. Hardness 10.
  - *Sp.* 1. Jade.
- Genus III. Hardness 6 to 7. Somewhat transparent.
  - *Sp.* 1. Phosphat of lime.
    Before the blow-pipe becomes surrounded with a luminous green vapour.
- Genus IV. Hardness 6. Opaque.
  - *Sp.* 1. Micarelle.
- Genus V. Stains the fingers. Colour lead grey.
  - *Sp.* 1. Plumbago.
    Spanish wax rubbed with plumbago does not become electric; or if it does, the electricity is negative. Streak lead grey even on earthen ware.

ORDER VII. Sp. gr. from 4.7385 to 4.569. Fusible with fixed alkalies.

Genus

GENUS I. Stains the fingers. Colour lead grey.
Sp. 1. Molybdena.
Spanish wax rubbed with molybdena becomes positively electric. Streak on earthen ware yellowish green.

ORDER VIII. Sp. gr. from 4.1668 to 2.479. Fusible with fixed alkalies.
* Hardness from 10 to 12.
GENUS I. Usually white. Crystals dodecahedrons. Double refraction. Fracture imperfectly conchoidal or splintery. Brittle.
Sp. 1. Quartz.
GENUS II. Usually dark brown. Fracture perfectly conchoidal. Brittle. Easily breaks into splinters.
Sp. 1. Flint.
GENUS III. Not brittle. Fracture even or imperfectly conchoidal.
Sp. 1. Chalcedony.
Sp. 2. Jasper.
GENUS IV. Forms with potass a violet glass, with soda or borax a brown glass, with microcosmic salt a honey yellow glass. Colour green. Amorphous.
Sp. 1. Chrysoprasium.
GENUS V. Tinges soda red. The colour disappears before the blue flame, and returns before the yellow flame.
Sp. 1. Oxyd of manganese and barytes.
Sp. 2. Black ore of manganese.
Sp. 3. Carbonat of manganese.
(Brown ore of iron. Red ore of iron.)
** Hardness 9 to 3.
GENUS VI. Flexible and elastic in every direction.
Sp. 1. Elastic quartz.
GENUS VII. Emits white flakes before the blow-pipe.
Sp. 1. Blende.
GENUS VIII. Becomes electric when heated.
Sp. 1. Calamine.
GENUS IX. Tinges borax green. Blackens before the blow-pipe.
Sp. 1. Mountain blue.
Colour blue.
Sp. 2. Green carbonat of copper.
Colour green.
GENUS X. Tinges borax green. Becomes attractable by the magnet by the action of the blow-pipe.
Sp. 1. Brown iron ore.
Colour brown.
Sp. 2. Red iron ore.
Colour red.
GENUS XI. Tinges borax smutty yellow. Becomes brownish black before the blow-pipe.
Sp. 1. Carbonat of iron.
GENUS XII. Feels greasy.
Sp. 1. Steatites.
(Black ore of Manganese. Carbonat of manganese. Mica.)

ORDER IX. Sp. gr. from 2.39 to 1.7.
GENUS I. Lustre glassy.
Sp. 1. Opal.
Sp. 2 Hyalite.
GENUS II. Lustre greasy.
Sp 1. Pitchstone.
GENUS III. Lustre waxy or pearly.
Sp. 1. Staurolite.

CLASS II. FUSIBLE.

ORDER I. Sp. gr. from 19 to 10.
GENUS I. Colour Yellow.
Sp. 1. Native gold.
GENUS II. Colour white.
Sp. 1. Native Silver.
GENUS III. Colour yellowish white.
Sp. 1. Alloy of silver and gold.

ORDER II. Sp. gr. from 7.786 to 4.5.
GENUS I. Flexible and malleable.
Sp. 1. Sulphuret of silver.
** Brittle.
GENUS II. Tinges borax white.
Sp. 1. Tinstone.
GENUS III. Tinges borax green.
Sp. 1. Sulphuret of copper.
Colour bluish grey.
Sp. 2. Chromat of lead.
Colour aurora red.
Sp. 3. Purple copper ore.
Colour purple.
GENUS IV. Tinges borax faint yellow. Becomes black when exposed to the vapour of sulphuret of ammonia.
Sp. 1. Galena.
Colour bluish grey. Lustre metallic. Fragments cubic.
Sp. 2. Black lead ore.
Colour black. Lustre metallic.
Sp. 3. Lead ochre.
Colour yellow, grey, or red. Lustre c.
Sp. 4. Carbonat of lead.
Colour white. Lustre waxy.
Sp. 5. Phosphat of lead.
Usually green. Lustre waxy. After fusion by the blow-pipe crystallizes on cooling.
Sp. 6. Molybdat of lead.
Colour yellow. Streak white. Lustre waxy.

ORDER III. Sp. gr. from 4.35 to 3.
* Hardness 14 to 9.
GENUS I. Melts without frothing into a grey enamel.
Sp. 1. Garnet.
Colour red.
GENUS II. Melts into a brownish enamel.
Sp. 1. Shorl.
Colour black. Opaque.
GENUS III. Froths and melts into a white enamel.
Sp. 1. Tourmaline.
Becomes electric by heat.
GENUS IV. Froths and melts into a greenish black enamel.
Sp. 1. Basaltine.
GENUS V. Froths and melts into a black enamel.
Sp. 1. Thallite.
Colour dark green.
Sp. 2. Thumerstone.
Colour clove brown.
** Hardness 5 to 8.
GENUS VI. Melts into a transparent glass.

Artificial Syſtem.

Sp. 1. Fluat of lime.
Powder phoſphoreſces when thrown on a hot iron.

GENUS VII. Melts into a black glaſs.
Sp. 1. Hornblende.

GENUS VIII. Melts into a black bead with a ſulphureous ſmell, and depoſits a blue oxyd on the charcoal.
Sp. 1. Sulphuret of tin.

GENUS IX. Melts into a brown glaſs. Tinges borax violet.
Sp. 1. Aſbeſtoid.
Colour green.

GENUS X. Melts into a brown (?) glaſs. When fuſed with potaſs, and diſſolved in water, the ſolution becomes of a fine orange yellow.
Sp. 1. Chromat of iron.

GENUS XI. Before the blow-pipe yields a bead of copper.
Sp. 1. Red oxyd of copper.
(Sulphuret of copper.)

ORDER IV. Sp. gr. from 2.945 to 2.437.

GENUS I. Compoſed of ſcales.
Sp. 1. Talk.
Feels greaſy. Spaniſh wax rubbed by it becomes poſitively electric.

GENUS II. Compoſed of thin plates, eaſily ſeparable from each other.
Sp. 1. Mica.
Plates flexible and elaſtic, may be torn but not broken. Spaniſh wax rubbed by it becomes negatively electric.
Sp. 2. Stilbite.
Plates ſomewhat flexible. Colour pearl white. Powder renders ſyrup of violets green. Froths and melts into an opaque white enamel.
Sp. 3. Lepidolite.
Colour violet. Powder white with a tint of red. Froths and melts into a white ſemitranſparent enamel full of bubbles.

GENUS III. Texture foliated.
Sp. 1. Felſpar.
Fragments rhomboidal. Hardneſs 9 to 10.
Sp. 2. Leucite.
Always cryſtallized. White. Powder renders ſyrup of violets green. Hardneſs 8 to 10.
Sp. 3. Argentine felſpar.
Always cryſtallized. Two faces dead white, two ſilvery white.
Sp. 4. Prehnite.
Colour green. Froths and melts into a brown enamel.

GENUS IV. Texture fibrous. Fibres eaſily ſeparated.
Sp. 1. Aſbeſtus.
Feels ſomewhat greaſy.

GENUS V. Texture ſtriated.
Sp. 1. Ædelite.
Abſorbs water. Froths and melts into a frothy maſs.

GENUS VI. Texture earthy or compact.
Sp. 1. Lazulite.
Froths and melts into a yellowiſh black maſs. If previouſly calcined, gelatinizes with acids.
Sp. 2. Borat of lime.
Tinges the flame greeniſh, froths and melts into a yellowiſh enamel garniſhed with ſmall projecting points. If the blaſt be continued, theſe dart off in ſparks.

ORDER V. Sp. gr. from 2.348 to 0.68.

GENUS I. Hardneſs 10.
Sp. 1. Obſidian.
Colour blackiſh, in thin pieces green.

GENUS II. Hardneſs 6 to 8.
Sp. 1. Zeolite.
Gelatinizes with acids. Becomes electric by heat.

GENUS III. Hardneſs 3 to 4.
Sp. 1. Amianthus.
Feels greaſy. Texture fibrous.
Sp. 2. Mountain Cork.
Elaſtic like cork.

CLASS III. FUSIBLE BY THE BLUE FLAME, INFUSIBLE BY THE YELLOW.

GENUS I. Sp. gr. from 4.43 to 4.4.
Sp. 1. Sulphat of barytes.

GENUS II. Sp. gr. from 3.96 to 3.51.
Sp. 1. Sulphat of ſtrontites.

GENUS III. Sp. gr. from 2.311 to 2.167.
Sp. 1. Sulphat of lime.

CLASS IV. FUSIBLE, AND PARTLY EVAPORATING.

ORDER I. Sp. gr. from 10 to 5.

GENUS I. Colour white or grey. Luſtre metallic.
* Sp. gr. 9 to 10.
Sp. 1. Native amalgam.
Tinges gold white. Creaks when cut.
Sp. 2. Alloy of ſilver and antimony.
Powder greyiſh black.
* * Sp. gr. from 6.467 to 5.309.
Sp. 3. Sulphuret of biſmuth.
Melts when held to the flame of a candle.
Sp. 4. Dull grey cobalt ore.
Streak bluiſh grey. Hardneſs 10. When ſtruck, emits an arſenical ſmell. Luſtre ſcarcely metallic.

GENUS II. Colour red, at leaſt of the ſtreak.
Sp. 1. Red ſilver ore.
Burns with a blue flame.
Sp. 2. Hepatic mercurial ore.
Does not flame, but gives out mercury before the blow-pipe.

GENUS III. Colour blue.
Sp. 1. Blue lead ore.
Burns with a blue flame and ſulphureous ſmell, and leaves a button of lead.

GENUS IV. Colour yellowiſh green.
Sp. 1. Phoſphat and arſeniat of lead combined.
When fuſed by the blow-pipe, cryſtallizes on cooling.

GENUS V. Colour uſually that of copper. Sp. gr.

Artificial System.

gr. 6.6084 to 6.6481.

Sp. 1. Sulphuret of nickel.
Exhales before the blow-pipe an arsenical smoke.

ORDER II. Sp. gr. from 4.6 to 3.44.

GENUS I. Colour grey.

Sp. 1. Grey ore of antimony.
Burns with a blue flame, and leaves a white oxyd.

Sp. 2. Grey copper ore.
Crackles before the blow-pipe.

GENUS II. Colour yellow.

Sp. 1. Pyrites.
Burns with a blue flame and sulphureous smell, and leaves a brownish bead.

Sp. 2. Yellow copper ore.
Melts into a black mass.

CLASS V. EVAPORATING.

ORDER I. Sp. gr. 13.6.

GENUS I. Fluid.

Sp. 1. Native mercury.

ORDER II. Sp. gr. from 10 to 5.419.

GENUS I. Colour red.

Sp. 1. Native cinnabar.

GENUS II Colour white or grey. Lustre metallic.

Sp. 1. Native bismuth.
Melts into a white bead, and then evaporates in a yellowish white smoke. Sp. gr. 9 to 9.5.

Sp. 2. Native antimony
Melts and evaporates in a grey smoke. Sp. gr. 6.6 to 6 8.

Sp. 3. Native arsenic.
Evaporates without melting, and gives out a garlic smell.

ORDER III. Sp. gr. from 4.8 to 3.33.

GENUS I Colour red.

Sp. 1. Red antimonial ore.
Melts with a sulphureous smell. Sp. gr. 4.7.

Sp. 2. Realgar.
Melt with a garlic smell. Sp. gr. 3.384.

GENUS II. Colour yellow.

Sp. 1. Orpiment.

CLASS VI. SOLUBLE WITH EFFERVESCENCE IN MURIATIC ACID.

Natural System.

GENUS I. Sp. gr. from 4.338 to 4.3.

Sp. 1. Carbonat of barytes.

GENUS II. Sp. gr. from 3.66 to 3.4.

Sp. 1. Carbonat of strontites.

GENUS III. Sp. gr. from 2.8 to 1 or under.

Sp. 1. Carbonat of lime.

We have purposely avoided giving names to the classes, orders, and genera; because a more careful examination will doubtless suggest many improvements in the arrangement, and an artificial system ought to be brought to a great degree of perfection before its classes, orders, and genera, be finally settled.

We have excluded from this arrangement all these bodies which in the following system are arranged under the class of combustibles; because there can scarcely be any difficulty in distinguishing them both from the other classes and from one another. For similar reasons we have excluded the class of salts.

CHAP. IV. NATURAL SYSTEM.

Avicenna, a writer of the 11th century, divided minerals into four classes; stones, salts, inflammable bodies, and metals (D). This division has been, in some measure, followed by all succeeding writers. Linnæus, indeed, the first of the moderns who published a system of mineralogy, being guided by the external characters alone, divided minerals into three classes, *petræ*, *mineræ*, *fossilia*: but Avicenna's classes appear among his orders. The same remark may be made with respect to the systems of Wallerius, Wolsterdorf, Cartheuser, and Justi, which appeared in succession after the first publication of Linnæus's *Systema Naturæ*, in 1736. At last, in 1758, the system of Cronstedt appeared. He reinstated the classes of Avicenna in their place; and his system was adopted by Bergman, Kirwan, Werner, and the most celebrated mineralogists who have written since. We also shall adopt his classes, with a few slight exceptions; because we are not acquainted with any other division which is intitled to a preference.

We shall therefore divide this treatise into four classes. I. Stones. II. Salts. III. Combustibles. IV. Ores. 23 Natural classes.

The first class comprehends all the minerals which are composed chiefly or entirely of earths; the second, all the combinations of acids and alkalies which occur in the mineral kingdom: the third, those minerals which are capable of combustion, and which consist chiefly of sulphur, carbon, and oil; the fourth, the mineral bodies which are composed chiefly of metals.

CLASS I. EARTHS AND STONES.

We shall divide this class into three orders. The first order shall comprehend all chemical combinations of earths with each other; the second order, chemical combinations of earths with acids; and the third order, mechanical mixtures of earths or stones. All the minerals belonging to the first order exhibit the same homogeneous appearance to the eye as if they were simple bodies. We shall therefore, for want of a better name, call the first order *simple*: the second order we shall distinguish by the epithet of *saline*: and the third we shall call

(D) Corpora mineralia in quatuor species dividuntur, scilicet in lapides, et in liquefactiva, sulphurea, et sales. Et horum quædam sunt raræ substantiæ et debilis compositionis, et quædam fortis substantiæ, et quædam ductibilia, et quædam non. *Avicenna de congelatione et conglutinatione lapidum*, Cap. 3. *Theatrum Chemicum*, t. iv. p. 997.

Earths and Stones.

call *aggregates*: becaufe moft of the minerals belonging to it confift of various *fimple ftones*, cemented, as it were, together.

Order I. SIMPLE STONES.

21 Cronftedt's genera

Cronstedt divided this order into nine genera, correfponding to nine earths; one of which he thought compofed the ftones arranged under each genus. The names of his genera were, *calcareæ, filiceæ, granatinæ, argillaceæ, micaceæ, fluores, afbeftinæ, zeolithicæ, magnefiæ*. All his earths were afterwards found to be compounds, except the firft, fecond, fourth, and ninth. Bergman, therefore, in his Sciagraphia, firft publifhed in 1782, reduced the number of genera to five; which was the number of primitive earths known when he wrote. Since that period three new earths have been difcovered. Accordingly, in the lateft fyftems of mineralogy, the genera belonging to this order amount to eight. Each genus is named from an earth; and they are arranged in the neweft Wernerian fyftem, which we have feen, as follows:

22 Improved.

1. Jargon genus.	5. Magnefian genus.
2. Siliceous genus.	6. Calcareous genus.
3. Glucina genus.	7. Barytic genus.
4. Argillaceous genus.	8. Strontian genus.

Mr Kirwan, in his very valuable fyftem of mineralogy, has adopted the fame genera. Under each genus, thofe ftones are placed, which are compofed chiefly of the earth which gives a name to the genus, or which at leaft are fuppofed to poffefs the characters which diftinguifh that earth.

23 Still deficient.

A little confideration will be fufficient to difcover that there is no natural foundation for thefe genera. Moft ftones are compofed of two, three, or even four ingredients; and, in many cafes, the proportion of two or more of thefe is nearly equal. Now, under what genus foever fuch minerals are arranged, the earth which gives it a name muft form the fmalleft part of their compofition. Accordingly, it has not been fo much the chemical compofition, as the external character, which has guided the mineralogift in the diftribution of his fpecies. The genera cannot be faid properly to have any character at all, nor the fpecies to be connected by any thing elfe than an arbitrary title. This defect, which muft be apparent in the moft valuable fyftems of mineralogy, feems to have arifen chiefly from an attempt to combine together an artificial and natural fyftem. As we have feparated thefe two from each other, it becomes neceffary for us to attend more accurately to the natural diftribution of genera than has hitherto been done. We have accordingly ventured to form new genera for this order, and we have formed them according to the following rules.

24 New genera.

The only fubftances which enter into the minerals belonging to this order, in fuch quantity as to deferve attention, are the following:

Alumina,	Glucina,
Silica,	Zirconia,
Magnefia,	Oxyd of iron,
Lime,	Oxyd of chromum,
Barytes,	Potafs.

Simple Stones.

All thofe minerals which are compofed of the *fame* ingredients we arrange under the *fame* genus. According to this plan, there muft be as many genera as there are varieties of combinations of the above fubftances exifting in nature. The varieties in the *proportion* of the ingredients conftitute fpecies. We have not impofed names upon our genera, but, in imitation of Bergman,* have denoted each by a fymbol. This fymbol is compofed of the firft letter of every fubftance which enters in any confiderable quantity into the compofition of the minerals arranged under the genus denoted by it. Thus, fuppofe the minerals of a genus to be compofed of *alumina, filica*, and *oxyd of iron*, we denote the genus by the fymbol *afi*. The letters are arranged according to the proportion of the ingredients; that which enters in the greateft proportion being put firft, and the others in their order. Thus the genus *afi* is compofed of a confiderable proportion of alumina, of a fmaller proportion of filica, and contains leaft of all of iron. By this contrivance, the fymbol of a genus contains, within the compafs of a few letters, a pretty accurate defcription of its nature and character. Where the proportions of the ingredients vary in the fame genus fo much, that the letters which conftitute its fymbol change their place, we fubdivide the genus into parts; and whenever the minerals belonging to any genus become too numerous, advantage may be taken of thefe fubdivifions, and each of them may be formed into a feparate genus. At prefent this feems unneceffary (E).

* *Opufc.* iv. 231.

The following is a view of the different genera belonging to this order, denoted each by its fymbol. Every genus is followed by the fpecies included under it; and the whole are in the order which we mean to follow in defcribing them:

I. A.
Telefia,
Corundum,
Native alumina.

II. AMC.
Ruby.

III. AIM.
Ceylanite,

IV. S.
Quartz,
Elaftic quartz,
Flint,
Opal,
Pitchftone,
Chryfopraſium.

V. 1. AS.
Topaz,
Sommite,
Shorlite.

2. SA.
Rubellite,
Hornflate,
Hornftone,
Chalcedony,
Jafper,
Tripoli.

VI. 1. ASI.
Micarell,
Shorl,
Granatite,

2. SAI.
Tourmaline,
Argentine felfpar,
Mica,
Talc,
Bafaltine,
Hornblende,
Obfidian,
Petrilite,
Felfite.

VII. SAP.
Felfpar,
Lepidolite,
Leucite.

VIII. SAG.
Emerald.

IX. SAB.
Staurolite.

X. 1. ASL.
Chryfoberyl.

2. SAL.
Hyalite,
Ædelite.

3. SAWL.

(E) We need hardly remark, that the laft three genera of Werner belong to the fecond order of the firft clafs of this treatife.

Earths and Stones.

3. SAWL.
Zeolite,
Stilbite,
Analcime.
4. SLA.
Lazulite.
XI. SALI.
Garnet,
Thumerstone,
Prehnite,
Thallite.
XII. 1. AMS.
Cyanite.
2. MSA.
Serpentine.
XIII. MSAL.
Pottstone,
Chlorite.
XIV. SLAM.
Siliceous spar.
XV. SAMLI.
Argillite.
XVI. SM.
Kiffekill,
Steatites.
XVII. MSI.
Chrysolite,
Jade.
XVIII. SML.
Asbestus,
Asbestinite.
XIX. 1. SILM.
Pyroxen,
Asbestoid.
2. SMIL.
Actinolite.
XX. SL.
Shistose hornestone.
XXI. ZS.
Zircon.

25
G. I. A.
Telesia.

GENUS I. A.

SPECIES 1. Telesia (F).

Oriental ruby, sapphire, and *topaz* of mineralogists.—*Rubis d'orient* of De Lisle.

Three stones, distinguished from each other by their colour, have long been held in high estimation on account of their hardness and beauty. These stones were known among lapidaries by the names of *ruby, sapphire,* and *topaz,* and the epithet *oriental* was usually added, to distinguish them from other three, known by the same names and the same colours, but very inferior in hardness and beauty. Mineralogists were accustomed to consider these stones as three distinct species, till Romé de Lisle observed that they agreed in the form of their crystals, their hardness, and most of their other properties. These observations were sufficient to constitute them one species; and accordingly they were made one species by Romé de Lisle himself, by Kirwan, and several other modern mineralogical writers. But this species was destitute of a proper name, till Mr Hauy, whose labours, distinguished equally by their ingenuity and accuracy, have contributed not a little to the progress of mineralogy, denominated it *telesia,* from the Greek word τελεσιος, which signifies *perfect.*

The telesia is found in the East Indies, especially in Pegu and the island of Ceylon; and it is most commonly crystallized. The crystals are of no great size: Their *primitive* form, according to Mr Hauy, is a regular six-sided prism, divisible in directions parallel both to its bases and its sides; and consequently giving for the form of its primitive nucleus, or of its *integrant molecule,* an equilateral three-sided prism.* The most usual variety is a dodecahedron, in which the telesia appears under the form of two very long slender six-sided pyramids, joined base to base.† The sides of these pyramids are isosceles triangles, having the angle at their vertex 22° 54′, and each of those at the base 78° 48′ (G). The inclination of a side of one pyramid to a contiguous side of the other pyramid is 139° 54′.† In some specimens the summits of the pyramids are wanting, so that the crystal has the appearance of a six-sided prism, somewhat thicker in the middle than towards the extremities.* The three alternate angles at each extremity of this prism are also sometimes wanting, and a small triangular face instead of them, which renders the bases of the supposed prism nine-sided. The inclination of each of these small triangles to the base is 122° 18′ ‡ For figures of these crystals we refer the reader to Romé de Lisle and Hauy.*

* Anne. de Chim. xvii. 313.
† Plate XXXVI. fig. 1.
† Ibid. and Romé de Lisle, ii. 215.
* Fig. 2.
‡ Hauy, Ibid.
* Ibid.

The texture of the telesia is foliated, and the joints are parallel to the base of the prism.† Its lustre varies from 3 to 4 (H). Transparency usually 3 or 4, sometimes only 2. It causes only a single refraction. Specific gravity from 4. to 4.288. Hardness from 15 to 17. It is either colourless, or red, yellow or blue. These colours have induced lapidaries to divide the telesia into the three following varieties.

† Hauy.

Variety 1. Red telesia.

Oriental ruby.

Colour carmine red, sometimes verging towards violet. Sometimes various colours appear in the same stone, as red and white, red and blue, orange red. Hardness 17. Sp. gr. 4 288.

Variety 2. Yellow telesia.

Oriental topaz.

Colour golden yellow. Transp. 4. Hardness 15. Sp. gr. 4.0106.

Variety 3. Blue telesia.

Oriental sapphyr

Colour Berlin blue, often so very faint that the stone appears almost colourless. Transp. 3, 4, 2. Hardness 17. Sp. gr. 3 991 to 4.083.‡ This variety is not probably the same with the sapphyr of the ancients. Their sapphyr was distinguished by gold-coloured spots, none of which are to be seen in the sapphyr of the moderns.‖

‡ Greville, Nicholson's Jour. iii. 11.
‖ Hill's Theophrastus, περι των λιθων, p. 102.

A specimen of this last variety, analysed by Mr Klaproth, was found to contain in 100 parts,

98.5 alumina,
1 0 oxyd of iron,
0.5 lime,

100.0 *.

* Beiträge, i. 81.

The colouring matter of all these varieties is, according to Bergman's experiments, iron, in different states of oxydation. He found that the topaz contained 06. the ruby .1, and the sapphyr .02 of that metal † But when these experiments were made, the analysis of stones was not arrived at a sufficient degree of perfection to ensure accuracy No conclusion, therefore, can be drawn from these experiments, even though we were certain that they were made upon the real varieties of telesia.

† Bergman, ii. 96.

SPECIES.

(F) See *Kirwan's Mineralogy,* I. 250.—*Gmelin's Systema Naturæ of Linnæus,* III. 170.—*Romé de Lisle's Crystallographie,* II. 212.—*Bergmanni Opuscula.* II. 72.

(G) In some instances, the angle at the vertex is 31°, those at the base 74° 30′, and the inclination of two triangles 122° 36′ See *Hauy, ibid.*

(H) When the *kind* of lustre is not specified, as in the present instance, the *common* is always meant.

Earths and Stones.

26 Corundum.

SPECIES 2. Corundum (I).

Corundum of Gmelin—*Adamantine spar* of Klaproth and Kirwan—*Corindon* of Hauy—*Corivinaum* of Woodward.

This stone, though it appears to have been known to Mr Woodward, may be said to have been first distinguished from other minerals by Dr Black. In 1768, Mr Berry, a lapidary in Edinburgh, received a box of it from Dr Anderson of Madras. Dr Black ascertained, that these specimens differed from all the stones known to Europeans; and, in consequence of its hardness, it obtained the name of *adamantine spar*. Notwithstanding this, it could scarcely be said to have been known to European mineralogists till Mr Greville of London, who has done so much to promote the science of mineralogy, obtained specimens of it, in 1784, from India, and distributed them among the most eminent chemists, in order to be analysed. Mr Greville also learned, that its Indian name was Corundum. It is found in Indostan, not far from the river Cavery, which is south from Madras, in a rocky matrix, of considerable hardness, partaking of the nature of the stone itself.* It occurs also in China; and a substance, not unlike the matrix of corundum, has been found in Teree, one of the western islands of Scotland †.

The corundum is usually crystallized. Its primitive form, discovered by Mr Hauy ‡ and the Count de Bournon,* is a rhomboidal parallelopiped, whose sides are equal rhombs, with angles of 86° and 94°, according to Bournon, or whose diagonals are to each other as $\sqrt{17}$ to $\sqrt{15}$, according to Hauy; which is very nearly the same thing †. The most common variety, for the primitive form has never yet been found, is the regular six-sided prism, the alternate angles of which are sometimes wanting ||, and the triangular faces, which occupy their place, are inclined to the base at an angle of 122° 34′ ‡. Sometimes the corundum is crystallized in the form of a six-sided pyramid, the apex of which is generally wanting. For a description and figure of these, and all the other varieties of corundum hitherto observed, we refer the reader to the dissertation of the Count de Bournon on the subject.*

The texture of the corundum is foliated, and the natural joints are parallel to the faces of the primitive rhomboidal parallelopiped. Lustre, when in the direction of the laminæ, 3; when broken across, 0. Opake, except when in very thin pieces. Hardness 15. Sp. gr. from 3.710 to 4.180 †. Colour grey, often with various shades of blue and green.

According to the analysis of Klaproth, the corundum of India is composed of

89.5	alumina,
5.5	silica,
1.25	oxyd of iron,
96.25 ‡.	

* Garrow and Greville, Nicholson's Jour. ii. 540.
† Greville, ibid.
‡ Jour de Min. N° xxviii. 262.
* Nicholson's Jour. ii. 541.
† Fig. 3.
|| Fig. 4.
‡ De Bournon.
* See also Hauy Jour. de Min. N° xxviii. 262.
† Klaproth. See also Mr Greville, Nicholson's Jour. iii. 11.
‡ Beiträge, i. 77.

A specimen from China of

84.0	alumina,
6.5	silica,
7.5	oxyd of iron,
98.0 ||.	

Notwithstanding the quantity of silica and of iron which these analyses exhibit in the corundum, we have been induced to include it in the present genius, on account of the strong resemblance between it and the third variety of telesia. The striking resemblance between the crystals of telesia and corundum will appear evident, even from the superficial description which we have given; and the observations of De Bournon* render this resemblance still more striking. It is not improbable, therefore, as Mr Greville and the Count de Bournon have suggested, that corundum may be only a variety of telesia, and that the seeming difference in their ingredients is owing to the impurity of those specimens of corundum which have hitherto been brought to Europe. Let not the difference which has been found in the primitive form of these stones be considered as an insuperable objection, till the subject has been again examined with this precise object in view; for nothing is easier than to commit an oversight in such difficult examinations.

27 Native alumina.

SPECIES 3. Native alumina (K).

This substance has been found at Halles in Saxony in compact kidney-form masses. Its consistence is earthy. Lustre 0. Opaque. Hardness 4. Brittle. Sp. gr. moderate. Feels soft, but meagre. Adheres very slightly to the tongue. Stains very slightly. Colour pure white. Does not readily diffuse itself in water.

It consists of pure alumina, mixed with a small quantity of carbonat of lime, and sometimes of sulphat of lime †.

28 G. II. AMC. Ruby.

GENUS II. AMC.

SPECIES 1 Ruby (L).

Spinel and *balass Ruby* of Kirwan—*Ruby* of Hauy—*Rubis spinelle octoedre* of De Lisle—*Spinelus* of Gmelin.

This stone, which comes from the island of Ceylon, is usually crystallized. The primitive form of its crystals is a regular octohedron, composed of two four-sided pyramids applied base to base, each of the sides of which is an equilateral triangle ‡ (M). In some cases two opposite sides of the pyramids are broader than the other two; and sometimes the edges of the octohedron are wanting, and narrow faces in their place. For figures and descriptions of these, and other varieties of these crystals, we refer the reader to *Romé de Lisle* and the *Abbé Estner*.*

The texture of the ruby is foliated. Its lustre is 3. Transp. 3.4. It causes a single refraction. Hardness 13. Sp. gr. 3.570 † to 3.625 ‡. Colour red; if deep, the ruby is usually called *balass*; if pale rosy, *spinell*.

The

|| Ibid. i. 78.
* Nicholson's Jour. iii. 9.
† Schreber.
‡ Fig. 5.
* Crystall. ii. 226. Estner's Miner. 75.
† Klaproth.
‡ Hatchette and Greville.

(I) See *Kirwan's Mineralogy*, I.—*Klaproth in Beob. der Berlin*, VIII. 295. and *Beiträge*, I. 47.—*Mr Greville* and the *Count de Bournon* in the *Philosophical Transactions* 1798, p. 403. and in *Nicholson's Journal*, II. 540. and III. 5.—*Mr Hauy Jour. de Phys.* XXX. 193. and *Jour de Min.* N° XXVIII. 262.

(K) See *Kirwan's Mineralogy*, I. 175, and *Schreber* 15. *Stück*, p. 209.

(L) See *Kirwan's Min.* I. 253.—*Romé de Lisle*, II. 224.—*Klaproth Beob. der Berlin*, III. 336. and *Beitrage*, II. 1.—*Vauquelin Ann. de Chim.* XXVII. 3. and XXXI. 141.

(M) We shall afterwards distinguish this octohedron either by the epithet *regular* or *aluminiform*, because it is the well known form of crystals of alum.

Earths and Stones.

The ruby, according to the analysis of Vauquelin, is composed of

86.00	alumina,
8.50	magnesia,
5.25	chromic acid.
99.75*	

* Ann. de Chim. xxvii. 15.

The ancients seem to have classed this stone among their hyacinths †.

† Plinii, l. 37. c. 9.

29 G. III. AIM. Ceylanite.

GENUS III. AIM.

SPECIES 1. Ceylanite

The mineral denominated *ceylanite*, from the island of Ceylon, from which it was brought into Europe, had been observed by Romé de Lisle ‡; but was first described by La Metherie in the Journal de Physique for January 1793.

‡ Crystallog. iii. 180. Note 21.

It is most commonly found in rounded masses; but sometimes also crystallized. The primitive form of its crystals is a regular octohedron: it commonly occurs under this form, but more commonly the edges of the octohedron are wanting, and small faces in their place ‡.

‡ Hauy, Jour. de Min. N° xxxviii. 264.

The fracture of the ceylanite is conchoidal.* Its internal lustre is glassy. Nearly opaque, except when in very thin pieces. Hardness 12. Sp. gr. from 3.7647 † to 3.793 ‡. Colour of the mass, black; of very thin pieces, deep green. Powder, greenish grey. According to the analysis of Descotils the ceylanite is composed of

* Ibid 263. † Hauy. ‡ Descotils.

68	alumina,
16	oxyd of iron,
12	magnesia,
2	silica.
98 §.	

§ Ann. de Chim. xxiii. 113.

30 G. IV. s. 1. Quartz.

SPECIES 1. Quartz ||.

|| Kirwan's Min. i. 241.

This stone, which is very common in most mountainous countries, is sometimes crystallized, and sometimes amorphous. The primitive form of its crystals, according to Mr Hauy, is a rhomboidal parallelopiped; the angles of whose rhombs are 93° 22′, and 86° 38; so that it does not differ much from a cube.* The most common variety is a dodecahedron ‡, composed of two six-sided pyramids, applied base to base, whose sides are isosceles triangles, having the angle at the vertex 40°, and each of the angles at the base 70°; the inclination of a side of one pyramid to the contiguous side of the other pyramid is 104°. There is often a six-sided prism interposed between the two pyramids, the sides of which always correspond with those of the pyramids ||. For a description and figure of the other varieties of quartz crystals, and for a demonstration of the laws which they have followed in crystallizing, we refer the reader to *Romé de Lisle* † and *Mr Hauy* ‡.

* Jour. de Min. N° xxviii. 255. ‡ Fig. 6. || Fig. 7.

The texture of quartz is more or less foliated. Fracture, conchoidal or splintery. Its lustre varies from 3 to 1, and its transparency from 4 to 1; and in some cases it is opaque. It causes a double refraction. Hardness, from 10 to 11. Sp. gr. from 2.64 to 2.67, and in one variety 2.691. Its colour is exceedingly various; a circumstance which has induced mineralogists to divide it into numerous varieties. Of these the following are the chief.

† Crystal. ii. 71. ‡ Mem. Par. 1786, p. 78. See also Lametherie, Jour. de Phys. xlii. 470.

Simple Stones.

1. Pure colourless, perfectly transparent crystallized quartz, having much the appearance of artificial crystal; known by the name of *rock crystal*.

2. Quartz less transparent, and with a splintery fracture, has usually been distinguished by the name of *quartz*, and separated from rock crystal. As there is no occasion for this separation, we have, in imitation of Mr Hauy, chosen the word quartz for the *specific name*, comprehending under it all the varieties.

3. Blood red quartz; formerly called *compostella hyacinth*, and by Hauy *quartz hematoide*. It owes its colour to oxyd of iron. The mineral known to mineralogists by the name of *sinople*, and considered by them as a variety of *jasper*, has been discovered by Dolomieu to be merely this variety of quartz in an amorphous state.*

* Jour. de Min. N° xxviii. 255.

5. Yellow quartz; called false topaz.

5. Rosy red quartz; called Bohemian ruby.

For a fuller enumeration of these varieties, we refer the reader to *Smeisser's Mineralogy* †, *Kirwan's Mineralogy* ‡, and Gmelin's edition of the *Systema Naturæ* of Linnæus §. This last writer, however, has arranged several minerals under quartz which do not belong to it.

† i. 89. ‡ i. 244. § iii. 194.

Pure quartz is composed entirely of silica; but some of the varieties of this species are contaminated with metallic oxyds, and with a small quantity of other earths.

31 Elastic quartz.

SPECIES 2. Elastic Quartz (N).

This singular stone is moderately elastic, and flexible in every direction. Texture, earthy. Lustre, 0 or 1. Hardness, 9. Brittle. Sp. gr. 2.624 Colour, greyish white. Phosphoresces when scraped with a knife in the dark. The specimen analysed by Mr Klaproth contained

96.5	silica,
2.5	alumina,
5	oxyd of iron,
99.5 †	

† Beiträge, ii. 116.

32 Flint.

SPECIES 3. Flint (O).

Pyromachus—Pierre a fusil—Silex of Hauy.

This stone, which has become so necessary in modern war, is found in pieces of different sizes, and usually of a figure more or less globular, commonly among chalk, and often arranged in some kind of order. In Saxony it is said to have been found crystallized in hexahedrons, composed of two low three-sided pyramids applied base to base.*

* Gmelin's Systema Naturæ, iii. 183.

Its texture is compact. Its fracture, smooth conchoidal. Lustre, external 0, the stones being always covered by a white crust; internal 1, inclining to greasy. Transp. 2; when very thin, 3. Hardness, 10 or 11. Sp. gr. from 2.58 to 2.63. Colour varies from honey yellow to brownish black. Very brittle, and splits into splinters in every direction. Two pieces of flint rubbed smartly together phosphoresce, and emit a peculiar odour. When heated it decrepitates, and becomes white and opaque. When exposed long to the air

(N) *Kirwan's Min.* I. 316—*Gerhard Mem. Berlin*, 1783, 107.—*Klaproth's Beitrage* 2 *Band*, 113. See also *Jour. de Phys.* XLI. 91.

(O) *Kirwan's Min.* I. 301—*Dolomieu Jour. de Min.* N° XXXIII. 693. and *Salivet, ibid.* 713. These last gentlemen give the only accurate account of the method of making gun flints.

Earths and Stones.

air it often becomes covered with a white cruft. A fpecimen of flint analyfed by Klaproth contained

98.00	filica,
.50	lime,
.25	alumina,
0.25	oxyd of iron,
1.00	water.
100.00†	

† Beiträge, i. 46.

Another fpecimen analyfed by Dolomieu was compofed of

97	filica,
1	alumina and oxyd of iron,
2	water.
100‡	

‡ Jour. de Min. N° xxxiii. 702.

The white cruft with which flint is enveloped, confifts of the fame ingredients, and alfo a little carbonat of lime. Dolomieu difcovered that water is effential to flint; for when it is feparated by heat the ftone lofes its properties§.

§ Ibid.

The manufacture of gun flints is chiefly confined to two or three departments in France. The operation is exceedingly fimple: a good workman will make a 1000 flints in a day. The whole art confifts in ftriking the ftone repeatedly with a kind of mallet, and bringing off at each ftroke a fplinter, fharp at one end and thicker at the other. Thefe fplinters are afterwards fhaped at pleafure, by laying the line at which it is wifhed they fhould break, upon a fharp iron inftrument, and then giving it repeatedly fmall blows with a mallet. During the whole operation the workman holds the ftone in his hand, or merely fupports it on his knee‖.

‖ Ibid.

33 Opal.

SPECIES 4. Opal (P).

This ftone is found in many parts of Europe. It is ufually amorphous. Its fracture is conchoidal, commonly fomewhat tranfparent. Hardnefs from 6 to 10. Sp. gr. from 1.7 to 2.66. The lownefs of its fpecific gravity, in fome cafes, is to be afcribed to accidental cavities which the ftone contains. Thefe are fometimes filled with drops of water. Some fpecimens of opal have the property of emitting various coloured rays, with a particular effulgency, when placed between the eye and the light. The opals which poffefs this property, are diftinguifhed by lapidaries by the epithet *oriental;* and often by mineralogifts by the epithet *nobilis*. This property rendered the ftone much efteemed by the ancients.

Variety 1. Opal edler—*Opalus nobilis.*

Luftre glaffy, 3. Tranfp. 3 to 2. Hardnefs, 6 to 8. Colour, ufually light bluifh white, fometimes yellow or green. When heated it becomes opaque, and fometimes is decompofed by the action of the atmofphere. Hence it feems to follow, that water enters effentially into its compofition. A fpecimen of this variety, analyfed by Klaproth, contained

90	filica,
10	water.
100¶	

¶ Beiträge, ii. 153.

Variety 2. Semi-opal.

Fracture, imperfectly conchoidal. Luftre, glaffy 2. Tranfp. 2 to 3. Hardnefs, 7 to 9. Its colours are very various, greys, yellows, reds, browns, greens of different kinds.

Simple Stones.

Specimens of this variety fometimes occur with rifts: thefe readily imbibe water, and therefore adhere to the tongue. Thefe fpecimens fometimes become tranfparent when foaked in water, by imbibing that fluid. They are then called *hydrophanes*.

Variety 3. Cat's eye*.

* Kirwan's Min. i. 301. Klaproth, Beiträge, i. 90.

This variety comes from Ceylon, and is feldom feen by European mineralogifts till it has been polifhed by the lapidary. Mr Klaproth has defcribed a fpecimen which he received in its natural ftate from Mr Greville of London. Its figure was nearly fquare, with fharp edges, a rough furface, and a good deal of brilliancy.

Its texture is imperfectly foliated. Luftre greafy, 2. Tranfp. 3 to 2. Hardnefs 10. Sp. gr. 2.56 to 2.66. Colour, grey; with a tinge of green, yellow or white: or brown, with a tinge of yellow or red. In certain pofitions it reflects a fplendid white, as does the eye of a cat; hence the name of this ftone.

Two fpecimens, analyfed by Klaproth, the firft from Ceylon, the other from Malabar, were compofed of

95.00	94.50	filica,
1.75	2.00	alumina,
1.50	1.50	lime,
0.25	0.25	oxyd of iron.
98.5 *	98.25†.	

* Beiträge, i. 94.
† Ibid. p. 96.

34 Pitchftone.

SPECIES 5. Pitchftone§.

Menelites.

§ Kir. Min. i. 292.—Daubanton, Mem. Par. 1787, p. 86.

This ftone, which occurs in different parts of Germany, France, and other countries, has obtained its name from fome refemblance which it has been fuppofed to have to pitch. It is moft ufually in amorphous pieces of different fizes; and it has been found alfo cryftallized in fix-fided prifms, terminated by three-fided pyramids.

Its texture is conchoidal and uneven, and fometimes approaches the fplintery. Luftre greafy, from 3 to 1. Tranfp. 2 to 1, fometimes 0. Hardnefs 8 to 10. Exceedingly brittle; it yields even to the nail of the finger. Sp. gr. 2.049 to 2.39. Its colours are numerous, greyifh black, bluifh grey, green, red, yellow of different fhades. Sometimes feveral of thefe colours appear together in the fame ftone. A fpecimen of pitchftone from Mefnil-montant near Paris*, analyfed by Mr Klaproth, contained

* See Jour. de Phyf. xxxi. 219.

85.5	filica,
11.0	air and water,
1.0	alumina,
.5	iron,
.5	lime and magnefia.
98.5†	

† Beiträge, ii. 169.

35 Chryfoprafium.

SPECIES 6. Chryfoprafium (Q).

This mineral, which is found in different parts of Germany, particularly near Kofemütz in Silefia, is always amorphous. Its fracture is either even or inclining to the fplintery. Scarcely any luftre. Tranfp. 2 to 3. Hardnefs 10 to 12. Sp. gr. 2.479. Colour, green. In a heat of 130° Wedgewood it whitens and becomes opaque.

A

(P) *Kirwan's Min.* I. 289.—*Hauy, Jour. d' Hift. Nat.* II. 9. *Delius. Nouv. Jour. de Phyf.* I. 45.
(Q) *Kirwan's Min.* I.—*Lehmann. Mem. Berlin.* 1755. *p.* 202.—*Klaproth Beitrage,* II. 127.

A specimen of this stone, analysed by Mr Klaproth, contained

96.16	silica,
1.00	oxyd of nickel,
0.83	lime,
0.08	alumina,
0.08	oxyd of iron.
98.15‡	

‡ *Beiträge*, ii. 133.

36
G. V. 1 AS. Topaz.

GENUS V. 1. AS.

SPECIES 1. Topaz (R).

Occidental ruby, topaz, and sapphyr.

The name *topaz* has been restricted by Mr Hauy to the stones called by mineralogists occidental ruby, topaz, and sapphyr; which, agreeing in their crystallization and most of their properties, were arranged under one species by Mr Romé de Lisle. The word *topaz*, derived from an island in the Red Sea (S), where the ancients used to find topazes, was applied by them to a mineral very different from ours. One variety of our topaz they denominated *chrysolite*.

The topaz is found in Saxony, Bohemia, Siberia, and Brazil, mixed with other minerals in granite rocks.

It is commonly crystallized. The primitive form of its crystals is a prism whose sides are rectangles, and bases rhombs, having their greatest angles 124° 22', and the integral molecule has the same form*; and the height of the prism is to a side of the rhomboidal bases as 3 to 2‡. The different varieties of topaz crystals hitherto observed, amount to 6. Five of these are eight-sided prisms, terminated by four-sided pyramids, or wedge-shaped summits, or by irregular figures of 7, 13, or 15 sides‖; the last variety is a twelve-sided prism, terminated by six-sided pyramids wanting the apex. For an accurate description and figure of these varieties we refer the reader to Mr Hauy†.

* Hauy, *Jour. de Min.* N° xxviii, 287.

‡ Fig. 8.

‖ Fig. 9.

† *Jour. de Min. ibid.*

The texture of the topaz is foliated. Its lustre is from 2 to 4. Transp. from 2 to 4. It causes a double refraction. Hardness 12 to 14. Sp. gr. from 3.5311 to 3.564. The Siberian and Brazil topazes, when heated, become positively electrified on one side, and negatively on the other §. It is infusible by the blow-pipe. The yellow topaz of Brazil becomes red when exposed to a strong heat in a crucible; that of Saxony becomes white by the same process. This shews us, that the colouring matter of these two stones is different.

§ *Hauy, ibid.*

The colour of the topaz is various, which has induced mineralogists to divide it into the following varieties:

1. Red topaz, of a red colour inclining to yellow; called *Brazilian* or *occidental ruby*.

2. Yellow topaz, of a golden yellow colour, and sometimes also nearly white; called *occidental* or *Brazil topaz*. The powder of this and the following variety causes syrup of violets to assume a green colour‖.

‖ *Vauquelin, Jour. de Min.* N° xxix. 165.

3. *Saxon topaz.* It is of a pale wine yellow colour, and sometimes greyish white.

4. *Aigue marine.* It is of a bluish or pale green colour.

5. *Occidental sapphyr.* It is of a blue colour; and sometimes white.

A specimen of white Saxon topaz, analysed by Vauquelin, contained

68	alumina,
31	silica.
99¶	

¶ *Jour. de Min.* N° xxiv. 3.

37
Sommite.

SPECIES 2. Sommite.

This stone was called sommite by La Metherie, from the mountain Somma, where it was first found. It is usually mixed with volcanic productions. It crystallizes in six-sided prisms, sometimes terminated by pyramids. Colour white. Somewhat transparent. Sp. gr. 3.2741. Infusible by the blow-pipe. According to the analysis of Vauquelin, it is composed of

49	alumina,
46	silica,
2	lime,
1	oxyd of iron.
98*	

* *Ibid.* N° xxviii. 279.

38
Shorlite.

SPECIES 3. Shorlite†.

† *Kirwan's Min.* i. 286.

This stone, which received its name from Mr Klaproth, is generally found, in irregular oblong masses or columns, inserted in granite. Its texture is foliated. Fracture uneven. Lustre 2. Transparency 2 to 1. Hardness 9 to 10. Sp. gr. 3.53. Colour greenish white, or sulphur yellow. Not altered by heat. According to the analysis of Klaproth, it is composed of

50	alumina,
50	silica.
100	

39
G. V. 2 SA. Rubellite.

GENUS V. 2. SA.

SPECIES 4. Rubellite (T).

Red shorl of Siberia.

This stone is found in Siberia mixed with white quartz. It is crystallized in small needles, which are grouped together and traverse the quartz in various directions. Texture fibrous. Fracture even, inclining to the conchoidal. Transparency 2; at the edges 3. Hardness 10. Brittle. Sp. gr. 3.1. Colour crimson, blood or peach red. By exposure to a red heat it becomes snow white; but loses none of its weight. It tinges soda blue, but does not melt with it.

According to the analysis of Mr Bindheim, it is composed of

57	silica,
35	alumina,
5	oxyds of iron and manganese.
97	

40
Hornslate

SPECIES 5. Hornslate (U).

Shistose porphyry.

This stone, which occurs in mountains, is generally amorphous; but sometimes also in columns. Struc-

 ture

(R) *Kirwan's Min.* I. 254.—*Pott. Mem. Berlin*, 1747, *p.* 46.—*Margraf, ibid.* 1776. *p.* 73. and 160.—*Henkel. Act. Acad. Nat. Cur.* IV. 316.

(S) It got its name from τοπαζω, *to seek*; because the island was often surrounded with fog, and therefore difficult to find. See *Plinii lib.* 37. *c.* 8.

(T) *Kirwan's Min.* I. 288. *Bindheim. Crell's Annals*, 1792, *p.* 320.

(U) *Kirwan's Min.* I. 307.—*Wiegleb. Crell's Annals*, 1787, 1 *Band.* 302.—See also *Reuss. Samml. Natur. Hist. Aufsätze, p.* 207.

Earths and Stones. ture flaty. Texture foliated. Fracture uneven and splintery; sometimes approaching the conchoidal. Lustre 0. Transparency 1 or 0. Hardness about 10. Sp. gr. from 2.512 to 2.7. Colour different shades of *grey*, from *ash* to *bluish* or *olive green*. Melts at 145° Wedgewood into an enamel. A specimen, analysed by Wedgewood, contained

73.0	silica,
23.9	alumina,
3.5	iron.
100.4	

41 Hornstone. SPECIES 6. Hornstone (x).

Petrosilex—Chert.

This stone, which makes a part of many mountains, is usually amorphous; but, as Mr Kirwan informs us, it has been found crystallized by Mr Beyer on Schneeberg. Its crystals are six sided prisms, sometimes terminated by pyramids; hexahedrons, consisting of two three-sided pyramids applied base to base: and cubes, or six-sided plates.* Its texture is foliated. Fracture splintery, and sometimes conchoidal. Lustre 0. Transparency 1 to 2. The crystals are sometimes opaque. Hardness 7 to 9. Sp. gr. 2.532 to 2.653. Colour usual dark blue: but hornstone occurs also of the following colours; grey, red, blue, green, and brown of different shades.†

* *Kirwan*, i. 303.

According to Kirwan, it is composed of

72	silica,
22	alumina,
6	carbonat of lime.
100‡	

† *Schmeisser's Min.* i. 103.

‡ *Ibid.* p. 305.

42 Chalcedony. SPECIES 7. Chalcedony.

This stone is found abundantly in many countries, particularly in Iceland and the Faro islands. It is most commonly amorphous, stalactitical, or in rounded masses; but it occurs also crystallized in six-sided prisms, terminated by pyramids, or more commonly in four or six-sided pyramids, whose sides are convex. Surface rough. Fracture more or less conchoidal. Lustre 1. Somewhat transparent. Hardness 10 to 11. Sp. gr. 2.56 to 2.665. Not brittle.

According to Bergman, the chalcedony of Faroe is composed of

84	silica,
16	alumina, mixed with iron.
100	

Variety 1. Common chalcedony.

Fracture even, inclining to conchoidal. Transparency 2 to 3; sometimes 1. Its colours are various; it is most commonly greyish, with a tint of yellow, green, blue, or pearl; often also white, green, red, yellow, brown, black, or dotted with red. When striped white and black, or brown, alternately, it is called *onyx*; when striped white and grey, it is called *chalcedonix*. Black or brown chalcedony, when held between the eye and a strong light, appears dark red.

Variety 2. Cornelian.

Fracture conchoidal. Transparency 3 to 1; often cloudy. Its colours are various shades of red, brown, and yellow. Several colours often appear in the same mass. To this variety belong many of the stones known by the name of *Scotch pebbles*. Simple Stones.

SPECIES 8. Jasper (y). 43 Jasper.

This stone is an ingredient in the composition of many mountains. It occurs usually in large amorphous masses, and sometimes also crystallized in six-sided irregular prisms. Its fracture is conchoidal. Lustre from 2 to 0. Either opaque, or its transparency is 1. Hardness 9 to 10. Sp. gr. from 2.5 to 2.82. Its colours are various. When heated, it does not decrepitate. It seems to be composed of silica and alumina, and often also contains iron.

Variety 1. Common jasper.

Sp. gr. from 2.58 to 2.7. Its colours are, different shades of white, yellow, red, brown, and green; often variegated, spotted, or veined, with several colours.

Variety 2. Egyptian pebble.

This variety is found chiefly in Egypt. It usually has a spheroidal or flat rounded figure, and is enveloped in a coarse rough crust. It is opaque. Hardness 10. Sp. gr. 2.564. It is chiefly distinguished by the variety of colours, which always exist in the same specimen, either in concentric stripes or layers, or in dots or dendritical figures. These colours are, different browns and yellows, milk white, and isabella green; black also has been observed in dots.

Variety 3. Striped jasper.

This variety is also distinguished by concentric stripes or layers of different colours: these colours are, yellow, brownish red, and green. It is distinguished from the last variety by its occurring in large amorphous masses, and by its fracture, which is nearly even.

SPECIES 9. Tripoli. 44 Tripoli.

This mineral is found sometimes in an earthy form, but more generally indurate[1]. Its texture is earthy. Its fracture often somewhat conchoidal. Lustre 0. Generally opaque. Hardness 4 to 7. Sp. gr. 2.080 to 2.529. Absorbs water. Feel, harsh dry. Hardly adheres to the tongue. Takes no polish from the nail. Does not stain the fingers. Colour generally pale yellowish grey, also different kinds of yellow, brown, and white.

It contains, according to Haasse, 90 parts of silica, 7 alumina, and 3 of iron. A mineral belonging to this species was analysed by Klaproth, and found to contain

66.5	silica,
7.0	alumina,
2.5	oxyd of iron,
1.5	magnesia,
1.25	lime,
19.	air and water.
97.75	

GENUS VI. I. ASI.

SPECIES 1. Micarell.*

45 G. VI. I. Asi. Micarell. This name has been given by Mr Kirwan to a stone which former mineralogists considered as a variety of mica. It is found in granite. Its texture is foliated, and

* *Kirwan's Min* i. 212.

(x) *Kirwan's Min.* I. 303.—*Baumer Jour. de Phys.* II. 154. and *Monnet, ibid.* 331.—*Wiegleb. Crell's Annals*, 1788, *p.* 45 and 135.

(y) *Kirw. Min.* I. 309.—*Borral Hist. Natur. de Corse.*—*Henkel Act. Acad. Nat. Curios.* V. 339.

Earths and Stones. and it may be ſplit into thin plates. Luſtre metallic, 3. Opaque. Hardneſs 6. Sp. gr. 2.980. Colour browniſh black. At 153° Wedgewood, it melts into a black compact glaſs, the ſurface of which is reddiſh.†

† *Kirw. ibid.*

A ſpecimen analyſed by Klaproth contained

63.00	alumina,
29.50	ſilica,
6.75	iron.
99.25	

46 SPECIES 2. Shorl.‡

Shorl.

‡ *Ibid.* i. 265.

No word has been uſed by mineralogiſts with leſs limitation than *ſhorl*. It was firſt introduced into mineralogy by Cronſtedt, to denote any ſtone of a columnar form, conſiderable hardneſs, and a ſpecific gravity from 3 to 3.4. This deſcription applied to a very great number of ſtones. And ſucceeding mineralogiſts, though they made the word more definite in its ſignification, left it ſtill ſo general, that under the deſignation of *ſhorl* almoſt 20 diſtinct ſpecies of minerals were included.

Mr Werner firſt defined the word *ſhorl* preciſely, and reſtricted it to one ſpecies of ſtones. We uſe the word in the ſenſe aſſigned by him.

Shorl is found abundantly in mountains, either maſſive or cryſtallized, in three or nine-ſided priſms, often terminated by three-ſided ſummits. The ſides of the cryſtals are longitudinally ſtreaked. Its texture is foliated. Its fracture conchoidal. Luſtre 2. Opaque. Hardneſs 10. Sp. gr. 2.92 to 3.212. Colour black. Streak grey. It does not become electric by heat. When heated to redneſs, its colour becomes browniſh red; and at 127° Wedgewood, it is converted into a browniſh compact enamel.* According to Wiegleb, it is compoſed of

* *Ibid.* i. 166.

41.25	alumina,
34.16	ſilica,
20.00	iron,
5.41	manganeſe.
100.82 †	

† *Crell's Beiträge*, I. *Bandes.* 4. *Stück*, p. 21.

SPECIES 5. Granatite.

Staurotide of Hauy—*Pierre de Croix* of De L'Iſle—*Staurolithe* of Lametherie.

47 We have adopted from Mr Vauquelin the term *granatite* to denote this ſtone, becauſe all the other names are ambiguous, having been applied to another mineral poſſeſſed of very different properties.

Granatite.

Granatite is found in Galicia in Spain, and Britanny in France. It is always cryſtallized in a very peculiar form; two ſix-ſided priſms interſect each other, either at right angles or obliquely.‡ Hence the name *croſſſtone*, by which it was known in France and Spain.* Mr Hauy has proved, in a very ingenious manner, that the primitive form of the granatite is a rectangular priſm, whoſe baſes are rhombs, with angles of 129½° and 50½°; and that the height of the priſm is to the greater diagonal of a rhomb as 1 to 6; and that its integrant molecules are triangular priſms, ſimilar to what would be obtained by cutting the primitive cryſtal in two, by a plane paſſing vertically through the ſhorter diagonal of the rhomboidal baſe. From this ſtructure he has demonſtrated the law of the formation of the cruciform varieties.* The colour of granatite is greyiſh or reddiſh brown.

‡ Fig. 10.

* *Romé de Liſle*, ii. 435.

Simple Stones.

* *Ann. de Chim.* vi. 142.

According to the analyſis of Vauquelin, it is compoſed of

47.06	alumina,
30.59	ſilica,
15.30	oxyd of iron,
3.00	lime,
95.95 †	

† *Ibid.* xxx. 106.

GENUS VI. 2. SAL.

48 SPECIES 4. Tourmaline (z).

G. VI. 2. SAL. Tourmaline.

This ſtone was firſt made known in Europe by ſpecimens brought from Ceylon; but it is now found frequently forming a part of the compoſition of mountains. It is either in amorphous pieces, or cryſtallized in three or nine-ſided priſms, with four-ſided ſummits.

Its texture is foliated: Its fracture conchoidal. Internal luſtre 2 to 3. Tranſparency 3 to 4; ſometimes only 2 (A). Cauſes only ſingle refraction.* Hardneſs 9 to 11. Sp. gr. 3.05 to 3.155. Colour brown, often ſo dark that the ſtone appears black; the brown has alſo ſometimes a tint of green, blue, red, or yellow.

* *Hauy, Jour. de Min.* No xxviii. 265.

When heated to 200° Fahrenheit, it becomes electric; one of the ſummits of the cryſtal negatively, the other poſitively.† It reddens when heated; and is fuſible *per ſe* with intumeſcence into a white or grey enamel.

† *Æpinus.*

A ſpecimen of the tourmaline of Ceylon, analyſed by Vauquelin, was compoſed of

40	ſilica,
39	alumina,
12	oxyd of iron,
4	lime,
2.5	oxyd of manganeſe,
97.5 ‡.	

‡ *Ann. de Chim.* xxx. 105.

SPECIES 5. Argentine felſpar.§

49 This ſtone was diſcovered by Mr Dodun in the black mountains of Languedoc. It is either amorphous, or cryſtallized in rhomboidal tables, or ſix or eight-ſided priſms. Its texture is foliated. Fragments rectangular. Laminæ inflexible. Internal luſtre 4. Tranſparency 2. Colour white; two oppoſite faces of the cryſtals are ſilver white, two others dead white. Hardneſs of the ſilvery laminæ 6, of the reſt 9. Brittle. Sp. gr. 2.5. When the flame of the blow-pipe is directed againſt the edges of the cryſtal (ſtuck upon glaſs), it eaſily melts into a clear compact glaſs; but when the flame is directed againſt the faces, they preſerve their luſtre, and the edges alone ſlowly melt.

Argentine felſpar.

§ *Kirwan*, i. 327.

According to the analyſis of Dodun, it is compoſed of

46	ſilica,
36	alumina,
16	oxyd of iron,
98	

When this ſtone is expoſed to the atmoſphere, it is apt

(z) *Kirw.* I. 271.—*Berg.* II. 118. and V. 402.—*Gerhard. Mem. Berlin.* 1777, p. 14.—*Hauy Mem. Par.* 1784, 270.—*Wilſon Phil. Tranſ.* XLI. 308.—*Æpinus. Recueil ſur la Tourmaline.* See alſo *La Porterie. Le Sapphir, l'Oeil de Chat, et la Tourmaline de Ceylon demaſqués.*

(A) And when black only 1.

Earths and Stones. apt to decay: Its furface becomes iridefcent, and at laft changes to ochre yellow: Its fpecific gravity is 2.3 or 2.212; and when breathed upon, it gives out an earthy fmell.

50 Mica. ‖ Kirw. i. 210.—Gm. Lex. Nov. Com. Petrop. xii. 549.

SPECIES 6. Mica ‖.

This ftone forms an effential part of many mountains, and has been long known under the names of *glacies mariæ* and *Mufcovy glafs*. It confifts of a great number of thin laminæ adhering to each other fometimes of a very large fize. Specimens have been found in Siberia nearly 2½ yards fquare (B).

It is fometimes cryftallized: Its primitive form is a rectangular prifm, whofe bafes are rhombs, with angles of 120° and 60° †: Its integrant molecule has the fame form. Sometimes it occurs in rectangular prifms, whofe bafes alfo are rectangles, and fometimes alfo in fhort fix-fided prifms †; but it is much more frequently in plates or fcales of no determinate figure or fize.*

† Fig. 11

† Fig. 12.

* Hauy, Jour. de Min. N° xxviii. 296.

Its texture is foliated. Its fragments flat. The lamellæ flexible, and fomewhat elaftic. Luftre metallic, from 3 to 4. Tranfparency of the laminæ 3 or 4, fometimes only 2 (C). Hardnefs 6. Very tough. Often abforbs water. Sp. gr. from 2.6546 to 2.9342. Feels fmooth, but not greafy. Powder feels greafy. Colour, when pureft, filver white or grey; but it occurs alfo yellow, greenifh, reddifh, brown, and black. Mica is fufible by the blow-pipe into a white, grey, green, or black, enamel; and this laft is attracted by the magnet (D). Spanifh wax rubbed by it becomes negatively electric.*

* Ibid.

A fpecimen of mica, analyfed by Vauquelin, contained

50.00 filica,
35.00 alumina,
7.00 oxyd of iron,
1.35 magnefia,
1.33 lime,

94.68 †.

† Ibid. 302.

Mica has long been employed as a fubftitute for glafs. A great quantity of it is faid to be ufed in the Ruffian marine for panes to the cabin windows of fhips; it is preferred, becaufe it is not fo liable as glafs to be broken by the agitation of the fhip.

51 Talc. Kirw. i. 150.—Pott. Mem. Berl. 1746, p. 63.

SPECIES 7. Talc ‡.

This ftone has a very ftrong refemblance to mica, and was long confidered as a mere variety of that mineral. It occurs fometimes in fmall loofe fcales, and fometimes in an indurated form; but it has not hitherto been found cryftallized.

Its texture is foliated. The lamellæ are flexible, but not elaftic. Its luftre is from 2 to 4. Tranfparency from 2 to 4. Hardnefs 4 to 6. Sp. gr. when indurated, from 2.7 to 2.8. Feels greafy. Colour moft commonly whitifh or greenifh. Spanifh wax rubbed with it becomes *pofitively* electric §.

§ Hauy, Jour. de Min. N° xxviii. 291.

Variety 1. Scaly talc.

Talcite of Kirwan.

This variety occurs under the form of fmall fcales, fcarcely cohering. Luftre 3 to 4. Very light. Adheres to the fingers. When rubbed upon the fkin, it gives it a glofs. Colour white, with a fhade of red or green; fometimes leek green.

Simple Stones.

Variety 2. Common talc.

Venetian talc.

This variety often occurs in oblong nodules. Luftre, nearly metallic, 4. Tranfparency 2 to 3; when very thin 4. Hardnefs 4 to 5. Colour white, with a fhade of green or red; or apple green, verging towards filver white. By tranfmitted light, green.

Variety 3. Shiftofe talc.

Its ftructure is flaty. Fracture hackly and long fplintery. Eafily crumbles when rubbed in the fracture. External luftre 2 to 3; internal, 1; but fometimes, in certain pofitions, 3. Colour grey, with a fhade of white, green or blue. Becomes white and fcaly when expofed to the air.

A fpecimen of *common talc*, analyfed by Mr Chenevix, contained

48.0 filica,
37.0 alumina,
6.0 oxyd of iron,
1.5 magnefia,
1.5 lime,
5.0 water,

99.0.*

* Ann. de Chim. xxviii. 200.

52 Bafaltine. † Kirw. i. 219.

SPECIES 8. Bafaltine †.

Bafaltic hornblende of Werner—*Actinote* of Hauy—*Zillertite* of Lametherie—*Shorl prifmatique hexagone* of Sauffure.

This ftone is found commonly in bafaltic rocks; hence its name, which we have borrowed from Mr Kirwan. It is cryftallized, either in rhomboidal prifms, or fix or eight-fided prifms, terminated by three-fided pyramids. Its texture is foliated. Its fracture uneven. Luftre 3. Tranfparency, when in very thin plates, 1. Hardnefs from 9 to 10. Sp. gr. 3.333. Colour black, dark green, or yellowifh green. Streak white. Tranfmits a reddifh yellow light. Before the blow-pipe, it melts into a greyifh coloured enamel, with a tint of yellow †. A fpecimen, feemingly of this ftone, analyfed by Bergman, contained

† Le Lievre, Jour. de Min. N° xxviii. 269.

58 filica,
27 alumina,
9 iron,
4 lime,
1 magnefia,

99 ‡.

‡ Berg. iii. 207.

53 Hornblende. ¶ Kirw. i. 213.

SPECIES 9. Hornblende ¶.

Amphibole of Hauy (E).

This ftone enters into the compofition of various mountains. Its texture is very confpicuoufly foliated. Fracture conchoidal. Fragments often rhomboidal. Luftre 2. Opaque. Hardnefs 5 to 9. Tough. Sp. gr. 2.922 to 3.41. Colour black, blackifh green, olive green,

(B) *Hift. General de Voyages*, T. XVIII. 272, quoted by Hauy *Jour. de Min.* N° XXVIII. 299.

(C) Black mica is often nearly opaque.

(D) *Hauy, ibid.* p. 295. Bergman, however, found pure mica infufible *per fe*; and this has been the cafe with all the fpecimens of Mufcovy glafs which we have tried.

(E) We fufpect, that under this name Mr Hauy comprehends *fhorl* alfo.

Earths and Stones.

green, or leek green. Streak greenifh. It neither becomes electric by friction nor heat.* Before the blow-pipe it melts into a black glafs. A fpecimen of black hornblende, analyfed by Mr Hermann, was compofed of

* *Hauy, Jour. de Min.* N° xxviii. 267.

37 filica,
27 alumina,
25 iron,
5 lime,
3 magnefia,

97 †

† *Beob. der Berlin,* 5. *Band.* 317.

54
Refplendent hornblende.

SPECIES 10. Refplendent Hornblende

There are two minerals which Werner confiders as varieties of hornblende, and Mr Kirwan as conftituting a diftinct fpecies. Thefe, till future analyfes decide the point, we fhall place here under the name of refplendent hornblende, the name given them by Mr Kirwan; and we fhall defcribe them feparately.

Variety 1. Labradore hornblende.

Texture, curved foliated. Luftre, in fome pofitions, 0; in others metallic, and from 3 to 4. Opaque. Hardnefs 8 to 9. Sp. gr. from 3.35 to 3.434. Colour, in moft pofitions, greyifh black; in others, it reflects a ftrong iron grey, fometimes mixed with copper red.

Variety 2. Shiller fpar.*

* *Kirw.* i. 221.

Texture foliated. Luftre metallic, 4. Transparency, in thin pieces, 1. Hardnefs 8 to 9. Sp. gr. 2.882. Colour green, often with a fhade of yellow; alfo golden yellow. In fome pofitions it reflects white, grey, or yellow. At 141° Wedgewood, hardened into a porcelain mafs. A fpecimen, analyfed by Gmelin, was compofed of

43.7 filica,
17.9 alumina,
23.7 iron,
11.2 magnefia.

96.5 †.

† *Bergbaukunde,* 1 *Band.* p. 92.

It has been found in the Hartz, ftuck in a ferpentine rock.

55
Obfidian.

SPECIES 11. Obfidian ‖.

‖ *Kirw.* i. 264.

Iceland agate.

This ftone is found either in detached maffes, or forming a part of the rocks which compofe many mountains. It is ufually invefted with a grey or opaque cruft. Its fracture is conchoidal. Its internal luftre 3. Tranfparency 1. Hardnefs 10. Sp. gr. 2.348. Colour black or greyifh black; when in very thin pieces, green. It melts into an opaque grey mafs. According to Bergman, it is compofed of

69 filica,
22 alumina,
9 iron.

100 §.

§ *Berg.* iii. 204.

56
Petrilite.

SPECIES 12. Petrilite.*

* *Kirw.* i. 325.

Cubic felfpar.

This ftone is found in the mafs of mountains. It is amorphous. Texture foliated. Fracture fplintery. Fragments cubic, or inclining to that form; their faces unpolifhed. Luftre 2. Tranfparency partly 2, partly 1. Hardnefs 9. Sp. gr. 3.081. Colour reddifh brown. Does not melt at 160° Wedgewood.

57
Felfite.

SPECIES 13. Felfite †.

† *Kirw.* i. 326.

Compact felfpar.

This ftone alfo forms a part of many mountains, and is amorphous. Texture fomewhat foliated. Fracture uneven, approaching to the fplintery. Luftre 1. Tranfparency fcarce 1. Hardnefs 9. Colour azure blue, and fometimes brown and green. Streak white. Before the blow-pipe, whitens and becomes rifty; but is infufible *per fe*.

Simple Stones.

GENUS VII. SAP.

58
G. VII. SAP. Felfpar.

SPECIES 1. Felfpar ‡.

‡ *Kirw.* i. 316. and *Jour. de Phyf.* paffim.

This ftone forms the principal part of many of the higheft mountains. It is commonly cryftallized. Its primitive form, according to De Lifle, is a rectangular prifm, whofe bafes are rhombs, with angles of 65° and 115° †. Sometimes the edges of the prifm are wanting, and faces in their place; and fometimes this is the cafe alfo with the acute angles of the rhomb. For a defcription and figure of thefe, and other varieties, we refer the reader to *Romé de Lifle,** *Mr Hauy* †, and *Mr Pini* ‡.

† Fig. 13. and 14.

* *Cryftall.* ii. 461.
† *Mem. Par.* 1784, p. 273.
‡ *Sur de Nouvelle Cryftallifation, &c.* 8.

Its texture is foliated. Its crofs fracture uneven. Fragments rhomboidal, and commonly fmooth and polifhed on four fides. Luftre of the polifhed faces often 3. Tranfparency from 3 to 1. Hardnefs 9 to 10. Sp. gr. from 2.437 to 2.7. Gives a peculiar odour when rubbed. It is made electric with great difficulty by friction. Fufible *per fe* into a more or lefs tranfparent glafs. When cryftallized, it decrepitates before the blow-pipe.

Variety 1. Pure Felfpar.

Moon ftone—Adularia.

This is the pureft felfpar hitherto found. It occurs in Ceylon and Switzerland; and was firft mentioned by Mr Sage. Luftre nearly 3. Tranfparency 2 to 3. Hardnefs 10. Sp. gr. 2.559. Colour white; fometimes with a fhade of yellow, green, or red. Its furface is fometimes iridefcent.

Variety 2. Common Felfpar.

Luftre of the crofs fracture 0; of the fracture, in the direction of the laminæ, from 3 to 1. Tranfparency 2 to 1. Colour moft commonly flefh red; but often bluifh grey, yellowifh white, milk white, brownifh yellow; and fometimes blue, olive green, and even black.

Variety 3. Labradore felfpar.

This variety was difcovered on the coaft of Labradore by Mr Wolfe; and fince that time it has been found in Europe. Luftre 2 to 3. Tranfparency from 1 to 3. Sp. gr. from 2.67 to 2.6925. Colour grey. In certain pofitions, fpots of it reflect a blue, purple, red, or green colour.

Variety 4. Continuous felfpar.

This variety moft probably belongs to a different fpecies; but as it has not hitherto been analyfed, we did not think ourfelves at liberty to alter its place.

It is found in large maffes. Texture earthy. Fracture uneven, fometimes fplintery. Luftre 0. Tranfparency 1. Hardnefs 10. Sp. gr. 2.609. Colour reddifh grey, reddifh yellow, flefh red.

A fpecimen of green felfpar from Siberia, analyfed by Vauquelin, contained

62.83 filica,
17.02 alumina,
16.00 petafs,
3.00 lime,
1.00 oxyd of iron.

99.85 ‖.

‖ *Journ. de Min.* xx.

SPECIES 106.

Earths and Stones.

SPECIES 2. Lepidolite (F).
Lilalite.

59 Lepidolite.

This stone appears to have been first observed by the Abbé Poda, and to have been first described by De Born§. Hitherto it has only been found in Moravia in Germany, and Sudermania in Sweden*. There it is mixed with granite in large amorphous masses. It is composed of thin plates, easily separated, and not unlike those of mica†. Lustre, pearly 3. Transparency between 1 and 2. Hardness 4 to 5. Not easily pulverised‡. Sp. gr. from 2.816‖ to 2.8549¶. Colour of the mass, violet blue; of the thin plates, silvery white. Powder white, with a tint of red§. Before the blowpipe, it froths, and melts easily into a white semitransparent enamel, full of bubbles. Dissolves in borax with effervescence, and communicates no colour to it*. Effervesces slightly with soda, and melts into a mass spotted with red. With microcosmic salt, it gives a pearl coloured globule†.

§ Crell's Annals, 1791, ii. 196.
* Beyer, Ann. de Chim. xxix. 108.
† Le Lievre, Jour. de Min. N° li. 219.
‡ Ibid.
‖ Klaproth.
¶ Hauy.
§ Le Lievre, Jour. de Min. N° li. 219.
* Ibid.
† Klaproth, Ann. de Chim. xxii. 37.

This stone was first called lilalite from its colour, that of the *lily*. Klaproth, who discovered its component parts, gave it the name of *lepidolite* (G).

It is composed of

53	silica,
20	alumina,
18	potash,
5	fluat of lime,
3	oxyd of manganese,
1	oxyd of iron.
100‡	

‡ Vauquelin, Ann. de Chim. xxx. 105.

SPECIES 3. Leucite‖.
Vesuvian of Kirwan—*White garnet* of Vesuvius.

60 Leucite.
‖ Kirw. i. 285.

This stone is usually found in volcanic productions, and is very abundant in the neighbourhood of Vesuvius. It is always crystallized. The primitive form of its crystals is either a cube or a rhomboidal dodecahedron, and its integrant molecules are tetrahedrons; but the varieties hitherto observed are all polyhedrons: The most common has a spheroidal figure, and is bounded by 24 equal and similar trapeziods†; sometimes the faces are 12, 18, 36, 54, and triangular, pentagonal, &c. For a description and figure of several of these, we refer the reader to Mr Hauy‖. The crystals vary from the size of a pin head to that of an inch.

† Fig. 15.
‖ Jour. de Min. N° xxvii. 185.

The texture of the leucite is foliated. Its fracture somewhat conchoidal. Lustre 3; when in a state of decomposition 0. Transparency 3 to 2; when decomposing 0. Hardness 8 to 10; when decomposing 5 to 6. Sp. gr. 2.4648. Colour white, or greyish white (H). Its powder causes syrup of violets to assume a green colour*.

* Vauquelin, Jour. de Min. N° xxxix. 165.

It is composed, as Klaproth has shewn, of

54	silica,
23	alumina,
22	potash.
99 (I)	

It was by analysing this stone that Klaproth discovered the presence of potash in the mineral kingdom; which is not the least important of the numerous discoveries of that accurate and illustrious chemist.

Simple Stones.

Leucite is found sometimes in rocks which have never been exposed to volcanic fire; and Mr Dolomieu has rendered it probable, from the substances in which it is found, that the leucite of volcanoes has not been formed by volcanic fire, but that it existed previously in the rocks upon which the volcanoes have acted, and that it was thrown out unaltered in fragments of these rocks§.

§ Jour. de Min. N° xxxix. 177.

GENUS VIII. SAG.

SPECIES 1. Emerald (K).

61 G. VIII. SAG. Emerald.

This stone has hitherto been only found crystallized. The primitive form of its crystals is a regular six-sided prism; and the form of its integrant molecules is a triangular prism, whose sides are squares, and bases equilateral triangles*. The most common variety of its crystals is the regular six-sided prism, sometimes with the edges of the prism, or of the bases, or the solid angles, or both wanting‡, and small faces in their place†. The sides of the prism are generally channelled.

* Hauy, Jour. de Min. N° xix 72.
‡ Fig. 16.
† Romé de Lisle, ii. 245. and Hauy, ibid.

Its texture is foliated. Its fracture conchoidal. Lustre usually from 3 to 4. Transparency from 2 to 4. Causes a double refraction. Hardness 12. Sp. gr. 2.65 to 2.775. Colour green. Becomes electric by friction, but not by heat. Its powder does not phosphoresce when thrown on a hot iron†. At 150° Wedgewood it melts into an opaque coloured mass. According to Dolomieu, it is fusible *per se* by the blow-pipe‡.

† Dolomieu, Jour. de Min. N° xviii. 19.
‡ Ibid.

This mineral was formerly subdivided into two distinct species, the *emerald*, and *beryl* or *aqua marina*. Hauy demonstrated, that the emerald and beryl corresponded exactly in their structure and properties, and Vauquelin found that they were composed of the same ingredients; henceforth, therefore, they must be considered as varieties of the same species.

The variety formerly called *emerald* varies in colour from the pale to the perfect green. When heated to 120° Wedgewood, it becomes *blue*, but recovers its colour when cold. A specimen, analysed by **Vauquelin,** was composed of

64.60	silica,
14.00	alumina,
13.00	glucina,
3.50	oxyd of chromum,
2.56	lime,
2.00	moisture or other volatile ingredient.
99.66‖	

‖ Ann. de Chim. xxvi. 264.

The *beryl* is of a greyish green colour, and sometimes blue, yellow, and even white: sometimes different colours appear in the same stone§. It is found in Ceylon, different parts of India, Brazil, and especially in Siberia and Tartary, where its crystals are sometimes a foot long¶.

§ Dolomieu, ibid.
¶ Ibid.

(F) *Kirw.* I. 208.—*Karsten. Beob. der Berlin, 5 Band.* 71.—*Klaproth Beiträge,* I. 279. and II. 191.

(G) That is, *scale stone,* or stone composed of scales: From λεπις, *the scale of a fish,* and λιθος, *a stone.*

(H) Hence the name leucite, from λευκος, *white.*

(I) See *Jour. de Min.* N° XXVII. 194. and 201. and *Klaproth's Beiträge,* II. 39.

(K) *Kir.* I. 247. and 248.—*Dolomieu. Magazin Encyclopædique,* II. 17. and 145.; and *Jour. de Min.* N° XVIII. 19.—*Klaproth Beiträge,* II. 12.

Earths and Stones.

long. A specimen of beryl, analysed by Vauquelin, contained

69 silica,
13 alumina,
16 glucina,
1.5 oxyd of iron.

——

99.5‖

‖ *Ann. de Chim.* xxviii. 168.

It was by analysing this stone that Vauquelin discovered the earth which he called *glucina*.

62
G. IX. SAB.
Staurolite.
* *Kirw.* i. 282.

Genus IX. SAB.

Species 1. Staurolite*.

Andreolite of Lametherie and Hauy—*Hyacinthe blanche cruciforme*, var. 9. of Romé de Lisle.

This stone has been found at Andreasberg in the Hartz. It is crystallized, and the form of its crystals has induced mineralogists to give it the name of *cross-stone*. Its crystals† are two four-sided flattened prisms, terminated by four sided pyramids, intersecting each other at right angles: the plane of intersection passing longitudinally through the prisms (L).

† Fig. 17.

Its texture is foliated. Its lustre waxy, 2. Transparency from 1 to 3. Hardness 9. Brittle. Sp. gr. 2.355 to 2.361. Colour milk white. When heated slowly, it loses 0.15 or 0.16 parts of its weight, and falls into powder. It effervesces with borax and microcosmic salt, and is reduced to a greenish opaque mass. With soda it melts into a frothy white enamel. When its powder is thrown on a hot coal, it emits a greenish yellow light†.

† *Hauy, Jour. de Min.* N° xxviii. 280.

A specimen analysed by Westrum was composed of

44 silica,
20 alumina,
20 barytes,
16 water.

——

100

Klaproth found the same ingredients, and nearly in the same proportions‡.

‡ *Beiträge*, ii. 80.

A variety of staurolite has been found only once, which has the following peculiarities.

Its lustre is pearly, 2. Sp. gr. 2.361. Colour brownish grey. With soda it melts into a purplish and yellowish frothy enamel. It is composed, according to Westrum, of

47.5 silica,
12.0 alumina,
20.0 barytes,
16.0 water,
4.5 oxyds of iron and manganese.

——

100.0

63
G. X. ASL.
Chrysoberyl.
* *Kirw.* i. 261.

Genus X. I. ASL.

Species 1. Chrysoberyl*.

Oriental chrysolite of jewellers—*Cymophane* of Hauy.

Hitherto this stone has been found only in Brazil, the island of Ceylon, and as some affirm near Nortschink in Siberia. Werner first made it a distinct species, and gave it the name which we have adopted. It is usually found in round masses about the size of a pea, but it is sometimes also crystallized. The primitive form of its crystals is a four-sided rectangular prism, whose height is to its breadth as $\sqrt{3}$ to 1, and to its thickness as $\sqrt{2}$ to 1†. The only variety hitherto observed is an eight-sided prism, terminated by six-sided summits‡. Two of the faces of the prism are hexagons, two are rectangles, and four trapeziums; two faces of the summits are rectangles, and the other four trapeziums. Sometimes two of the edges of the prism are wanting, and small faces in their place†.

Simple Stones.

† Fig. 18.
‡ Fig. 19.

† *Hauy, Jour. de Min.* N° xxi. 5.

Its texture is foliated. Laminæ parallel to the faces of the prism. Lustre 3 to 4. Transparency 3 to 4. Causes single refraction. Hardness 12. Sp. gr. from 3.698‡ to 3.7961‖. Colour yellowish green, surface sparkling. It is infusible by the blow-pipe *per se*, and with soda.

‡ *Werner.*
‖ *Hauy.*

A specimen of chrysoberyl, analysed by Klaproth, was composed of

71.5 alumina,
18.0 silica,
6.0 lime,
1.5 oxyd of iron.

——

97.0§

§ *Beiträge*, i. 102.

64
G. X. 2. SAL.
Hyalite.
* *Kirw.* i. 296.

Genus X. 2. SAL.

Species 2. Hyalite*.

This stone is frequently found in trap. It occurs in grains, filaments, and rhomboidal masses. Texture foliated. Fracture uneven, inclining to conchoidal. Lustre glassy (M), 2 to 3. Transparency 2 to 3; sometimes, tho' seldom, it is opaque. Hardness 9. Sp. gr. 2.11†. Colour pure white. Infusible at 150° Wedgewood; but it yields to soda‡. According to Mr Link, it is composed of

† *Kirwan.*
‡ *Id.*

57 silica,
18 alumina,
15 lime.

——

90 and a very little iron‖.

‖ *Crell's Annal.* 1790, 2 *Band.* 232.

65
Ædelite.
* *Kirw.* i. 276.

Species 3. Ædelite*.

This stone has hitherto been found only in Sweden at Mosseberg and Ædelfors. From this last place Mr Kirwan, who first made it a distinct species, has given it the name which we have adopted. It was first mentioned by Bergman†. Its form is tuberose and knotty. Texture striated; sometimes resembles quartz. Lustre from 0 to 1. Sp. gr. 2.515 after it has absorbed water‡. Colour light grey, often tinged red; also yellowish brown, yellowish green and green. Before the blow-pipe it intumesces and forms a frothy mass. Acids convert it into a jelly§. A specimen from Mosseberg, analysed by Bergman, contained

† *Opusc.* vi. 101.
‡ See *Kirwan's Min.* i. 276.
§ *Berg.* iii. 227.

69 silica,
20 alumina,
8 lime,
3 water.

——

100‖

‖ *Opusc.* vi. 101.

A specimen from Ædelfors yielded to the same chemist

62 silica,
18 alumina,
16 lime,
4 water.

——

100¶

¶ *Id.*

Genus

(L) See *Gillot, Jour. de Phys.* 1793, p. 1 and 2.

(M) Hence probably the name *hyalite*, which was imposed by Werner from ὕαλος, *glass*, and λίθος, *a stone*.

Earths and Stones.

Simple Stones.

66 G. X. 3. SAWL. Zeolite.

GENUS X. 3. SAWL.

SPECIES 4. Zeolite (N).

This stone was first described by Cronstedt in the Stockholm Transactions for 1756. It is found sometimes amorphous and sometimes crystallized. The primitive form of its crystals is a rectangular prism, whose bases are squares. The most common variety is a long four-sided prism, terminated by low four sided pyramids.*

* Hauy, Jour. de Min. N° xiv. 86.

Its texture is striated or fibrous. Its lustre is silky, from 3 to 1. Transparency from 2 to 4; sometimes 1. Hardness 6 to 8; sometimes only 4. Absorbs water. Sp. gr. 2.07 to 2.3. Colour white, often with a shade of red or yellow; sometimes brick-red, green, blue. When heated, it becomes electric like the tourmaline.† Before the blow-pipe it froths (O), emits a phosphorescent light, and melts into a white semitransparent enamel, too soft to cut glass, and soluble in acids. In acids it dissolves slowly and partially without effervescence; and at last, unless the quantity of liquid be too great, it is converted into a jelly.

† Hauy, ibid. N° xxviii. 276.

A specimen of zeolite (P), analysed by Vauquelin, contained

53.00	silica,
27.00	alumina,
9.46	lime,
10.00	water.
99.46 ‡.	

‡ Ibid. N° xliv. 576.

67 Stilbite.

SPECIES 5. Stilbite.

This stone was first formed into a distinct species by Mr Hauy. Formerly it was considered as a variety of zeolite.

The primitive form of its crystals is a rectangular prism, whose bases are rectangles. It crystallizes sometimes in dodecahedrons, consisting of a four-sided prism with hexagonal faces, terminated by four-sided summits, whose faces are oblique parallelograms; sometimes in six-sided prisms, two of whose solid angles are wanting, and a small triangular face in their place.*

* Hauy, Jour. de Min. N° xiv. 86.

Its texture is foliated. The laminæ are easily separated from each other; and are somewhat flexible. Lustre pearly, 2 or 3 (Q). Hardness inferior to that of zeolite, which scratches stilbite. Brittle. Sp. gr. 2.500.† Colour pearl white. Powder bright white, sometimes with a shade of red. This powder, when exposed to the air, cakes and adheres as if it had absorbed water. It causes syrup of violets to assume a green colour. When stilbite is heated in a porcelain crucible, it swells up and assumes the colour and semitransparency of baked porcelain. By this process it loses 0.185 of its weight. Before the blow-pipe it froths like borax, and then melts into an opaque white coloured enamel.§

† Hauy, ibid. N° xxviii. 276.

§ Vauquelin, ibid. N° xxxix. 161.

According to the analysis of Vauquelin, it is composed of

52.0	silica,
17.5	alumina,
9.0	lime,
18.5	water.
97.0 ‖	

‖ Ibid. 164.

68 Analcime.

SPECIES 6. Analcime.

This stone, which was discovered by Mr Dolomieu, is found crystallized in the cavities of lava. It was first made a distinct species by Mr Hauy. Mineralogists had formerly confounded it with zeolite.

The primitive form of its crystals is a cube. It is sometimes found crystallized in cubes, whose solid angles are wanting, and three small triangular faces in place of each; sometimes in polyhedrons with 24 faces. It is usually somewhat transparent. Hardness about 8; scratches glass slightly. Sp. gr. above 2. When rubbed, it acquires only a small degree of electricity, and with difficulty (R). Before the blow-pipe it melts without frothing, into a white semitransparent glass.*

* Hauy, Jour. de Min. N° xiv. 86. and xxviii. 278.

69 G. X. 4. SLA. Lazulite.

GENUS X. 4. SLA.

SPECIES 7. Lazulite.†

This stone, which is found chiefly in the northern parts of Asia, has been long known to mineralogists by the name of *lapis lazuli*. This term has been contracted into *lazulite* by Mr Hauy; an alteration which was certainly proper, and which therefore we have adopted.

† Kirw. i. 283.

Lazulite is always amorphous. Its texture is earthy. Its fracture uneven. Lustre 0. Opaque, or nearly so. Hardness 8 to 9. Sp. gr. 2.76 to 2.945 ‡. Colour blue (S); often spotted white from specks of quartz, and yellow from particles of pyrites.

‡ Brisson.

It retains its colour at 100° Wedgewood; in a higher heat it intumesces, and melts into a yellowish black mass. With acids it effervesces a little, and if previously calcined, forms with them a jelly.

Margraff published an analysis of lazulite in the Berlin Memoirs for 1758. His analysis has since been confirmed by Klaproth, who found a specimen of it to contain

46.0	silica,
14.5	alumina,
28.0	carbonat of lime,
6.5	sulphat of lime,
3.0	oxyd of iron,
2.0	water.
100.0 §	

§ Beiträge, i. 196.

70 G. XI. SALI. Garnet.

GENUS XI. SALI.

SPECIES 1. Garnet (T).

This stone is found abundantly in many mountains. It is usually crystallized. The primitive form of its chrystals

(N) *Kirw.* I. 278.—*Guettard*, IV. 637.—*Bucquet*, *Mem. Sav. Etrang.* IX. 576.—*Pelletier*, *Jour. de Phys.* XX. 420.

(O) Hence the name *zeolite*, given to this mineral by Cronstedt; from ζεω, *to ferment*, and λιθος, *a stone*.

(P) Dr Black was accustomed to mention, in the course of his lectures, that Dr Hutton had discovered *soda* in zeolite. This discovery has not hitherto been verified by any other chemical mineralogist.

(Q) Hence the name given to this mineral by Hauy, *stilbite*, from στιλβω, *to shine*.

(R) Hence the name *analcime* given it by Hauy, from αναλκις, *weak*.

(S) Hence the name *lazulite*, from an Arabian word *azul*, which signifies *blue*.

(T) *Kirw.* I. 258.—*Gerhard*, *Disquisitio physico-chymica Granatorum*, &c.—*Pasumot*, *Jour. de Phys.* III. 442.—*Wiegleb*, *Ann. de Chim.* I. 231.

Earths and Stones.

crystals is a dodecahedron whose sides are rhombs, with angles of 78° 31′ 44″, and 120° 28′ 16″. The inclination of the rhombs to each other is 120°. This dodecahedron may be considered as a four-sided prism, terminated by four-sided pyramids.* It is divisible into four parallelopipeds, whose sides are rhombs; and each of these may be divided into four tetrahedrons, whose sides are isosceles triangles, equal and similar to either of the halves into which the rhomboidal faces of the dodecahedron are divided by their shorter diagonal. The integrant molecules of garnet are similar tetrahedrons.† Sometimes the edges of the dodecahedron are wanting, and small faces in their place; and sometimes garnet is crystallized in polyhedrons, having 24 trapezoidal faces. For a description and figure of these, and other varieties of garnet, we refer to *Romé de Lisle* and *Hauy*.‡

* Fig. 20.
* *De Lisle*, ii. 322 and *Hauy*, *Ann. de Chim.* xvii. 305.
† *Hauy*, *ibid.* 306.
‡ *Ibid.*

The texture of garnet, as Bergman first shewed, is foliated.‖ Its fracture commonly conchoidal. Internal lustre from 4 to 2. Transparency from 2 to 4; sometimes only 1 or 0. Causes single refraction.§ Hardness from 10 to 14. Sp. gr. 3.75 to 4.188. Colour usually red. Often attracted by the magnet. Fusible *per se* by the blow-pipe.

‖ *Opusc.* ii. 9.
§ *Hauy*, *Jour. de Min.* N° xxviii. 260.

Variety 1. Oriental garnet (u).

Internal lustre 3 to 4. Transparency 4. Hardness 13 to 14. Sp. gr. 4 to 4.188. Colour deep red, inclining to violet (x).

Variety 2. Common garnet.

Fracture uneven, inclining to the conchoidal. Internal lustre 2 to 3. Transparency from 3 to 0. Hardness 10 to 11; sometimes only 9. Sp. gr. 3.75 to 4. Colour commonly deep red, inclining to violet; sometimes verging towards black or olive; sometimes leek green, brown, yellow.

Variety 3. Amorphous garnet.

Structure flaty. Lustre 2. Transparency 2 to 1. Hardness 11 to 12. Sp. gr. 3 89. Colour brownish or blackish red. Found in Sweden, Switzerland, and the East Indies.

A specimen of oriental garnet, analysed by Klaproth, contained

35.75	silica,
27.25	alumina,
36.00	oxyd of iron,
0.25	oxyd of manganese.
99 25 *	

* *Beiträge*, ii. 26.

A specimen of red garnet, analysed by Vauquelin, contained

52.0	silica,
20.0	alumina,
17.0	oxyd of iron,
7.7	lime.
96.7 †	

† *Jour. de Min.* N° xliv. 575.

A specimen of black garnet yielded to the same chemist

43	silica,
16	alumina,
20	lime,
16	oxyd of iron,
4	moisture.
99 ‡.	

‡ *Ibid.* 573.

Mr Klaproth found a specimen of Bohemian garnet, composed of

40 00	silica,
28 50	alumina,
16.50	oxyd of iron,
10.00	magnesia,
3.50	lime,
.25	oxyd of manganese.
98 75 ¶	

¶ *Beiträge*, ii. 21.

SPECIES 2. Thumerstone.*

71 Thumerstone.

Yanolite of Lametherie—*Axinite* of Hauy.

This stone was first described by Mr Schreber, who found it near Balme d'Auris in Dauphiné, and gave it the name of *shorl viole*.† It was afterwards found near Thum in Saxony, in consequence of which Werner called it *thumerstone*.

* *Kirw.* i. 273—*Pelletier*, *Jour. de Phys.* xxvi. 66.
† *De Lisle*, ii. 353.

It is sometimes amorphous; but more commonly crystallized. The primitive form of its crystals is a rectangular prism, whose bases are parallelograms with angles of 101° 32′ and 78° 28′.‡ The most usual variety is a flat rhomboidal parallelopiped, with two of its opposite edges wanting, and a small face in place of each.§ The faces of the parallelopiped are generally streaked longitudinally.

‡ *Hauy*, *Jour. de Min.* N° xxviii. 264.
§ Fig. 21.
§ *De Lisle*, *ibid.*

The texture of thumerstone is foliated. Its fracture conchoidal. Lustre 2. Transparency, when crystallized, 3 to 4; when amorphous, 2 to 1. Causes simple refraction ‖ Hardness 10 to 9. Sp. gr. 3.2956. Colour clove brown; sometimes inclining to red, green, grey, violet, or black. Before the blow-pipe it froths like zeolite, and melts into a hard black enamel. With borax it exhibits the same phenomena, or even when the stone is simply heated at the end of a pincer.¶

‖ *Hauy*, *ibid.*
¶ *Vauquelin*, *Jour. de Min.* N° xxiii. 1.

A specimen of thumerstone, analysed by Klaproth, contained

52.7	silica,
25.6	alumina,
9.4	lime,
9.6	oxyd of iron with a trace of manganese.
97.3 *	

* *Beiträge*, ii. 126.

A specimen, analysed by Vauquelin, contained

44	silica,
18	alumina,
19	lime,
14	oxyd of iron,
4	oxyd of manganese.
99 †	

† *Jour. de Min. ibid.*

SPECIES 3. Prehnite (y).

72 Prehnite.

Though this stone had been mentioned by Sage,† Romé de Lisle,* and other mineralogists, Werner was the first who properly distinguished it from other minerals, and made it a distinct species. The specimen which he examined was brought from the Cape of Good Hope by Colonel Prehn; hence the name *prehnite*, by which he distinguished it. It was found near Dumbarton by Mr Grotche †; and since that time it has been observed in other parts of Scotland.

† *Miner.* i. 232.
* *Crystallog.* ii. 275.
† *Ann. de Chim.* i. 215.

(u) This seems to be the *carbuncle* (ανθραξ) of Theophrastus, and the *carbunculus garamanticus* of other ancient writers. See *Hill's Theophrastus περι λιθων*, p. 74 and 77.

(x) Hence, according to many, the name *garnet* (in Latin *granatus*), from the resemblance of the stone in colour to the blossoms of the pomegranate.

(y) *Kirw.* I. 274.—*Hassenfratz*, *Jour. de Phys.* XXXII. 81.—*Sage*, *ibid.* XXXIV. 446.—*Klaproth*, *Beob. der Berlin*, 2 *Band.* 211. And *Ann. de Chim.* I. 201.

It is both amorphous and cryftallized. The cryftals are in groups, and confufed: they feem to be four-fided prifms with dihedral fummits ‡. Sometimes they are irregular fix-fided plates, and fometimes flat rhomboidal parallelopipeds.

‡ *Hauy, Jour. de Min.* N° xxviii. 277.

Its texture is foliated. Fracture uneven. Internal luftre pearly, fcarcely 2. Tranfparency 3 to 2. Hardnefs 9 to 10. Brittle. Sp. gr. 2.6969 ‖. Colour apple green, or greenifh grey. Before the blow-pipe it froths more violently than zeolite, and melts into a brown enamel. A fpecimen of prehnite, analyfed by Klaproth, was compofed of

‖ *Hauy, ibid.*

43.83	filica,
30.33	alumina,
18.33	lime,
5.66	oxyd of iron,
1.16	air and water.
99.31 §	

§ *Ann. de Chim.* i. 208.

Whereas Mr Haffenfratz found in another fpecimen

50.0	filica,
20.4	alumina,
23.3	lime,
4.9	iron,
.9	water,
.5	magnefia.
100.0 ¶	

¶ *Ibid.* and *Jour. de Phyf.* N° xxxii. 81.

SPECIES 4. Thallite.

73 Thallite.

Green fhorl of Dauphiné of De Lifle *—*Delphinite* of Sauffure.

* *Cryftallog.* ii. 401.

This ftone is found in the fiffures of mountains; and hitherto only in Dauphiné and on Chamouni in the Alps.

It is fometimes amorphous, and fometimes cryftallized. The primitive form of its cryftals is a rectangular prifm, whofe bafes are rhombs with angles of 114° 37′, and 65° 23′ †. The moft ufual variety is an elongated four-fided prifm (often flattened), terminated by four-fided incomplete pyramids §; fometimes it occurs in regular fix-fided prifms ‡. The cryftals are often very flender.

† *Hauy, Jour. de Min.* N° xxviii. 271.
§ Fig. 22.
‡ *Romé de Lifle, ibid.* and *Hauy, Jour. de Min.* N° xxi. 415.

Its texture appears fibrous. Luftre inconfiderable. Tranfparency 2 to 3, fometimes 4; fometimes nearly opaque. Caufes fingle refraction. Hardnefs 9 to 10. Brittle. Sp. gr. 3.4529 to 3.46. Colour dark green (z). Powder white or yellowifh green, and feels dry. It does not become electric by heat. Before the blow-pipe, froths and melts into a black flag. With borax melts into a green bead ‖.

‖ *Hauy* and *Defcotils, ibid.*

A fpecimen of thallite, analyfed by Mr Defcotils, contained

37	filica,
27	alumina,
17	oxyd of iron,
14	lime,
1.5	oxyd of manganefe.
96.5 §	

§ *Ibid.* N° xxx. 420.

GENUS XII. 1. AMS.

SPECIES 1. Cyanite.*

Sappare of Sauffure.

74 G. XII. AMS. Cyanite.

* *Kirw.* i. 209.—*Sage, Jour. de Phyf.* xxxv. 39.

This ftone was firft defcribed by Mr Sauffure, the fon, who gave it the name of *Sappare* †. It is commonly found in granite rocks. The primitive form of its cryftals is a fourfided oblique prifm, whofe fides are inclined at an angle of 103°. The bafe forms with one fide of the prifm an angle of 103°; with another, an angle of 77°. It is fometimes cryftallized in fix-fided prifms ‡.

† *Jour. de Phyf.* xxxiv. 213.
‡ *Hauy, Jour. de Min.* N° xxviii. 282.

Its texture is foliated. Laminæ long. Fragments long, fplintery. Luftre pearly, 2 to 3. Tranfparency of the laminæ 3. Caufes fingle refraction ‖. Hardnefs 6 to 9. Brittle. Sp. gr. from 3.092 to 3.622 §. Feels fomewhat greafy. Colour milk white, with fhades of fky or pruffian blue (A); fometimes bluifh grey; fometimes partly bluifh grey, partly yellowifh or greenifh grey.

‖ *Hauy, ibid.*
§ *Kirwan.*

Before the blow pipe it becomes almoft perfectly white; but does not melt. According to the analyfis of Sauffure, it is compofed of

66.92	alumina,
13.25	magnefia,
12.81	filica,
5.48	iron,
1.71	lime.
100.17 ¶	

¶ *Jour. de Phyf. ibid.*

Cyanite has alfo been analyfed by Struvius and Hermann, who agree with Sauffure as to the ingredients; but differ widely from him and one another as to the proportions.

Struvius.		Hermann.
5.5	- - - -	30 alumina
30.5	- - - -	39 magnefia,
51.5	- - - -	23 filica,
5.0	- - - -	2 iron,
4.0	- - - -	3 lime.
96.5 *		97 †

* *Crell's Annals*, 1790.
† *Ibid.*

GENUS XII. 2. MSA.

SPECIES 2. Serpentine (B).

75 G. XII. 2. MSA Serpentine.

This ftone is found in amorphous maffes. Its fracture is fplintery. Luftre 0. Opaque. Hardnefs 6 to 7. Sp. gr. 2.2645 to 2.709. Feels rather foft, almoft greafy. Generally emits an earthy fmell when breathed upon. Its colours are various fhades of green, yellow, red, grey, brown, blue: commonly one or two colours form the ground, and one or more appear in fpots or veins (C).

Before the blow-pipe it hardens and does not melt.

A fpecimen of ferpentine, analyfed by Mr Chenevix, contained

34.5	magnefia,
28.0	filica,
23.0	alumina,
4.5	oxyd of iron,
0.5	lime,
10.5	water.
101.0*	

* *Ann. de Chim.* xxviii 199.

GENUS

(Z) Hence the name *thallite* given it by Lametherie, from θαλλος, *a green leaf*.

(A) Hence the name *cyanite*, impofed by Werner.

(B) *Kirw* I. 156.—*Margraf, Mem. Berlin*, 1759, p. 3.—*Bayen, Jour. de Phyf.* XIII. 46.—*Mayer, Crell's Annals*, 1789, II. 416.

(C) Hence the name *ferpentine*, given to the ftone from a fuppofed refemblance in colours to the fkin of a ferpent.

Earths and Stones.

GENUS XIII. MSAI.

SPECIES 1. Potſtone †.

76 G. XIII. MSAI. Potſtone. † Kirw. i. 155.

This ſtone is found in neſts and beds, and is always amorphous. Its ſtructure is often ſlaty. Texture undulatingly foliated. Luſtre from 1 to 3. Tranſparency from 1 to 0; ſometimes 2. Hardneſs 4 to 6. Brittle. Sp. gr. from 2.8531 to 3.023. Feels greaſy. Sometimes abſorbs water. Colour grey with a ſhade of green, and ſometimes of red or yellow; ſometimes leek green; ſometimes ſpeckled with red.

Potſtone is not much affected by fire; and has therefore been made into utenſils for boiling water; hence its name.

According to Wiegleb, the potſtone of Como contains
38 magneſia,
38 ſilica,
7 alumina,
5 iron,
1 carbonat of lime,
1 fluoric acid.

90

SPECIES 2. Chlorite.*

77 Chlorite. * Kirw. i. 147.

This mineral enters as an ingredient into different mountains. It is ſometimes amorphous, and ſometimes cryſtallized in oblong, four-ſided, acuminated cryſtals. Its texture is foliated. Its luſtre from 0 to 2. Opaque. Hardneſs from 4 to 6; ſometimes in looſe ſcales. Colour green.

Variety 1. Farinaceous chlorite.

Compoſed of ſcales ſcarcely cohering, either heaped together, or inveſting other ſtones. Feels greaſy. Gives an earthy ſmell when breathed on. Difficult to pulveriſe. Colour graſs green, ſometimes greeniſh brown; ſometimes dark green, inclining to black. Streak white. When the powder of chlorite is expoſed to the blow-pipe it becomes brown. Before the blow-pipe, farinaceous chlorite froths and melts into a dark brown glaſs; with borax it forms a greeniſh brown glaſs*.

* Vauquelin. Jour. de Min. N° xxxix. 167.

Variety 2. Indurated chlorite.

This variety is cryſtallized. Luſtre 1. Hardneſs 6. Feel meagre. Colour dark green, almoſt black. Streak mountain green.

Variety 3. Slaty chlorite.

Structure ſlaty. Fragments flatted. Internal luſtre 1 to 2. Hardneſs 5. Colour greeniſh grey, or dark green inclining to black. Streak mountain green.

A ſpecimen of the firſt variety, analyſed by Vauquelin, contained
43.3 oxyd of iron,
26.0 ſilica,
15.5 alumina,
8.0 magneſia,
2.0 muriat of potaſs,
4.0 water.

98.8†

† Ann. de Chim. xxx. 106.

Simple Stones.

A ſpecimen of the ſame variety yielded Mr Hœpner
12.92 oxyd of iron,
37.50 ſilica,
4.17 alumina,
43.75 magneſia,
1.66 lime.

100.0 ‡

‡ Sauſſure's Voyag. ii. 133.

A ſpecimen of the ſecond variety, analyſed by the ſame chemiſt, contained
10.15 oxyd of iron,
41.15 ſilica,
6.13 alumina,
39.47 magneſia,
1.50 lime,
1.50 air and water.

99.9 §

§ Crell's Annals, 1793, p. 56.

On the ſuppoſition that theſe analyſes are accurate, the enormous difference between them is a demonſtration that chlorite is not a chemical combination, but a mechanical mixture.

GENUS XIV. SLAM.

SPECIES 8. Siliceous ſpar (D).

78 G. XIV. SLAM. Siliceous ſpar.

This ſtone has been found in Tranſylvania. It is cryſtallized in 4 or 6 ſided priſms, channelled tranſverſely, and generally heaped together. Its texture is fibrous. Its luſtre ſilky, 2. Its colours white, yellow, green, light blue. According to Bindheim, it contains
61.1 ſilica,
21.7 lime,
6.6 alumina,
5.0 magneſia,
1.3 oxyd of iron,
3.3 water.

99.0*

* Berg. vi. 104.

GENUS XV. SAMLI.

SPECIES 1. Argillite †.

Argillaceous ſchiſtus—Common ſlate.

79 G. XV. SAMLI. Argillite. † Kirw. i. 234.

This ſtone conſtitutes a part of many mountains. Its ſtructure is ſlaty. Its texture foliated. Fracture ſplintery. Fragments often tabular. Luſtre moſt commonly ſilky, 2; ſometimes 0. Tranſparency from 0 to 1. Hardneſs from 5 to 8. Sp. gr. from 2.67 to 2.88. Does not adhere to the tongue. Gives a clear ſound when ſtruck. Often imbibes water. Streak white or grey. Colour moſt commonly grey, with a ſhade of blue, green, or black; ſometimes purpliſh, yellowiſh, mountain green, brown, bluiſh black; ſometimes ſtriped or ſpotted with a darker colour than the ground.

It is compoſed, according to Kirwan, of ſilica, alumina, magneſia, lime, oxyd of iron. In ſome varieties the

(D) Is this the *tremolite* of Lowitz from the lake Baikal in Siberia? If ſo, the name of the genus ought to be SLM; for he found it to contain no alumina. According to his analyſis, it was compoſed of
52 ſilica,
20 lime,
12 carbonat of lime,
12 magneſia,

96

Earths and Stones. Simple Stones.

the lime is wanting. Several varieties contain a considerable quantity of carbonaceous matter.

80 G. XVI. SLACMI. Smaragdite.

GENUS XVI. SLACMI.

SPECIES 1. Smaragdite.

This stone was called *smaragdite* by Mr Saussure, from some resemblance which it has to the emerald. Its texture is foliated. The laminæ are inflexible. Fracture even. Hardness 7. Colour in some cases fine green, in others it has the grey colour and metallic lustre of mica: it assumes all the shades of colour between these two extremes.†

† *Hauy, Jour. de Min.* N° xxviii. 272.

According to the analysis of Vauquelin, it is composed of

50.0	silica,
13.0	lime,
11.0	alumina,
7.5	oxyd of chromum,
6.0	magnesia,
5.5	oxyd of iron,
1.5	oxyd of copper.
94.5 ‡	

‡ *Ann. de Chim.* xxx. 106.

81 G. XVII. SM. Kiffekil.

GENUS XVII. SM.

SPECIES 1. Kiffekil.*

Myrsen—Scafroth.

This mineral is dug up near Konie in Natolia, and is employed in forming the bowls of Turkish tobacco pipes. The sale of it supports a large monastery of dervises established near the place where it is dug. It is found in a large fissure six feet wide, in grey calcareous earth. The workmen assert, that it grows again in the fissure,† and puffs itself up like froth (E). This mineral, when fresh dug, is of the consistence of wax; it feels soft and greasy; its colour is yellow; its sp. gr. 1.600 ‡: when thrown on the fire it sweats, emits a fetid vapour, becomes hard, and perfectly white.

* *Kirwan's Min.* i. 144.

† *Reigness. Philos. Mag.* iii. 165.

‡ *Klaproth.*

According to the analysis of Klaproth, it is composed of

50.50	silica,
17.25	magnesia,
25.00	water,
5.00	carbonic acid,
.50	lime.
98.25 §	

§ *Beiträge,* ii. 172.

82 Steatites.

SPECIES 2. Steatites (F).

Though this mineral was noticed by the ancients, little attention was paid to it by mineralogists, till Mr Pott published his experiments on it in the Berlin Memoirs for 1747.

It is usually amorphous, but sometimes it is crystallized in six-sided prisms. Its texture is commonly earthy, but sometimes foliated. Lustre from 0 to 2. Transparency from 0 to 2. Hardness 4 to 7. Sp. gr. from 2.61 to 2.794.* Feels greasy. Seldom adheres to the tongue. Colour usually white or grey; often with a tint of other colours; the foliated commonly green. Does not melt *per se* before the blow-pipe.

* *Erisson.*

Variety 1. Semi-indurated steatites.

Texture earthy. Fracture sometimes coarse splintery. Lustre 0. Transparency 0, or scarce 1. Hardness 4 to 5. Absorbs water. Takes a polish from the nail. Colour white, with a shade of grey, yellow, or green; sometimes pure white; sometimes it contains dendritical figures; and sometimes red veins.

Variety 2. Indurated steatites.

Fracture fine splintery, often mixed with imperfectly conchoidal. External lustre 2 to 1, internal 0. Transparency 2. Often has the feel of soap. Absorbs water. Colour yellowish or greenish grey; often veined or spotted with deep yellow or red.

Variety 3. Foliated or striated steatites.

The texture of this variety is usually foliated; sometimes striated. Fragments cubiform. Lustre 3. Transparency 2 to 1. Hardness 6 to 7. Colour leek green, passing into mountain green or sulphur yellow. Streak pale greenish grey. When heated to redness, it becomes grey; and at 147° Wedgewood, it forms a grey porous porcelain mass.*

* *Kirwan,* i. 155.

A specimen of steatites, analysed by Klaproth, contained

59.5	silica,
30.5	magnesia,
2.5	iron,
5.5	water,
98.0 †.	

† *Beiträge,* ii. 179.

A specimen of white steatites, analysed by Mr Chenevix, contained

60.00	silica,
28.50	magnesia,
3.00	alumina,
2.50	lime,
2.25	iron.
96.25 ‡	

‡ *Ann. de Chim.* xxviii. 200.

83 G. XVIII. MSI. Chrysolite.

GENUS XVIII. MSI.

SPECIES 1. Chrysolite (G).

Peridot of the French—*Topaz* of the ancients.

The name *chrysolite* was applied, without discrimination, to a great variety of stones, till Werner defined it accurately, and confined it to that stone which the French chemists distinguish by the appellation of *peridot*. This stone is the *topaz* of the ancients; their chrysolite is now called *topaz*.§

§ *Plinii,* lib. 37. c. 8.

Chrysolite is found sometimes in unequal fragments, and sometimes crystallized.† The primitive form of its crystals is a right angled parallelopiped,‡ whose length, breadth, and thickness, are as 5, $\sqrt{8}$, $\sqrt{5}$.*

† Fig. 23.

‡ Fig. 24.

* *Hauy, Jour. de Min.* N° xxviii. 281.

The texture of the chrysolite is foliated. Its fracture conchoidal. Its internal lustre from 2 to 4. Its transparency from 4 to 2. Causes double refraction. Hardness

The carbonat of lime was only mechanically interposed between the fibres of the stone. See *Pallas, Neu. Nord. Beiträge,* 6 *Band,* p. 146.

(E) Hence the name *kiff-kil*, or rather *keff-kelli*, "clay froth," or "light clay."

(F) *Kirw.* I. 151.—*Pott, Mem. Berlin,* 1747, p. 57.—*Wiegleb, Jour. de Phys.* XXIX. 60.—*Lavoisier, Mem. Par.* 1778, 433.

(G) *Kirw.* I. 262.—*Cartheuser, Min.* 94.—*Dolomieu, Jour. de Min.* N° xxix. 365.—*La Metherie, Nouv. Jour. de Phys.* I. 397.

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Hardness 9 to 10. Brittle. Sp. gr. from 3.265 to 3.45. Colour green. It is infusible at 150°, but loses its transparency, and becomes blackish grey.† With borax it melts without effervescence into a transparent glass of a light green colour. Infusible with microcosmic salt ‡ and fixed alkali.§

† Kir. Min. i. 263.

‡ Vauquelin, Ann. de Chim. xxi. 97.

§ Kirw. ibid.

Variety 1. Common chrysolite.

Found in Ceylon, and South America, and in Bohemia, amidst sand and gravel.‖ Lustre 3 to 4. Transparency 4 to 3. Colour yellowish green, sometimes verging to olive green, sometimes to pale yellow.

‖ Coquebert, Jour. de Min. N° xxii. 20.

Variety 2. Olive chrysolite—*Olivine*.¶

¶ Kirwan's Min. i. 263.—Le Lievre, Jour. de Phys. xxx. 397.

Found commonly among traps and basalts; sometimes in small grains, sometimes in pretty large pieces; but it has not been observed in crystals. Lustre 2 to 3. Transparency 3 to 2. Colour olive green.

The first variety, according to the analysis of Klaproth, is composed of

41.5	magnesia,
38.5	silica,
19.0	oxyd of iron.
99.0 †	

† Klaproth's Beiträge, i. 103.

According to that of Vauquelin, it is composed of

51.5	magnesia,
38.0	silica,
9.5	oxyd of iron.
99.0 ‡	

‡ Ann. de Chim. ibid.

The second variety, according to the analysis of Klaproth, is composed of

37.58	magnesia,
50.00	silica,
11 75	oxyd of iron,
.21	lime.
99.54 §.	

§ Beiträge, i. 112.

84 Jade.

SPECIES 2. Jade (H).

This stone was formerly called *lapis nephriticus*, and was much celebrated for its medical virtues. It is found in Egypt, China, America, and in the Siberian and Hungarian mountains. It is sometimes adhering to rocks, and sometimes in detached round pieces.

Its surface is smooth. Its fracture splintery. External lustre 0, or scarce 1; internal waxy, 1. Transparency from 2 to 1. Hardness 10. Not brittle. Sp. gr. from 2.95 to 2.9829; or, according to Saussure, to 3.389. Feels greasy. Looks as if it had imbibed oil. Colour dark leek green, or verging towards blue; in some prominencies inclining to greenish or bluish white. When heated it becomes more transparent and brittle, but is infusible *per se*. According to Hœpfner, it is composed of

47	silica,
38	carbonat of magnesia,
9	iron,
4	alumina,
2	carbonat of lime,
100	

This is the stone which the inhabitants of New Zealand make into hatchets and other cutting instruments.

GENUS XIX. SMI.

Simple Stones.

85 G. XIX. SMI. Asbestus.

SPECIES 1. Asbestus (I).

This mineral was well known to the ancients. They even made a kind of cloth from one of the varieties, which was famous among them for its incombustibility. It is found abundantly in most mountainous countries, and no where more abundantly than in Scotland.

It is commonly amorphous. Its texture is fibrous. Its fragments often long splintery. Lustre from 0 to 2; sometimes 3, and then it is metallic. Transparency from 0 to 2. Hardness from 3 to 7. Sp. gr. from 2.7 to 0.6806. Absorbs water. Colour usually white or green. Fusible *per se* by the blow-pipe.

Variety 1. Common Asbestus.

Lustre 2 to 1. Transparency 1. Hardness 6 to 7. Sp. gr. 2.577 to 2.7. Feels somewhat greasy. Colour leek green; sometimes olive or mountain green; sometimes greenish or yellowish grey. Streak grey. Powder grey.

Variety 2. Flexible asbestus.

Amiantus.

Composed of a bundle of threads slightly cohering. Fibres flexible. Lustre 1 to 2, sometimes 3. Transparency 1 to 2, sometimes 0. Hardness 3 to 4. Sp. gr. before it absorbs water, from 0.9088 to 2.3134; after absorbing water, from 1.5662 to 2.3803.† Feels greasy. Colour greyish or greenish white; sometimes yellowish or silvery white, olive or mountain green, pale flesh red, and mountain yellow.

† Brisson.

Variety 3. Elastic abestus.

Mountain cork.

This variety has a strong resemblance to common cork. Its fibres are interwoven. Lustre commonly 0. Opaque. Hardness 4. Sp. gr. before absorbing water, from 0.6806 to 0.9933; after absorbing water, from 1.2492 to 1.3492. Feels meagre. Yields to the fingers like cork, and is somewhat elastic. Colour white; sometimes with a shade of red or yellow; sometimes yellow or brown.

A specimen of the first variety from Dalecarlia, analysed by Bergman, contained

63.9	silica,
16.0	carbonat of magnesia,
12.8	carbonat of lime,
6.0	oxyd of iron,
1.1	alumina.
99.8 *	

* Opusc. iv. 170.

A specimen of the second variety yielded to the same chemist

64.0	silica,
17.2	carbonat of magnesia,
13.9	carbonat of lime,
2.7	alumina,
2.2	oxyd of iron.
100.0 ‡	

‡ Ibid. p. 163.

A specimen of the third variety contained, according to the same analysis,

56.2	silica,
26.1	carbonat of magnesia,
12.7	carbonat of lime,
3.0	iron,
2.0	alumina.
100.0 ‖	

‖ Ibid. p. 170.

Twelve

(H) Kirw. I. 171.—Bartolin, De Lapide Nephritico.—Lehmann, Nov. Comm. Petropol. X. 381.—Hœpfner, Hist. Nat. de la Suisse, I. 251.

(I) Kirw. I. 159.—Bergman, IV. 160.—Plot, Phil. Trans. XV. 1051.—Nebel, Jour. de Phys. II. 62.—Ibid. III. 367.

Earths and Stones.

Twelve different specimens of asbestus, analysed by Bergman, yielded the same ingredients, differing a little in their proportions†.

† Opusc. iv. 175.

86 Asbestinite.

SPECIES 2. Asbestinite (K).

This stone is amorphous. Texture foliated or broad striated. Lustre silky, 3. Transparency 1 to 2. Hardness 5 to 6. Sp gr. from 2.806 to 2.880. Colour white, with shades of red, yellow, green, or blue. At 150° Wedgewood it melts into a green glass.

87 G. XX. I. SILM. Pyroxen.

GENUS XX. I. SILM.

SPECIES I. Pyroxen.

This stone is found abundantly in lava and other volcanic productions (L). It is always crystallized. The primitive form of its crystals is an oblique angled prism, whose bases are rhombs with angles of 92° 18′, and 37° 42′‡. It generally crystallizes in eight-sided prisms, terminated by dihedral summits‖. Its texture is foliated. Hardness 9. Colour black; sometimes green. Powder greenish grey*. Commonly attracted by the magnet†. Scarcely fusible by the blow-pipe‡. With borax it melts into a yellowish glass, which appears red while it is hot§.

‡ Hauy, Jour. de Min. N° xxviii. 269.
‖ De Lisle, ii. 398.
* Vauquelin.
† Ferber.
‡ Le Lievre.
§ Vauquelin.

According to the analysis of Vauquelin, it is composed of

52.00	silica,
14.66	oxyd of iron,
13.20	lime,
10.00	magnesia,
3.33	alumina,
2.00	oxyd of manganese.
95.19‖	

‖ Jour. de Min. N° xxxix. 172.

88 Asbestoid.

SPECIES 2. Asbestoid*.

* Kirwan, i. 166.

This stone has obtained its name from its similarity to common asbestus. It is amorphous. Its texture is foliated or striated. Its lustre common or glassy, from 2 to 3. Transparency from 0 to 1. Hardness 6 to 7. Sp. gr. from 3 to 3.31. Colour olive or leek green; when decomposing, brown. Before the blowpipe it melts *per se* into a brown globule. With borax it forms a violet coloured globule verging towards hyacinth†. According to the analysis of Mr Macquart, it is composed of

† Macquart, Ann. de Chim. xxii. 83.

46	silica,
20	oxyd of iron,
11	lime,
10	oxyd of manganese,
8	magnesia.
95‡	

‡ Ibid.

There is a variety of this species which Kirwan calls metalliform asbestoid. Its lustre is semimetallic, 3. Opaque. Hardness 8 to 9. Sp. gr. 3.356. Colour grey, sometimes inclining to red*.

* Kirwan's Min. i. 167.

Simple Stones.

89 G. XX. 2. SMIL. Shorlaceous actinolite.

GENUS XX. 2. SMIL.

SPECIES 3. Shorlaceous actinolite (M).

This stone crystallizes in four or six-sided prisms, thicker at one end than the other; hence it has been called by the Germans *strahlstein*, "arrow-stone." The crystals sometimes adhere longitudinally. Fracture hackly. External lustre glassy, 3 to 4; internal, 1 to 2. Transparency from 2 to 3; sometimes 1. Hardness from 7 to 10. Sp. gr. 3.023 to 3.45. Colour leek or dark green.

This stone is often the matrix of iron, copper, and tin ores.

90 Lamellar actinolite.

SPECIES 5. Lamellar actinolite.

This stone resembles hornblende. It is amorphous. Texture foliated. Lustre various in different places. Transparency 0, or scarce 1. Sp. gr. 2.916. Colour dark yellowish or greenish grey.

91 Glassy actinolite.

SPECIES 6. Glassy actinolite.

This stone is found amorphous, composed of fibres adhering longitudinally, or in slender four or six-sided prisms. Texture fibrous. Fragments long splintery, so sharp that they can scarcely be handled without injury. External lustre glassy or silky, 3 to 4; internal 0. Transparency 2. Exceedingly brittle. Sp. gr. 2.95 to 3.493. Colour leek green; sometimes verging towards greenish or silver white; sometimes stained with yellowish or brownish red. According to Bergman it is composed of

72.0	silica,
12.7	carbonat of magnesia,
6.0	carbonat of lime,
7.0	oxyd of iron,
2.0	alumina.
99.7*	

* Opusc. iv. 171.

92 G. XXI. SL. Shistose hornstone.

GENUS XXI. SL.

SPECIES I. Shistose hornstone†.

† Kirwan, i. 305.

The structure of this stone is slaty. Lustre from 0 to 1. Commonly opaque. Hardness 9 to 10. Sp. gr. from 2.596 to 2.641. Colour dark bluish or blackish grey. Infusible *per se*.

Variety 1. Siliceous shistus.

Commonly intersected by reddish veins of iron stone. Fracture splintery. Lustre 0. Transparency from 0 to 1.

Variety 2. Basanite or Lydian stone.

Commonly intersected by veins of quartz. Fracture even; sometimes inclining to conchoidal. Lustre scarce 1. Hardness 10. Sp. gr. 2.596. Powder black. Colour greyish black.

This, or a stone similar to it, was used by the ancients as a touchstone. They drew the metal to be examined along the stone, and judged of its purity by the

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(K) *Kirw. Min.* I. 165. Is this the *tremolite* of Werner? It certainly is not the *tremolite* of the French mineralogists.

(L) Hence the name *pyroxen* given it by Hauy; from πυρ *fire*, and ξενος, *a stranger*. It means, as he himself explains it, a *stranger in the regions of fire*. By this he means to indicate, that pyroxen, though present in lava, is not a volcanic production.

(M) In this and the following species we have followed Mr Kirwan's new arrangement exactly, without even venturing to give the synonimes of other authors. The descriptions which have been given are so many and incomplete, and the minerals themselves are still so imperfectly known, and have got so many names, that no part of mineralogy is in a state of greater confusion.

Earths and Stones.

the colour of the metallic ſtreak. On this account they called it βασανος, *the trier*. They called it alſo *Lydian ſtone*, becauſe, as Theophraſtus informs us, it was found moſt abundantly in the river Tmolus in Lydia†.

† *Hill's Theophraſtus*, περι λιθων, p. 190.

A ſpecimen of the firſt variety, analyſed by Wiegleb, contained

75.0	ſilica,
10.0	lime,
4.6	magneſia,
3.5	iron,
5.2	carbon.
98.3	

This ſpecies is rather a mechanical mixture than a chemical combination.

93
G. XXII. zs Zircon.

Genus XXII. zs.

species 1. Zircon*.

Jargon—Hyacinth.

* *Kirwan*, i. 257. and 333.

This ſtone is brought from Ceylon, and found alſo in France, Spain, and other parts of Europe. It is commonly cryſtallized. The primitive form of its cryſtals is an octahedron§, compoſed of two four-ſided pyramids applied baſe to baſe, whoſe ſides are iſoſceles triangles (N). The inclination of the ſides of the ſame pyramid to each other is 124° 12′; the inclination of the ſides of one pyramid to thoſe of another 82° 50′. The ſolid angle at the apex is 73° 44′†. The varieties of the cryſtalline forms of zircon amount to ſeven. In ſome caſes there is a four-ſided priſm interpoſed between the pyramids of the primitive form; ſometimes all the angles of this priſm are wanting, and two ſmall triangular faces in place of each; ſometimes the cryſtals are dodecahedrons, compoſed of a flat four-ſided priſm with hexagonal faces, terminated by four-ſided ſummits with rhomboidal faces‖; ſometimes the edges of this priſm, ſometimes the edges where the priſm and ſummit join, and ſometimes both together, are wanting, and we find ſmall faces in their place. For an accurate deſcription and figure of theſe varieties, we refer to *Mr Hauy*‡.

§ Fig. 25.

† *Hauy. Jour. de Min.* N° xxvi. 91.

‖ Fig. 26.

‡ *Ibid.*

The texture of the zircon is foliated. Internal luſtre 3. Tranſparency from 4 to 2. Cauſes a very great double refraction. Hardneſs from 10 to 16. Sp. gr. from 4.2 to 4.165†. Colour commonly reddiſh or yellowiſh; ſometimes it is limpid.

† *Ibid.*

Before the blow-pipe it loſes its colour, but not its tranſparency. With borax it melts into a tranſparent glaſs. Infuſible with fixed alkali and microcoſmic ſalt.

1. The variety formerly called *hyacinth* is of a yellowiſh red colour, mixed with brown. Its ſurface is ſmooth. Its luſtre 3. Its tranſparency 3 to 4.

2. The variety formerly called *jargon of Ceylon*, is either grey, greeniſh, yellowiſh brown, reddiſh brown, or violet. It has little external luſtre. Is ſometimes nearly opaque.

The firſt variety, according to the analyſis of Vauquelin, is compoſed of

64.5	zirconia,
32.0	ſilica,
2.0	oxyd of iron.
98.5†	

† *Ibid.* p. 106.

A ſpecimen analyſed by Klaproth contained

70.0	zirconia,
25.0	ſilica,
0.5	oxyd of iron.
95.5‡	

‡ *Beiträge*, i. 231.

The ſecond variety, according to Klaproth, who diſcovered the component parts of both theſe ſtones, contains

68.0	zirconia,
31.5	ſilica,
0.5	nickel and iron.
100.0§	

§ *Ibid.* i. 219.

Saline Stones.

Order II. SALINE STONES.

Under this order we comprehend all the minerals which conſiſt of an earthy baſis combined with an acid. They naturally divide themſelves into five genera. We ſhall deſcribe them in the following order. 94 Genera.

I. calcareous salts.
- Carbonat of lime,
- Sulphat of lime,
- Phoſphat of lime,
- Fluat of lime,
- Borat of lime.

II. barytic salts.
- Carbonat of barytes,
- Sulphat of barytes.

III. strontitic salts.
- Carbonat of ſtrontites,
- Sulphat of ſtrontites.

IV. magnesian salts.
- Sulphat of magneſia.

V. aluminous salts.
- Alum.

95
G. I. Calcareous ſalts.

Genus I. calcareous salts.

This genus comprehends all the combinations of lime and acids which form a part of the mineral kingdom.

96
Carbonat of lime.

species 1. Carbonat of lime.

No other mineral can be compared with carbonat of lime in the abundance with which it is ſcattered over the earth. Many mountains conſiſt of it entirely, and hardly a country is to be found on the face of the globe where, under the names of limeſtone, chalk, marble, ſpar, it does not conſtitute a greater or ſmaller part of the mineral riches.

It is often amorphous, often ſtalactitical, and often cryſtallized. The primitive form of its cryſtals is a parallelopiped, whoſe ſides are rhombs, with angles of 77° 30′ and 102° 30′‡. Its integrant molecules have the ſame form. The varieties of its cryſtals amount to more than 40; for a deſcription and figure of which we refer to *Romé de Liſle** and *Hauy* (O).

‡ Fig. 28.

* *Cryſtal.* i. 497.

When cryſtallized, its texture is foliated; when amorphous, its ſtructure is ſometimes foliated, ſometimes ſtriated, ſometimes granular, and ſometimes earthy. Its luſtre

(N) Let ABC (fig. 27.) be one of the ſides. Draw the perpendicular BD; then AB = 5, BD = 4, AD = 3.

(O) *Eſſai d'une Theorie*, &c. p. 75.—*Jour. de Phyſ.* 1793, Auguſt, p. 114.—*Jour. d'Hiſt. Nat.* 1792, February, p. 148.—*Ann. de Chim.* XVII. 249. &c.—*Jour. de Min.* N° XXVIII. 304.

Earths and Stones.

luftre varies from 0 to 3. Tranfparency from 0 to 4. It caufes double refraction; and it is the only mineral which caufes double refraction through two parallel faces of the cryftal. Hardnefs from 3 to 9. Sp. gr. from 2.315 to 2.78. Colour, when pure, white. Effervefces violently with muriatic acid, and diffolves completely, or leaves but a fmall refiduum. The folution is colourlefs.

This fpecies occurs in a great variety of forms; and therefore has been fubdivided into numerous varieties. All thefe may be conveniently arranged under two general divifions.

I. Soft carbonat of lime.

Variety 1. Agaric mineral.

Mountain milk, or *mountain meal* of the Germans.

This variety is found in the clefts of rocks, or the bottom of lakes. It is nearly in the ftate of powder; of a white colour, fometimes with a fhade of yellow; and fo light, that it almoft floats on water.

Variety. 2. Chalk.

The colour of chalk is white, fometimes with a fhade of yellow. Luftre 0. Opaque. Hardnefs 3 to 4. Sp. gr. from 2.315 to 2.657. Texture earthy. Adheres flightly to the tongue. Feels dry. Stains the fingers, and marks. Falls to powder in water. It generally contains about $\frac{2}{100}$ of alumina, and $\frac{1}{100}$ of water; the reft is carbonat of lime.

Variety 3. Arenaceous limeftone.

Colour yellowifh white. Luftre 1. Tranfparency 1. So brittle, that fmall pieces crumble to powder between the fingers. Sp. gr. 2.742. Phofphorefces in the dark when fcraped with a knife, but not when heated. It confifts almoft entirely of pure carbonat of lime.

Variety 4. Teftaceous tufa.

The colour of this variety is yellowifh or greyifh white. It is exceedingly porous and brittle; and is either compofed of broken fhells, or refembles mortar containing fhells; or it confifts of fiftulous concretions varioufly ramified, and refembling mofs.

II. Indurated carbonat of lime.

Variety 1. Compact limeftone.

The texture of this variety is compact. It has little luftre; and is moft commonly opaque. Hardnefs 5 to 8. Sp. gr. 1.3864 to 2.72. Colour grey, with various fhades of other colours. It moft commonly contains about $\frac{1}{10}$th of alumina, oxyd of iron, &c.; the reft is carbonat of lime. This variety is ufually burnt as lime.

Variety 2. Granularly foliated limeftone.

Structure fometimes flaty. Texture foliated and granular. Luftre 2 to 1. Tranfparency 2 to 1. Hardnefs 7 to 8. Sp. gr. 2.71 to 2.8376. Colour white, of various fhades from other colours.

Variety 3. Sparry limeftone.

Structure fparry. Texture foliated. Fragments rhomboidal. Luftre 2 to 3. Tranfparency from 2 to 4; fometimes 1. Hardnefs 5 to 6. Sp. gr. from 2.693 to 2.718. Colour white: often with various fhades of other colours. To this variety belong all the cryftals of carbonat of lime.

Variety 4. Striated limeftone.

Texture ftriated or fibrous. Luftre 1 to 0. Tranfparency 2 to 1. Hardnefs 5 to 7. Sp. gr. commonly from 2.6 to 2.77. Colours various.

Saline Stones.

Variety 5. Swine ftone.

Texture often earthy. Fracture often fplintery. Luftre 1 to 0. Tranfparency 0 to 1. Hardnefs 6 to 7. Sp. gr. 2.701 to 2.7121. Colour dark grey, of various fhades. When fcraped or pounded, it emits an urinous or garlic fmell.

Variety 6. Oviform.

This variety confifts of a number of fmall round bodies, clofely compacted together. Luftre 0. Tranfparency 0 or 1. Hardnefs 6 to 7.

SPECIES. 2. Sulphat of lime. 97

Gypfum—Selenite.

Sulphat of lime.

This mineral is found abundantly in Germany, France, England, Italy, &c.

It is found fometimes in amorphous maffes, fometimes in powder, and fometimes cryftallized. The primitive form of its cryftals, according to Romé de Lifle, is a decahedron ‡, which may be conceived as two four-fided pyramids, applied bafe to bafe, and which, inftead of terminating in pointed fummits, are truncated near their bafes; fo that the fides of the pyramids are trapeziums, and they terminate each in a rhomb. Thefe rhombs are the largeft faces of the cryftal. The angles of the rhombs are 52° and 158°. The inclination of two oppofite faces of one pyramid to the two fimilar faces of the other pyramid is 145°, that of the other faces 110.* Sometimes fome of the faces are elongated: fometimes it cryftallizes in fix-fided prifms, terminated by three or four-fided fummits, or by an indeterminate number of curvilinear faces. For a defcription and figure of thefe varieties, we refer to *Romé de Lifle* †.

‡ Fig. 29.

* *Cryftal.* i. 144.

† *Ibid.*

The texture of fulphat of lime is moft commonly foliated. Luftre from 0 to 4. Tranfparency from 0 to 4. It caufes double refraction. Its hardnefs does not exceed 4. Its fp. gr. from 1.872 to 2.311. Colour commonly white or grey.

Before the blow-pipe, it melts into a white enamel, provided the blue flame be made to play upon the edges of its laminæ. When the flame is directed againft its faces, the mineral falls into powder ‡.

‡ *Le Lievre, Jour. de Min.* N° xxviii. 315.

It does not effervefce with muriatic acid, except it be impure; and it does not diffolve in it.

The following varieties of this mineral are deferving of attention.

Variety 1. Broad foliated fulphat.

Texture broad foliated. Luftre glaffy, from 4 to 2. Tranfparency from 4 to 3. Hardnefs 4. Sp. gr. 2.311. Colour grey, often with a fhade of yellow.

Variety 2. Grano-foliated fulphat.

Texture foliated, and at the fame time granular; fo that is eafily crumbles into powder. Luftre 2 to 3. Tranfparency 2 to 3. Hardnefs 4 to 3. Sp. gr. from 2.274 to 2.310. Feels foft. Colour white or grey, often with a tinge of yellow, blue, or green; fometimes flefh red brown, or olive green.

Variety 3. Fibrous fulphat.

Texture fibrous. Fragments long fplintery. Luftre 2 to 3. Tranfparency 2 to 1; fometimes 3. Hardnefs 4. Brittle. Sp. gr. 2.300. Colour white, often with a fhade of grey, yellow, or red; fometimes flefh red, and fometimes honey yellow; fometimes feveral of thefe colours meet in ftripes.

Variety 4. Compact fulphat.

Texture compact. Luftre 1 or 0. Tranfparency 2 to 1,

Earths and Stones.

1, sometimes 0. Hardness 4. Sp. gr. from 1.872 to 2.288. Feels dry, but not harsh. Colour white, with a shade of grey, yellow, blue, or green; sometimes yellow; sometimes red; sometimes spotted, striped, or veined.

Variety 5. Farinaceous sulphat.

Of the consistence of meal. Lustre 0. Opaque. Scarcely sinks in water. Is not gritty between the teeth. Feels dry and meagre. Colour white. When heated below redness, it becomes of a dazzling white.

98 Phosphat of lime.

SPECIES 3. Phosphat of lime.

Apatite—Phosphorite—Chrysolite—of the French.

This substance is found in Spain, where it forms whole mountains, and in different parts of Germany. It is sometimes amorphous, and sometimes crystallized. The primitive form of its crystals is a regular six-sided prism. ‡ Its integrant molecule is a regular triangular prism, whose height is to a side of its base as 1 to $\sqrt{2}$ §. Sometimes the edges of the primitive hexagonal prism are wanting, and small faces in their place; sometimes there are small faces instead of the edges which terminate the prism; sometimes these two varieties are united; sometimes the terminating edges and the angles of the prism are replaced by small faces †; and sometimes the prism is terminated by four-sided pyramids.*

‡ Fig. 30.
§ *Hauy, Jour. de Min.* N° xxviii. p. 310.
† Fig. 31.
* *Hauy, ibid.*

Its texture is foliated. Its fracture uneven, tending to conchoidal. External lustre from 2 to 3, internal 3 to 2. Transparency from 4 to 2. Causes single refraction. Hardness 6 to 7. Brittle. Sp. gr. from 2.8249 to 3.218. Colour commonly green or grey; sometimes brown, red, blue, and even purple.

It is infusible by the blow-pipe. When its powder is thrown upon burning coals, it emits a yellowish green phosphorescent light. It is soluble in muriatic acid without effervescence or decomposition, and the solution often becomes gelatinous.

99 Fluat of lime.

SPECIES 4. Fluat of lime.

Fluor.

This mineral is found abundantly in different countries, particularly in Derbyshire. It is both amorphous and crystallized.

The primitive form of its crystals in the regular octohedron; that of its integrant molecules the regular tetrahedron.* The varieties of its crystals hitherto observed amount to 7. These are the primitive octohedron; the cube; the rhomboidal dodecahedron; the cubo octohedron †, which has both the faces of the cube and of the octohedron; the octohedron wanting the edges; the cube wanting the edges, and either one face ‡, or two faces in place of each. For a description and figure of these we refer to *Mr Hauy* †.

* *Hauy, ibid.* p. 325.
† Fig. 32.
‡ Fig. 33.
† *Ibid.*

The texture of fluat of lime is foliated. Lustre from 2 to 3, sometimes 0. Transparency from 2 to 4, sometimes 1. Causes single refraction. Hardness 8. Very brittle. Sp. gr. from 3.0943 to 3.1911. Colours numerous, red, violet, green, red yellow, blackish purple. Its powder thrown upon hot coals emits a bluish or greenish light. Two pieces of it rubbed in the dark phosphoresce. It decrepitates when heated. Before the blowpipe it melts into a transparent glass ‡.

‡ *Ibid.*

It admits of a polish, and is often formed into vases and other ornaments.

100 Borat of lime.

SPECIES 5. Borat of lime.

Boracite.

This mineral has been found at Kalkberg near Luneburg, seated in a bed of sulphat of lime. It is crystallized. The primitive form of its crystals is the cube §. In general, all the edges and angles of the cube are truncated; sometimes, however, only the alternate angles are truncated.* The size of the crystals does not exceed half an inch.

Saline Stones.

§ *Hauy, Jour. de Min.* N° xxviii. p. 325.
* *Hauy and Westrum.*

The texture of this mineral is compact. Its fracture is flat conchoidal. External lustre 3; internal, greasy, 2. Transparency from 2 to 3. Hardness 9 to 10. Sp. gr. 2.566. Colour greyish white, sometimes passing into greenish white or purplish.

When heated it becomes electric; and the angles of the cube are alternately positive and negative †.

† *Hauy, ibid.* and *Ann. de Chim.* ix. 59.

Before the blow-pipe it froths, emits a greenish light, and is converted into a yellowish enamel, garnished with small points, which, if the heat be continued, dart out in sparks ‖.

‖ *Le Lievre, Jour. de Min. ibid.*

According to Westrum, who discovered its component parts, it contains

68	boracic acid,
13.5	magnesia,
11	lime,
1	alumina,
2	silica,
1	iron.
96 §	

§ *Ann. de Chim.* ii. 116.

101 Nitrat of lime.

SPECIES 6. Nitrat of lime.

Found abundantly mixed with native nitre. For a description see the article CHEMISTRY in this *Supplement*, n° 672.

102 G. II. Barytic salts.

GENUS II. BARYTIC SALTS.

This genus comprehends the combinations of barytes with acids.

103 Carbonat of barytes.

SPECIES 1. Carbonat of barytes.

Witherite.

This mineral was discovered by Dr Withering; hence Werner has given it the name of *witherite*. It is found both amorphous and crystallized. The crystals are octohedrons or dodecahedrons, consisting of four or six-sided pyramids applied base to base; sometimes the six-sided pyramids are separated by a prism; sometimes several of these prisms are joined together in the form of a star.

Its texture is fibrous. Its fracture conchoidal. Its fragments long splintery. Lustre 2. Transparency 2 to 3. Hardness 5 to 6 Brittle. Sp. gr. 4.3 to 4.338. Colour greenish white. When heated it becomes opaque. Its powder phosphoresces when thrown on burning coals.*

* *Hauy.*

It is soluble with effervescence in muriatic acid. The solution is colourless.

According to Pelletier it contains

62	barytes,
22	carbonic acid,
16	water.
100 †	

† *Jour. de Min.* N° xxi p. 46.

104 Sulphat of barytes.

SPECIES 2. Sulphat of barytes.

Baroselenite.

This mineral is found abundantly in many countries, particularly in Britain. It is sometimes in powder, often in amorphous masses, and often crystallized. The primitive form of its crystals is a rectangular prism, whose

whoſe baſes are rhombs, with angles of $101^\circ\ 30'$ and $78^\circ\ 30'$.‡ The varieties of its cryſtals are very numerous. For a deſcription and figure of them we refer to *Romé de Liſle* || and *Hauy*.* The moſt common varieties are the octohedron with cuneiform ſummits, the ſix or four-ſided priſm, the hexangular table with bevelled edges. Sometimes theſe cryſtals are needle form.

Its texture is commonly foliated. Luſtre from 0 to 2. Tranſparency from 2 to 0; in ſome caſes 3 or 4. Hardneſs from 5 to 6. Sp. gr. from 4.4 to 4.44. Colour commonly white, with a ſhade of yellow, red, blue, or brown.

When heated it decrepitates. It is fuſible *per ſe* by the blue flame of the blow-pipe, and is converted into ſulphurat of barytes. Soluble in no acid except the ſulphuric; and precipitated from it by water.

‡ *Hauy, Eſſai d'une Theorie*, &c. p. 119.
|| *Cryſtal.* i. 588.
* *Ibid.* and *Ann. de Chim.* xii. 3.

Variety 1. Foliated ſulphat.

Luſtre 3 to 3. Tranſparency from 4 to 2, ſometimes 1. Colours white, reddiſh, bluiſh, yellowiſh, blackiſh, greeniſh. Mr Werner ſubdivides this variety into three, according to the nature of the texture. Theſe three ſubdiviſions are *granularly foliated*, *ſtraight foliated*, *curve foliated*.

Variety 2. Fibrous ſulphat.

Texture fibrous; fibres converging to a common centre. Luſtre ſilky or waxy, 2. Tranſparency 2 to 1. Hardneſs 5. Colours yellowiſh, bluiſh, reddiſh.

Variety 3. Compact ſulphat.

Texture compact. Luſtre 0 to 1. Tranſparency 1 to 0. Feels meagre. Almoſt conſtantly impure. Colours light yellow, red, or blue.

Variety 4. Earthy ſulphat.

In the form of coarſe duſty particles, ſlightly cohering. Colour reddiſh or yellowiſh white.

105 G. III. Strontitic ſalts.

GENUS III. STRONTITIC SALTS.

This genus comprehends all the combinations of ſtrontites and acids which form a part of the mineral kingdom.

106 Carbonat of ſtrontites.

SPECIES 1. Carbonat of ſtrontites.

This mineral was firſt diſcovered in the lead mine of Strontion in Argyleſhire; and ſince that time it is ſaid to have been diſcovered, though not in great abundance, in other countries. It is found amorphous, and alſo cryſtallized in needles, which, according to Hauy, are regular ſix-ſided priſms.

Its texture is fibrous; the fibres converge. Fracture uneven. Luſtre 2. Tranſparency 2. Hardneſs 5. Sp. gr. from 3.4 to 3.66. Colour light green. Does not decrepitate when heated. Before the blow-pipe becomes opaque and white, but does not melt. With borax it effervеſces, and melts into a tranſparent colourleſs glaſs. Effervеſces with muriatic acid, and is totally diſſolved. The ſolution tinges flame purple.

107 Sulphat of ſtrontites.

SPECIES 2. Sulphat of ſtrontites.

Celeſtine.

This mineral has been found in Pennſylvania, in Germany, in France, in Sicily, and Britain. It was firſt diſcovered near Briſtol by Mr Clayfield. There it is found in ſuch abundance, that it has been employed in mending the roads.

It occurs both amorphous and cryſtallized. The cryſtals are moſt commonly bevelled tables, ſometimes rhomboidal cubes. Its texture is foliated. More or leſs tranſparent. Hardneſs 5. Sp. gr. from 3.51 to 3.96. Colour moſt commonly a fine ſky blue; ſometimes reddiſh; ſometimes white, or nearly colourleſs.*

Klaproth found a ſpecimen of this mineral from Pennſylvania compoſed of

58	ſtrontites,
42	ſulphuric acid.
100†	

According to the analyſis of Mr Clayfield, the ſulphat of ſtrontites found near Briſtol is compoſed of

58.25	ſtrontites,
41.75	ſulphuric acid of 2.24, and a little iron.‡
100.00	

According to the analyſis of Vauquelin, the ſulphat of ſtrontites found at Bouvron in France, which was contaminated with .1 of carbonat of lime, is compoſed of

54	ſtrontites,
45	ſulphuric acid.
99§	

* *Clayfield, Nicholſon's Jour.* iii. 36.
† *Beiträge*, ii. 97.
‡ *Ibid. Nicholſon's Journal.*
§ *Jour. de Min.* N° xxxvii. 6.

108 G. IV. Magneſian Salts.

GENUS IV. MAGNESIAN SALTS.

This genus comprehends the combinations of magneſia and acids which occur in the mineral kingdom. Only two ſpecies have hitherto been found; namely,

109 Sulphat of magneſia.

SPECIES 1. Sulphat of magneſia.

It is found in Spain, Bohemia, Britain, &c.; and enters into the compoſition of many mineral waters.

For a deſcription of it, we refer to CHEMISTRY, n° 633. in this *Suppl.*

110 Nitrat of magneſia.

SPECIES 2. Nitrat of Magneſia.

Found ſometimes aſſociated with nitre. For a deſcription ſee CHEMISTRY, n° 674.

111 G. V. Aluminous ſalts.

GENUS V. ALUMINOUS SALTS.

This genus comprehends thoſe combinations of alumina and acids which occur in the mineral kingdom.

112 Alum.

SPECIES 1. Alum.

This ſalt is found in cryſtals, in ſoft maſſes, in flakes, and inviſibly mixed with the ſoil. For a deſcription, we refer to CHEMISTRY, n° 636.

ORDER III. AGGREGATES.

THIS order comprehends all mechanical mixtures of earths and ſtones found in the mineral kingdom. Theſe are exceedingly numerous: the mountains and hills, the mould on which vegetables grow, and indeed the greater part of the globe, may be conſidered as compoſed of them. A complete deſcription of aggregates belongs rather to geology than mineralogy. It would be improper, therefore, to treat of them fully here. But they cannot be altogether omitted; becauſe aggregates are the firſt ſubſtances which preſent themſelves to the view of the practical mineralogiſt, and becauſe, without being acquainted with the names and component parts of many of them, the moſt valuable mineralogical works could not be underſtood.

113 Diviſion of aggregates.

Aggregates may be comprehended under four diviſions: 1. Mixtures of earths; 2. Amorphous fragments of ſtones agglutinated together; 3. Cryſtallized ſtones, either agglutinated together or with amorphous ſtones; 4. Aggregates formed by fire. It will be exceedingly convenient

convenient to treat each of theſe ſeparately. We ſhall therefore divide this order into four ſections.

Sect. I. *Aggregates of Earths.*

The moſt common earthy aggregates may be comprehended under the following genera:

1. Clay,
2. Colorific earths,
3. Marl,
4. Mould.

Genus. I. clay.

114 Clay.

Clay is a mixture of alumina and ſilica in various proportions. The alumina is in a ſtate of an impalpable powder; but the ſilica is almoſt always in ſmall ſtones, large enough to be diſtinguiſhed by the eye. Clay, therefore, exhibits the character of alumina, and not of ſilica, even when this laſt ingredient predominates. The particles of ſilica are already combined with each other; and they have ſo ſtrong an affinity for each other, that few bodies can ſeparate them: whereas the alumina, not being combined, readily diſplays the characters which diſtinguiſh it from other bodies. Beſides alumina and ſilica, clay often contains carbonat of lime, of magneſia, barytes, oxyd of iron, &c. And as clay is merely a mechanical mixture, the proportion of its ingredients is exceedingly various.

Clay has been divided into the follow ſpecies:

115 Porcelain clay.

species 1. Porcelain clay.

Its texture is earthy. Its luſtre 0. Opaque. Hardneſs 4. Sp. gr. from 2.23 to 2.4. Colour white, ſometimes with a ſhade of yellow or red. Adheres ſlightly to the tongue. Feels ſoft. Falls to powder in water.

A ſpecimen, analyſed by Haſſenfratz, contained

62	ſilica,
19	alumina,
12	magneſia,
7	ſulphat of barytes.
100 *	

* Ann. de Chim. xiv. 144.

A ſpecimen, analyſed by Mr Wedgewood, contained

60	alumina,
20	ſilica,
12	air of water.
92	

116 Common clay.

species 2. Common clay.

Its texture is earthy. Luſtre 0. Opaque. Hardneſs 3 to 6. Sp. gr. 1.8 to 2.68. Adheres ſlightly to the tongue. Often feels greaſy. Falls to powder in water. Colour, when pure, white: often tinged blue or yellow.

Variety 1. Potter's clay.

Hardneſs 3 to 4. Sp. gr. 1.8 to 2. Stains the fingers ſlightly. Acquires ſome poliſh by friction. Colour white; often with a tinge of yellow or blue; ſometimes browniſh, greeniſh, reddiſh. Totally diffuſible in water; and, when duly moiſtened, very ductile.

Variety 2. Indurated clay.

Hardneſs 5 to 6. Does not diffuſe itſelf in water, but falls to powder. Diſcovers but little ductility. Colours grey, yellowiſh, bluiſh, greeniſh, reddiſh, browniſh.

Variety 3. Shiſtoſe clay.

Structure ſlaty. Sp. gr. from 2.6 to 2.68. Feels ſmooth. Streak white or grey. Colour commonly bluiſh, or yellowiſh grey; ſometimes blackiſh, reddiſh, greeniſh. Found in ſtrata uſually in coal mines.

This variety is ſometimes impregnated with bitumen. It is then called bituminous *ſhale*.

117 Lithomarga.

species 3. Lithomarga.

Texture earthy. Fracture conchoidal. Luſtre from 0 to 2. Opaque. Hardneſs 3 to 7. Sp. gr. when pretty hard, 2.815. Surface ſmooth, and feels ſoapy. Adheres ſtrongly to the tongue. Falls to pieces, and then to powder, in water; but does not diffuſe itſelf through that liquid. Fuſible *per ſe* into a frothy maſs.

Variety 1. Friable lithomarga.

Formed of ſcaly particles ſlightly cohering. Luſtre 1 to 0. Hardneſs 3 to 4. Exceedingly light. Feels very ſmooth, and aſſumes a poliſh from the nail. Colour white; ſometimes tinged yellow or red.

Variety 2. Indurated lithomarga.

Hardneſs 4 to 7. The ſofter ſorts adhere very ſtrongly to the tongue when newly broken; the harder very moderately. Colours grey, yellow, red, brown, blue.

A ſpecimen of lithomarga from Oſmund, analyſed by Bergman, contained

60.0	ſilica,
11.0	alumina,
5.7	carbonat of lime,
4.7	oxyd of iron,
0.5	carbonat of magneſia,
18.0	water and air.
99.9 †	

† Opuſc. iv.

118 Bole.

species 4. Bole.

Texture earthy. Fracture conchoidal. Luſtre 0. Tranſparency ſcarce 1. Hardneſs 4. Sp. gr. from 1.4 to 2. Acquires a poliſh by friction. Scarcely adheres to the tongue. Feels greaſy. Colour yellow or brown; ſometimes red; ſometimes ſpotted.

The lemnian earth which belongs to this ſpecies, according to the analyſis of Bergman, contains

47.0	ſilica,
19.0	alumina,
6.0	carbonat of magneſia,
5.4	carbonat of lime,
5.4	oxyd of iron,
17.0	water and air.
99.8 ‡	

‡ Ibid. p. 157.

119 Fullers earth.

species 5. Fullers earth.

Texture earthy. Structure ſometimes ſlaty. Fracture imperfectly conchoidal. Luſtre 0. Opaque. Hardneſs 4. Receives a poliſh from friction. Does not adhere to the tongue. Feels greaſy. Colour uſually light green.

A ſpecimen from Hampſhire, analyſed by Bergman, contained

51.8	ſilica,
25.0	alumina,
3.3	carbonat of lime,
3.7	oxyd of iron,
0.7	carbonat of magneſia,
15.5	moiſture.
100.0 §	

§ Ibid. 156.

This

Earths and Stones.

This earth is ufed by fullers to take the greafe out of their cloth before they apply foap. It is effential to fullers earth that the particles of filica be very fine, otherwife they would cut the cloth. Any clay, poffeffed of this laft property, may be confidered as *fullers earth*; for it is the alumina alone which acts upon the cloth, on account of its ftrong affinity for greafy fubftances.

120 G. II. Colorific earths.

Genus II. Colorific Earths.

The minerals belonging to this genus confift of clay, mixed with fo large a quantity of fome colouring ingredient as to render them ufeful as paints. The colouring matter is commonly oxyd of iron, and fometimes charcoal.

121 Red chalk.

Species 1. Red chalk.

Reddle.

Texture earthy. Fracture conchoidal. Luftre 0. Opaque. Hardnefs 4. Sp. gr. inconfiderable. Colour dark red.

Feels rough. Stains the fingers. Adheres to the tongue. Falls to powder in water. Does not become ductile. When heated it becomes black, and at 159° Wedgewood melts into a greenifh yellow frothy enamel.

Compofed of clay and oxyd of iron.

122 Yellow chalk.

Species 2. Yellow chalk.

Texture earthy. Fracture conchoidal. Hardnefs 3. Sp. gr. inconfiderable. Colour ochre yellow.

Feels fmooth or greafy. Stains the fingers. Adheres to the tongue. Falls to pieces in water. When heated becomes red; and at 156° Wedgewood melts into a brown porous porcelain.

According to Sage, it contains

50 alumina,
40 oxyd of iron,
10 water, with fome fulphuric acid.

100*

* *Mem. Par.* 1779, 313.

123 Black Chalk.

Species 3. Black chalk.

Structure flaty. Texture earthy. Fragments fplintery. Luftre 0. Opaque. Hardnefs 5. Sp. gr. 2.144 to 2.277. Colour black. Streak black.

Feels fmooth. Adheres flightly to the tongue. Does not moulder in water. When heated to rednefs it becomes reddifh grey.

According to Wiegleb, it is compofed of

64.50 filica,
11.25 alumina,
11.00 charcoal,
2.75 oxyd of iron,
7.50 water.

97.00 †

† *Ann. de Chim.* xxx. 13.

124 Green earth.

Species 4. Green earth.

Texture earthy. Luftre 0. Opaque. Hardnefs 6 to 7. Sp. gr. 2.637. Colour green.

Commonly feels fmooth. Does not ftain the fingers. Often falls to powder in water. When heated it becomes reddifh brown; and at 147° Wedgewood melts into a black compact glafs.

Compofed of clay, oxyds of iron and nickel.

125 G. III. Marl.

Genus III. Marl.

A mixture of carbonat of lime and clay, in which the carbonat confiderably exceeds the other ingredient, is called *marl*.

Aggregates.

Its texture is earthy. Luftre 0. Opaque. Hardnefs from 4 to 8; fometimes in powder. Sp. gr. from 1.6 to 2.877. Colour ufually grey, often tinged with other colours. Effervefces with acids.

Some marls crumble into powder when expofed to the air; others retain their hardnefs for many years.

Marls may be divided into two fpecies: 1. Thofe which contain more filica than alumina; 2. Thofe which contain more alumina than filica. Mr Kirwan has called the firft of thefe *filiceous*, the fecond *argillaceous*, marls. Attention fhould be paid to this diftinction when marls are ufed as a manure.

Genus IV. Mould. 126 G. IV. Mould.

By *mould* is meant the foil on which vegetables grow. It contains the following ingredients: filica, alumina, lime, magnefia (fometimes), iron, carbon derived from decayed vegetable and animal fubftances, carbonic acid, and water. And the good or bad qualities of *foils* depends upon a proper mixture of thefe ingredients. The filica is feldom in the ftate of an impalpable powder, but in grains of a greater or fmaller fize: Its chief ufe feems to be to keep the foil open and pervious to moifture. If we pafs over the carbon, the iron, and the carbonic acid, the goodnefs of a foil depends upon its being able to retain the quantity of moifture which is proper for the nourifhment of vegetables, and no more. Now the retentive power of a foil increafes with the proportion of its alumina, lime, or magnefia, and diminifhes as the proportion of its filica increafes. Hence it follows, that in a dry country, a fertile foil fhould contain lefs filica, and more of the other earths, than in a wet country.

Giobert found a fertile foil near Turin, where it rains annually 30 inches, to contain

From 77 to 79 filica,
9 — 14 alumina,
5 — 12 lime,

Near Paris, where it rains about 20 inches annually, Mr Tillet found a fertile foil to contain

Coarfe fand 25
Fine fand 21
— 46.0 filica,
16.5 alumina,
37.5 lime.

100.0‡

‡ *Kirwan on Manures.*

The varieties of mould are too numerous to admit an accurate defcription: we fhall content ourfelves, therefore, with mentioning the moft remarkable.

Species 1. Sand. 127 Sand.

This confifts of fmall grains of filiceous ftones not cohering together, nor foftened by water. When the grains are of a large fize, the foil is called *gravel*.

Species 2. Clay. 128 Clay.

This confifts of common clay mixed with decayed vegetable and animal fubftances.

Species 3. Loam. 129 Loam.

Any foil which does not cohere fo ftrongly as clay, but more ftrongly than chalk, is called *loam*. There are many varieties of it. The following are the moft common.

Variety

Earths and Stones.

Variety 1. Clayey loam; called also *strong*, *stiff*, *cold*, and *heavy*, loam.

It consists of a mixture of clay and coarse sand.

Variety 2. Chalky loam.

A mixture of clay, chalk, and coarse sand; the chalk predominating.

Variety 3. Sandy loam.

A mixture of the same ingredients; the sand amounting to .8 or .9 of the whole.

130 Till.

SPECIES 4. Till.

Till is a mixture of clay and oxyd of iron. It is of a red colour, very hard and heavy.

SECT. II. *Aggregates of amorphous stones.*

THE aggregates which belong to this section consist of amorphous fragments of stones cemented together. They may be reduced to the following genera:

1. Sandstone,
2. Puddingstone,
3. Amygdaloid,
4. Breccia.

131 G. I. Sandstone.

GENUS I. SANDSTONE.

Small grains of sand, consisting of quartz, flint, hornstone, siliceous schistus, or felspar, and sometimes of mica, cemented together, are denominated sandstones They feel rough and sandy; and when not very hard, easily crumble into sand. The cement or basis by which the grains of sand are united to each other is of four kinds; namely, lime, alumina, silica, iron. Sandstones, therefore, may be divided into four species.

132 Calcareous.

SPECIES 1 Calcareous sandstones.

Calcareous sandstones are merely carbonat of lime or marl, with a quantity of sand interposed between its particles Though the quantity of sand, in many cases, far exceeds the lime, calcareous sandstones are sometimes found crystallized; and, in some cases, the crystals, as might be expected, have some of the forms which distinguish carbonat of lime. Thus the calcareous sandstone of Fountainbleau is crystallized in rhomboidal tables. It contains, according to the analysis of Lassone

62.5	siliceous sand,
37.5	carbonat of lime.
100	

Calcareous sandstones have commonly an earthy texture. Their surface is rough. Their hardness from 6 to 7. Their specific gravity about 2.5 or 2.6. Their colour grey; sometimes yellowish or brown. They are sometimes burned for lime.

133 Aluminous.

SPECIES 2. Aluminous sandstones.

The basis of argillaceous sandstones is alumina, or rather clay. Their structure is often slaty. Their texture is compact, and either fine or coarse grained, according to the size of the sand of which they are chiefly composed. Their hardness is from 6 to 8, or even 9. Their colour is usually grey, yellow, or brown.

They are often formed into mill-stones, filtering-stones, and coarse whet-stones.

134 Siliceous.

SPECIES 3. Siliceous sandstones.

Siliceous sandstones consist of grains of sand cemented together by silica, or some substance which consists chiefly of silica or flint. They are much harder than any of the other species.

Sometimes stones occur, consisting of grains of lime cemented together with silica. These stones are also denominated siliceous sandstones. Aggregates.

135 Ferruginous.

SPECIES 4. Ferruginous sandstones.

The iron which acts as a cement in ferruginous sandstones is not far from a metallic state. When iron is completely oxydated, it loses the property of acting as a cement. This is the reason that ferruginous sandstones, when exposed to the air, almost always crumble into powder.

The colour of ferruginous sandstones is usually dark red, yellow, or brown. The grains of sand which compose them are often pretty large. Their hardness is commonly inconsiderable.

136 G. II. Pudding stone.

GENUS II. PUDDING STONE.

Pebbles of quartz, flint, or other similar stones of a round or eliptical form, from the size of rape seed to that of an egg, cemented together by a siliceous cement, often mixed with iron, have been denominated *pudding stones*.

Pudding stones, of course, are not inferior in hardness to quartz, flint, chalcedony, &c. of which the pebbles may consist. The colour of the cement is usually yellow, brown, or red. Its fracture is conchoidal.

The finer sorts of pudding stones are capable of a fine polish; the coarse are used for mill-stones.

137 G. III. Amygdaloid.

GENUS III. AMYGDALOID.

Rounded or eliptical masses of chalcedony, zeolite, limestone, lithomarga, steatites, green earth, garnets, hornblend, or opal, cemented together by a basis of indurated clay, trap, mullen, walken or kragg, constitute an *amygdaloid*.

Amygdaloids are opaque. They have no lustre. Their fracture is uneven or conchoidal. Hardness 6 to 9. Their colours are as various as the ingredients of which they are composed.

138 G. IV. Breccia.

GENUS IV. BRECCIA.

Angular fragments of the same *species* of stone agglutinated together, constitute a *breccia*. Thus *calcareous* breccia consists of fragments of marble cemented together by means of lime.

SECT. III. *Aggregates of Chrystals.*

THE minerals belonging to this section consist either of crystals of different kinds cemented together, or of crystals and amorphous stones cemented together.

They may be reduced under the following genera.

1. Granite.
2. Sienite.
3. Granatine.
4. Granitell.
5. Granilite.
6. Trap.
7. Porphyry.

139 G. I. Granite.

GENUS I. GRANITE.

An aggregate of felspath, quartz, and mica, whatever be the size or the figure of the ingredients, is denominated *granite*. This aggregate may be divided into two species, namely, *common* granite, and *schistose* granite or gneiss.

140 Common.

SPECIES 1. Common granite.

Its structure is always granular. The felspar is often amor-

Earths and Stones.

amorphous, and constitutes most frequently the greatest part of the aggregate.

Common granites differ much in their appearance, according to the size, proportion, colour, and figure of their component parts. They are commonly very hard: Their specific gravity varies from 2.5388 to 2.9564.

141 Gneiss.

SPECIES 2. Shistose granite or gneiss.

The structure of gneiss is always flaty, and this constitutes its specific character. In gneiss, the proportion of quartz and felspar is nearly equal: the proportion of mica is smallest. It is evidently subject to the same varieties with common granite.

142 G. II. Sienite.

GENUS II. Sienite.

Mr Werner has given the name of *sienite* to aggregates composed of felspar, hornblende, and quartz; or of felspar, hornblende, quartz, and mica. These aggregates were formerly confounded with quartz.

Sienite is found both of a granular and flaty structure: it might, therefore, like granite, be divided into two species. In sienite the quartz is commonly in by far the smallest proportion.

143 G. III. Granatine.

GENUS III. GRANATINE.

Mr Kirwan has applied the name *granatine* to the following aggregates.

Quartz, Felspar, Shorl.	Quartz, Mica, Garnet.	Quartz, Hornblende, Jade.	Felspar, Mica, Shorl.
Quartz, Felspar, Jade.	Quartz, Shorl, Hornblende,	Quartz, Hornblende, Garnet.	Felspar, Mica, Hornblende.
Quartz, Felspar, Garnet.	Quartz, Shorl, Jade.	Quartz, Jade, Garnet.	Felspar, Quartz, Serpentine
Quartz, Mica, Shorl.	Quartz, Shorl, Garnet.	Quartz, Hornblende, Hornstone.	Felspar, Quartz, Steatites.
Quartz, Mica, Jade.			

One of these aggregates, namely, *quartz, mica, garnet*, was called by Cronstedt *norka* or *murksten*.

144 G. IV. Granitell.

GENUS IV. GRANITELL.

Mr Kirwan gives the name of *granitell* to all aggregates composed of any two of the following ingredients: quarts, felspath, mica, shorl, hornblende, jade, garnet, steatites. The most remarkable of these are:

Quartz, Felspar.	Quartz, Hornblende.	Quartz, Steatites.	Felspar, Hornblende.
Quartz, Mica.	Quartz, Jade.	Felspar, Mica.	Felspar, Jade.
Quartz, Shorl.	Quartz, Garnet.	Felspar, Shorl.	Felspar, Garnet.
Mica, Shorl.	Mica, Jade.	Hornblende, Jade.	Jade, Garnet.
Mica, Hornblende.	Mica, Garnet.	Hornblende, Garnet.	Steatites, Shorl.

Aggregates.

Some of these aggregates have received particular names. The aggregate of *quartz* and *mica*, when its structure is flaty, is called by Werner *shistose mica*: by the Swedes, it is denominated *fellsten*, whatever be its structure.

The aggregate of hornblende and mica is called *grunstein*, from the dark green colour which it usually has.

145 G. V. Granilite.

GENUS V. GRANILITE.

Under the name of *granilite*, Mr Kirwan comprehends all aggregates containing more than three ingredients. Of these the following are the most remarkable.

Quartz, Felspar, Mica, Shorl.	Quartz, Mica, Shorl, Garnet.	Quartz, Sulph. of barytes, Mica, Shorl.
Quartz, Felspar, Mica, Steatites.	Quartz, Felspar, Mica, Garnet.	Quartz, Sulph. of barytes, Mica, Hornblende.

146 G. VI. Trap.

GENUS VI. TRAP. (P).

Under this genus we class not only what has commonly been called *trap*, but also wacken, and mullen, and kragstone of Kirwan.

147 Common.

SPECIES I. Common trap.

This stone is very common in Scotland, and is known by the name of *whinstone*. Whole hills are formed of it; and it occurs very frequently in large rounded detached fragments. Sometimes it assumes the form of immense columns, and is then called *basalt*. The Giants Causeway in Ireland, the island of Staffa, and the south side of Arthur's Seat in Scotland, are well known instances of this figure.

Its texture is earthy or compact. Its fracture uneven. Its lustre commonly 0. Opaque. Hardness 8 to 9. Not brittle. Sp. gr. from 2.78 to 3.021.* Colour black, with a shade of grey, blue, or purple; sometimes blackish or reddish brown; in some cases greenish grey. By exposure to the atmosphere, it often becomes invested with a brownish rind. Before the blow-pipe, it melts *per se* into a more or less black glass.

* *Kirwan.*

Trap consists of small crystals of hornblende, felspar, olivine, &c. usually set in a ground composed apparently of clay and oxyd of iron. A specimen, in the form of basaltes, from Staffa, analysed by Dr Kennedy of Edinburgh, contained 48 silica,

16 alumina,
16 oxyd of iron,
9 lime,
5 moisture,
4 soda,
1 muriatic acid.

99†

† *Edin. Trans.* v. 89.

A

(P) *Kirw.* I. 231 and 431.—*Faujas de St Fond. Essai sur l'Hist. Nat. des Roches de Trap.*—*Phil. Trans.* passim. See also a very ingenious set of experiments on the fusion of trap, by Sir James Hall in *Trans. Edin.* V. 43.

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A specimen from Salisbury rock, near Edinburgh, contained, according to the analysis of the same gentleman,

46.0 silica,
19.0 alumina,
17.0 oxyd of iron,
8.0 lime,
4.0 moisture,
3.5 soda,
1.0 muriatic acid.

98.5 ‡

‡ *Edin. Transf.* v. 90.

Dr Kennedy conducted these analyses with great ingenuity and judgment; and the discovery in which they terminated, that trap contains soda, is certainly of importance, and may lead to valuable consequences both in a geological and mineralogical view.

148 Wacken.

SPECIES 2. Wacken.*

* *Kirw.* i. 223.

This stone often forms considerable parts of hills, and, like trap, is amorphous. Its texture is earthy. Its fracture usually even. Lustre 0. Opaque. Hardness 6 to 9. Sp. gr. from 2.535 to 2.893 †. Colour grey, with a shade of green, black, red, brown. When exposed to the atmosphere, it withers and becomes more grey.

† *Kirwan.*

It melts into a grey porous slag.

149 Mullen.

SPECIES 3. Mullen ‡

‡ *Kirw.* i. 225.

This stone is also found in considerable masses, and sometimes has a tendency to a columnar form like basalt. Texture earthy. Fracture uneven, and fine splintery. Lustre 0, except from some shining particles of basaltine. Opaque. Hardness from 7 to 9. Sp. gr. from 2.6 to 2.738. Colour ash or bluish grey; sometimes mixed with ochre yellow, in consequence of the decomposition of the stone. At 130° Wedgewood it melts into a black compact glass.

When mullen is exposed to the air, its surface becomes covered with a greyish white rind, sometimes slightly ochry.

150 Kragstone.

SPECIES 4. Kragstone.*

* *Kirw.* i. 226.

This stone, which like the others, forms considerable parts of rocks, was formed into a distinct species by Mr Kirwan. Its texture is earthy. It is exceedingly porous, and the pores are often filled with the crystals of other minerals. Fracture uneven. Lustre 0. Opaque. Hardness 5 to 7. Sp. gr. 2.314. Feels rough and harsh. Colour reddish grey. Streak yellowish grey. At 138° Wedgewood it melts into a reddish brown porcelain mass.

151 G. VII. Porphyry.

GENUS VII. PORPHYRY.

Any stone which contains scattered crystals or grains of felspar, visible to the naked eye, is denominated a *porphyry*. Besides felspar, porphyries generally contain small crystals of quartz, hornblende, and mica. These crystals are usually of a different colour from the stone in which they are found, and they are stuck in it as in a cement. It is evident from this definition, that the number of porphyries must be great. Each species receives its name from the stone which forms its basis. To describe them would be unnecessary. We shall only give a catalogue of the principal species.

Aggregates.

1. Hornstone porphyry.
2. Pitchstone porphyry.
3. Hornslate porphyry.
4. Felspar or petunse porphyry.
5. Clay porphyry.
6. Hornblende porphyry.
7. Trap porphyry.
8. Wacken porphyry.
9. Mullen porphyry.
10. Krag porphyry.
11. Argilitic porphyry.
12. Potstone porphyry.
13. Serpentine porphyry.
14. Sandstone porphyry.

The aggregates belonging to this section compose most of the mountains of the globe. In giving an account of them, we have adhered implicitly to the arrangement most generally received by mineralogists. It must be acknowledged that this arrangement is by no means complete, and that some of the genera are too vague to be of much use. The number of aggregates already discovered is too great for giving to each a particular name. Perhaps it would be better henceforth to adopt the method proposed by Mr Hauy, namely, to constitute the genera from that ingredient which enters most abundantly into the aggregate, and which forms as it were its basis, and to distinguish the species according to the nature and proportion of the other ingredients. According to this plan, the aggregates hitherto discovered have been divided by Hauy into the following genera:

1. Felspathic rock.
2. Quartzous rock.
3. Micaceous rock.
4. Chloritous rock.
5. Serpentine rock.
6. Trappean rock.
7. Hornblendean rock.
8. Petro-siliceous rock.
9. Garnetic rock.
10. Calcareous rock.
11. Argillaceous rock.
12. Corneous rock.

SECT. IV. *Volcanic Aggregates.*

AGGREGATES formed by volcanoes may be reduced to the following genera.

1. Lava.
2. Tufa.
3. Pumice.
4. Ashes.

GENUS I. LAVA. 152 G. I. Lava.

All substances which have issued out of a volcano in a state of fusion are called *lavas*. They have been divided into three species.

SPECIES 1. Vitreous lava. 153 Vitreous.

Found in small pieces.

Texture glossy. Fracture conchoidal. Lustre 3. Transparency from 3 to 1. Hardness 9 to 10. Sp. gr. from 2 to 3. Colour blackish, greenish, or whitish. Commonly somewhat porous.

SPECIES 2. Cellular lava. 154 Cellular.

This species is full of cells. Surface rough and full of cavities. Texture earthy. Lustre 0. Opaque. Hardness 7 to 9. Sp. gr. varies, but does not exceed 2.8. Colour brown or greyish black. Commonly somewhat magnetic.

SPECIES 3. Compact lava. 155 Compact.

This species is the most common of all; it runs into the

Combuf-tibles.

the fecond by infenfible degrees; and indeed is feldom found of any confiderable fize without fome pores. It bears in general a very ftrong refemblance to trap.

A fpecimen of the lava of Catania in Sicily, analyfed by Dr Kennedy, contained

51.0 filica,
19.0 alumina,
14.5 oxyd of iron,
9.5 lime,
4.0 foda,
1.0 muriatic acid.

99.0†

† *Tranf. Edin.* v. 93.

A fpecimen of the lava of Sta. Venere in Sicily he found to contain

50.75 filica,
17.50 alumina,
14.25 oxyd of iron,
10.00 lime,
4.00 foda,
1.00 muriatic acid.

97.5‡.

‡ *Ibid.* 94.

Thus we fee, that the refemblance between trap and lava holds not only in their external appearance, but alfo in their component parts.

Combuf-tibles.

156 G. II. Puzzolana.

Genus II. puzzolana.

Found in fmall pieces. Surface rough. Texture earthy and porous. Fracture uneven. Luftre 0. Opaque. Hardnefs 3. Very brittle. Sp. gr. from 2.57 to 2.8. Colour brown or dark grey. Magnetic. Eafily melts into a black flag.

When mixed with lime into a mortar, it poffeffes the property of hardening even under water. This property it owes moft probably, as Mr Kirwan fuppofes, to the iron which it contains. The iron decompofes the water of the mortar, and by this means it becomes too hard to be acted upon by water in a very fhort time.

157 G. III. Pumice.

Genus III. pumice.

This is a very light fubftance ejected from volcanoes. It is porous. Hardnefs 3. Brittle Sp. gr. below 1. Colour grey or brown.

In fome varieties the luftre and tranfparency are 0: in others, the luftre is glaffy, 2. Tranfparency from 1 to 2.

158 G. IV. Volcanic afhes.

Genus IV. volcanic ashes.

Thefe are analogous to the afhes of common pit coal. Loofe and fmooth, very light, and fine. Slowly diffufible in water, and when wet fomewhat ductile.

Class II. SALTS.

UNDER this clafs we comprehend all the combinations of alkalies with acids which exift in the mineral kingdom. As they have been already defcribed in the article Chemistry, *Suppl.* we fhall here only give a lift of their names.

159 Genera.

Genus I. potass.

Sp. 1. Sulphat of potafs.
2. Nitrat of potafs.

Genus II. soda.

Sp. 1. Carbonat of foda.
2. Sulphat of foda.
3. Muriat of foda.
4. Borax.

Genus III. ammonia.

Sp. 1. Sulphat of ammonia.
2. Muriat of ammonia.

Class III. COMBUSTIBLES.

160 Genera.

THE combuftible fubftances belonging to the mineral kingdom, excluding the metals, may be comprehended under the following genera.

1. Sulphur.
2. Carbon.
3. Bitumen.
4. Coal.
5. Amber.

161 G. I. Sulphur.

Genus I. sulphur.

SPECIES 1. Native fulphur.

This fubftance is found abundantly in many parts of the world, efpecially near volcanoes, as Hecla, Ætna, Vefuvius, the Lipari iflands, &c. It is either in the ftate of powder, or maffive, or cryftallized. The primitive form of its cryftals is an octohedron, compofed of two four-fided pyramids, joined bafe to bafe†. The fides of thefe pyramids are fcalene triangles, and fo inclined that the plane where the bafes of the pyramids join is a rhomb, whofe long diagonal is to its fhort as 5 to 4*. Sometimes the apices of the pyramids, to ufe the language of De Lifle, are truncated; fometimes they are feparated from each other by a prifm; fometimes they are truncated near their bafes, and a low four-fided pyramid rifes from the truncature: this pyramid is alfo fometimes truncated near its apex‡. Finally, one of the edges of the pyramids is fometimes truncated. For figures of thefe varieties, and for the laws of their formation, we refer to *Mr Lefroy*†.

† Fig. 34.

* *Romé de Lifle*, i. 292. *Hauy* and *Lefroy, Jour. de Min.* N° xxix. 337.

‡ Fig. 35.

† *Jour. de Min.* N° xxix. 337.

Colour yellow, with a fhade of green; fometimes reddifh (q). Luftre greafy, 2. Tranfparency varies from 0 to 4. Caufes double refraction‡. Texture compact. Hardnefs 4 to 5. Brittle—For its other properties, we refer to Chemistry in this *Suppl.*

‡ *Hauy.*

Sometimes fulphur is mixed with different proportions of earths. Thefe combinations are hardly fufceptible of accurate defcription.

Sulphur combines alfo with metals. Thefe combinations fhall be defcribed in the fourth clafs.

162 G. II. Carbon.

Genus II. carbon.

This genus comprehends all minerals compofed of pure carbon, or of carbon combined with a little earth.

163 Diamond.

SPECIES 1. Diamond.

This mineral, which was well known to the ancients, is

(q) It then contains arfenic.

Combustibles.

is found in different parts of Asia, particularly in the kingdoms of Golconda and Visapour; it is found also in Brazil.

It is always crystallized; but sometimes so imperfectly, that at the first sight it might pass for amorphous. Its primitive form is a regular octogon†; but it more commonly assumes a spheroidal form, and then has usually 36 curvilinear triangular faces, six of which are raised upon each of the faces of the primitive octogon‡. Its integrant molecule, according to Hauy, is a regular tetrahedron.—For a more particular account of the crystals of this mineral, we refer the reader to *Mr Romé de Lisle** and *Mr Hauy*†.

† Fig. 36.
‡ Fig. 37.
* *Cryst.* ii. 191.
† *Jour. de Min.* N° xxix. 343.
‡ *Hauy, ibid.*

Texture foliated. Lustre 4. Transparency from 2 to 4. Causes single refraction. Hardness 20. Sp. gr. 3.5185 to 3.5310‡. Colour various; sometimes limpid, sometimes red, orange, yellow, green, blue, and even blackish.

When rubbed it becomes positively electric, even before it has been cut by the lapidary, which is not the case with any other gem‖.

It is composed of pure carbon§.

‖ *Id. ibid.*
§ *Morveau, Ann. de Chim.* xxxi. 72.

164
Mineral charcoal.

SPECIES 2. Mineral charcoal.

Kilkenny coal—Wales culm.

This mineral has been found in Hungary, Italy, France, Ireland, and Wales. It occurs in stratified masses, or in lumps nestled in clay.

Colour black. Lustre 4, metallic. Opaque. Texture foliated. Hardness 5 to 7. Sp. gr. 1.4 to 1.526. Often stains the fingers. Insoluble in acids. Deflagrates with nitre. Does not burn till wholly ignited, and then consumes slowly without emitting flame or smoke.

It consists almost entirely of *charcoal*, which, as Morveau has proved, is an oxyd of carbon*.

* *Ibid.*

165
Anthracite.

SPECIES 3. Anthracite (R).

Anthracolite.

This substance, as Dolomieu informs us, is found exclusively in the primitive mountains. It is always amorphous. Colour black or brownish black. Lustre 3 to 4. Structure slaty. Fragments rhomboidal. Hardness 6 to 7. Sp. gr. greater than that of coal. Often stains the fingers.

Burns precisely like the last species, and leaves .40 of white ashes. According to Dolomieu, it is composed of about

64.0	charcoal,
32.5	silica,
3.5	iron.
100.0†	

† *Jour. de Min.* N° xxix. 338.

It is probable that the charcoal in the two last substances is in the same state in which it exists in plumbago, combined with oxygen, but not containing so much as charcoal does‡.

‡ *Morveau, ibid.*

166
G. III. Bitumen.

GENUS III. BITUMEN.

By bitumen we understand, with mineralogists in general, an oil, which is found in different parts of the earth, in various states of consistence. These different states form distinct species; in our arrangement of which we shall be guided by the observations which Mr Hatchett has made in his valuable paper on bituminous substances*.

* *Nicholson's Journal*, ii. 101, 248.

167
Naphtha.

SPECIES 1. Naphtha.

This substance is found sometimes on the surface of the water of springs, and sometimes issuing from certain strata. It is found in great abundance in Persia.

It is as fluid and transparent as water. Colour white or yellowish white. Smell strong, but not disagreeable. Sp. gr. when white, .708* or .729†; when yellowish, .8475‡. Feels greasy. Catches fire on the approach of flame, burns with a white flame, and leaves scarce any residuum.

* *Muschenbroek.*
† *Bouldus.*
‡ *Brisson.*

Insoluble in alcohol. Does not freeze at 0° Fahrenheit. When pure naphtha is exposed to the air, it becomes yellow and then brown; its consistence is increased, and it passes into *petroleum**.

* *Hatchett.*

168
Petroleum.

SPECIES 2. Petroleum.

This substance is also found in Persia, and likewise in many countries in Europe, particularly Italy, France, Switzerland, Germany, Sweden, England, and Scotland.

Not so fluid nor transparent as water. Colour yellow, either pale or with a shade of red or green; reddish brown and reddish black. Smell that of naphtha, but less pleasant. Sp. gr. .8783*. When burned it yields a soot, and leaves a small quantity of coally residuum.

* *Brisson.*

By exposure to the air it becomes like tar, and is then called *mineral tar*†.

† *Hatchett, ibid.*

169
Mineral tar.

SPECIES 3. Mineral tar.

This substance is found in many parts of Asia, America, and Europe. It is viscid, and of a black, brownish black, or reddish colour. Smell sometimes strong, but often faint. Sp. gr. 1.1. When burned, emits a disagreeable bituminous smell. By exposure to the air it passes into *mineral pitch* and *maltha**.

* *Hatchett, ibid.*

170
Mineral pitch and maltha.

SPECIES 4. Mineral pitch and maltha.

This substance has a strong resemblance to common pitch. When the weather is warm it is soft, and has some tenacity; it is then called *adhesive mineral pitch*: when the weather is cold, it is brittle; its hardness is 5; and its fracture has a glassy lustre. In this state it is called *maltha*. Colour black, dark brown, or reddish. Lustre 0. Opaque. Sp. gr. from 1.45 to 2.07. Does not stain the fingers. On a white hot iron it flames with a strong smell, and leaves a quantity of grey ashes. It is to the presence of the earths which compose these ashes that the great specific gravity of this bitumen is to be ascribed. By farther induration, it passes into *asphalt*.

171
Asphalt.

SPECIES 5. Asphalt.

This substance is found abundantly in many parts of Europe, Asia, and America, especially in the island of Trinidad.

Colour black or brownish black. Lustre greasy 2. Opaque. Fracture conchoidal, of a glassy lustre. Hardness from 7 to 8. Very brittle. Sp. gr. 1.07 to 1.165*. Feel smooth, but not greasy. Does not stain the fingers. Has little or no smell, unless when rubbed or heated. When heated melts, swells, and inflames; and when pure, burns without leaving any ashes.

* *Kirwan.*

172
Elastic bitumen.

SPECIES 6. Elastic bitumen.

Mineral caoutchouc.

This substance was found about the year 1786 in the lead

3 U

(R) This name was given by Hauy from ανθραξ, *a coal.*

Combuftibles.

lead mine of Odin, near Caftletown, Derbyfhire. It was firft mentioned by Mr De Born.

Colour yellowifh or reddifh brown, fometimes blackifh brown. In its appearance it has a ftrong refemblance to caoutchouc or Indian rubber; hence its name. Confiftency various: fometimes fo foft as to adhere to the fingers; fometimes nearly as hard as afphalt. When foft it is elaftic; when hard brittle. Sp. gr. 0.9053 to 1.0233 ‡.

‡ Hatchett, ibid.

Infoluble in alcohol, ether, and oil of turpentine, but foluble in oil of olives. Not affected by nitric acid. When diftilled, it yields a bituminous oil infoluble in alcohol; the refiduum is carbonaceous.*

* Lambe-, Jour. de Phyf. xxxi. 312.

There is a variety of this fubftance found in a rivulet near the mine of Odin, which, when frefh cut, exactly refembles fine cork in colour and texture; but in a few days after being expofed to the air, becomes of a pale reddifh brown. This fubftance contains within it a nucleus of elaftic bitumen. It feems to be the elaftic bitumen altered in its texture by the water †.

† Hatchett, ibid.

173 G. IV. Coal.

Genus IV. coal.

The fubftances belonging to this genus are compofed of carbon or rather charcoal, and bitumen.

174 Jet.

Species 1. Jet (s).

This fubftance is found in France, Spain, Germany, Britain, and other countries. It is found in detached kidneyform maffes, of various fizes, from an inch to feven or eight feet in length.

Colour full black. Luftre 3 to 4; internal glaffy. Opaque. Hardnefs 7 to 8. Not near fo brittle as afphalt. Texture ftriated. Fracture conchoidal. Sp. gr. 1.259.* It has no odour except when heated, and then it refembles the odour of afphaltum. Melts in a ftrong heat, burns with a greenifh flame, and leaves an earthy refiduum †

* Briffon.

Becomes fomewhat electric by friction ‡. When diftilled yields a peculiar acid §.

† Hatchett. ‡ Kirwan. § Vauquelin.

This mineral is formed into buttons, beads, and other trinkets. The manufacture has been almoft confined to France ‖.

‖ Jour. de Min. N° iv. 41.

175 Cannel coal.

Species 2. Cannel coal.

This mineral is found in Lancafhire, and in different parts of Scotland, where it is known by the name of *parrot coal*.

Colour black. Luftre common, 2. Opaque. Structure fometimes flaty. Texture compact. Fracture conchoidal. Hardnefs 5 to 8. Brittle. Sp. gr. 1.232 to 1.426. Does not ftain the fingers.

Kindles eafily, and burns with a bright white flame like a candle (t), which lafts but a fhort time. It does not cake. It leaves a ftony or footy refiduum.

A fpecimen of Lancafhire cannel coal, analyfed by Mr Kirwan, contained 75.20 charcoal,
21.68 maltha,
3.10 alumina and filica.

99 98 †

† Mineral. ii. 523.

A fpecimen of the flaty kind from Airfhire, called *fplent coal*, was compofed of
47.62 charcoal,
32 52 maltha,
20.00 earths.

100.14 ‡

‡ Ibid. 524.

Cannel coal is fufceptible of polifh, and, like jet, is often wrought into trinkets.

176 Common coal.

Species 3. Common coal.

This very ufeful combuftible is never found in the primitive mountains, but only in the fecondary mountains, or in plains formed of the fame materials with them. It is always in ftrata, and generally alternates with clay, fandftone, or limeftone.

Colour black, more or lefs perfect. Luftre ufually greafy or metallic, 2 to 4. Opaque. Structure generally flaty. Texture often foliated. Fracture various. Hardnefs 4 to 6. Sp. gr. 1.25 to 1.37. Ufually ftains the fingers. Takes fire more flowly, and burns longer, than the laft fpecies. Cakes more or lefs during combuftion.

Of this fpecies there are many varieties, diftinguifhed in Britain by the names of caking coal, rock coal, &c. Thefe are too well known to require any defcription.

Mr Kirwan analyfed a variety of different kinds of coal: The refult of his experiments may be feen by the following table.

Whitehaven coal.	Wigan.	Swanfey.	Leeirim.	
57.0	61.73	73.53	71.43	charcoal.
41.3	36.7	23.14	23.37	maltha & afph.
1.7	1.57	3.33	5.20	earths ‡.
100.0	100.00	100.00	100.00	

‡ Mineral. ii. 525.

177 Spurious coal.

Species 4. Spurious coal.

This mineral is generally found amidft ftrata of genuine coal. It is alfo called *parrot coal* in Scotland.

Colour greyifh black. Luftre 0 to 1. Structure ufually flaty. Texture earthy. Hardnefs 7 to 8. Sp. gr. 1.5 to 1.6. Generally explodes, and burfts when heated.

Compofed of charcoal, maltha, and afphalt, and above .20 of ftony matter.

178 G. V. Amber.

Genus V. amber.

Species 1. Common amber.

This fubftance, called *electrum* by the ancients, is found in different countries; but moft abundantly in Pruffia, either on the fea fhore, or under ground at the depth of about 100 feet, repofing on *wood coal*.* It is in lumps of different fizes.

* Kirw. Min. ii. 66.

Colour yellow. Luftre 3 to 2. Transparency 2 to 4. Fracture conchoidal. Hardnefs 5 to 6. Sp. gr. 1.078 to 1.085. Becomes electric by friction.

If a piece of amber be fixed upon the point of a knife, and then kindled, it burns to the end without melting †.

† Hauy,

By diftillation it yields fuccinic acid.

Class

(s) It was called *gagathes* by the ancients, from the river Gages in Licia, near which it was found; *jayet* in French, *azabache* in Spanifh, *gagath* in German.

(t) Hence it has been called *cannel coal*. *Candle*, in the Lancafhire and Scotch dialect, is pronounced *cannel*.

CLASS IV. METALLIC ORES.

THIS clafs comprehends all the mineral bodies, compofed either entirely of metals, or of which metals conftitute the moft confiderable and important part. It is from the minerals belonging to this clafs that all metals are extracted; for this reafon they have obtained the name of *ores*.

179 Orders. The metals hitherto difcovered amount to 21; we fhall therefore divide this clafs into 21 orders, allotting a diftinct order for the ores of every particular metal.

Metals exift in ores in one or other of the four following ftates. 1. In a metallic ftate, and either folitary or combined with each other. 2. Combined with fulphur. 3. In the ftate of oxyds. 4. Combined with acids. Each order therefore may be divided into the four following genera.

180 Genera.
1. Alloys.
2. Sulphurets.
3. Oxyds.
4. Salts.

It muft be obferved, however, that every metal has not hitherto been found in all thefe four ftates, and that fome of them are hardly fufceptible of them all. Some of the orders therefore want one or more genera, as may be feen from the following table.

ORDER I. *Gold ores.*
1. Alloys.

ORDER II. *Silver ores.*
1. Alloys.
2. Sulphurets.
3. Oxyds.
4. Salts.

ORDER III. *Platinum ores.*
1. Alloys.

ORDER IV. *Ores of mercury.*
1. Alloys.
2. Sulphurets.
3. Oxyds.
4. Salts.

ORDER V. *Copper ores.*
1. Alloys.
2. Sulphurets.
3. Oxyds.
4. Salts.

ORDER VI. *Iron ores.*
1. Alloys.
2. Sulphurets.
3. Carburets.
4. Silicated iron.
5. Oxyds.
6. Salts.

ORDER VII. *Tin ores.*
1. Sulphurets.
2. Oxyds.

ORDER VIII. *Lead ores.*
1. Sulphurets.
2. Oxyds.
3. Salts.

ORDER IX. *Zinc ores.*
1. Sulphurets.
2. Oxyds.
3. Salts.

ORDER X. *Antimonial ores.*
1. Alloys.
2. Sulphurets.
3. Oxyds.
4. Salts.

ORDER XI. *Bifmuth ores.*
1. Alloys.
2. Sulphurets.
3. Oxyds.

ORDER XII. *Arfenic ores.*
1. Alloys.
2. Sulphurets.
3. Oxyds.

ORDER XIII. *Cobalt ores.*
1. Alloys.
2. Sulphurets.
3. Oxyds.
4. Salts.

ORDER XIV. *Nickel ores.*
1. Sulphurets.
2. Oxyds.
3. Salts.

ORDER XV. *Manganefe ores.*
1. Oxyds.
2. Salts.

ORDER XVI. *Tungften ores.*
1. Oxyds.
2. Salts.

ORDER XVII. *Ores of molybdenum.*
1. Sulphurets.

ORDER XVIII. *Ores of uranium.*
1. Oxyds.
2. Salts.

ORDER XIX. *Ores of titanium.*
1. Oxyds.

ORDER XX. *Ores of tellurium.*
1. Alloys.

ORDER XXI. *Ores of chromum.*
1. Oxyds.

ORDER I. GOLD ORES.

181 Where found. No metal perhaps, if we except iron, is more widely fcattered through the mineral kingdom than gold*. Hitherto it has been found only in a metallic ftate; moft commonly in grains, ramifications, leaves, or rhomboidal, octohedral, or pyramidal cryftals. It is generally mixed with quartz, though there are inftances of its having occurred in calcareous rocks. It is not uncommon alfo to find it diffeminated through the ores of other metals: efpecially iron, mercury, copper, and zinc. The greateft quantity of gold is found in the warmer regions of the earth. It abounds in the fands of many African rivers, and is very common in South America and India. Europe, however, is not deftitute of this metal. Spain was famous in ancient times for its gold mines, and feveral of the rivers in France contain it in their fands †. But the principal gold mines in Europe are thofe of Hungary, and next to them thofe of Salzburgh. Gold alfo has been difcovered in Sweden and Norway, and more lately in the county of Wicklow in Ireland ‡.

* *Bergman.*

† *Reaumur, Mem. Par* 1718, p. 68.

‡ *Lloyd, Phil. Tranf.* 1796, p. 36. *Mills, ibid.* p. 38.—*Nicholfon's Journ.* ii. 224.

GENUS I. Alloys of gold.

SPECIES 1. Native gold.

182 G. I. Native gold. Native gold is never completely pure; it is alloyed with fome filver or copper, and fometimes with iron. In the native gold found in Ireland, indeed, the quantity of alloy appears to have been exceedingly fmall.

Its colour is yellow. Luftre metallic. Fracture hackly. Hardnefs 5. Sp. gr. from 12 to 19.

ORDER II. SILVER ORES.

183 Where found. SILVER is found moft commonly in quartz, limeftone, hornftone; or combined with the ores of other metals, moft commonly with copper, antimony, zinc, cobalt, and lead. This laft metal indeed is feldom totally deftitute of filver.

GENUS I. Alloys of filver.

SPECIES 1. Native filver.*

184 G. I. Native filver. Native filver, fo called becaufe the filver is nearly in a ftate of purity, forms the principal part of fome of the richeft filver mines in the world. It is fometimes in fmall lumps; fometimes cryftallized in cubes, hexahedrons, octohedrons, or dodecahedrons; fometimes in leaves, or threads, often fo connected with each other as to refemble branches of trees, and therefore called *dendrites*. The filver in the famous mines of Potofi has this laft form. When newly extracted, it is not unlike fmall branches of fir †.

The colour of native filver is white; often tarnifhed. Luftre metallic. Fracture hackly. Hardnefs 6. Malleable. Sp. gr. from 10 to 10.338.

This filver in this fpecies is almoft conftantly alloyed with from .03 to .05 of fome other metal, frequently gold or arfenic.

* *Kirw.* ii. 108.—*Cal. Ing. Act. Liter. Suec.* 1738, p. 420.

† *Bournon, Phil. Journ.* — *Min.* N° xvi. p. 26.

Silver. Metallic ores.

185 Alloy of silver and gold.

SPECIES 2. Alloy of silver and gold.

Auriferous native silver.

This alloy is not uncommon in silver mines. Its colour is yellowish white. Its lustre metallic. Hardness 5. Malleable. Sp. gr. above 10.6. Dr Fordyce found a specimen from Norway composed of

72 silver,
28 gold.
100*

* *Phil. Trans.* 1776, p. 532.

186 Alloy of silver and antimony.

SPECIES 3. Alloy of silver and antimony†.

Antimoniated silver ore.

This alloy, which is found in the silver mines of Spain and Germany, is sometimes in grains or lumps, and sometimes crystallized in six-sided prisms, whose sides are longitudinally channelled‡.

Its colour is white. Its lustre metallic. Hardness 10. Brittle. Sp. gr. from 9.4406§ to 10‖. Texture foliated. Fracture conchoidal. Before the blow-pipe the antimony evaporates in a grey smoke, and leaves a brownish slag, which tinges borax green. If borax be used at first, a silver bead may be obtained.

This alloy was long supposed to contain arsenic. Bergman examined it, and found only silver and antimony¶. His analysis has been confirmed by the experiments of Vauquelin and Selb*. According to Selb, it is composed of 89 silver,

11 antimony.
100

A specimen, analysed by Klaproth, contained

84 silver,
16 antimony.
100

Another specimen contained

76 silver,
24 antimony.
100†

† *Kirwan*, ii. 110.
‡ *Romé de Lisle*, iii. 461.
§ *Hauy, Jour. de Min.* N° xxx. p. 473.
‖ *Kirwan*, *ibid.*
¶ *Opusc.* ii. 415.
* *Jour. de Min. ibid.*
† *Beiträge*, ii. 301.

187 G. II. Sulphurets. Common sulphuret of silver.

GENUS II. SULPHURETS OF SILVER.

SPECIES 1. Common sulphuret of silver‡.

Vitreous silver ore.

This ore occurs in the silver mines of Germany and Hungary. It is sometimes in masses, sometimes in threads, and sometimes crystallized. Its crystals are either cubes or regular octohedrons, whose angles and edges are often variously truncated. For a description of the varieties produced by these truncatures, we refer the reader to *Romé de Lisle*¶.

Its colour is dark bluish grey, inclining to black; often tarnished. Internal lustre metallic. Texture foliated. Fracture uneven. Hardness 4 to 5. May be cut with a knife like lead. Flexible and malleable. Sp. gr. 6.909* to 7.215†. In a gentle heat the sulphur evaporates. Melts when heated to redness.

A specimen of this ore, analysed by Klaproth, contained 85 silver,

15 sulphur.
100‡

‡ *Kirwan*, ii. 115.
¶ *Crystal.* iii. 441.
* *Brisson.*
† *Gellert.*
‡ *Beiträge*, i. 162.

188 Antimoniated silver ore.

SPECIES 2. Antimoniated silver ore*.

Sulphuret of silver with antimony and iron.

This ore, which occurs in Saxony and Hungary, seems to be sulphuret of silver contaminated with antimony and iron, and ought therefore, in all probability, to be considered merely as a variety of the last species. It is sometimes in masses, but more frequently crystallized in six-sided prisms, tables, or rhomboids; generally indistinct and accumulated together.

Its colour is iron grey; often tarnished. Its lustre metallic. Fracture uneven. Hardness 4 to 5. Brittle. Sp. gr. 7.208†. Before the blow-pipe the sulphur and antimony exhale, leaving a bead, which may be freed from iron by fusion with nitre and borax.

A specimen of this ore, analysed by Klaproth, contained

66.5	silver,
12.0	sulphur,
10.0	antimony,
5.0	iron,
1.0	silica,
0.5	arsenic and copper.
95.0‡	

* *Kirwan*, ii. 118.
† *Gellert.*
‡ *Beiträge*, i. 166.

189 Sulphuret of silver and copper.

SPECIES 3. Sulphuret of silver and copper*.

Cupriferous sulphurated silver ore.

This ore, which is found in the Korbolokinsk mountains in Siberia, was first described by Mr Renovantz. It is in amorphous masses, varying in size from that of the thumb to that of the fist.

Its colour is bluish grey like lead. Lustre metallic. Hardness 5 to 6. Brittle. Its powder, when rubbed on the skin, gives it a black colour and a leaden gloss. Before the blow-pipe the sulphuret of silver melts readily; that of copper with difficulty. This ore is composed of about 42 silver,

21 copper,
35 sulphur.
98

* *Kirwan*, ii. 121.

190 G. III. Oxyds. Calciform silver ore.

GENUS III. OXYDS OF SILVER.

SPECIES 1. Calciform silver ore†.

This ore was first described by Mr Widenman. It is sometimes in masses, sometimes disseminated through other minerals.

Its colour is greyish black. Its streak bright. Its lustre metallic. Its fracture uneven. Hardness 4 to 5. Brittle. Sp. gr. considerable. Effervesces with acids. Melts easily before the blow-pipe. Froths with borax.

According to Selb, it contains 72.5 silver,

15.5 copper,
12.0 carbonic acid.
100.0

† *Kirwan*, ii. 112.

191 Red silver ore.

SPECIES 2. Red silver ore (u).

This ore is very common in several German silver mines. It occurs in masses, disseminated and crystallized. The primitive form of its crystals is a dodecahedron‡, whose sides are equal rhombs, and which may be con-

‡ Fig. 38.

(u) *Kirw.* II. 122.—*Scopoli de Minera Argenti Rubra.*—*Sage, Jour. de Phys.* XXXIV. 331. and XLI. 370; and *Nouv. Jour. de Phys.* II. 284.—*Westrum, Jour. de Phys.* XLIII. 291.—*Klaproth, Beiträge*, I. 141.

Silver.

considered as a six-sided rhomboidal prism, terminated by three-sided summits*. Sometimes the prism is lengthened, and sometimes its edges, or those of the terminating summits, or both, are wanting. For a description and figure of these varieties, we refer to *De Lisle*† and *Hauy*‡.

* *Romé de Lisle*, iii. 447.
† *Ibid.*
‡ *Jour. d'Hist. Naturelle*, N° 18. p. 216.

Its colour is commonly red. Streak red. External lustre metallic, internal common. Transparency from 3 to 1; sometimes opaque. Fracture flat conchoidal. Hardness 5 to 7. Brittle. Sp. gr. from 5.44§ to 5.592¶. Becomes electric by friction, but only when insulated‖. Soluble in nitric acid without effervescence*. Before the blow-pipe melts, blackens, burns with a blue flame, gives out a white smoke with a slight garlic smell, and leaves a silver bead†.

§ *Kirwan.*
¶ *Vauquelin, Jour. de Min.* N° xvii. p. 2.
‖ *Hauy, ibid.* N° xxx. p. 476.
* *Hauy, ibid.* N° xxxi. p. 518.
† *Vauquelin, ibid.*

Variety 1. Light red.

Colour intermediate between blood and cochineal red; sometimes variegated. Streak orange red. Powder black.

Variety 2. Dark red.

Colour commonly between dark cochineal red and lead grey; sometimes nearly black and without any shade of red. Streak dark crimson red.

This ore was long supposed to contain arsenic, Klaproth first ascertained its real composition‡; and his analysis has been confirmed by Vauquelin, who found a specimen composed of 56.6748 silver,

‡ *Ann. de Chim.* xviii. 81.

16.1300 antimony,
15.0666 sulphur,
12.1286 oxygen.

100.

Klaproth proved, that the silver and antimony are in the state of oxyds; and Vauquelin, that the sulphur is combined partly with the oxyd of silver and partly with the oxyd of antimony. Klaproth obtained a little sulphuric acid; but this acid, as Vauquelin, with his usual ingenuity, demonstrated, was formed during the analysis.

This ore sometimes contains a minute portion of arsenic, but never more than .02*.

* *Vauquelin, ibid.* p. 8.

192
G. IV.
Salts.
Muriat of silver.

GENUS IV. SALTS OF SILVER.

SPECIES 1. Muriat of silver (x).

Corneous silver ore.

This ore occurs at Johanngeorgenstadt in Saxony, in South America, &c. It is often amorphous, sometimes nearly in powder, and sometimes crystallized in cubes or parallelepipeds.

Its colours are various: when exposed to the light it becomes brown. Internal lustre greasy, 2; external, 2 to 1. Acquires a gloss when scraped with a knife. Transparency 2 to 1. Texture foliated. Hardness 4 to 5. Sp. gr. 4.745* to 4.804† Before the blow-pipe it instantly melts, and gradually evaporates, but may be reduced by adding an alkali.

* *Brisson.*
† *Gellert.*

Metallic ores.

That this ore contains muriatic acid, has been long known. Mr Woulfe first shewed that it contained also sulphuric acid‡: and this discovery has been confirmed by Klaproth, according to whose analysis this ore is composed of

‡ *Phil. Transf.* 1776.

67.75 oxyd of silver,
6.00 oxyd of iron,
21.00 muriatic acid,
.25 sulphuric acid,
1.75 alumina.

96.75¶

¶ *Beiträge*, i. 134.

The alumina can only be considered as mixed with the ore. Sometimes its quantity amounts to .67 of the whole§.

§ *Ibid.* p. 137.

ORDER III. ORES OF PLATINUM (y).

193
Mines.

HITHERTO no mine of platinum has been discovered. It is found in small scales or grains on the sands of the river Pinto, and near Carthagena in South America. It is always in a metallic state, and always combined with iron.

194
G. I. Alloys.
Native platinum.

GENUS I. ALLOYS OF PLATINUM.

SPECIES 1. Native platinum.

Its colour is whitish iron grey. Magnetic. Sp. gr. from 12 to 16. Soluble in nitro-muriatic and oxy-muriatic acids.

ORDER IV. ORES OF MERCURY.

MERCURY is employed in medicine; it serves to separate silver and gold from their ores; the silvering of looking glasses, gilding, &c. are performed by means of it; and its sulphuret forms a beautiful paint.

195
Mines.

Mercury abounds in Europe, particularly in Spain, Germany, and Hungary: it is found also in China (z), the Philippines*, and in Peru, and perhaps Chili (A) in South America. The most productive mines of mercury are those of Idria†; of Almaden, near Cordova in Spain, which were wrought by the Romans (B); of the Palatinate‡; and of Guanca Velica in Peru (C).

* *Carreri's Voyage.*
† *Scopoli, Jour. de Min.* N° xxxvi. p. 915.
‡ *Jour. de Min.* N° vi. and vii.

Mercury has never been found in Britain, nor has any mine worth working been discovered in France. It occurs most commonly in argillaceous shistus, limestones, and sandstones.

196
G. I. Alloys.
Native mercury.

GENUS I. ALLOYS OF MERCURY.

SPECIES 1. Native mercury.

Native mercury is found in most mercurial mines: it is in small globules, scattered through different kinds of stones, clays, and ores.

Fluid. Colour white. Sp. gr. about 13.6.

SPECIES

(x) *Kirw.* II. 113.—*Laxmann. Nov. Comm. Petropol.* XIX. 482.—*Monnet. Mem. Sçav. Etrang.* IX. 717.

(y) See *Brownrigg, Phil. Transf.* XLVI. 584.—*Lewis, ibid.* XLVIII. 638. and L. 148.—*Margraf. Mem. Berlin*, 1757. p. 314.—*Macquer, Mem. Par.* 1758, p. 119.—*Buffon, Jour. de Phys.* III. 324.—*Morveau, ibid.* VI. 193.—*Bergman, Opusc.* II. 166.—*Tillet. Mem. Par.* 1779, p. 373, and 383, and 545.—*Crell, Crell's Annals*, 1784. 1 *Band.* 328.—*Wallis, Manchester Memoirs*, III. 467.—*Mussin Puschkin, Ann. de Chim.* XXIV. 205.—*Morveau, ibid.* XXV. 3.

(z) See *Entrecolle's Letteres Edifiantes.*

(A) See *Molina's Natural History of Chili.*

(B) See *Bowle's Natural History of Spain*, and *Jour. de Min.* N° xxxi. p. 555.

(C) See *Ulloa's Memoirs concerning America.*

Ores of Mercury.

197 Amalgam of silver.

SPECIES 2. Amalgam of silver.*

Native amalgam.

This mineral has been found in the silver mine of Sahlberg †, in the province of Dalecarlia, in Sweden; in the mines of Deux Ponts ‡, in the Palatinate; and in other places. It is in thin plates, or grains, or crystallized in cubes, parallelopipeds, or pyramids.

Its colour is silvery white or grey. Lustre metallic. Creaks when cut. Sp. gr. above 10. Tinges gold white. Before the blow-pipe the mercury evaporates and leaves the silver.

A specimen of this amalgam, analysed by Klaproth, contained 64 mercury,
36 silver.

100 §

Sometimes it contains a mixture of alumina, and sometimes the proportion of mercury is so great that the amalgam is nearly as soft as paste.

* Kirwan, ii. 223.
† Cronstedt's Min.
‡ Heyer. Crell's Annals, 1790.
§ Beiträge, i. 185.

198 G. II. Sulphurets. Common sulphuret.

GENUS II. SULPHURETS OF MERCURY.

SPECIES 1. Common sulphuret.*

Native cinnabar.

This ore, which is found in almost all mercurial mines, is sometimes in veins, sometimes disseminated, sometimes in grains, and sometimes crystallized. The form of its crystals is a tetrahedron or three-sided pyramid, most commonly wanting the summit; sometimes two of these pyramids are joined base to base: and sometimes there is a three-sided prism interposed between them †.

Its colour is red. Its streak red and metallic. Lustre when crystallized 2 to 3; when amorphous, often 0. Transparency, when crystallized, from 1 to 3; when amorphous, often 0. Texture generally foliated. Hardness from 3 to 8. Sp. gr. from 5.419 to 10.1285.

Before the blow-pipe evaporates with a blue flame and sulphureous smell. Insoluble in nitric acid ‡.

Variety. 1. Dark red.

Colour cochineal red. Hardness 6 to 7. Sp. gr. when pure, 10.1285 §; sometimes only 7.2, or even 6.188 ¶.

Variety 2. Bright red.

Colour commonly scarlet. Sp. gr. 6.9022 † to 5.419 ‡.

* Kirwan, ii. 228.
† Romé de Lisle, iii. 154.
‡ Hauy, Jour. de Min. N° xxxi. p. 518.
§ Brisson.
¶ Muschenbrock.
† Brisson.
‡ Gellert.

199 G. III. Oxyds. Hepatic mercurial ore.

GENUS III. OXYDS OF MERCURY.

SPECIES 1. Hepatic mercurial ore.*

This ore, which is the most common in the mines of Idria, is always amorphous, and is often mixed with native mercury and cinnabar.

Its colour is somewhat red. Its streak dark red and brighter. Lustre commonly metallic. Hardness from 6 to 8. Sp. gr. from 9.2301 † to 7.186 ‡. When heated the mercury evaporates.

Though this ore has never been accurately analysed, chemists have concluded that the mercury which it contains is in the state of a red oxyd, because it is insoluble in nitric and soluble in muriatic acid ¶. When purest, it contains about .77 of mercury §. It contains also some sulphur and iron.

Werner has divided this species into two varieties, the *compact* and the *slaty*. The second is often nothing more than bituminous shale impregnated with oxyd of mercury †.

* Kirwan. ii. 224.
† Brisson.
‡ Kirwan.
¶ Sage, Jour. de Phys. xxiv. 61.
§ Scopoli, Jour. de Min. N° xxxvi. p. 919.
† Kirwan, ii. 226.

Metallic Ores.

200 Mercurial Salts. Muriat of mercury.

GENUS IV. MERCURIAL SALTS.

SPECIES 1. Muriat of mercury.*

Corneous mercury.

This ore, which occurs in the Palatinate, is sometimes in scales, sometimes in grains, and sometimes crystallized. Its crystals are either small four or six-sided prisms whose sides are rhombs †, or cubes, or four-sided pyramids wanting their angles. They are always very small and generally confused.

Its colours are various; but it is most frequently white. Its lustre, when white, is pearly. Sometimes opaque, and sometimes semitransparent. Evaporates before the blow pipe.

Mr Woulfe discovered, that this ore generally contains some sulphuric acid ‡. Specimens have been found in which the quantity of sulphuric acid exceeds that of the muriatic §.

* Kirwan, ii. 226.
† Romé de Lisle, iii. 161.
‡ Phil. Trans. lxvi. 618.
§ Suckow.

ORDER V. COPPER ORES.

MANY of the most useful utensils are formed of copper: it enters largely into the composition of brass, bronze, and bell metal; not to mention the dyes and paints of which it is the basis.

201 Mines.

Copper mines abound in most countries. They are wrought in China, Japan, Sumatra; the north of Africa; in Chili and Mexico; and in most parts of Europe; especially Britain, Germany, Russia, Hungary.

Copper is found most commonly in rocks of hornblende, shistus, and quartz.

202 G. I. Alloys. Native copper.

GENUS I. ALLOYS OF COPPER.

SPECIES 1. Native copper.*

Native copper occurs now and then in the greater number of copper mines: Sometimes it is in masses, sometimes in plates and threads, which assume a variety of forms; and sometimes, as in Siberia, it is crystallized in cubes, or other forms nearly resembling cubes †.

Colour commonly that of copper, but sometimes dark brown. Lustre metallic. Streak brighter. Fracture hackley. Flexible and malleable. Hardness 6 to 7. Sp. gr. from 7.6 ‡ to 8.5844 ¶.

* Kirwan, ii. 127.—Gartheuser.
† Hauy, Jour. de Min. N° xxxi. 509.
‡ Kirwan's Min. ii. 128.
¶ Hauy, ibid. p. 509.

203 White copper ore.

SPECIES 2. White copper ore §.

Alloy of copper, iron, and arsenic.

This ore, which is said to be uncommon, occurs in masses. Colour white. Lustre metallic. Fracture uneven. Hardness 8 to 9. Brittle. Sp. gr. considerable.

Before the blow-pipe gives out a white arsenical smoke, and melts into a greyish black slag.*

§ Kir. Min. ii. 152.
* Widenman.

204 G. II. Sulphurets of copper. Common sulphuret of copper.

GENUS II. SULPHURETS OF COPPER.

SPECIES 1. Common sulphuret of copper †.

Vitreous copper ore.

This ore, which is found in Cornwal, Hungary, and Siberia, occurs in masses, plates, threads, and crystallized in six-sided prisms, or four-sided pyramids, joined base to base.

Colour bluish grey. Streak brighter grey. Lustre metallic. Hardness 4 to 7. Sp. gr. 5.452 ‡ to 5.565 §; sometimes so low as 4.129.* Detonates with nitre.

Before the blow-pipe it melts easily; and while in fusion exhibits a green pearl, which, on cooling, is covered with a brown crust. Tinges borax green.

Werner makes two varieties of this ore: the first he calls

† Kirwan, ii. 144.
‡ Kirwan.
§ Gellert.
* Kirwan.

Copper Ores.

calls *compact*, from its fracture; and the second, for the same reason, he calls *foliated*. This last is somewhat darker coloured than the first, but in other respects they agree.

205 Copper pyrites. * Kirwan, ii. 140.

SPECIES 2. Copper pyrites.*
Yellow copper ore.

This ore, which is probably nothing else than sulphuret of iron combined with copper, and which, therefore, would be more properly placed among iron ores, is found frequently in copper mines, and mixed with common pyrites or sulphuret of iron. It is sometimes amorphous, and sometimes crystallized. Its crystals are either three or four-sided pyramids applied base to base, or six-sided plates.

Its colour is yellow; often tarnished. Its internal lustre metallic. Hardness 6 to 7; sometimes 9. Brittle. Sp. gr. 4.314 † to 4.08 ‡. Deflagrates; but does not detonate with nitre ||.

† Brisson. ‡ Kirwan. || Id. Min. ii. 141.

Before the blow-pipe decrepitates, gives a greenish sulphureous smoke, and melts into a black mass, which tinges borax green. Does not effervesce with nitric acid.

206 Purple copper ore. * Kirwan, ii. 142.

SPECIES 3. Purple copper ore.*

This ore is found in masses, or plates, or disseminated; sometimes, also, it is crystallized in octohedrons. Colour various, but most commonly purple; internally reddish. Streak reddish and bright. Lustre metallic. Hardness 6 to 7. Brittle. Sp. gr. 4.956 to 4.983 †.

† Ibid. ii. 143.

Effervesces with nitric acid, and tinges it green. Deflagrates with nitre. Before the blow-pipe melts readily, without smoke, vapour, or smell; but is not reduced. Tinges borax a bright green.

A specimen of this ore, analysed by Klaproth, contained

	58 copper,
	18 iron,
	19 sulphur,
	5 oxygen.
	100 ‡

‡ Beiträge, ii. 286.

207 Grey copper ore. § Kirwan, ii. 146.

SPECIES 4. Grey copper ore §.

This ore is found in Cornwal, Saxony, Hungary, &c. It is often amorphous, but often also crystallized. The primitive form of its crystals is the regular tetrahedron; but, in general either the angles or the edges, or both, are truncated or bevelled ||.

|| Romé de Lisle, iii. 315.

Colour steel grey; often tarnished, and then dark grey. Streak dark grey; sometimes reddish brown. Powder blackish; sometimes with a tint of red. Lustre metallic. Hardness 7 to 8. Very brittle. Sp. gr. 4.8648.* Deflagrates with nitre. Before the blow-pipe crackles, but at last melts, especially if assisted by borax. The bead gives a white smoke, without any particular smell; tinges borax yellow or brownish red, but does not unite with it.

* Hauy, Jour. de Min. N° xxxi. 512.

A specimen of this ore from Cremnitz, analysed by Klaproth, contained

	31 copper,
	14 silver,
	34 antimony,
	3 iron,
	11 sulphur.
	93

Napion, in an ore from the valley of Lanzo, found copper, silver, and antimony, nearly in the same proportions, but more iron, and some arsenic †. Sworeck, as Baron Born informs us, besides the ingredients of Klaproth's analysis, found some gold and mercury in grey copper ore ‡: and Klaproth himself found lead in most of the other specimens which he examined.

Metallic Ores.

† Mem. Tur. v. 175.

‡ Crell. ii. 498.

208 G. III. Oxyds. Red oxyd of copper. § Kirwan, ii. 135.

GENUS III OXYDS OF COPPER.

SPECIES 1. Red oxyd of copper §.
Florid red copper ore—Red copper glass.

This ore is found in Cornwal, and many other countries. It occurs in masses, disseminated, in scales, and crystallized. The figure of its crystals is most commonly the regular octohedron.*

* Hauy, Jour. de Min. N° xxxi. 517.

Colour commonly cochineal red. Streak brick red. Lustre semimetallic. Transparency, when amorphous, generally 0; when crystallized, 3 or 4. Hardness from 4 to 7. Soluble with effervescence in nitric acid. Before the blow-pipe melts easily, and is reduced.

This ore was supposed to be composed of carbonic acid and red oxyd of copper; but a specimen, examined by Vauquelin, which consisted of pure crystals, contained no acid †. It must therefore be considered as an oxyd of copper.

† Ibid.

Werner has made three varieties of this ore, which, from their texture, he has denominated *compact*, *foliated*, and *fibrous*. The first is seldom or never found crystallized, and is opaque; the second occurs amorphous, crystallized, and in scales; the third is carmine, ruby, or scarlet red; and occurs always in short capillary crystals, or delicate flakes.

This ore sometimes contains a mixture of red oxyd of iron; it is then called *brick red copper ore*, *copper malm*, or *copper ochre*.

This ore is sometimes mixed with bitumen. Its colour is then brownish black, and it is called *pitch ore*.

209 Green oxyd of copper. § Kirwan, ii. 149.

SPECIES 3. Green oxyd of copper §.
Green sand of Peru.

This ore, which was brought from Peru by Dombey, is a grass green powder, mixed with grains of quartz. When thrown on burning coals, it communicates a green colour to the flame. It is soluble both in nitric and muriatic acids without effervescence. The solution is green. It was supposed to contain muriatic acid;* but Vauquelin has discovered, that the appearance of this acid was owing to the presence of some common salt, which is accidently mixed with the sand ‡.

* Berthollet, Mem. Par. 1786, 462.

‡ Jour. de Min. N° xxxi. 519.

210 G. IV. Salts. Blue carbonat of copper.

GENUS IV. SALTS OF COPPER.

SPECIES 1. Blue carbonat of copper (D).
Mountain blue—Azur de cuivre—Blue calx of copper—Kupfer lazur.

This ore, which occurs in the copper mines of Siberia, Sweden, Germany, Hungary, Cornwal, &c. is either amorphous or crystallized. The crystals are small, and difficult to examine. According to Romé de Lisle, their primitive form is an octohedron, the sides of which are isosceles triangles, and two of them more inclined than the others §. Be that as it may, the crystals of blue carbonat of copper are often rhomboidal prisms, either regular, or terminated by dihedral summits.*

§ Crystallogr. iii. 343.

* Ibid. iii. 345.

Its colour is azure or smalt blue. Streak blue. Hardness

(D) Kirw. II. 129.—Morveau, Mem. Dijon, 1782. 1 Semestr., p. 100.

Copper Ores.

nefs 4 to 6. Brittle. Sp. gr. 3.608 ‡. It effervefces with nitric acid, and gives it a blue colour. Before the blow-pipe it blackens, but does not melt. Tinges borax green with effervefcences.

‡ Briffon.

The cryftals, according to Pelletier, are compofed of

66 to 70 copper,
18 — 20 carbonic acid,
8 — 10 oxygen,
2 — 2 water.

Fontana firft difcovered that this ore contained carbonic acid gas.

Variety 1. Earthy blue carbonat.

Mountain blue.

This variety generally contains a mixture of lime. It is never cryftallized; and fometimes is almoft in the ftate of powder. Luftre 0. Texture earthy.

Variety 2. Striated blue carbonat of copper.

Luftre glaffy. Tranfparency, when cryftallized, 2; when amorphous, 1. Texture ftriated; fometimes approaching to the foliated.

211 Green carbonat of copper.

SPECIES 2. Green carbonat of copper (E).

Oxygenated carbonat of copper—Malachite.

This ore is generally amorphous, but fometimes it is cryftallized in four-fided prifms, terminated by four-fided pyramids.

Colour green. Luftre filky. Hardnefs 5 to 7. Brittle. Sp. gr. 3.571* to 3.653‡. Effervefces with nitric acid, and gives a blue colour to ammonia. Before the blow-pipe it decrepitates and blackens, but does not melt. Tinges borax yellowifh green. It is compofed of carbonic acid and green oxyd of iron.

* Briffon. ‡ Kirwan.

Variety 1. Fibrous malachite.

Texture fibrous. Opaque when amorphous; when cryftallized its tranfparency is 2. Colour generally grafs green.

Variety 2. Compact malachite.

Texture compact. Opaque. Colour varies from the dark emerald green to blackifh green.

A fpecimen of malachite from Siberia, analyfed by Klaproth, contained

58.0 copper,
18.0 carbonic acid,
12.5 oxygen,
11.5 water.

100 *

* Beiträge, ii 290.

This fpecies is fometimes mixed with clay, chalk, and gypfum, in various proportions; it is then known by the name of

Common mountain green.

Its colour is verdigris green. Luftre 0. Tranfparency 0 to 1. Hardnefs 3 to 4. Brittle. Texture earthy. Effervefces feebly with acids. Before the blow-pipe it exhibits the fame phenomena with malachite.

212 Sulphat of copper.

SPECIES 3. Sulphat of copper.

For a defcription of this falt, fee CHEMISTRY, n° 648. in this *Supplement*.

213 Arfeniat of copper.

SPECIES 4. Arfeniat of copper ‡.

‡ Kirwan, ii. 151.

Olive copper ore.

This ore is found at Carrarach in Cornwal. It is generally cryftallized in fix-fided compreffed prifms. Its colour is olive green. Streak fometimes ftraw coloured, fometimes olive green. Luftre glaffy. Tranfparency from 4 to 2. Fracture conchoidal. Hardnefs 4 to 7. Before the blow-pipe deflagrates with an arfenical fmoke, and melts into a grey coloured bead. This bead, fufed with borax, leaves a button of pure copper ‖.

Metallic Ores.

‖ Klaproth's Obfervations on Cornwal, p. 29.

Klaproth difcovered that it was compofed of oxyd of copper and arfenic acid.

Sometimes this ore is combined with iron. It then cryftallizes in cubes. Thefe cubes are of a dark green colour; before the blow-pipe they froth, give out an arfenical fmoke, and do not fo quickly form a grey bead as the arfeniat of copper.*

* Ibid. p. 29.

ORDER VI. IRON ORES.

To defcribe the ufes of iron, would be to write the hiftory of every art and manufacture, fince there is not one which is not more or lefs dependent upon this ufeful metal. Nor is its abundance inferior to its utility. It exifts almoft every where, and feems, as it were, the bond which connects the mineral kingdom together.

214 Mines.

215 G. I. Alloys. Native iron.

GENUS I. ALLOYS OF IRON.

SPECIES 1. Native iron (F).

Native iron has been found in Siberia and in Peru in immenfe maffes, which feemed as if they had been fufed. Thefe maffes evidently did not originate in the place where they were found. See *FIRE-Balls, Suppl.*

Colour bluifh white. Fracture hackly. Luftre metallic. Malleable. Magnetic. Hardnefs 8 to 9. Sp. gr. 7.8. Proust has difcovered, that the native iron found in Peru is alloyed with nickel ¶.

¶ Nicholfon's Jour. iii. 374.

216 G. II. Sulphurets. Common fulphuret of iron.

GENUS II. SULPHURETS OF IRON.

SPECIES 1. Common fulphuret of iron.*

Pyrites.

This mineral occurs very frequently both in ores and mixed with other bodies, for inftance in flates. It is often amorphous, and often alfo cryftallized. The primitive form of its cryftals is either a regular cube or an octohedron. The varieties of its form hitherto defcribed amount to 30; for a defcription of which we refer the reader to *Romé de Lifle* †.

* Kirwan, ii. 76.—Henkel's Pyritologia. † Cryftal. iii. 208.

Its colour is yellow. Its luftre metallic. Hardnefs 8 to 10. Brittle. Sp. gr. 3.44 to 4.6. Soluble in nitric acid with effervefcence. Scarce foluble in fulphuric acid. Before the blow-pipe burns with a blue flame and a fulphureous fmell, and leaves a brownifh bead, which tinges borax of a fmutty green.

Variety 1. Common pyrites.

Fracture uneven. Hardnefs 10. Decrepitates when heated. Emits a fulphureous fmell when rubbed. Not magnetic. It occurs often in coal mines and in flates.

Variety 2. Striated pyrites.

Texture ftriated. Hardnefs 10. Not magnetic.

Variety 3. Capillary.

Colour often fteel grey. Found in needle-form cryftals. Uncommon. Not magnetic.

Variety 4. Magnetic pyrites.

Found in maffes. Texture compact. Hardnefs 8, 9. Slightly magnetic. Seems to contain lefs fulphur than the other varieties.

In pyrites the proportion of the fulphur to the iron is variable, and this explains the variety of its cryftalline forms.

GENUS

(E) *Kirw.* II. 131.—*Fontana, Jour. de Phyf.* XI. 509.—*Klaproth, Beiträge*, II. 287.

(F) *Pallas, Phil. Tranf.* LXVI. 523.—*Rubin de Celis, ibid.* LXXVIII. 37.—See alfo *Schreiber, Jour. de Phyf.* XLI. 3.; and *Stehn, Phil. Tranf.* LXIV. 461.

Iron Ores.

217 G. III. Plumbago.

GENUS III. CARBURET OF IRON.

SPECIES I. Plumbago.*

Graphite of Werner.

This mineral is found in England, Germany, France, Spain, America, &c. It occurs in kidney-form lumps of various sizes. Its colour is dark iron grey or brownish black; when cut, bluish grey. Lustre metallic, from 3 to 4. Opaque. Structure slaty. Texture fine grained. Hardness 4 to 5. Brittle. Sp. gr. from 1.987 to 2.089; after being soaked in water 2.15; after being heated 2.3, and when heated after that 2.41 †. Feels somewhat greasy. Stains the fingers, and marks strongly. The use of this mineral when manufactured into pencils is known to every person.

* *Kirwan*, ii. 58.

† *Brisson.*

Its composition was discovered by Scheele. When pure it contains

90 carbon,
10 iron.

100

But it is often exceedingly impure: A specimen, for instance, from the mine of Pluffier, in France, analysed by Vauquelin, contained

23 carbon,
2 iron,
38 silica,
37 alumina.

100 ‡

‡ *Jour. de Min.* N° xii. p. 16.

218 G. IV. Emery.

GENUS IV. IRON COMBINED WITH SILICA.

SPECIES I. Emery.*

This mineral is commonly disseminated through other fossils, but sometimes in the East Indies it occurs in large masses.

* *Kirwan*, ii. 193.

Its colour is bluish grey, greyish brown, or bluish black, often covered with a yellowish rind; internally it discovers red or purple spots. Lustre 1 or 0; in some parts 2, and metallic. Opaque. Hardness 14. Brittle. Sp. gr. 3.92 †. Before the blow-pipe it blackens and gives a smutty yellow tinge to borax.

† *Brisson.*

According to Wiegleb it contains

95.6 silica,
4.3 iron.

99.9

219 G. V. Oxyds.

GENUS V. OXYDS OF IRON.

This genus is very extensive; for iron is much more frequently found in the state of an oxyd than in any other.

220 Black oxyd of iron.

SPECIES I. Black oxyd of iron ‡.

Common magnetic iron stone—Blackish octohedral iron ore.

‡ *Kirwan*, ii. 158.

This species of ore is very common in Sweden; it is found also in Switzerland, Norway, Russia, &c. It occurs in masses, plates, grains, and crystallized. The primitive form of its crystals is a regular octohedron †. Sometimes two opposite sides of the pyramids are trapeziums, which renders the apex of the pyramids cuneiform. Sometimes the crystals pass into rhomboidal parallelepipeds, and into dodecahedrons with rhomboidal faces §.

* *Romé de Lisle*, iii. 178.
§ *Ibid.*
* *Hauy, Jour. de Min.* N° xxxiii. 659.

Its surface is brownish black; internally bluish grey. Powder black.* Streak blackish grey, brighter. Lustre metallic. Hardness 9 to 10. Brittle. Sp. gr. from 4.094 to 4.688 †. Attracted by the magnet, and generally possessed of more or less magnetic virtue ‡. To this species belongs the magnet. Before the blow-pipe it becomes browner, but does not melt. Tinges borax dark green.

† *Kirwan's Min.* ii. 159.
‡ *Hauy, Jour. de Min.* N° xxxi. 527.

Metallic Ores.

When pure it consists entirely of oxyd of iron; and this oxyd appears to contain from .15 to .24 oxygen, and from .76 to .85 iron §. Undoubtedly it consists of a mixture of iron in two different states of oxydation. It is often also mixed and contaminated with foreign ingredients.

§ *Kirwan's Min.* ii. 159.

There are two varieties of this ore. The first is what we have just described; the second is in the form of sand and has therefore been called

Magnetic sand.*

This substance is found in Italy, Virginia, St Domingo, the East Indies, and in the sand of the river Don at Aberdeen in Scotland. It is black, very hard, magnetic. Sp. gr. about 4 6. Not altered by the blow-pipe *per se*; melts into a black glass with potass, and into a green glass with microcosmic salt, both opaque †. It probably contains some silica, as Kirwan has supposed ‡.

* *Kirwan*, ii.—*Dufuget, Jour. de Min.* N° xxi. p. 75.
† *Fourcroy, Ann. de Chim.* ii. 127.
‡ *Min.* ii. 161.

221 Specular iron ore.

SPECIES 2. Specular iron ore ¶.

Fer oligiste.

This ore is found abundantly in the isle of Elba near Tuscany. It is either in masses or crystallized. The primitive form of its crystals, and of its integrant molecules, is the cube.* The varieties hitherto observed amount to 7. These are the rhomboidal parallelopiped, the cube, with three triangular faces instead of two of its angles diagonally opposite; two six-sided pyramids, applied base to base, wanting the summits ‡, and sometimes the angles at the bases, and sometimes the alternate edges of the pyramid; a polyhedron of 24 sides, resembling a cube with three triangular faces for two angles diagonally opposite, and two triangles for the rest of its angles. For a description and figure of these varieties, we refer to *Romé de Lisle* † and *Hauy* ‡.

¶ *Kirw.* ii. 162.—*Coudrai, Jour. de Phys.* iv. 52.
* *Hauy, Jour. de Min.* N° xxxiii. 660.
‡ Fig. 39.
† *Cryst.* iii. 189.
‡ *Ibid.* 660.

Colour steel grey: often tarnished, and beautifully iridescent, reflecting yellow, blue, red. Streak red. Powder dark red. Lustre metallic. Hardness 9 to 10. Not brittle. Sp. gr. 5.0116 † to 5.218 ‡. Slightly magnetic. Little altered by the blow-pipe. Tinges borax an obscure yellow.

† *Hauy.*
‡ *Brisson.*

This ore, according to Mr Mushet, is composed of

66.1 iron,
21.2 oxygen,
10.7 water and carbonic acid,
2.0 lime.

100.0 †

† *Philos. Mag.* iii. 354.

The quantity of oxygen here stated is probably too small, owing to the unavoidable inaccuracy which results from the *dry way* of analysis which Mr Mushet followed.

Micaceous iron ore

Is generally considered as a variety of this species. Kirwan, however, supposes it to contain carbon, and to be a distinct species.

It is found in Saxony, and in the isle of Elba. &c. generally in amorphous masses, composed of thin six-sided laminæ. Colour iron grey. Streak bluish grey. Lustre metallic. Opaque. Feel greasy. Hardness 5 to 7. Brittle. Sp. gr. from 4.5 to 5.07. Slightly magnetic.

magnetic. Infufible by the blow-pipe. Tinges borax greenifh brown.

222
Laminated fpecular iron ore.

SPECIES 3. Laminated fpecular iron ore.
Fer pyrocete of Hauy.

This ore, which is found at Mont d'or in Auvergne, was ufually arranged under the laft fpecies; but has been feparated from it, we think properly, by Mr Hauy, becaufe the form of its cryftals is incompatible with the fuppofition that their primitive nucleus is a cube, as we have feen is the cafe with common fpecular iron ore. Its cryftals are thin octagonal plates, bounded by fix linear trapeziums, alternately inclined different ways †.

† *De Lifle*, iii. 188.

Colour fteel grey. Powder reddifh black. Luftre metallic; furface polifhed. Fracture glaffy. Very brittle ‡. Hauy fuppofes that this ore has been produced by fire, and accordingly has given it a name which denotes its origin.

‡ *Hauy, Jour. de Min.* N° xxxi. 33.

223
Brown iron ore.

SPECIES 4. Brown iron ore ¶.

¶ *Kirw.* ii. 163.

This fpecies of ore is found abundantly in Britain, particularly in Cumberland and Lancafhire; and it is alfo very common in other counties. It confifts of the brown oxyd of iron, more or lefs contaminated with other ingredients.

Its colour is brown. Its ftreak reddifh brown. Sp. gr. from 3.4771 to 3.951. Before the blow-pipe blackens, but does not melt. Tinges borax greenifh yellow.

Variety 1. Brown hæmatites.

The name hæmatites (bloodftone) was probably applied by the ancients only to thofe ores which are of a red colour, and have fome refemblance to clotted blood; but by the moderns it is applied to all the ores of iron which give a reddifh coloured powder, provided they be of a fibrous texture.

Brown hæmatites occurs in maffes of various fhapes, and it is faid alfo to have been found cryftallized in five or fix-fided acute angled pyramids. Colour of the furface brown or black, fometimes iridefcent; internally nut brown. Powder red. Texture fibrous. Hardnefs 8 to 10. Brittle. Sp. gr. 3.789 † to 3.951 ‡. Not magnetic.

† *Gellert.*
‡ *Kirwan.*

This variety has not been analyfed, but it feems to confift of brown oxyd of iron, oxyd of manganefe, and alumina ¶.

¶ *Kirwan's Min.* ii. 164.

Variety 2. Compact brown iron ftone.

This variety occurs in maffes of very various and often fantaftical fhapes.

Colour brown. Internal luftre metallic. Texture compact. Hardnefs 6 to 9. Brittle. Sp. gr. 3.4771 † to 3.551 ‡.

† *Briffon.*
‡ *Kirwan.*

Variety 3. Brown Scaly iron ore.

This variety is generally incumbent on other minerals. Colour brown. Luftre metallic. Stains the fingers, marks ftrongly. Feels unctuous. Texture foliated. Hardnefs 3 to 5. Brittle. So light as often to float on water.

Variety 4. Brown iron ochre.

This variety occurs both maffive and diffeminated. Colour from nut brown to orange. Luftre 0. Strongly ftains the fingers. Texture earthy. Hardnefs 3 to 4. When flightly heated reddens.

224
Red iron ore.

SPECIES 5. Red iron ore †.

† *Kirw.* ii. 168.

Colour red. Streak blood red. Sp. gr. from 3.423 to 5.005. Before the blow-pipe blackens, but does not melt. Tinges borax yellowifh olive green. When digefted in ammonia, it becomes black and often magnetic.

Variety 1. Red hæmatites.

Found in maffes, and all the variety of forms of ftalactites. Colour between brownifh red and fteel grey. Powder red. Internal luftre metallic. Texture fibrous. Hardnefs 9 to 10. Brittle. Sp. gr. 4.74 † to 5.005 ‡.

† *Gellert.*
‡ *Kirwan.*

When pure it confifts of red oxyd of iron, but it often contains manganefe and alumina §.

§ *Kirwan's Min.* ii. 169.

Variety 2. Compact red iron ore.

Found maffive and ftalactitic; fometimes in cryftals of various forms, but they feem to be only fecondary; fometimes in columns like bafalt.

Colour between brown red and fteel grey. Stains the fingers. Luftre 1 to 0; often femimetallic. Texture compact. Hardnefs 7 to 9. Brittle. Sp. gr. 3.423 to 3.76 †. Sometimes invefted with a rofy red ochre.

† *Kirwan.*

Variety 3. Red ochre.

Found fometimes in powder, fometimes indurated. Colour blood red. Stains the fingers. Luftre 0. Texture earthy. Hardnefs 3 to 5. Brittle.

Variety 4. Red fcaly iron ore.

This variety is generally found incumbent upon other iron ores. Colour between cherry red and fteel grey. Stains the fingers. Luftre filky, inclining to metallic. Texture foliated. Feels unctuous. Hardnefs 3 to 4. Brittle. Heavy.

225
Argillaceous iron ore.

SPECIES 6. Argillaceous iron ore †.
Oxyd of iron combined or mixed with clay.

† *Kirw.* ii. 173.

This ore is exceedingly common; and though it contains lefs iron than the fpecies already defcribed, it is, in this country at leaft, preferred to them, becaufe the method of extracting pure iron from it is eafier, or rather becaufe it is better underftood.

Colour moft commonly dark brown. Streak red or yellowifh brown. Sp. gr. from 2.673 to 3.471 ‡. Before the blow-pipe blackens, and tinges borax olive green and blackifh. It is compofed of oxyd of iron, alumina, lime, filica in various proportions. It generally yields from 30 to 40 *per cent.* of iron.

‡ *Kirwan.*

Variety 1. Common argillaceous iron ore.

The minerals arranged under this variety differ confiderably from each other in their external characters. They are found in maffes of various fhapes, and often form large ftrata.

Colour various fhades of grey, brown, yellow, and red. Streak reddifh yellow or dark red. Luftre 0. Hardnefs from 3 to 8. Smell earthy when breathed upon.

Variety 2. Columnar or fcapiform iron ore.

This variety is found in columns, adhering to each other, but eafily feparable: They are commonly incurvated, and their furface is rough. Colour brownifh red. Streak dark red. Slightly ftains the fingers. Luftre 0. Adheres ftrongly to the tongue. Sound hollow. Feel dry. Texture earthy.

Variety 3. Acinofe iron ore.

This variety is found in maffes, and is commonly lenticular. Colour generally brownifh red. Luftre metallic, nearly. Texture granular. Hardnefs 5 to 9. Brittle.

Variety

Variety 4. Nodular, or kidney-form iron ore.
Ætites or *Eagleſtone.*

This variety, which was mentioned by the ancients, is generally found under the form of a rounded knob, more or leſs reſembling a kidney, though ſometimes it is quadrangular; and it contains within it a kernel, which is ſometimes looſe, and ſometimes adheres to the outſide rind. Colour of the ſtone yellowiſh brown; of the kernel ochre yellow. Surface generally fouled with earth. Luſtre of the rind metallic; of the kernel 0. Hardneſs from 4 to 7. Brittle.

Variety 5. Piſiform or granular iron ore.

This variety occurs in rounded maſſes, from the ſize of a pea to that of a nut. Surface rough. Colour commonly dark brown. Streak yellowiſh brown. Hardneſs 5 to 6. Brittle.

The oolitic ore found at Creuſot, near mount Cenis, belongs to this variety. It is compoſed of

50	lime,
30	iron,
20	alumina.
100	

226 Lowland iron ore.

SPECIES 7. Lowland iron ore.*

This ſpecies of ore is ſuppoſed to conſiſt of oxyd of iron, mixed with clay and phoſphuret or phoſphat of iron. It is called lowland ore, becauſe it is found only in low grounds; whereas the laſt ſpecies is more commonly in high grounds; and is therefore called *highland ore.*

* *Kirw.* ii. 179.

This ore occurs in amorphous maſſes, and alſo in grains or powder. Its colour is brown. Streak yellowiſh brown. Luſtre 0, or common. Texture earthy. Hardneſs 3 to 5.

Variety 1. Meadow lowland ore.

Colour blackiſh or yellowiſh brown: Both colours often meet in the ſame ſpecimen. Found in lumps of various ſizes, often perforated. Fracture compact. Moderately heavy.

Frequently yields from 32 to 38 *per cent.* of iron.

Variety 2. Swampy iron ore.

This variety is generally found under water. It is in lumps, which are commonly perforated or corroded, and mixed with ſand. Colour dark yellowiſh brown, or dark nut brown. Hardneſs 3 to 4. Brittle. Sp. gr. 2.944. It often contains .36 of iron.

Variety 3. Moraſſy iron ore.

This variety is found either in a looſe form or in perforated lumps. Colour light yellowiſh brown. Stains the fingers. Hardneſs 3. Friable.

227 G. VI. Salts.

GENUS VI. SALTS OF IRON.

Sparry iron ore.

SPECIES 1. Sparry iron ore (G).

This ore is common in Germany, France, and Spain. It is found ſometimes in amorphous maſſes, and ſometimes cryſtallized.

Its colour is white; but it becomes tarniſhed by expoſure to the air, and then aſſumes various colours. Streak grey or white. External luſtre often metallic; internal common or glaſſy. Tranſparency 1 or 2; ſometimes 0. Texture foliated. Fragments rhomboidal. Hardneſs 5 to 7. Brittle. Sp. gr. 3.6 to 3.810. Not magnetic. Soluble in acids with very little efferveſcence. Before the blow-pipe decrepitates, becomes browniſh black, and magnetic; but is ſcarcely fuſible. Tinges borax ſmutty yellow, with ſome efferveſcence.

This ore, as Bergman aſcertained, conſiſts of iron, mangaueſe, lime, and carbonic acid.

One ſpecimen, according to his analyſis, contained

38	iron,
24	mangaueſe,
38	carbonat of lime.
100	

Another contained

22	iron,
28	manganeſe,
50	carbonat of lime.
100	

Whether the iron be combined with the carbonic acid is ſtill a diſputed point. The cryſtals of this ore are rhomboidal parallelopipeds; which is preciſely the form of carbonat of lime. This amounts nearly to a demonſtration, that the carbonic acid is combined with the lime; and that, as Cronſtedt and Hauy have ſuppoſed, this ore is merely carbonat of lime, contaminated with a quantity of the oxyds of iron and manganeſe. 228

SPECIES 2. Arſeniat of iron. Arſeniat of iron.

Mr Prouſt has diſcovered this ore in Spain. Its colour is greeniſh white. Its texture granular. Inſoluble in water and nitric acid. When melted on charcoal, the arſenical acid eſcapes with efferveſcence ‡.

‡ *Ann. de Chim.* i. 195.

SPECIES 3. Sulphat of iron. 229 Sulphat of iron.

For a deſcription of this ſalt, ſee CHEMISTRY, n° 631. in this *Suppl.*

ORDER VII. TIN ORES (H).

TIN is employed to cover plates of iron and copper, and to ſilver the backs of looking glaſſes: It enters into the compoſition of pewter; and forms a very important article in dyeing.

Tin ores are by no means ſo common as the ores of the metals which we have already deſcribed. They are found only in the *primitive mountains* (I). Hence Werner ſuppoſes them to be the moſt ancient of all metallic ores. They occur moſt frequently in granite, ſometimes in porphyry, but never in limeſtone. 230 Mines.

(G) *Kirw.* II. 190.—*Bergman*, II. 184.—*Bayen. Jour. de Phyſ.* VII. 213.—*Razowmowſki, Mem. Lauſanne*, 1783, p. 149.

(H) *Geoffroy, Mem. Par.* 1738, p. 103.—*Morveau, Ann. de Chim.* XXIV. 127.

(I) Geologiſts have divided mountains into three claſſes; *primitive, ſecondary*, and *tertiary*. The *primitive* occupy the centre of all extenſive chains; they are the higheſt, the moſt rugged, and exhibit the moſt pointed tops. They are conſidered as the moſt ancient mountains of the globe.

The *ſecondary* mountains occupy the outſide of extenſive ranges. They are uſually compoſed of ſtrata, more or leſs inclined, and commonly reſt againſt the ſides of the primitive mountains.—The *tertiary* mountains are much ſmaller than the others, and are often ſolitary. We uſe the terms *primitive, ſecondary*, &c. merely as

Tin Ores.

Almoſt the only tin mines known to Europeans are thoſe of Cornwall, Devonſhire, Saxony, Bohemia, Sileſia, Hungary, Gallicia; thoſe of the iſland of Banca and the peninſula of Malacca in India; and thoſe of Chili and Mexico in America.

231
G. I. Sulphurets. Sulphuret of tin and copper.

GENUS I. SULPHURETS OF TIN.

SPECIES 1. Sulphuret of tin and copper.*

Tin pyrites.

Hitherto this ore has only been found in Cornwal. There is a vein of it in that county, in the pariſh of St Agnes, nine feet wide, and twenty yards beneath the ſurface †.

Its colour is yellowiſh grey, paſſing into the ſteel grey. Not unlike grey copper ore. Luſtre metallic. Hardneſs 5 to 6. Very brittle. Sp. gr. 4.35 ‡. Before the blow-pipe it melts eaſily, with a ſulphureous ſmell, into a black bead, and depoſits a bluiſh oxyd on the charcoal.

* Kirw. ii. 200.
† Klaproth's Cornwall, p. 21.
‡ Klaproth.

The compoſition of this ore, as Klaproth informs us, was firſt diſcovered by Mr Raſpe. According to Klaproth's analyſis, it is compoſed of

34 tin,
36 copper,
25 Sulphur,
3 iron,
2 earth.

100 §

§ Ib. 58.

232
G. II. Oxyds. Brown oxyd of tin.

GENUS II. OXYDS OF TIN.

SPECIES 1. Brown oxyd of tin.*

Tinſtone—Woodtin.

This ore, which may be conſidered as almoſt the only ore of tin, occurs in maſſes, in rounded pieces, and cryſtallized. Theſe cryſtals are very irregular. Hauy ſuppoſes, that their primitive form is a cube †; but Romé de Liſle, with more probability, makes it an octohedron; ‡ and in this opinion Mr Day agrees with him ||. The octohedron is compoſed of two four-ſided pyramids, applied baſe to baſe. The ſides of the pyramids are iſoſceles triangles, the angle at the vertex of which is 70°, and each of the other angles 55°. The ſides of the two pyramids are inclined to each other at an angle of 90° §. This primitive form, however, never occurs, but cryſtals of tinſtone are ſometimes found, in which the two pyramids are ſeparated by a priſm. For a complete deſcription of the varieties of the cryſtals of tinſtone, we refer the reader to *Romé de Liſle* and *Mr Day*.*

* Kirw. ii. 197.
† Jour. de Min. N° xxxii. 576.
‡ Cryſtallog. iii. 413.
|| Philoſ. Mag. iv. 152.
§ Romé de Liſle, ibid.

Metallic Ores.

Its colour is commonly brown. Streak grey. Hardneſs 9 to 10. Sp. gr. 6.9 to 7.0. Brittle.

* Philoſ. Mag. ibid.

Variety 1. Common tinſtone.

Colour dark brown; ſometimes yellowiſh grey, and ſometimes nearly white. Streak light grey. Somewhat tranſparent when cryſtallized. Hardneſs 10. Sp. gr. 6.9 to 6.97. Before the blow-pipe it decrepitates, and on charcoal is partly reduced. Tinges borax white.

According to Klaproth, it is compoſed of

77.50 tin,
21.50 oxygen,
.25 iron,
.75 ſilica.

100.00 †

† Beiträge, ii. 256.

Variety 2. Woodtin.

This variety has hitherto been found only in Cornwal. It occurs always in fragments, which are generally rounded. Colour brown; ſometimes inclining to yellow. Streak yellowiſh grey. Opaque. Texture fibrous. Hardneſs 9. Sp. gr. 7.0. Before the blowpipe becomes browniſh red; decrepitates when red hot, but is not reduced.

Klaproth obtained from it .63 of tin; and, in all probability, it is an oxyd of tin nearly pure.

ORDER VIII. ORES OF LEAD.

THE uſeful purpoſes to which lead in its metallic ſtate is applied, are too well known to require deſcription. Its oxyds are employed in painting, in dyeing, and ſometimes alſo in medicine.

Ores of lead occur in great abundance in almoſt every part of the world. They are generally in veins; ſometimes in ſiliceous rocks, ſometimes in calcareous rocks.

233
G. I. Sulphurets. Galena, or pure ſulphuret of lead.

GENUS I. SULPHURETS OF LEAD.

SPECIES 1. Galena, or pure ſulphuret of lead ‡.

This ore, which is very common, is found both in maſſes and cryſtallized. The primitive form of its cryſtals is a cube. The moſt common varieties are the cube, ſometimes with its angles wanting, and the octohedron, compoſed of two four-ſided pyramids applied baſe to baſe: The ſummits of theſe pyramids are ſometimes cuneiform, and ſometimes their ſolid angles are wanting ||.

‡ Kirw. ii. 216.
|| Romé de Liſle, iii. 364.

Its colour is commonly bluiſh grey, like lead. Streak bluiſh grey and metallic. Luſtre metallic. Sometimes ſtains

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proper names, without affirming or denying the truth or falſehood of the theory on which theſe names are founded. That the reader may have a more accurate idea of the compoſition of theſe different claſſes of mountains, we have ſubjoined a liſt of the ſubſtances which, according to Werner, enter into the compoſition of each.

I. PRIMARY MOUNTAINS.

1. Granite,	4. Argillaceous ſhiſtus,	7. Shiſtoſe porphyry,	10. Serpentine,
2. Gneiſs,	5. Syenite,	8. Quartz,	11. Topaz rock.
3. Micaceous ſhiſtus	6. Porphyry,	9. Primitive limeſtone,	

II. SECONDARY MOUNTAINS.

1. Argillaceous ſhiſtus,	3. Secondary limeſtone,	5. Grunſtein,
2. Rubble ſtone,	4. Shiſtoſe hornblende,	6. Amygdaloid.

III. TERTIARY MOUNTAINS.

1. Trap,	4. Sandſtone,	7. Chalk,	10. Ferruginous clay,
2. Argillaceous ſhiſtus,	5. Breccia,	8. Sulphat of lime,	11. Potters earth.
3. Stratified limeſtone,	6. Coal,	9. Rock ſalt,	

Ores of Lead. stains the fingers. Texture foliated. Fragments cubical. Hardness 5 to 7; sometimes even 9. Brittle. Sp. gr. 6.884 to 7.786 §. Effervesces with nitric and muriatic acids. Before the blow-pipe decrepitates, and melts with a sulphureous smell; part sinks into the charcoal.

§ *Watson.*

It is composed of from .45 to .83 lead, and from .086 to .16 of sulphur. It generally contains some silver, and sometimes also antimony and zinc.

Variety 1. Common galena.

This variety corresponds nearly with the above description. Sp. gr. 7.051 to 7.786. Sometimes stains the fingers.

Compact galena.

Found only in amorphous masses. Texture compact, inclining to foliated. Hardness 6 to 8. Sp. gr. 6.886 to 7.444. Lustre common. Streak lead grey, brighter and metallic. Often feels greasy, and stains the fingers.

234 Sulphuret of lead, with silver and antimony. SPECIES 2. Sulphuret of lead, with silver and antimony.*

Plumbiferous antimoniated silver ore.

* *Kirw.* ii. 119.

Found in amorphous masses. Colour grey. Hardness 5 to 6. Brittle. Sp. gr. from 5.2 to 8.

Variety 1. Light grey silver ore.

Colour light bluish grey. Streak light bluish grey, and brighter. Lustre metallic. Texture compact. Before the blow pipe partly evaporates, and leaves a silver bead on the charcoal, surrounded by yellow dust.

According to Klaproth, it contains

48.06 lead,
20.40 silver,
7.88 antimony,
12.35 sulphur,
2.25 iron,
7.00 alumina,
.25 silica.

98.09 †

† *Beiträge*, i. 172.

Variety 2. Dark grey silver ore.

Colour iron grey, verging on black. Powder black, and stains the fingers. Lustre 0. Texture earthy.

According to Klaproth, it contains

41.00 lead,
21.50 antimony,
29.25 silver,
22.00 sulphur,
1.75 iron,
1.00 alumina,
.75 silica.

97.25 ‡

* *Ibid* 175.

235 Blue lead ore. SPECIES 3. Blue lead ore.*

* *Kirw.* ii. 220.

This ore, which is found in Siberia, Germany, and Hungary, and is very rare, occurs sometimes in masses, and sometimes crystallized in six-sided prisms.

Colour between indigo blue and lead grey; sometimes inclining to black. Internal lustre metallic. Streak brighter. Texture compact. Hardness 6. Sp. gr. 5.461. †. Before the blow-pipe melts with a low blue flame and a sulphureous smell, and is easily reduced.

† *Gellert.*

236 Black lead ore. SPECIES 4. Black lead ore ‡.

‡ *Kirw.* ii. 221.

This ore, which is found in Germany and Brittany, and which is supposed to be common galena decayed, is sometimes in stalactites of various forms, and sometimes crystallized in six-sided prisms, which are [illegible]ly truncated and confused.

Metallic Ores.

Colour black, often with some streaks of red, or light bluish grey. Internal lustre metallic. Hardness 5 to 6. Brittle. Sp. gr. from 5.744 || to 5.77. Before the blow-pipe decrepitates, melts easily, and is reduced.

|| [illegible]

According to the experiments of Laumont, this ore is a sulphuret of lead (or rather sulphuret of oxyd of lead), mixed with some phosphat of lead.

237 Sulphuret of lead, bismuth, and silver. SPECIES 5. Sulphuret of lead, bismuth, and silver.

This ore, which occurs in the valley of Schapbach in Saxony, was first taken notice of by Selb, and afterwards described by Weidenmann and Emerling.

Its colour is light bluish grey. Its lustre metallic. Its fracture uneven. Hardness 5. Melts easily before the blow-pipe, emitting some smoke, and leaves a silver bead.

A specimen, analysed by Mr Klaproth, contained

33.0 lead,
27.0 bismuth,
15.0 silver,
16.3 sulphur,
4.3 iron,
0.9 copper.

96.5 †

† *Beiträge*, ii. 297.

GENUS II. OXYDS OF LEAD.

238 G. II. Oxyds. Lead ochre. SPECIES 1. Lead ochre ‡.

‡ *Kirw.* ii. 225.

This ore, which is a mixture of the oxyd of lead with various earths, is found massive, and of various degrees of hardness.

Its colour is either yellow, grey or red. Lustre 0. Transparency 0 to 1. Hardness 6 to 8; sometimes in powder. Sp. gr. from 4.165 to 5.545 §. Texture compact. Effervesces with nitric and muriatic acids. Easily reduced by the blow-pipe, leaving a black slag, unless the lead be mixed with too great a proportion of earth.

§ *Kirwan.*

GENUS III. SALTS OF LEAD.

239 G. III. Salts. Carbonat of lead. SPECIES 1. Carbonat of lead ‡.

White lead spar.

‡ *Kirw.* ii. 202.

This ore of lead, which is very common, is sometimes in masses, and sometimes crystallized. But the crystallization is in general so confused, that the primitive form of the crystals has not yet been ascertained (K).

Its colour is white. External lustre, waxy or silky, from 3 to 1; internal 1 to 2. Generally somewhat transparent. Hardness 5 to 6. Brittle. Sp. gr. from 5.349 || to 6.92 §. Effervesces with nitric and muriatic acids when they are heated. Soluble in fat oils. Blackened by sulphuret of ammonia.* Decrepitates when heated. Before the blow-pipe, in a silver spoon, it becomes red by the yellow cone of the flame, while the blue cone renders it yellow †. On charcoal it is immediately reduced.

|| *Kirwan.*
§ *Gellert.*
* *Pelletier, Ann. de Chim.* ix. 56.
† *Rhode, Crell's Annalen*, [illegible]

It contains from .60 to .85 of lead, and from .18 to .24 of carbonic acid. It is generally contaminated with carbonat of lime and oxyd of iron.

SPECIES

(K) See *Hauy, Jour. de Min.* N° XXXI. 502. and *Rome de Lisle*, III. 380.

Ores of Lead.

240 Phofphat of lead.

SPECIES 2. Phofphat of lead †.

† *Kirw.* ii. 207.

This ore, which is found in Siberia, Scotland, England, Germany, Carinthia, Brittany, &c. is fometimes amorphous, and fometimes cryftallized. The primitive form of its cryftals according to Romé de Lifle, is a dodecahedron, confifting of a fix-fided rectangular prifm, terminated by fix-fided pyramids, the fides of which are ifofceles triangles (L). Sometimes the pyramids are truncated and even altogether wanting. The cryftals of this ore are often acicular.

Its colour is commonly green; fometimes yellowifh or brownifh, or greyifh white. Streak commonly greenifh white. Powder yellowifh. External luftre, waxy, 2 to 3. Somewhat tranfparent, except when its colour is greyifh white. Hardnefs 5 to 6. Brittle. Sp. gr. from 6.86.* to 6.27 †. Infoluble in water and fulphuric acid, and nearly infoluble in nitric acid; foluble in hot muriatic acid, with a flight effervefcence ‡. Before the blow-pipe it eafily melts on charcoal, and cryftallizes on cooling: with foda the lead is in fome meafure reduced.

* *Briffon.* † *Klaproth.* ‡ *Fourcroy, Ann. de Chim.* ii. 207.

The compofition of this ore was firft difcovered by Gahn.

According to Fourcroy's analyfis, a fpecimen from Erlenbach in Alface, confifts of

96	phofphat of lead,
2	phofphat of iron.
2	water.
100	

Or it contains

79	oxyd of lead,
1	oxyd of iron,
18	phofphoric acid,
2	water.
100 ¶	

¶ *Ibid.*

241 Arfeniat of lead.

SPECIES 3. Arfeniat of lead §.

§ *Kirw.* ii. 209.

This ore, which has hitherto been found only in Andalufia in Spain, and always in quartz or feldfpar, is in fmall maffes. Colour meadow green, often paffing into wax yellow. Luftre waxy, 2. Tranfparency 2. Before the blow-pipe it melts, and retains its colour, and does not cryftallize on cooling. When heated to whitenefs, the arfenic acid efcapes, and the lead is reduced.*

* *Prouft, Jour. de Phyf.* xxx. 394.

242 Phofphat and arfeniat of lead.

SPECIES 4. Phofphat and arfeniat of lead.

Arfenio phofphat of lead. †

† *Kirw.* ii. 210.

This ore, which has been found in Auvergne in France, is either in maffes, or cryftallized in fmall fix-fided prifms, with curvilineal faces.

Colour yellowifh green, or fhews alternate layers of pale and light green. Powder yellowifh. The cryftals are fomewhat tranfparent; but when maffive, this ore is opaque. Hardnefs 5 to 7. Brittle. Sp. gr. 6.8465 ‡. Soluble in hot muriatic acid, but not in nitric. When heated it decrepitates. Before the blow-pipe melts eafily, effervefces, emits a white fmoke, with an arfenical fmell. Some particles of lead are reduced, a brown fluid remains, which cryftallizes on cooling like phofphat of lead.

‡ *Briffon.*

Metallic Ores.

According to Fourcroy, from whom the whole of this defcription has been taken, it is compofed of

65	arfeniat of lead,
27	phofphat of lead,
5	phofphat of iron,
3	water.
100 *	

* *Ann. de Chim.* ii. 23.

243 Molybdat of lead.

SPECIES 5. Molybdat of lead (M).

This ore, which is found in Carinthia and at Leadhills in Scotland, was firft mentioned in 1781 by Mr Jacquin (N). It occurs either in maffes, or cryftallized in cubic, or rhomboidal, or octohedral plates.

Its colour is yellow. Streak white. Luftre waxy. Generally fomewhat tranfparent. Texture foliated. Fracture conchoidal. Hardnefs 5 to 6. Sp. gr. 5.486 †; when purified from its gangue by nitric acid, 5.706 ‡.

† *Macquart.* ‡ *Hatchett.*

Soluble in fixed alkalies and in nitric acid. Communicates a blue colour to hot fulphuric acid. Soluble in muriatic acid, and decompofed by it. Before the blow-pipe decrepitates, melts into a yellowifh grey mafs, and globules of lead are reduced ‖.

‖ *Macquart.*

Klaproth firft proved that this ore was molybdat of lead.

A very pure fpecimen, analyfed by him, contained

64.42	oxyd of lead,
34.25	molybdic acid.
98.67 ¶	

¶ *Beiträge*, ii. 275.

According to the analyfis of Mr Hatchett, it is compofed of

58.40	oxyd of lead,
38.00	molybdic acid,
2.10	oxyd of iron,
.28	filica.
98.78 *	

* *Phil. Tranf.* lxxxvi. 323.

Macquart found a fpecimen to contain

58.74	lead,
4.76	oxygen,
28.00	molybdic acid,
4.50	carbonat of lime,
4.00	filica.
100.00 †	

† *Jour. de Min.* N° xvii. 32.

Its gangue is carbonat of lime.

244 Sulphat of lead.

SPECIES 6. Sulphat of lead ‡.

‡ *Kirw. Min.* ii. 211.

This ore, which is found in Anglefey and in Andalufia, is generally cryftallized. The cryftals are regular octohedrons §, and very minute.

§ *Hauy, Jour. de Min.* N° xxxi. 508.

Colour white. Luftre 4. Tranfparency 4. Before the blow-pipe it is immediately reduced.

The compofition of this ore was firft afcertained by Dr Withering.

ORDER IX. ORES OF ZINC.

HITHERTO zinc has not been applied to a great variety of ufes. It enters into the compofition of brafs; it is ufed in medicine; and Morveau has fhewn that its oxyd

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(L) *Cryftal.* III. 391. See alfo *Hauy's* remarks on the fame fubject in the *Jour. de Min.* N° XXXI, 506.

(M) *Kirw.* II. 212.—*Klaproth, Ann. de Chim.* VIII. 103.—*Hatchett, Phil. Tranf.* 1796, p. 285.

(N) In his *Mifcellanea Auftriaca*, Vol. II. p. 139.

Ores of Zinc.

Metallic Ores.

oxyd might be employed with advantage as a white paint.

Ores of zinc are very abundant; they generally accompany lead ores, particularly galena. Calamine, or oxyd of zinc, has never been diſcovered in the primitive mountains.

245 G. I. Sulphurets. Common ſulphuret of zinc.

GENUS I. SULPHURETS OF ZINC.

SPECIES 1. Common ſulphuret of zinc.*

Blende.

This ore very commonly accompanies ſulphuret of lead. It occurs both in amorphous maſſes and cryſtallized. The primitive form of its cryſtals is a rhomboidal dodecahedron, conſiſting of a ſix-ſided priſm, terminated by three-ſided pyramids. All the faces of the cryſtals are equal rhombs. This dodecahedron may be mechanically divided into four equal rhomboidal parallelopipeds, and each of theſe into ſix tetrahedrons, whoſe faces are equal iſoſceles triangles. The figure of its integrant particles is the tetrahedron, ſimilar to theſe.*

The principal varieties of its cryſtals are the tetrahedron; the octohedron: the octohedron with its edges wanting;* a 24-ſided cryſtal, 12 of whoſe faces are trapezoids, and 12 elongated triangles;† and, laſtly a 28-ſided figure, which is the laſt variety, augmented by four equilateral triangles †.

Colour yellow, brown, or black. Streak reddiſh, browniſh, or grey. Luſtre commonly metallic. Generally ſomewhat tranſparent. Texture foliated. Hardneſs 6 to 8. Sp. gr. 3.93 ‡ to 4.1665 ¶. Before the blow-pipe decrepitates, and gives out white flowers of zinc, but does not melt. Borax does not affect it. When breathed upon, loſes its luſtre, and recovers it very ſlowly ‖.

Variety 1. Yellow blende.

Colour commonly ſulphur yellow, often paſſing into olive green or browniſh red. Powder pale yellow. Streak yellowiſh or reddiſh grey, not metallic. Luſtre metallic. Tranſparency 2 to 4. Often phoſphoreſces when ſcraped or rubbed.*

According to Bergman, it is compoſed of

64 zinc,
20 ſulphur,
5 iron,
4 fluor acid,
1 ſilica,
6 water.

100 †

Variety 2. Brown blende.

Colour different ſhades of Brown. Surface often tarniſhed. Powder browniſh grey. Streak reddiſh or yellowiſh grey, not metallic. Luſtre commonly metallic. Tranſparency 0 to 2.

A ſpecimen of this variety, analyſed by Bergman, contained

44 zinc,
17 ſulphur,
24 ſilica,
5 iron,
5 alumina,
5 water.

100 ‡

Variety 3. Black blende.

Colour black, or browniſh black; ſurface often tarniſhed blue; tips of the cryſtals often blood red. Powder browniſh black. Streak reddiſh, browniſh, or grey. Luſtre common or metallic. Tranſparency 0 to 1; the red parts 2. Hardneſs 8.

A ſpecimen of this variety, analyſed by Bergman, contained

52 zinc,
26 ſulphur,
4 copper,
8 iron,
6 ſilica,
4 water.

100 ‡

246 G. II. Oxyds. White oxyd of zinc.

GENUS II. OXYDS OF ZINC.

SPECIES 1. White oxyd of zinc †.

Calamine.

This ore is either found looſe, or in maſſes, or cryſtallized. The primitive form of its cryſtals appears, from the mechanical diviſion of one of them by Mr Hauy, to be an octohedron compoſed of two four-ſided pyramids, whoſe ſides are equilateral triangles †. But the cryſtals are minute, and their figure not very diſtinct. They are either four or ſix-ſided tables with bevelled edges, ſix-ſided priſms, or three-ſided pyramids.

Colour commonly white, grey, or yellow. Luſtre often 0, ſometimes 2 or 1. Opaque. The cryſtals are ſomewhat tranſparent. Hardneſs from 4 to 9, ſometimes in powder. Sp. gr. from 2.585 to 3.674 ‡. When heated, becomes electric, without friction, like the tourmaline †. Not blackened by ſulphuret of ammonia. Soluble in ſulphuric acid. Before the blow-pipe decrepitates, and does not melt.

This ore conſiſts of oxyd of zinc more or leſs contaminated with iron, ſilica, lime, and other foreign ingredients. In one ſpecimen Bergman found the following ingredients:

84 oxyd of zinc,
3 oxyd of iron,
12 ſilica,
1 alumina.

100 ¶

In another ſpecimen, which gelatinized with acids, like zeolite, Klaproth found

66 oxyd of zinc,
33 ſilica.

99

In another ſpecimen, analyſed by Pelletier, the contents were

52 ſilica,
36 oxyd of zinc,
12 water.

100 *

Mr Kirwan has divided this ſpecies into three varieties.

Variety 1. Friable calamine.

In maſſes which eaſily crumble between the fingers. Luſtre 0. Opaque. Texture earthy. When its colour is white, it is pure oxyd of zinc; when yellow, it is mixed with oxyd of iron. The white often becomes yellow when placed in a red heat, but reſumes its colour on cooling. Common in China, where it is called *ou-kan* or *ore of Tutenag*.

Variety

* *Kirw.* ii. 238.—*Berg.* ii. 329.

* *Hauy, Jour. de Min.* Nº xxxiii. 669.

* Fig. 40.

† Fig. 41.

† See *Hauy, ibid* and *Romé de Liſle*, iii. 65.

‡ *Gellert.*

¶ *Briſſon.*

‖ *Hauy, Jour. de Min. ibid.*

* *Bergman*, ii. 345.

† *Ibid.* 347.

‡ *Ibid.* 353.

‡ *Bergman*, ii. 335.

† *Kirw.* ii. 233.—*Berg.* ii. 321.

† *Jour. de Min.* Nº xxxii. 596.

‡ *Kirwan.*

† *Hauy, Jour. de Min. ibid.*

¶ *Bergman*, ii. 323.

* *Jour. de Phyſ.* xx 428.

Ores of Antimony.

Variety 2. Compact calamine.

Colour different ſhades of grey; ſometimes yellow or browniſh red. Luſtre 0. Opaque. Texture compact.

Variety 3. Striated calamine.

This variety alone is found cryſtallized; but, like the others, it is alſo often amorphous. Colour white, and alſo various ſhades of grey, yellow, and red. Somewhat tranſparent. Texture ſtriated. Luſtre 2 to 1.

247 G. III. Salts. Sulphat of zinc.

GENUS III. SALTS OF ZINC.

SPECIES 1. Sulphat of zinc.

For a deſcription of this ſalt, we refer to CHEMISTRY, n° 643. *Suppl.*

ORDER X. ORES OF ANTIMONY.

ANTIMONY is much uſed to give hardneſs to thoſe metals which otherwiſe would be too ſoft for certain purpoſes: printers types, for inſtance, are compoſed of lead and antimony. It is uſed alſo in medicine.

Ores of antimony are found abundantly in Germany, Hungary, France, Spain, Britain, Sweden, Norway, &c. They often accompany galena and hæmatites. They are found both in the ſecondary and primitive ſtratified mountains. Their gangue (o) is often quartz and ſulphat of barytes.

248 G. I. Alloys Native antimony.

GENUS I. ALLOYS OF ANTIMONY.

SPECIES 1. Native antimony*.

* Kirw. ii. 245.

This mineral, which was firſt diſcovered by Dr Swab, has been found in Sweden and in France, both in maſſes and kidney-ſhaped lumps. Colour white, between that of tin and ſilver. Luſtre metallic. Texture foliated. Hardneſs 6. Sp. gr. above 6. Deflagrates with nitre. Before the blow-pipe melts and evaporates, depoſiting a white oxyd of antimony.

It conſiſts of antimony, alloyed with 3 or 4 *per cent.* of arſenic.

249 G. II. Sulphurets. Grey ore of antimony.

GENUS II. SULPHURETS OF ANTIMONY.

SPECIES 1. Grey ore of antimony*.

* Kirw. ii. 247.

This ore, which is the moſt common, and indeed almoſt the only ore of antimony, occurs both maſſive, diſſeminated, and cryſtallized. Its cryſtals are four-ſided priſms, ſomewhat flattened, whoſe ſides are nearly rectangles, terminated by ſhort four-ſided pyramids, whoſe ſides are trapeziums†. Sometimes two of the edges are wanting, which renders the priſm ſix-ſided‡.

† *Romé de Liſle*, iii. 49.

‡ *Ibid.*—See alſo *Hauy*, *Jour. de Min.* N° xxxii. 606.

¶ *Briſſon.*

Colour grey. Luſtre metallic. Streak grey, metallic, and brighter. Powder black or greyiſh black. Hardneſs 6 to 7. Sp. gr. from 4.1327 to 4.516¶. Often ſtains the fingers. Before the blow-pipe melts eaſily, burns with a blue flame, and depoſits a white oxyd on the charcoal. When placed in an open veſſel, over a ſlow fire, the ſulphur evaporates, and leaves a grey oxyd of antimony. This oxyd, if fuſed with tartar, is reduced.

This ore, when taken out of the mine, almoſt always contains a large proportion of quartz or other ſtony matter. When pure, it is compoſed of about

Metallic Ores.

74 antimony,
26 ſulphur.

100

Werner has divided this ſpecies into three varieties.

Variety 1. Compact ſulphuret.

Colour bluiſh grey, ſurface often tarniſhed, and then it is blue or purpliſh. Luſtre 1 to 2. Texture compact. Fracture fine grained, uneven. Powder black, dull, and earthy. Slightly ſtains the fingers.

Variety 2. Foliated ſulphuret.

Colour light ſteel grey. Luſtre 3 to 4. Texture foliated. Powder as that of the laſt variety.

Variety 3. Striated ſulphuret.

Colour dark ſteel grey, and light bluiſh grey; ſurface often tarniſhed, and then it is dark blue or purpliſh. Luſtre 3 to 2. Texture ſtriated. Powder greyiſh black. This variety alone has been hitherto found cryſtallized.

SPECIES 2. Plumoſe antimonial ore†. 250 Plumoſe antimonial ore.

Sulphurets of antimony and arſenic.

† Kirw. ii. 250.

This ſpecies, which is ſometimes found mixed with the cryſtals of ſulphurated antimony, is in the form of brittle, capillary, or lanuginous cryſtals, often ſo ſmall that they cannot be diſtinctly ſeen without a microſcope.

Colour ſteel or bluiſh grey, often tarniſhed, and then brown or greyiſh black. Luſtre 1, ſemimetallic. Before the blow-pipe emits a ſmoke, which depoſits a whitiſh and yellowiſh powder on the charcoal: it then melts into a black ſlag.

It is ſuppoſed to conſiſt of ſulphur, antimony, arſenic, and ſome ſilver.

SPECIES 3. Red antimonial ore†. 251 Red antimonial ore.

Hydroſulphuret of antimony.

† Kirw. ii. 250.

This ſpecies is generally found in cavities of ſulphurated antimonial ore. It is cryſtallized in delicate needles, often diverging from a common centre.

Colour red. Luſtre 2, ſilky. Sp. gr. 4.7. Before the blow-pipe melts eaſily, and evaporates with a ſulphureous ſmell.

This ore has not been analyſed. Mineralogiſts have ſuppoſed it to be a natural kermes. If ſo, we may conclude, from the experiments of Berthollet*, that it is a hydroſulphuret of antimony, and conſequently compoſed of oxyd of antimony, ſulphur, and ſulphurated hydrogen gas.

* *Ann. de Chim.* xxv. 259.

252 G. III. Oxyds of antimony.

GENUS III. OXYDS OF ANTIMONY.

There is a ſubſtance found incumbent on ſulphuret of antimony, of a yellow colour, and an earthy appearance, which has been ſuppoſed an oxyd of antimony, and denominated antimonial ochre. But hitherto it has not been analyſed.

GENUS

(o) The word *gang* is uſed by German mineralogiſts to denote a metallic vein. Now, it is not often that theſe veins conſiſt entirely of *ore*; in general, they contain ſtony matter beſides. For inſtance, in the copper mine at Airthry, near Stirling, the copper ore is merely a narrow ſtripe in the middle of the vein, and the reſt of it is filled up with ſulphat of barytes. We uſe the word *gangue* (as the French do), to denote, not the *metallic* vein, but the *ſtony* matter which accompanies the ore in the vien. The gangue of the copper ore at Airthry is ſulphat of barytes.

Ores of Bismuth.

253
G. IV. Salts. Muriat of antimony.

GENUS IV. SALTS OF ANTIMONY.

SPECIES 1. Muriat of antimony*.

This ore, which has been found in Bohemia, is sometimes in quadrangular tables; sometimes in acicular crystals grouped like zeolites; and sometimes in prisms.

Colour pale yellowish or greyish white. Lustre 3 to 1, nearly metallic. Transparency 2. Texture foliated. Melts easily by the flame of a candle, and emits a white vapour†. Before the blow-pipe decrepitates; when powdered, and just ready to melt, it evaporates, and leaves a white powder around. Between two pieces of coal it is reducible to a metallic state.

* *Kirw.* ii. 251.
† *Hauy, Jour. de Min.* N° xxxii. 609.

ORDER XI. ORES OF BISMUTH*.

BISMUTH is employed in the manufacture of pewter, of printers types, in soldering; and perhaps also its property of rendering other metals more fusible, might make it useful in anatomical injections. The quantity consumed in commerce is not great.

It has been found only in the primitive mountains, and is by no means common. When unaccompanied by any other metal, it does not form veins, but kidney-form masses. It often accompanies cobalt. Its gangue is commonly quartz. Its ores are not very abundant. They have been found chiefly in Sweden, Norway, Transylvania, Germany, France, and England.

* *Pott, Observ. Chym.* 134—*Geoffroy, Mem. Par.* 1753, p. 296.

254
G. I. Alloys. Native bismuth.

GENUS I. ALLOYS OF BISMUTH.

SPECIES 1. Native bismuth*.

This mineral, which is found at Schneeberg, Johanngeorgenstadt, &c. in Germany, has commonly the form of small plates lying above one another. Sometimes it is crystallized in four-sided tables, or indistinct cubes.

Colour white with a shade of red; surface often tarnished red, yellow, or purple. Lustre metallic, 3 to 2. Opaque. Texture foliated or striated. Hardness 6. Sp. gr. 9.022† to 9.57‡. Exceedingly fusible. Before the blow-pipe gives a silvery white bead, and at last evaporates in a yellowish white smoke, which is deposited on the charcoal.

It is generally accompanied by cobalt, and sometimes contains arsenic.

* *Kirw.* ii. 264.
† *Brisson.*
‡ *Kirwan.*

255
G. II. Sulphurets. Common sulphuret of bismuth.

GENUS II. SULPHURETS OF BISMUTH.

SPECIES 1. Common sulphuret of bismuth*.

This ore, which is found in Sweden, Saxony, and Bohemia, occurs sometimes in amorphous masses, and sometimes in needleform crystals.

Colour commonly bluish grey, sometimes white; surface often tarnished yellow, red, and purple. Powder black and shining. Lustre metallic, 2 to 3. Streak obscurely metallic. Texture foliated. Hardness 5. Brittle. Sp. gr. 6.131† to 6.4672‡. When held to the flame of a candle, it melts with a blue flame and sulphureous smell. Before the blow-pipe emits a reddish yellow smoke, which adheres to the charcoal. This powder becomes white when it cools, and resumes its former colour when the flame is directed upon it*.

This ore, according to Sage, contains 60 bismuth, And, according to La Perouse, it holds 36 sulphur.

99

* *Kirw.* ii. 266—*Sage, Mem. Par.* 1782, 307.
† *Kirwan.*
‡ *Brisson.*
* *Gillet, Jour. de Min.* N° xxxii. 585.

A specimen, analysed by Klaproth, contained

95 bismuth,
5 sulphur.

100†

It is commonly accompanied by quartz, asbestos, or sparry iron ore.

† *Beiträge*, i. 256.

256
G. III. Oxyds. Yellow oxyd of bismuth.

GENUS III. OXYDS OF BISMUTH.

SPECIES 1. Yellow oxyd of bismuth‡.

Bismuth ochre.

This ore generally accompanies the two species already described. It is found in two states; either of an earthy consistence, or crystallized in cubes or quadrangular plates.

Colour usually greenish yellow, sometimes grey. Soluble in nitrous acid without effervescence, and may in a great measure be precipitated by the effusion of water.

‡ *Kirw.* ii. 265.

ORDER XII. ORES OF ARSENIC.

ARSENIC is used as an alloy for several other metals, especially copper. It is sometimes employed to facilitate the fusion of glass, or to render it opaque, in order to form an enamel. Preparations of arsenic are employed as paints; and, like most other violent poisons, it has been introduced into medicine.

This metal is scattered in great abundance over the mineral kingdom, accompanying almost every other metal, and forming also sometimes peculiar veins of its own. Of course it occurs in almost every species of mountain, and is accompanied by a variety of gangues.

257
G. I. Alloys. Native arsenic.

GENUS I. ALLOYS OF ARSENIC.

SPECIES 1. Native arsenic†.

This mineral is found in different parts of Germany. It occurs generally in masses of various shapes, kidney-form, botryoidal, &c.

Colour that of steel. Its surface quickly becomes tarnished by exposure to the air. Lustre metallic (when fresh), 3 to 2. Streak bluish grey, metallic, and bright. Powder dull and black. Texture compact. Hardness 7 to 8. Brittle. Sp. gr. 5.67† to 5.7249‡. Gives an arsenical smell when struck. Before the blow-pipe emits a white smoke, diffuses a garlic smell, burns with a blue flame, gradually evaporates, depositing a white powder.

It is always alloyed with some iron§, and often contains silver, and sometimes gold.

† *Kirw.* ii. 255.
† *Kirwan.*
‡ *Brisson.*
§ *D. Born. Catal. of M. Raab*, ii. 194.

258
G. II. Sulphurets. Orpiment.

GENUS II. SULPHURETS OF ARSENIC.

SPECIES 1. Orpiment (P).

Auripigmentum.

This ore, which is found in Hungary, Wallachia, Georgia, and Turkey in Asia, is either massive or crystallized. The crystals are confused, and their figure cannot be easily determined; some of them appear octohedrons, and others minute four-sided prisms.

Its colour is yellow. Streak orange yellow. Lustre waxy, 2 to 3. Transparency from 0 to 2. Texture foliated. Hardness 4 to 8. Sp. gr. from 3.0[illegible]* to 3.521‡. Effervesces with hot nitric acid. Burns with a

* *Kirwan.*
‡ *Gellert.*

(P) *Kirw.* II. 260.—*Alberti de Auripigmento.*—*Scopoli in Anno* 5to *Hist. Naturalis*, p. 59,—*Berg.* II. 297.

Ores of Arfenic. a bluifh white flame. Before the blow-pipe melts, fmokes, and evaporates, leaving only a little earth and fome traces of iron.

Compofed of 80 fulphur,
20 arfenic.

100

259. Realgar. * Kirw. ii. 261—Berg. ii. 297.

SPECIES 2. Realgar.*

This mineral is found in Sicily, about Mount Vefuvius, in Hungary, Tranfylvania, and various parts of Germany. It is either maffive or cryftallized. The primitive form of the cryftals is, according to Romé de Lifle, a four-fided rhomboidal prifm, terminated by four fided pyramids, the fides of which are rhombs †. It commonly appears in 4, 6, 8, 10, or 12 fided prifms, terminated by four-fided fummits ‡.

† Cryftall. iii. 34. ‡ Id.

Colour red. Streak yellowifh red. Powder fcarlet. Luftre 3 to 2. Tranfparency from 2 to 3; fometimes 0. Hardnefs 5 to 6. Sp. gr. 3.3384 §. It is an electric *per fe*, and becomes negatively electric by friction ‖. Nitric acid deprives it of its colour. Before the blow-pipe it melts eafily, burns with a blue flame and garlic fmell, and foon evaporates.

§ Briffon. ‖ Hauy, Jour. de Min. N° xxxii. 612.

Compofed of 20 fulphur,
80 arfenic.

100

260 G. III. Oxyds. White oxyd of arfenic. * Kirw. ii. 258—Berg. ii. 285.

GENUS III. OXYDS OF ARSENIC.

SPECIES 1. White oxyd of arfenic.*

Native calx of arfenic.

This ore is found in various parts of Germany, Hungary, &c. either in powder, or maffive, or cryftallized in prifmatic needles.

Colour white or grey, often with a tint of red, yellow, green, or black. Luftre common, 1 to 2. Tranfparency 1 to 0; when cryftallized, 2. Texture earthy. Hardnefs 6. Brittle. Sp. gr. 3.7 †. Soluble in hot diluted nitric acid without effervefcence. Soluble at 60° Fahreneit in 80 times its weight of water. Before the blow-pipe fublimes, but does not inflame. Tinges borax yellow.

† Kirwan.

ORDER XIII. COBALT ORES.

COBALT is employed to tinge glafs of a blue colour, and is ufeful in painting upon porcelain.

Cobalt ores are found almoft exclufively in the ftratified mountains, except one fpecies, fulphuret of cobalt, which affects the primitive mountains. They are not very abundant; and for that reafon cobalt is more valuable than many of the other metals which have been already treated of. They are commonly accompanied by nickel, bifmuth, or iron. They are moft abundant in Germany, Sweden, Norway, and Hungary; they have been found alfo in Britain and France, but not in any great quantity.

261 G. I. Alloys. Cobalt alloyed with arfenic. † Kirw. ii. 270.

GENUS I. ALLOYS OF COBALT.

SPECIES 1. Cobalt alloyed with arfenic †.

Dull grey cobalt ore.

This ore, which occurs in different parts of Germany, is either amorphous or cryftallized. The forms of its cryftals are the cube; fometimes the cube with its angles, or edges, or both wanting; and the octohedron ‡.

‡ Romé de Lifle, iii. 123.

Metallic Ores.

Its colour, when frefh broken, is whitifh or bluifh grey, fometimes with a fhade of red; when expofed to the air it foon becomes tarnifhed. Streak bluifh grey and metallic. Luftre fcarcely metallic, 0 to 1. Texture compact. Hardnefs 10. Difficultly frangible. Sp. gr. when amorphous, 5.309 to 5.571 §; when cryftallized 7.7207 †. When ftruck it gives out an arfenical fmell. Before the blow-pipe it gives out an arfenical vapour, becomes magnetic, and melts eafily, unlefs it contains a great quantity of iron. Tinges borax dark blue, and a fmall metallic bead is obtained.

§ Kirw. ii. 270. † Hauy, Jour. de Min. N° xxxii. 588.

A fpecimen of this ore from Cornwall, examined by Mr Klaproth, contained 20 cobalt,
24 iron,
33 arfenic,

77

with fome bifmuth and ftony matter.*

* Klaproth's Cornwall, p. 61.

Another fpecimen from Tunaberg, according to the analyfis of the fame chemift, contained
55.5 arfenic,
44.0 cobalt,
.5 fulphur.

100 †

† Beiträge, ii. 307.

262 G. II. Sulphurets. White cobalt ore. ‡ Kirw. ii. 273.—Sage Jour. de Phyf. xxxix. 53.

GENUS II. SULPHURETS OF COBALT.

SPECIES 1. White cobalt ore ‡.

Sulphuret of cobalt, arfenic, and iron.

The defcriptions which different mineralogifts have given of this ore are fo various, that it is impoffible not to fuppofe that diftinct fubftances have been confounded together.

It occurs either in maffes, or cryftallized in cubes, dodecahedrons, octohedrons, and icofahedrons.

Colour tin white, fometimes tarnifhed reddifh or yellowifh. Powder fteel grey. Luftre partly metallic, and from 2 to 4; partly 0 or 1. Texture foliated. Hardnefs 8 to 9. Sp. gr. from 6.284 † to 6.4509 ‡. Before the blow-pipe generally gives out an arfenical vapour, and does not melt.

† Kirwan. ‡ Hauy.

The analyfes that have been given of this ore are very various. Sometimes it has been found to contain no arfenic nor iron, and fometimes, to contain both. A fpecimen from Tunaberg in Sweden, which ought to belong to this fpecies, was analyfed by Taffaert, and found to confift of 49 arfenic,
36.6 cobalt,
5.6 iron,
6.5 fulphur.

97.8 †

† Ann. de Chim. xxviii. 100.

Klaproth found a fpecimen of the fame ore to contain 55.5 arfenic,
44.0 cobalt,
0.5 fulphur.

100.0 ‡

‡ Beiträge, ii. 307.

263 G. III. Oxyds. Black cobalt ore or ochre. § Kirw. ii. 275.

GENUS III. OXYDS OF COBALT.

SPECIES 1. Black cobalt ore or ochre §.

This ore, which occurs in different parts of Germany, is either in the form of a powder, or indurated.

Colour black, often with a fhade of blue, grey, brown, or green. Luftre 0 to 1. Streak brighter. Hardnefs (of the indurated) from 4 to 8. Sp. gr. 3 to 4. Soluble in muriatic acid. Tinges borax blue.

Ores of Nickel.

264 Brown cobalt ore. * Kirw. ii. 276.

SPECIES 2. Brown cobalt ore.*

Colour greyish or dark leather brown. Streak brighter, unctuous. Communicates a pale blue tinge in fusion.

265 Yellow cobalt ore. † Ibid.

SPECIES 3. Yellow cobalt ore †.

Colour yellow. Dull and earthy. Hardness 4 to 5. Texture earthy. Streak brighter, unctuous. Gives a weak blue tinge.

266 G. IV. Salts. Arseniat of cobalt. ‡ Id. 278.

GENUS IV. SALTS OF COBALT.

SPECIES 1. Arseniat of cobalt ‡.

Red cobalt ore.

This species, like most other ores of cobalt, has neither been accurately described nor analysed.

It is found in masses of various shapes, and crystallized in quadrangular tables or acicular prisms.

Colour red. Lustre from 2 to 3, sometimes 0. Transparency 0 to 2. Hardness 5 to 7. Brittle. Before the blow-pipe becomes blackish grey. Diffuses a weak arsenical smell. Tinges borax blue.

ORDER XIV. ORES OF NICKEL.

HITHERTO nickel has been found in too small quantities to be applied to any use; of course there are, properly speaking, no mines of nickel. It occurs only (as far as is yet known) in the secondary mountains, and it commonly accompanies cobalt. It has been found in different parts of Germany, in Sweden, Siberia, Spain, France, and Britain.

267 G. I. Sulphurets. Sulphuret of nickel with arsenic and iron. * Ibid. 286.

GENUS I. SULPHURETS OF NICKEL.

SPECIES 1. Sulphuret of nickel with arsenic and iron.

*Kupfer nickel.**

This, which is the most common ore of nickel, occurs either massive or disseminated, but never crystallized.

Colour often that of copper, sometimes yellowish white or grey. Recent fracture often silver white. Lustre metallic, 2 to 3. Texture compact. Hardness 8. Sp. gr. 6.6086 to 6.6481 ‡. Soluble in nitric and nitro-muriatic acids. Solution green. Before the blow-pipe exhales an arsenical smoke, and melts into a bead which darkens by exposure to the air.

‡ Brisson.

It is composed of various proportions of nickel, arsenic, iron, cobalt, sulphur; often contains bismuth, and sometimes silver and copper.

268 G. II. Oxyds. Nickel ochre. * Kirw. ii. 284.

GENUS II. OXYDS OF NICKEL.

SPECIES 1. Nickel ochre.*

This mineral occurs either in the form of a powder, or indurated, and then is either amorphous, or crystallized in acicular form crystals. The powder is generally found on the surface of other nickel ores.

Colour different shades of green. Lustre 1 to 0. Texture earthy. Sp. gr. considerable. Slowly dissolves in acids: solution green. Before the blow-pipe does not melt; but gives a yellowish or reddish brown tinge to borax.

This ore often contains sulphat of nickel, which is soluble in water. The solution, when evaporated, gives oblong rhomboidal crystals, from which alkalies precipitate a greyish green oxyd. This oxyd is soluble by acids and by ammonia. The acid solution is green; the alkaline blue.

Metallic Ores.

GENUS III. SALTS OF NICKEL.

SPECIES 1. Arseniat of nickel †. 269 G. III. Salts. Arseniat of nickel. † Kirw. ii. 285.

This ore, which was lately discovered at Regendorff by Mr Gmelin, is found in shapeless masses, and is often mixed with plates of sulphat of barytes.

Colour pale grey, here and there mixed with pale green. Streak white. Lustre 0. Texture compact. Hardness 7. Difficultly frangible. Sp. gr. considerable. Adheres slightly to the tongue, and gives an earthy smell when breathed on. Soluble in hot nitric and muriatic acids: solution green.

Contains some cobalt and alumina.

ORDER XV. ORES OF MANGANESE (q).

HITHERTO manganese, in its metallic state, has scarcely been put to any use; but under the form of an oxyd it has become of great importance. The oxyd of manganese has the property of rendering colourless a variety of bodies which injure the transparency of glass; and it has been long used in glass manufactories for this purpose under the name of *glass soap*. By means of the same oxyd, oxy-muriatic acid is prepared, which has rendered manganese of great importance in bleaching. Not to mention the utility of manganese to the chemist, the property which it has of facilitating the oxydation of other metals, and of rendering iron more fusible—will probably make it, in no very remote period, of very considerable importance in numerous manufactories.

Ores of manganese occur often in strata, both in the primitive and secondary mountains; scarcely ever, however, we believe, in those mountains which are considered as the most ancient of all. They are very common, having been found abundantly in Germany, France, Spain, Britain, Sweden, Norway, Siberia, and other countries.

GENUS I. OXYDS OF MANGANESE. 270 G. I. Oxyds.

Hitherto manganese has only been found in the state of oxyd. La Perouse, indeed, suspected that he had found it in a metallic state: but probably there was some mistake or other in his observations.

SPECIES 1. Oxyd of manganese combined with barytes. 271 Oxyd of manganese combined with barytes.

This species, which exists in great abundance in Romaneche near the river Soane in France, is found massive, forming a stratum in some places more than 12 feet thick.

Colour greyish black or brownish black, of great intensity. Lustre, external, 0; internal, metallic, 1. Soon tarnishes by exposure to the air, and then becomes intensely black. Texture granular. Fracture uneven; sometimes conchoidal. Often porous. Hardness 11. Difficultly frangible. Sp. gr. from 3.950 to 4.10. Absorbs water. When taken out of water after a minute's immersion, it has a strong argillaceous smell. Conducts electricity nearly as well as if it were in a metallic state ‡. Infusible by the blow-pipe. Tinges soda red; the colour disappears before the blue cone of flame, and is reproduced by the action of the yellow flame.

(q) *Pott. Miscelan. Berolins*, VI. 40—*Margraff, Mem. Berlin*, 1773, p. 3.—*La Perouse, Jour. de Phys.* XVI. 156. and XV. 67. and XXVIII. 68.—*Sage, Mem. Par.* 1785, 235.

Ores of Manganeſe.

From the analyſis of Vauquelin, it appears that it is compoſed of

50.0 white oxyd of manganeſe,
33.7 oxygen,
14.7 barytes,
1.2 ſilica,
.4 charcoal.

100.0 ¶

¶ Dolomieu, Jour. de Min. N° xix. 42.

SPECIES 2. Grey ore of manganeſe.*

272 Grey ore of manganeſe. * Kirwan, ii. 291.

This ore occurs both maſſive and diſſeminated; it is alſo ſometimes cryſtallized in ſlender four-ſided priſms or needles.

Colour uſually duſky ſteel grey; ſometimes whitiſh grey, or reddiſh grey. Streak and powder black. External luſtre 3 to 2; internal metallic, 2 to 1. Texture ſtriated or foliated. Hardneſs 4 to 5. Brittle. Sp. gr. from 4.073 † to 4.8165 ‡. Before the blow-pipe darkens: tinges borax reddiſh brown.

† Vauquelin. ‡ Briſſon.

A ſpecimen of oxyd of manganeſe from the mountains of Voſges, which probably belonged to this ſpecies, and which was analyſed by Vauquelin, was compoſed of

82 oxyd of manganeſe,
7 carbonat of lime,
6 ſilica,
5 water.

100 §

§ Jour. de Min. N° xvii. 13.

Sometimes it contains a little barytes and iron.

SPECIES 3. Black or brown ore of manganeſe.*

273 Black or brown ore of manganeſe. * Kirwan, ii. 292— Wedgewood, Phil. Tranſ. lxxiii. 284.

This ore is found ſometimes in the ſtate of powder, and ſometimes indurated in amorphous maſſes of various figures. Colour either black, ſometimes with a ſhade of blue or brown; or reddiſh brown. Streak of the harder ſorts metallic; of the others, black. Luſtre 0 to 1; internal (when it is indurated), metallic. Texture compact. Hardneſs 5 to 7. Sp. gr. 3.7076 to 3.9039; that of the powdery ſometimes only 2. Before the blow-pipe it exhibits the ſame phenomena as the laſt ſpecies.

A ſpecimen of this ore, analyſed by Weſtrum, contained

45.00 manganeſe,
14.00 oxyd of iron,
11.00 ſilica,
7.25 alumina,
2.00 lime,
1.50 oxyd of copper,
18.00 air and water.

98.75

GENUS II. SALTS OF MANGANESE.

274 G. II. Salts. Carbonat of manganeſe. † Kirwan, ii. 297.

SPECIES. 1. Carbonat of manganeſe †.

White ore of manganeſe.

This ſpecies occurs in Sweden, Norway, and Tranſylvania. It is either in the form of looſe ſcales, or maſſive, or cryſtallized in needles.

Colour white, or reddiſh white. Texture either radiated or ſcaly. Luſtre of the ſcaly 2. Tranſparency 1 to 2. Hardneſs of the maſſive 6 to 9. Sp. gr. 2.794. Effervesces with mineral acids. Heated to redneſs, blackens. Tinges borax violet.

SPECIES 2. Red ore of manganeſe †.

Carbonat of manganeſe and iron.

Metallic Ores.

275 Red ore of manganeſe. † Kirwan, ii. 297— Napion, Mem. Turin, iv. 303.

This ſpecies has been found in Piedmont and in the Pyrenees. It is ſometimes in powder, ſometimes maſſive, ſometimes cryſtallized in rhomboidal priſms or needles.

Colour pale roſy red, mixed with white. Powder nearly white. Luſtre 0. Tranſparency 1. Hardneſs 8. Sp. gr. 3.233. Effervesces with nitric and muriatic acids. When heated to redneſs becomes reddiſh brown. Tinges borax red.

A ſpecimen, analyſed by Ruprecht, contained

55 ſilica,
35 oxyd of manganeſe,
7 oxyd of iron,
1.5 alumina.

98.5 §

§ Jour. de Phyſ. xxxi. 22.

ORDER XVI. ORES OF TUNGSTEN.

As no eaſy method has hitherto been diſcovered of reducing tungſten to a metallic ſtate, we need not be ſurprized that it has been applied to no uſe. Ores of tungſten are by no means common. They have hitherto been found only in the primitive mountains. Their gangue is commonly quartz. They very often accompany tin ores.

GENUS I. OXYDS OF TUNGSTEN.

276 G. I. Oxyds. Wolfram.

SPECIES 1. Wolfram (R).

Oxyds of tungſten, iron, and *manganeſe—Tungſtat of iron* and *manganeſe.*

This ſpecies is found in different parts of Germany, in Sweden, Britain, France, and Spain; and is almoſt conſtantly accompanied by ores of tin. It occurs both maſſive and cryſtallized. The primitive form of its cryſtals, according to the obſervations of Mr Hauy, is a rectangular parallelepiped ‡, whoſe length is 8.66, whoſe breadth is 5, and thickneſs 4.33.* It is not common, however, to find cryſtals of this perfect form; in many caſes, the angles, and ſometimes the edges, of the cryſtal are wanting ‡; owing, as Mr Hauy has ſhewn, to the ſuperpoſition of plates, whoſe edges or angles decreaſe according to a certain law †.

‡ Fig. 42. * Jour. de Min. N° xix. 8. ‡ Fig. 43. † Jour. de Min. N° xix. 8.

Colour brown or browniſh black. Streak reddiſh brown. Powder ſtains paper with the ſame colour. Luſtre external, 2; internal, 2 to 3; nearly metallic. Texture foliated. Eaſily ſeparated into plates by percuſſion. Hardneſs 6 to 8. Sp. gr. from 7.006 * to 7.333 †. Moderately electric by communication. Not magnetic. Infuſible by the blow-pipe. Forms with borax a greeniſh globule, and with microcoſmic ſalt a tranſparent globule of a deep red ¶.

* Kirwan. † Hauy. ¶ Vauquelin, Jour. de Min. N° xix. 11.

The ſpecimen of this ore examined by Meſſrs d'Elhuyarts, was compoſed of

65 oxyd of tungſten,
22 oxyd of manganeſe,
13 oxyd of iron.

100

Another

(R) *Kirw.* II. 316.—*De Luyart, Mem. Thouloufe,* II. 141.—*Gmelin, Crell's Jour.* English tranſ. III. 127, 205, and 293.—*La Perouſe Jour. de Min.* N° IV. p. 23.

Ores of Molybdenum.

Another ſpecimen from Pays le Mines in France, analyſed by Vauquelin and Hecht, contained

67.00 oxyd of tungſten,
18.00 black oxyd of iron,
6.25 black oxyd of manganeſe,
1.50 ſilica,
7.25 oxyd of the iron and manganeſe.

100.00 §

§ *Vauquelin, Jour. de Min.* N° xix. 11.

GENUS II. SALTS OF TUNGSTEN.

SPECIES 1. Tungſtat of lime (s).

Tungsten.

277 G. II. Salts. Tungſtat of lime.

This ore, which is now exceedingly ſcarce, has hitherto been found only in Sweden and Germany. It is either maſſive or cryſtallized; and, according to Hauy, the primitive form of its cryſtals is the octohedron †.

† *Jour. de Min.* N° xxxiii. 657.

Colour yellowiſh white or grey. Luſtre 3 to 2. Tranſparency 2 to 3. Texture foliated. Hardneſs 6 to 9. Sp. gr. 5.8 to 6.0665. Becomes yellow when digeſted with nitric or muriatic acids. Infuſible by the blow-pipe. With borax forms a colourleſs glaſs, unleſs the borax exceed, and then it is brown. With micro-coſmic ſalt it forms a blue glaſs, which loſes its colour by the yellow flame, but recovers it in the blue flame ‡.

‡ *Scheele* and *Bergman.*

It is compoſed of about 70 oxyd of tungſten,
30 lime,

100

with a little ſilica and iron §.

§ *Scheele.*

SPECIES 2. Brown tungſtat.

278 Brown tungſtat.

This ore is found in Cornwal, and is either maſſive or compoſed of ſmall cryſtalline grains.

Colour grey, variegated with yellow and brown. Luſtre 2, waxy. Hardneſs 6 to 7. Sp. gr. 5.57. Its powder becomes yellow when digeſted in aqua regia.

According to Klaproth, it is compoſed of

88 oxyd of tungſten,
11.5 lime.

99.5

ORDER XVII. ORES OF MOLYBDENUM.

If ever molybdenum be found in abundance, it will probably be uſeful in dyeing and painting. At preſent it is very ſcarce, having only been found in Sweden, Germany, Carniola, and among the Alpes. Like tin and tungſten, it affects the primitive mountains.

GENUS I. SULPHURET OF MOLYBDENUM.

SPECIES 1. Common ſulphuret (T).

Molybdena.

279 G. I. Sulphuret. Common ſulphuret.

This ore, which is the only ſpecies of molybdenum ore at preſent known, is found commonly maſſive; ſometimes, however, it is cryſtallized in hexahedral tables.

Colour light lead grey; ſometimes with a ſhade of red. Streak bluiſh grey, metallic. Powder bluiſh. Luſtre metallic, 3 to 2. Texture foliated. Lamellæ ſlightly flexible. Hardneſs 4. Sp. gr. 4.569* to 4.7385 †. Feels greaſy; ſtains the fingers. Marks bluiſh black. A piece of reſin rubbed with this mineral becomes poſitively electric ‡. Inſoluble in ſulphuric and muriatic acids: but in a boiling heat colours them green. Effervesces with warm nitric acid, leaving a grey oxyd undiſſolved. Before the blow-pipe, on a ſilver ſpoon, emits a white ſmoke, which condenſes into a white powder, which becomes blue in the internal, and loſes its colour in the external, flame. Scarcely affected by borax or microcoſmic ſalt. Effervesces with ſoda, and gives it a reddiſh pearl colour.

* *Karſten.* † *Briſſon.* ‡ *Hauy, Jour. de Min.* N° xix. 70.

Compoſed of about 60 molybdenum,
40 ſulphur.

100 *

* *Klaproth.*

ORDER XVIII. ORES OF URANIUM.

URANIUM has hitherto been found only in Germany, and has not been applied to any uſe. The only two mines where it has occurred are in the primitive mountains.

GENUS I. OXYDS OF URANIUM.

SPECIES 1. Sulphuret of uranium †.

Pechblende.

280 G. I. Oxyds. Sulphuret of uranium.

This ore, which has been found at Johanngeorgenſtadt in Saxony, and Joachimſthal in Bohemia, is either maſſive or ſtratified with other minerals.

† *Kirwan,* ii. 305.

Colour black or browniſh black; ſometimes with a ſhade of grey or blue. Streak darker. Powder opaque and black. Luſtre ſemimetallic, from 3 to 1. Fracture conchoidal. Hardneſs 7 to 8. Very brittle. Sp. gr. from 6.3785‡, to 7.5, and even higher §. Imperfectly ſoluble in ſulphuric and muriatic acids; perfectly in nitric acid and aqua regia. Solution wine yellow. Infuſible with alkalies in a crucible: infuſible by the blow-pipe *per ſe*. With borax and ſoda forms a grey opaque ſlag; with microcoſmic ſalt, a green glaſs.

‡ *Morveau, Jour. de Min.* N° xxxii. 610. § *Klaproth, Beiträge,* ii. 197.

Compoſed of oxyd of uranium and ſulphur, and mixed with iron and ſilica, and ſometimes lead.

A ſpecimen of this ore from Joachimſthal, analyſed lately by Klaproth, contained

86.5 uranium,
6.0 ſulphuret of lead,
5.0 ſilica,
2.5 oxyd of iron,

100.0 *

* *Beiträge,* ii. 221.

SPECIES 2. Yellow oxyd of uranium ‡.

Uranitic ochre.

281 Yellow oxyd of uranium.

This ore is generally found on the ſurface of the laſt ſpecies at Johanngeorgenſtadt, and is either maſſive or in powder.

‡ *Kirwan,* ii. 305.

Colour yellow, red, or brown. Streak of the yellow ſorts yellow; of the red, orange yellow. Luſtre 0. Slightly ſtains the fingers. Feels meagre. Texture earthy. Hardneſs 3 to 4. Sp. gr. 3.2438 ‖. Infuſible by the blow-pipe; but in a ſtrong heat becomes browniſh grey.

‖ *Hauy, Jour. de Min.*

Compoſed of oxyd of uranium and oxyd of iron.

GENUS

(s) *Kirw.* II. 314.—*Scheele's Works* (French tranſlation), II. 81.—*Bergman, ibid.* p. 94.—*Crell, Chem. Annalen.* 1784. 2 *Band* 195.

(T) *Kirw.* II. 322.—*Scheele's Works* (French tranſlation), I. 236.—*Pelletier, Jour. de Phyſ.* XXVII. 434.—*Ilſemann, ibid.* XXXIII. 292.—*Sage. ibid.* 389.—*Klaproth* and *Meder, Ann. de Chim.* III. 120.

Ores of Titanium. — Metallic Ores.

GENUS II. SALTS OF URANIUM.

SPECIES 1. Carbonat of uranium¶.

282 G. II. Salts. Carbonat of uranium. This ſubſtance is alſo found at Johanngeorgenſtadt, and near Eibenſtock and Rheinbreidenbach§. It is ſometimes amorphous, but more commonly cryſtallized. Its cryſtals are ſquare plates, octohedrons, and ſix-ſided priſms.

Colour green; ſometimes nearly white; ſometimes, though rarely, yellow. Streak greeniſh white. Luſtre 3 to 2; internal, 2; ſometimes pearly; ſometimes nearly metallic. Tranſparency 2 to 3. Texture foliated. Hardneſs 5 to 6. Brittle. Soluble in nitric acid without effervescence. Infuſible by alkalies.

Compoſed of carbonat of uranium, with ſome oxyd of copper. When its colour is yellow it contains no copper.

¶ Kirwan, ii. 304.
§ Gmelin.

ORDER XIX. ORES OF TITANIUM.

TITANIUM has been known for ſo ſhort a time, and its properties are yet ſo imperfectly aſcertained, that many of its uſes muſt remain to be diſcovered. Its oxyd, as we learn from Mr Darcet, has been employed in painting on porcelain*. Hitherto it has been found only in the primitive mountains, the Crapacks†, the Alpes (v), and the Pyrenees‡. It has been found alſo in Brittany‖ and in Cornwal.

* Jour. de Min. N° xv. 27.
† Ibid. N° xii. 51.
‡ Jour. de Min. N° xxxii. 614.
‖ Ibid.

GENUS I. OXYDS OF TITANIUM.

SPECIES 1. Red oxyd of Titanium.

Red ſhorl—Sagenite.

This ore has been found in Hungary, the Pyrenees,
283 G. I. Oxds. Red oxyd of titanium. the Alpes, and in Brittany in France. It is generally cryſtallized. The primitive form of its cryſtals, according to the obſervations of Mr Hauy, is a rectangular priſm, whoſe baſe is a ſquare; and the form of its molecules is a triangular priſm, whoſe baſe is a right angled iſoſceles triangle, and the height is to any of the ſides of the baſe about the right angle as $\sqrt{12}$ to $\sqrt{5}$, or nearly as 3 : 2¶. Sometimes the cryſtals of titanium are ſix-ſided, and ſometimes four-ſided, priſms, and often they are implicated together‡.

Colour red or browniſh red. Powder brick or orange red. Luſtre 3. Tranſparency commonly 0; ſometimes 1. Texture foliated. Hardneſs 9. Brittle. Sp. gr. from 4.18* to 4.2469†. Not affected by the mineral acids. When fuſed with carbonat of potaſs, and diluted with water, a white powder precipitates, heavier than the titanium employed. Before the blow-pipe it does not melt, but becomes opaque and brown. With microcoſmic ſalt it forms a globule of glaſs, which appears black; but its fragments are violet. With borax it forms a deep yellow glaſs, with a tint of brown. With ſoda it divides and mixes, but does not form a tranſparent glaſs.

When pure, it is compoſed entirely of oxyd of titanium.

¶ Jour. de Min. N° xv. 28. and xxxii. 615.
‡ Fig. 44.
* Klaproth.
† Vauquelin and Hecht.

SPECIES 2. Menachanite (x).

284 Menachanite. *Oxyd of titanium combined with iron.*

This ſubſtance has been found abundantly in the valley of Menachan in Cornwal; and hence was called menachanite by Mr Gregor, the diſcoverer of it. It is in ſmall grains, like gunpowder, of no determinate ſhape, and mixed with a fine grey ſand. Colour black. Eaſily pulverized. Powder attracted by the magnet. Sp. gr. 4.427. Does not detonate with nitre. With two parts of fixed alkali it melts into an olive coloured maſs, from which nitric acid precipitates a white powder. The mineral acids only extract from it a little iron. Diluted ſulphuric acid, mixed with the powder, in ſuch a proportion that the maſs is not too liquid, and then evaporated to dryneſs, produces a blue coloured maſs. Before the blow-pipe does not decrepitate nor melt. It tinges microcoſmic ſalt green; but the colour becomes brown on cooling: yet microcoſmic ſalt does not diſſolve it. Soluble in borax, and alters its colour in the ſame manner.

According to the analyſis of Mr Gregor, it is compoſed of

46	oxyd of iron,
45	oxyd of titanium.
91	with ſome ſilica and mangaueſe†.

According to Mr Klaproth's analyſis, it is compoſed of

51.00	oxyd of iron,
45.25	oxyd of titanium,
3.50	ſilica,
.25	oxyd of manganeſe.
100.00‡	

† Mr Gregor Jour. de Phyſ. xxxix. 72. 152.
‡ Beiträge, ii. 231.

A mineral, nearly of the ſame nature with the one juſt deſcribed, has been found in Bavaria. Its ſpecific gravity, however, is only 3.7. According to the analyſis of Vauquelin and Hecht, it is compoſed of

49	oxyd of titanium,
35	iron,
2	manganeſe,
14	oxygen combined with the iron and manganeſe.
100§	

§ Jour. de Min. N° xix. 57.

SPECIES 3. Calcareo ſiliceous ore of titanium.

Oxyd of titanium combined with lime and ſilica—Titanite†.

This ore has hitherto been found only near Paſſau. 285 Calcareo ſiliceous ore of titanium.
It was diſcovered by Profeſſor Hunger. It is ſometimes maſſive, but more commonly cryſtallized in four-ſided priſms, not longer than one-fourth of an inch.

Colour reddiſh, yellowiſh, or blackiſh brown; ſometimes whitiſh grey. Powder whitiſh grey. Luſtre waxy or nearly metallic, 2 to 3. Tranſparency from 0 to 2. Texture foliated. Hardneſs 9 or more. Brittle. Sp. gr. 3.510. Muriatic acid, by repeated digeſtion, diſſolves one-third of it. Ammonia precipitates from this ſolution a clammy yellowiſh ſubſtance. Infuſible by the blow-pipe, and alſo in a clay crucible; but in charcoal is converted into a black opaque porous ſlag.

† Kirwan, ii. 331.

According to the analyſis of Klaproth, it is compoſed of

33	oxyd of titanium,
35	ſilica,
33	lime.
101	

ORDER

(v) *Dolomieu, Jour. de Min.* N° XLII. 431. and *Sauſſure, Voyages*, N° 1894.
(x) *Kirw.* II. 326.—*Gregor, Jour. de Phyſ.* XXXIX. 72. and 152.—*Schmeiſſer, Crell's Annals* (Engliſh tranſlation), III. 252.

Ores of Tellurium.

Order XX. ORES OF TELLURIUM.

Hitherto tellurium has only been found in Transylvania. It occurs in three different mines; that of Fatzbay, Offenbanya, and Nagyag, which are considered as gold mines, because they contain less or more of that metal. Its gangue is commonly quartz.

286 G. I. Alloys. White gold ore of Fatzbay.

Genus I. ALLOYS OF TELLURIUM.

SPECIES 1. White gold ore of Fatzbay.

Alloy of tellurium and iron, with some gold.

This species is generally massive. Its colour is between tin white and lead grey. Lustre considerable, metallic. Texture granular*.

According to Klaproth's analysis, it is composed of

72.0 iron,
25.5 tellurium,
2.5 gold.

100.0†

* *Ann. de Chim.* xxv. 327.

† *Ibid.* 280.

287 Graphic golden ore of Offenbanya.

SPECIES 2. Graphic golden ore of Offenbanya.

Tellurium alloyed with gold and silver.

This ore is composed of flat prismatic crystals; the arrangement of which has some resemblance to Turkish letters. Hence the name of the ore.

Colour tin white, with a tinge of brass yellow‡. Lustre metallic, 3. Hardness 4 to 5. Brittle. Sp. gr. 5.723. Before the blow-pipe decrepitates, and melts like lead. Burns with a lively brown flame and disagreeable smell, and at last vanishes in a white smoke, leaving only a whitish earth‖.

According to Klaproth's analysis, is is composed of

60 tellurium,
30 gold,
10 silver.

100§

‡ *Ann. de Chim.* xxv. 328.

‖ *De Born, Kirwan's Min.* ii. 101.

§ *Ann. de Chim.* xxv. 280.

The yellow gold ore of Nagyag would belong to this species were it not that it contains lead. Its composition, according to Klaproth's analysis, is as follows:

45.0 tellurium,
27.0 gold,
19.5 lead,
8.5 silver.

100.0 and an atom of sulphur*.

* *Ibid.*

288 Grey foliated gold ore of Nagyag.

SPECIES 3. Grey foliated gold ore of Nagyag.

This ore is found in plates, of different degrees of thickness, adhering to one another, but easily separable: these are sometimes hexahedral, and often accumulated so as to leave cells between them.

Colour deep lead grey, passing to iron black, spotted. Lustre metallic, moderate. Texture foliated; leaves slightly flexible†. Hardness 6. Sp. gr. 8.919 Stains the fingers. Soluble in acids with effervescence‡.

According to Klaproth, it is composed of

50.0 lead,
33.0 tellurium,
8.5 gold,
7.5 sulphur,
1.0 silver and copper.

100.0§

† *Klaproth, Ann. de Chim.* xxv. 329.

‡ *De Born, Kirwan's Min.* ii. 99.

§ *Ann. de Chim. ibid.* 280.

Ores of Chromum.

Order XXI. ORES OF CHROMUM.

Chromum has hitherto been found in too small quantities for its extensive application to the arts. Whenever it becomes plentiful, its properties will render it of great importance both to the dyer and painter. Nature has used it to colour some of her most beautiful mineral productions: And can art copy after a better model? Hitherto it has been found only in two places, near Ekaterinbourg in Siberia, and in the department of the Var in France. In the first of these places, and probably also in the second, its gangue is quartz.

Genus I. SALTS OF CHROMUM. 289 G. I. Salts. Chromat of lead.

SPECIES 1. Chromat of lead.

Red lead ore of Siberia.

This singular mineral, which has now become scarce, is found in the gold mines of Beresof near Ekaterinbourg in Siberia, crystallized in four-sided prisms, sometimes terminated by four-sided pyramids, sometimes not.

Colour red, with a shade of yellow. Streak and powder a beautiful orange yellow. Lustre from 2 to 3. Transparency 2 to 3. Structure foliated. Texture compact. Fracture uneven. Hardness 5 to 4. Sp. gr. 6.0269† to 5.75‡. Does not effervesce with acids. Before the blow-pipe decrepitates; some lead is reduced, and the mineral is converted to a black slag, which tinges borax green.

† *B[illegible]*

‡ *B[illegible]*

According to the analysis of Vauquelin, it is composed of

65.12 oxyd of lead,
34.88 chromic acid.

100.00‖.

‖ *Jour. de Min.* N° xxxiv. 760.

SPECIES 2. Chromat of iron.

This mineral, which has been found only near Gassin in the department of Var in France, is in irregular masses. 290 Chromat of iron.

Colour brown, not unlike that of brown blende. Lustre metallic. Hardness moderate. Sp. gr. 4.0326. Melts with difficulty before the blow-pipe; to borax it communicates a dirty green. Insoluble in nitric acid. Melted with potass, and dissolved in water, the solution assumes a beautiful orange yellow colour.

It is composed of 63.6 chromic acid,
36.0 oxyd of iron.

99.6†

† *Tassaert, Ann. de Chim.* xxxi. 220.

Chap. IV. Of the Chemical Analysis of Minerals.

The progress which the art of analysing minerals has made within these last twenty years is truly astonishing. To separate five or six substances intimately combined together, to exhibit each of them separately, to ascertain the precise quantity of each, and even to detect the presence and the weight of substances which do not approach $\frac{1}{1000}$th part of the compound, would, at no very remote period, have been considered as a hopeless, if not an impossible, task; yet this can now be done with the most rigid accuracy. 291 Analysis of minerals.

The first person who undertook the analysis of minerals was Margraaf of Berlin. His attempts were indeed rude; but their importance was soon perceived by other chemists, particularly by Bergman and Scheele, 292 Begun by Margraaf.

whose

Analysis of Minerals.

whose industry and address brought the art of analysing minerals to a considerable degree of perfection.

But their methods, though they had very considerable merit, and, considering the state of the science, are wonderful proofs of the genius of the inventors, were often tedious and uncertain, and could not, in all cases

293 Improved by Klaproth.

be applied with confidence. These defects were perceived by Mr Klaproth of Berlin, who applied himself to the analysis of minerals with a persevering industry which nothing could fatigue, and an ingenuity and accuracy which nothing could perplex. He corrected what was wrong, and supplied what was wanting, in the analytical method; invented new processes, discovered new instruments; and it is to his labours, more than to those of any other chemist, that the degree of

294 And other chemists.

perfection, to which the analysis of minerals has attained, is to be ascribed. Many improvements, however, were introduced by other chemists, especially by Mr. Vauquelin, whose analyses in point of accuracy and ingenuity rival those of Klaproth himself.

We shall, in this chapter, give a short description of the most perfect method of analysing minerals, as far as we are acquainted with it. We shall divide the chapter into four sections. In the first, we shall give an account of the instruments used in analyses; in the second, we shall treat of the method of analysing stones; in the third, of analysing combustibles; and in the fourth, of the analyses of ores.

Sect. I. *Of the Instruments of Analyses.*

295 Method of obtaining chemical agents pure.

I. The chemical agents, by means of which the analysis of minerals is accomplished, ought to be prepared with the greatest care, because upon their purity the exactness of the operation entirely depends. These agents are the three alkalies, both pure and combined with carbonic acid; the sulphuric, nitric, and muriatic acids; hydrosulphuret of potass and sulphurated hydrogen gas dissolved in water; prussic alkali, and a few neutral salts.

1. Potass and soda may be obtained pure, either by means of alcohol, or by the method described in the article Chemistry, n° 372. *Suppl.*. These alkalies are known to be pure when their solution in pure water occasions no precipitate in lime and barytic water; when the precipitate which it produces in a solution of silver is completely dissolved by nitric acid; and, lastly, when saturated with carbonic acid it deposits no silica.

2. Ammonia is procured by distilling one part of muriat of ammonia with two parts of quicklime, and receiving the gas in a dish containing a quantity of pure water, equal in weight to the muriat employed. Its purity is known by the same tests which ascertain the purity of fixed alkalies.

3. The carbonats of potass and soda may be formed by dissolving the potass and soda of commerce in pure water, saturating the solution with carbonic acid, and crystallizing them repeatedly. When pure, these crystals effloresce in the air; and the precipitate which they occasion in solutions of barytes and of silver is completely soluble in nitric acid. Carbonat of ammonia is obtained by distilling together one part of muriat of ammonia and two parts of carbonat of lime.

4. The sulphuric acid of commerce often contains nitric acid, potass, lead, &c. It may be purified by distillation in a low cucurbite. The first portion, when it comes over, must be set aside; it contains the nitric acid. The other impurities remain behind in the cucurbite. Sulphuric acid, when pure, dissolves indigo without altering its colour, does not attack mercury while cold, and causes no precipitate in pure alkaline solutions.

5. Nitric acid often contains both sulphuric and muriatic acids. It is easily purified by throwing into it about three parts of litharge in fine powder for every 100 parts of the acid, allowing the mixture to remain for 24 hours, shaking it occasionally, and then distilling it. The sulphuric and muriatic acids combine with the lead, and remain behind in the retort. Pure nitric acid occasions no precipitate in the solutions of barytes and silver.

6. The muriatic acid of commerce usually contains sulphuric acid, oxymuriatic acid, and oxyd of iron. It may be purified by distillation with a little muriat of soda; taking care to set aside the first portion which comes over. When pure it causes no precipitate in the solution of barytes, nor of pure alkalies, and does not attack mercury while cold.

7. Hydrosulphuret of potass is made by saturating a solution of pure potass with sulphurated hydrogen gas; and water may be saturated with sulphurated hydrogen gas in the same manner. See Chemistry, n° 857. *Suppl.*

8. The method of preparing prussic alkali, oxalic acid, and the other substances used in analyses, has been already described in the article Chemistry, *Suppl.* it is unnecessary therefore to repeat it here.

296 How to reduce the mineral to powder.

II. Before a mineral is submitted to analysis, it ought to be reduced to an impalpable powder. This is by no means an easy task when the stone is extremely hard. It ought to be raised to a bright red or white heat in a crucible, and then instantly thrown into cold water. This sudden transition makes it crack and break into pieces. If these pieces are not small enough, the operation may be repeated on each till they are reduced to the proper size. These fragments are then to be beaten to small pieces in a polished steel mortar; the cavity of which should be cylindrical, and the steel pestle should fit it exactly, in order to prevent any of the stone from escaping during the act of pounding. As soon as the stone is reduced to pretty small pieces, it ought to be put into a mortar of rock crystal or flint, and reduced to a coarse powder. This mortar should be about four inches in diameter, and rather more than an inch in depth. The pestle should be formed of the same stone with the mortar, and care should be taken to know exactly the ingredients of which this mortar is composed. Klaproth's mortar is of flint. We have given its analysis in n° 32, of this article.

When the stone has been reduced to a coarse powder, a certain quantity, whose weight is known exactly, 100 grains for instance, ought to be taken and reduced to as fine a powder as possible. This is best done by pounding small quantities of it at once, not exceeding 10 grains. The powder is as fine as possible when it feels soft, adheres together, and as it were forms a cake under the pestle. It ought then to be weighed exactly. It will almost always be found heavier after being pounded than it was before; owing to a certain quantity of the substance of the mortar which has been rubbed off during the grinding and mixed with the powder,

Analysis of Minerals.

der. This additional weight must be carefully noted; and after the analysis, a portion of the ingredients of the mortar, corresponding to it, must be subtracted.

297 Chemical dishes.

III. It is necessary to have a crucible of pure silver, or, what is far preferable, of platinum, capable of holding rather more than seven cubic inches of water, and provided with a cover of the same metal. There should also be ready a spatula of the same metal about four inches long.

The dishes in which the solutions, evaporations, &c. are performed, ought to be of glass or porcelain. Those of porcelain are cheaper, because they are not so apt to break. Those which Mr Vauquelin uses are of porcelain; they are sections of spheres, and are glazed both within and without, except that part of the bottom which is immediately exposed to the fire.

Sect. II. *Analysis of stones* (Y).

298 Ingredients of stones.

The only substances which enter into the composition of the simple stones, as far at least as analysis has discovered, are the six earths, silica, alumina, zirconia, glucina, lime, and magnesia; and the oxyds of iron, manganese, nickel, chromum, and copper (Z). Seldom more than four or five of these substances are found combined together in the same stone: we shall suppose, however, in order to prevent unnecessary repetitions, that they are all contained in the mineral which we are going to analyse.

299 Method of decomposing stones.

Let 100 or 200 grains of the stone to be analysed, previously reduced to a fine powder, be mixed with three times its weight of pure potass and a little water, and exposed in the silver or platinum crucible to a strong heat. The heat should at first be applied slowly, and the matter should be constantly stirred, to prevent the potass from swelling and throwing any part out of the crucible. When the whole water is evaporated, the mixture should be kept for half an hour or three quarters in a strong red heat.

If the matter in the crucible melts completely, and appears as liquid as water, we may be certain that the stone which we are analysing consists chiefly of silica; if it remains opaque, and of the consistence of paste, the other earths are most abundant; if it remains in the form of a powder, alumina is the prevalent earth. If the matter in the crucible be of a dark or brownish red colour, it contains oxyd of iron; if it is grass green, manganese is present: if it is yellowish green, it contains chromum.

When the crucible has been taken from the fire and wiped on the outside, it is to be placed in a capsule of porcelain, and filled with water. This water is to be renewed from time to time till all the matter is detached from the crucible. The water dissolves a part of the combination of the alkali with the silica and alumina of the stone, and if a sufficient quantity were used, it would dissolve the whole of that combination.

Muriatic acid is now to be poured in till the whole of the matter is dissolved. At first a flaky precipitate appears, because the acid combines with the alkali which kept it in solution. Then an effervescence takes place, owing to the decomposition of some carbonat of potass formed during the fusion. At the same time the flaky precipitate is redissolved; as is also that part of the matter which, not having been dissolved in the water, had remained at the bottom of the dish in the form of a powder. This powder, if it consists only of silica and alumina, dissolves without effervescence; but if it contains lime, an effervescence takes place.

If this solution in muriatic acid be colourless, we may conclude that it contains no metallic oxyd, or only a very small portion; if its colour be purplish red, it contains manganese; orange red indicates the presence of iron; and golden yellow the presence of chromum.

This solution is to be poured into a capsule of porcelain, covered with paper, and evaporated to dryness in a sand bath. When the evaporation is drawing towards its completion, the liquor assumes the form of jelly. It must then be stirred constantly with a glass or porcelain rod, in order to facilitate the disengagement of the acid and water, and to prevent one part of the matter from being too much, and another not sufficiently dried. Without this precaution, the silica and alumina would not be completely separated from each other.

300 How the silica is separated,

When the matter is reduced almost to a dry powder, a large quantity of pure water is to be poured on it; and, after exposure to a slight heat, the whole is to be poured on a filter. The powder which remains upon the filter is to be washed repeatedly, till the water with which it has been washed ceases to precipitate silver from its solutions. This powder is the whole of the *silica* which the stone that we are analysing contained. It must first be dried between folds of blotting paper, then heated red hot in a platinum or silver crucible, and weighed while it is yet warm. It ought to be a fine powder, of a white colour, not adhering to the fingers, and entirely soluble in acids. If it be coloured, it is contaminated with some metallic oxyd; and shews, that the evaporation to dryness has been performed at too high a temperature. To separate this oxyd, the silica must be boiled with an acid and then washed and dried as before. The acid solution must be added to the water which passed through the filter, and which we shall denominate A.

The watery solution A is to be evaporated till its quantity does not exceed 30 cubic inches, or nearly an English pint. A solution of carbonat of potass is then to be poured into it till no more matter precipitates. It ought to be boiled a few moments to enable all the precipitate to fall to the bottom. When the whole of the precipitate has collected at the bottom, the supernatant liquid is to be decanted off; and water being substituted in its place, the precipitate and water are to be thrown upon a filter. When the water has run off, the filter with the precipitate upon it is to be placed between folds of blotting paper. When the precipitate has acquired some consistence, it is to be carefully collected by an ivory knife, mixed with a solution of pure potass, and boiled in a porcelain capsule. If any alumina

(Y) Part of this section is to be considered as an abstract of a treatise of Vauquelin on the analysis of stones, published in the *Annales de Chimie*, Vol. XXX. p. 66.

(Z) Barytes has also been discovered in one single stone, the *staurolite*; but its presence in stones is so uncommon, that it can scarcely be looked for. The method of detecting it shall be noticed afterwards.

Analysis of Minerals. alumina or glucina be present, they will be dissolved in the potass; while the other substances remain untouched in the form of a powder, which we shall call B.

301 And the alumina, Into the solution of potass as much acid must be poured as will not only saturate the potass, but also completely redissolve any precipitate which may have at first appeared. Carbonat of ammonia is now to be added in such quantity that the liquid shall taste of it. By this addition the whole of the alumina will be precipitated in white flakes, and the glucina will remain dissolved, provided the quantity of carbonat of ammonia used be not too small. The liquid is now to be filtered, and the alumina which will remain on the filter is to be washed, dried, heated red hot, and then weighed. To see if it be really alumina, dissolve it in sulphuric acid, and add a sufficient quantity of sulphat or acetite of potass; if it be alumina, the whole of it will be converted into crystals of alum.

302 Glucina. Let the liquid which has passed through the filter be boiled for some time, and the glucina, if it contains any, will be precipitated in a light powder, which may be dried and weighed. When pure, it is a fine, soft, very light, tasteless powder, which does not concrete when heated, as alumina does.

303 Lime, The residuum B may contain lime, magnesia, and one or more metallic oxyds. Let it be dissolved in weak sulphuric acid, and the solution evaporated to dryness. Pour a small quantity of water on it. The water will dissolve the sulphat of magnesia, and the metallic sulphats; but the sulphat of lime will remain undissolved. Let it be heated red hot in a crucible, and weighed. The lime amounts to 0.41 of the weight.

Let the solution containing the remaining sulphats be diluted with a large quantity of water, let a small excess of acid be added, and then let a saturated carbonat of potass be poured in. The oxyds of chromium, iron, and nickel, will be precipitated, and the magnesia and oxyd of manganese will remain dissolved. The precipitate we shall call C.

304 Manganese, Into the solution let a solution of hydrosulphuret of potass be poured, and the manganese will be precipitated in the state of a hydrosulphuret. Let it be calcined in contact with air, and weighed. The magnesia

305 Magnesia, may then be precipitated by pure potass, washed, exposed to a red heat, and then weighed.

Let the residuum C be boiled repeatedly with nitric acid, then mixed with pure potass; and after being

306 Chromium, heated, let the liquid be decanted off. Let the precipitate, which consists of the oxyds of iron and nickel, be washed with pure water; and let this water be added to the solution of the nitric acid and potass. That solution contains the chromium converted into an acid, Add to this solution an excess of muriatic acid, and evaporate till the liquid assumes a green colour; then add a pure alkali: The chromium precipitates in the state of an oxyd, and may be dried, and weighed.

307 Iron, Let the precipitate, consisting of the oxyds of iron and nickel, be dissolved in muriatic acid; add an excess of ammonia: the oxyd of iron precipitates. Let it be washed, dried, and weighed.

308 And nickel. Evaporate the solution, and the oxyd of nickel will also precipitate; and its weight may be ascertained in the same manner with the other ingredients.

The weights of all the ingredients obtained are now to be added together, and their sum total compared with the weight of the matter submitted to analysis. If the two are equal, or if they differ only by .03 or .04 parts, we may conclude that the analysis has been properly performed: but if the loss of weight be considerable, something or other has been lost. The analysis must therefore be repeated with all possible care. If there is still the same loss of weight, we may conclude that the stone contains some substance, which has either evaporated by the heat, or is soluble in water.

A fresh portion of the stone must therefore be broken into small pieces, and exposed in a porcelain crucible to a strong heat. If it contains water, or any other volatile substance, they will come over into the receiver; and their nature and weight may be ascertained. 309 Method of detecting volatile bodies.

If nothing comes over into the receiver, or if what comes over is not equal to the weight wanting, we may conclude that the stone contains some ingredient which is soluble in water.

To discover whether it contains *potass*, let the stone, reduced to an impalpable powder, be boiled five or six times in succession, with very strong sulphuric acid, applying a pretty strong heat towards the end of the operation, in order to expel the excess of acid; but taking care that it be not strong enough to decompose the salts which have been formed. 310 Method of ascertaining whether stones contain potass

Water is now to be poured on, and the residuum, which does not dissolve, is to be washed with water till it becomes tasteless. The watery solution is to be filtered, and evaporated to dryness, in order to drive off any excess of acid which may be present. The salts are to be again dissolved in water; and the solution, after being boiled for a few moments, is to be filtered and evaporated to a consistence proper for crystallizing. If the stone contains a sufficient quantity of alumina, and if potass be present, crystals of alum will be formed; and the quantity of potass may be discovered by weighing them, it being nearly $\frac{1}{10}$th of their weight. If the stone does not contain alumina, or not in sufficient quantity, a solution of pure alumina in sulphuric acid must be added. Sometimes the alum, even when potass is present, does not appear for several days, or even weeks; and sometimes, when a great quantity of alumina is present, if the solution has been too much concentrated by evaporation, the sulphat of alumina prevents the alum from crystallizing at all. Care, therefore, must be taken to prevent this last source of error. The alum obtained may be dissolved in water, and barytic water poured into it as long as any precipitate forms. The liquor is to be filtered, and evaporated to dryness. The residuum will consist of potass and a little carbonat of potass. The potass may be dissolved in a little water. This solution, evaporated to dryness, gives us the potass pure; which may be examined and weighed.

If no crystals of alum can be obtained, we must look for some other substance than potass. The stone, for instance, may contain soda. The presence of this alkali may be discovered by decomposing the solution in sulphuric acid, already described, by means of ammonia. The liquid which remains is to be evaporated to dryness, and the residuum is to be calcined in a crucible. By this method, the sulphat of ammonia will be volatilized, and the soda will remain. It may be redissolved in water, crystallized, and examined. 311 Or soda.

If sulphuric acid does not attack the stone, as is often the case, it must be decomposed by fusion with soda,

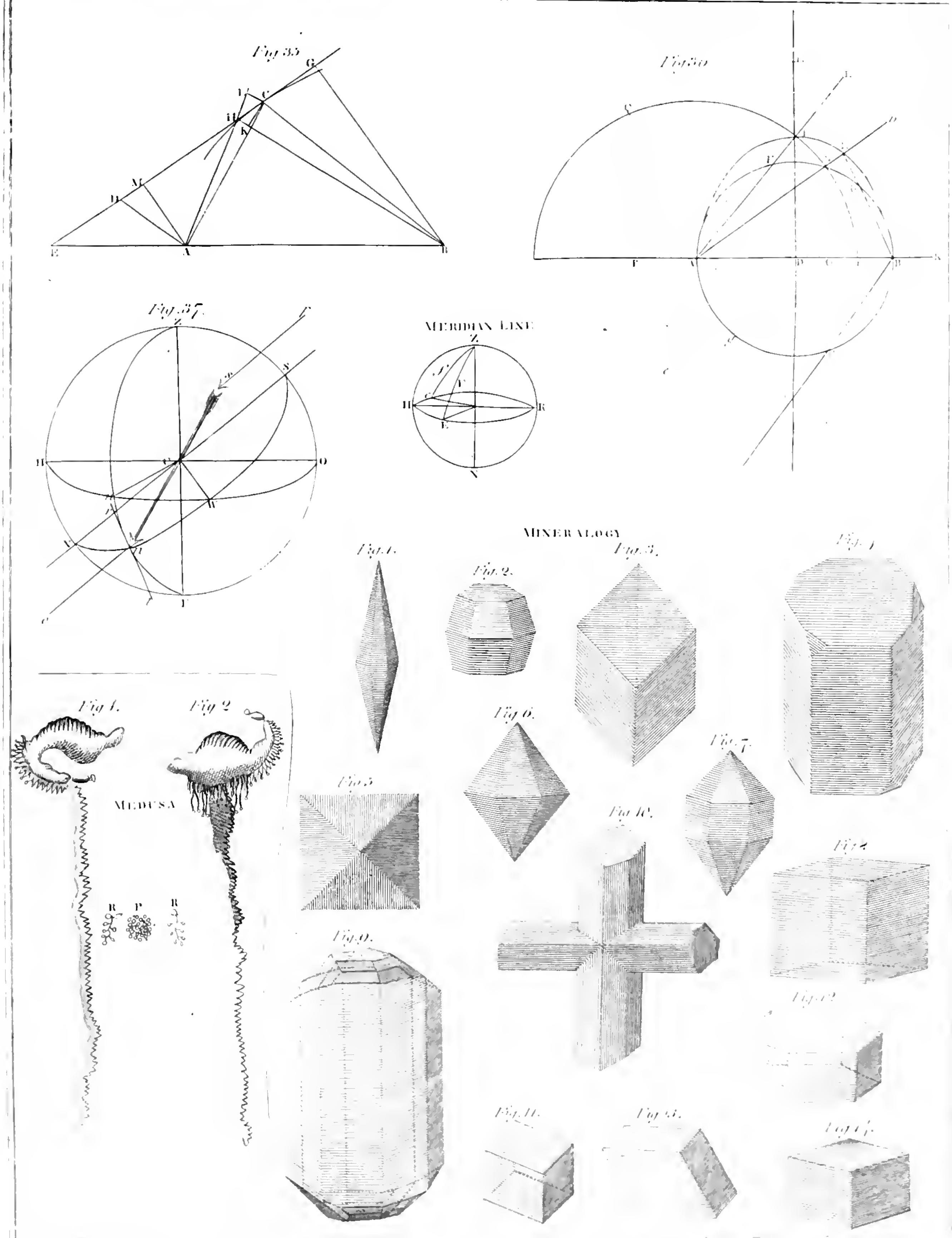
Fig. 35.
Fig. 36.
Fig. 37.
MERIDIAN LINE
MINERALOGY
Fig. 1.
Fig. 2.
Fig. 3.
Fig. 5.
Fig. 6.
Fig. 7.
Fig. 9.
Fig. 10.
Fig. 11.
MEDUSA
R
P
R

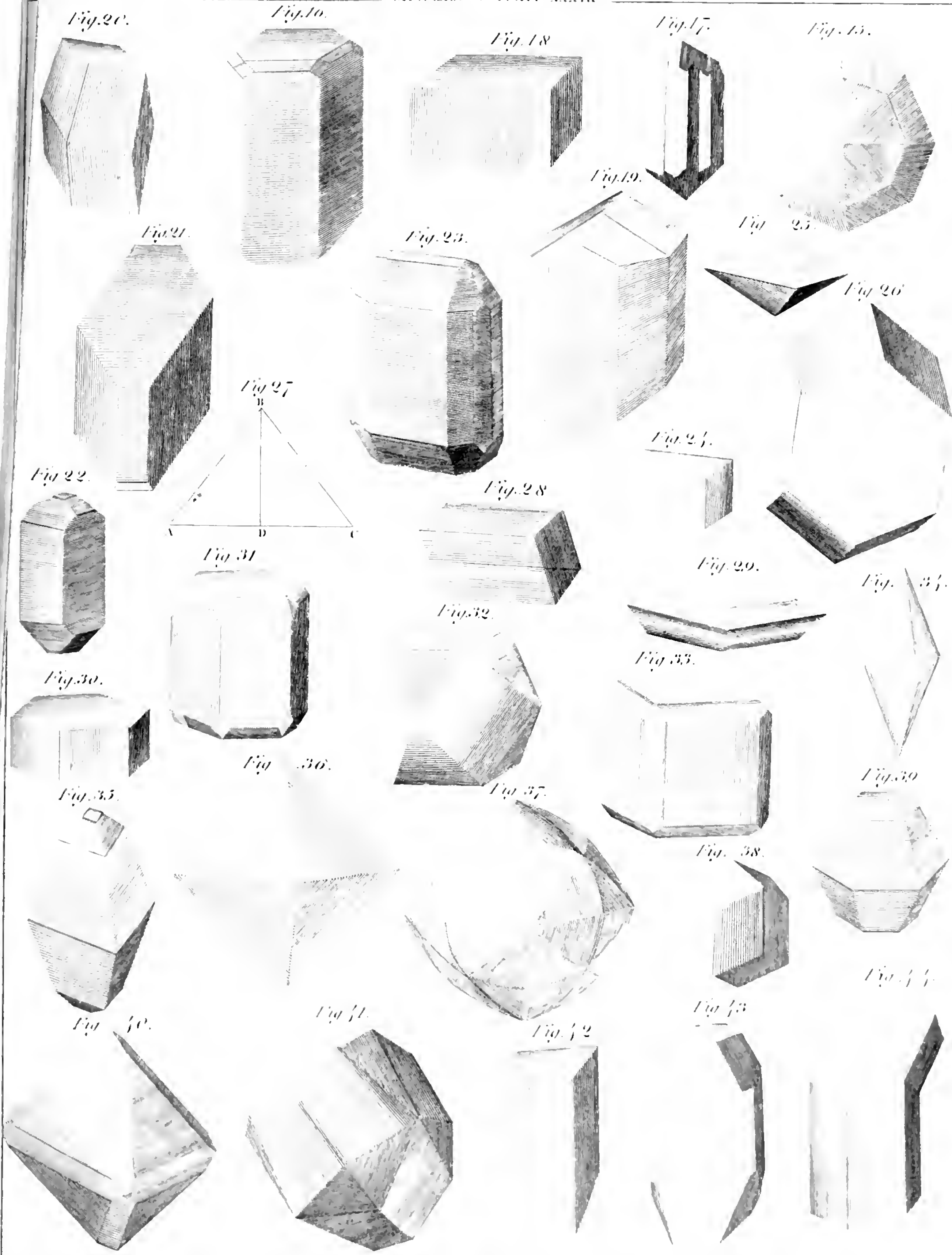
Fig. 20.
Fig. 16.
Fig. 18
Fig. 17.
Fig. 15.
Fig. 19.
Fig. 25.
Fig. 21.
Fig. 23.
Fig. 26.
Fig. 27
B
A
D
C
Fig. 24.
Fig. 22.
Fig. 28
Fig. 31
Fig. 29.
Fig. 34.
Fig. 32.
Fig. 33.
Fig. 30.
Fig. 36.
Fig. 35.
Fig. 37.
Fig. 39
Fig. 38.
Fig. 44.
Fig. 40.
Fig. 41.
Fig. 43
Fig. 42

Analysis of Minerals.

da, in the same manner as formerly directed with potass. The matter, after fusion, is to be diluted with water, and then saturated with sulphuric acid. The solution is to be evaporated to dryness, the residuum again dissolved in water, and evaporated. Sulphat of soda will crystallize first; and by a second evaporation, if the stone contains potass and alumina, crystals of alum will be deposited.

The presence of potass may be discovered, by mixing with a somewhat concentrated solution of muriat of platinum, the salt obtained, either by decomposing the stone immediately by an acid, or by saturating with an acid the matter obtained by fusing the stone with soda. If any potass be present, a very red precipitate will be formed. This precipitate is a triple salt, composed of potass, muriatic acid, and oxyd of platinum. Ammonia, indeed, produces the same precipitate; but ammonia has not hitherto been discovered in stones.

312
Analysis of saline stones,

In this manner may simple stones and aggregates be analysed. As to saline stones, their analysis must vary according to the acid which they contain. But almost all of them may be decomposed by one or other of two methods; of each of which we shall give an example.

I. Analysis of Carbonat of Strontites.

313
Of Carbonats,

Klaproth analysed this mineral by dissolving 100 parts of it in diluted muriatic acid: during the solution, 30 parts of carbonic acid escaped. The solution crystallized in needles, and when dissolved in alcohol, burnt with a purple flame. Therefore it contained strontites. He dissolved a grain of sulphat of potass in six ounces of water, and let fall into it three drops of the muriatic solution. No precipitate appeared till next day. Therefore the solution contained no barytes; for if it had, a precipitate would have appeared immediately.

He then decomposed the muriatic acid solution, by mixing it with carbonat of potass. Carbonat of strontites precipitated. By the application of a strong heat, the carbonic acid was driven off. The whole of the earth which remained was dissolved in water. It crystallized; and when dried, weighed $69\frac{1}{2}$*.

* *Klaproth's Beitrage*, i. 260.

II. Analysis of Sulphat of Strontites.

Mr Vauquelin analysed an impure specimen of this mineral as follows:

314
Sulphats,

On 200 parts of the mineral, diluted nitric acid was poured. A violent effervescence took place, and part of the mineral was dissolved. The undissolved portion, after being heated red hot, weighed 167. Therefore 33 parts were dissolved.

The nitric solution was evaporated to dryness: A reddish substance remained, which indicated the presence of oxyd of iron. This substance was redissolved in water, and some ammonia mixed with it; a reddish precipitate appeared, which, when dried, weighed 1, and was oxyd of iron. The remainder of the solution was precipitated by carbonat of potass. The precipitate weighed, when dried, 20, and possessed the properties of carbonat of lime. Therefore 200 parts of this mineral contain 20 of carbonat of lime, 1 of oxyd of iron, and the remainder of the 33 parts he concluded to be water.

The 167 parts, which were insoluble in nitric acid, were mixed with 500 parts of carbonat of potass, and 7000 parts of water, and boiled for a considerable time. The solution was then filtered, and the residuum washed and dried. The liquid scarcely effervesced with acids; but with barytes it produced a copious precipitate, totally indissoluble in muriatic acid. Therefore it contained sulphuric acid.

The undissolved residuum, when dried, weighed 129 parts. It dissolved completely in muriatic acid. The solution crystallized in needles; when dissolved in alcohol, it burnt with a purple flame; and, in short, had all the properties of muriat of strontites. Therefore these 129 parts were carbonat of strontites. Now, 100 parts of this carbonat contain 30 of carbonic acid; therefore 129 contain 38.7. Therefore the mineral must contain in 200 parts 90.3 of strontites.

Now, the insoluble residuum of 167 parts was pure sulphat of strontites; and we have seen that it contained 90.3 of strontites. Therefore the sulphuric acid must amount to 76.7 parts†.

† *Journ. de Min.* N° xxxvii. p. 2.

Nearly in the same manner as in the first of these examples, may the analysis of carbonat of lime and barytes be performed; and nearly in the same manner with the second, we may analyse the sulphats of lime and barytes.

315
Phosphats,

Phosphat of lime may be dissolved in muriatic acid, and the lime precipitated by sulphuric acid, and its quantity ascertained by decomposing the sulphat of lime obtained. The liquid solution may be evaporated to the consistence of honey, mixed with charcoal powder, and distilled in a strong heat. By this means phosphorus will be obtained. The impurities with which the phosphat may be contaminated will partly remain undissolved, and be partly dissolved, in muriatic acid. They may be detected and ascertained by the rules laid down in the second section of this chapter.

316
Fluats,

The fluat of lime may be mixed with sulphuric acid and distilled. The fluoric acid will come over in the form of gas, and its weight may be ascertained. What remains in the retort, which will consist chiefly of sulphat of lime, may be analysed by the rules already laid down.

317
And borats.

The borat of lime may be dissolved in nitric or sulphuric acid. The solution may be evaporated to dryness, and the boracic acid separated from the residuum by means of alcohol, which will dissolve it without acting on any of the other ingredients. The remainder of the dry mass may be analysed by the rules laid down in Sect. II. of this Chapter.

Sect. III. *Of the Analysis of Combustibles.*

The only combustibles of whose analysis it will be necessary to speak are coals and sulphur: for the method of analysing the diamond and oil has already been given in the article Chemistry, *Suppl.*

318
Earths of coal how examined.

Coal is composed of carbon, bitumen, and some portion of earth. The earths may be detected by burning completely a portion of the coal to be analysed. The ashes which remain after incineration consist of the earthy part. Their nature may be ascertained by the rules laid down in Sect. II. of this Chapter.

319
Method of detecting the relative proportions of charcoal and bitumen.

For the method of ascertaining the proportion of carbon and bitumen in coal, we are indebted to Mr Kirwan.

When nitre is heated red hot, and charcoal is thrown on it, a violent detonation takes place; and if the quantity of charcoal be sufficient, the nitre is completely decomposed. Now, it requires a certain quantity of pure

carbon

Analysis of Minerals.

carbon to decompose a given weight of nitre. From the experiments of Lavoisier, it follows, that when the detonation is performed in close vessels under water, 13.21 parts of charcoal are capable of decomposing 100 parts of nitre.* But when the detonation is performed in an open crucible, a smaller proportion of charcoal is necessary, because part of the nitre is decomposed by the action of the surrounding air. Scheele found, that under these circumstances 10 parts of plumbago were sufficient to decompose 96 parts of nitre, and Mr Kirwan found, that nearly the same quantity of charcoal was sufficient for producing the same effect.

Macquer long ago observed, that no volatile oily matter will detonate with nitre, unless it be previously reduced to a charcoal; and that then its effect upon nitre is precisely proportional to the charcoal which it contains †. Mr Kirwan, upon trying the experiment with *vegetable pitch* and *maltha*, found, that these substances did not detonate with nitre, but merely burn upon its surface with a white or yellow flame; and that after they were consumed, nearly the same quantity of charcoal was necessary to decompose the nitre which would have been required if no bitumen had been used at all ‡. Now coals are chiefly composed of charcoal and bitumen. It occurred therefore to Mr Kirwan, that the quantity of charcoal which any coal contains may be ascertained by detonating it with nitre: For since the bitumen of the coal has no effect in decomposing nitre, it is evident that the detonation and decomposition must be owing to the charcoal of the coal; and that therefore the quantity of coal necessary to decompose a given portion of nitre will indicate the quantity of carbon which it contains: and the proportion of charcoal and earth which any coal contains being ascertained, its bituminous part may be easily had from calculation.

* *Mem. Sçav. Etrang.* xi. 626.

† *Macquer's Dictionary*, 2d edit. p. 481.

‡ *Mineralogy*, ii. 522.

The crucible which he used in his experiments was large; it was placed in a wind furnace at a distance from the flue, and the heat in every experiment was as equal as possible. The moment the nitre was red hot, the coal, previously reduced to small pieces of the size of a pin head, was projected in portions of one or two grains at a time, till the nitre would no longer detonate; and every experiment was repeated several times to ensure accuracy.

He found, that 480 grains of nitre required 50 grains of Kilkenny coal to decompose it by this method. Therefore 10 grains would have decomposed 96 of nitre; precisely the quantity of charcoal which would have produced the same effect. Therefore Kilkenny coal is composed almost entirely of charcoal.

Cannel coal, when incinerated left a residuum of 3.12 in the 100 parts of earthy ashes. 66.5 grains of it were required to decompose 480 grains of nitre; but 50 parts of charcoal would have been sufficient: therefore 66.5 grains of cannel coal contain 50 grains of charcoal, and 2.08 of earth; the remaining 14.42 grains must be bitumen. In this manner may the composition of any other coal be ascertained.

320 Method of analysing sulphur.

As for sulphur, in order to ascertain any accidental impurities with which it may be contaminated, it ought to be boiled in thirty times its weight of water, afterwards in diluted muriatic acid, and lastly in diluted nitro-muriatic acid. These substances will deprive it of all its impurities without acting on the sulphur itself, at least if the proper cautions be attended to. The sulphur may then be dried and weighed. The deficiency in weight will mark the quantity of the substances which contaminate the sulphur. The solutions may be evaporated and examined, according to the rules laid down in the second and fourth sections of this chapter.

Sect. IV. *Of the analysis of Ores.*

The method of analysing ores must vary considerably, according to the metals which they are suspected to contain. A general method, therefore, of analysing would be of no use, even if it could be given, because it would be too complicated ever to be practised. We shall content ourselves with exhibiting a sufficient number of the analyses of ores, to take in most of the cases which can occur. He who wishes for more information on the subject, may consult the treatise of Bergman on the *Analyses of ores;* Mr Kirwan's treatise on the same subject; and, above all, he ought to study the numerous analyses of ores which have been published by Mr Klaproth. 321 No general method of analysing ores.

I. Analyses of Red Silver Ore.

Mr Vauquelin analysed this ore as follows: 322 Method of analysing red silver ore.

He reduced 100 parts of it to fine powder, poured over it 500 parts of nitric acid previously diluted with water, and applied a gentle heat to the mixture. The colour of the powder, which before the mixture with nitric acid was a deep purple, became gradually lighter, till at last it was pure white. During this change no nitrous gas was extricated; hence he concluded, that the metals in the ore were in the state of oxyds.

When the nitric acid, even though boiled gently, did not appear to be capable of dissolving any more of the powder, it was decanted off, and the residuum, after being carefully washed, weighed 42.06.

Upon these 42.06 parts concentrated muriatic acid was poured; and by the application of heat, a considerable portion was dissolved. The residuum was repeatedly washed with muriatic acid, and then dried. Its weight was 14.6666. One portion of these 14.6666 parts, when thrown upon burning coals, burnt with a blue flame and sulphureous smell. Another portion sublimed in a close vessel without leaving any residuum. In short, they had all the properties of sulphur. Therefore 100 parts of red silver ore contain 14.6666 of sulphur.

The muriatic acid solution was now diluted with a great quantity of water; it became milky, and deposited a white flaky powder, which when washed and dried weighed 21.25. This powder, when heated with tartar in a crucible, was converted into a bluish white brittle metal, of a foliated texture, and possessing all the other properties of antimony. Red silver ore therefore contains 21 25 of oxyd of antimony.

The solution in nitric acid remained now to be examined. When muriatic acid was poured into it, a copious white precipitate appeared, which, when washed and dried, weighed 72.66. It had all the properties of muriat of silver. According to Mr Kirwan's tables, 72.66 of muriat of silver contain 60.57 of oxyd of silver, Therefore red silver ore, according to this analysis, is composed of

60.57	oxyd of silver,
21.25	oxyd of antimony,
14.66	sulphur.
96.48	

The

The loſs, which amounts to 3.52 parts, is to be aſcribed to unavoidable errors which attend ſuch experiments.

II. Antimoniated Silver Ore.

323 Analyſis of antimoniated ſilver ore.

Klaproth analyſed this ore as follows:

On 100 parts of the ore, reduced to a fine powder, he poured diluted nitric acid, raiſed the mixture to a boiling heat, and after pouring off the acid, added new quantities repeatedly, till it would diſſolve nothing more. The reſiduum was of a greyiſh yellow colour, and weighed, when dry, 26.

Thoſe 26 parts he digeſted in a mixture of nitric and muriatic acid; part was diſſolved and part ſtill remained in the form of a powder. This reſiduum, when waſhed and dried, weighed 13 parts. It had the properties of ſulphur; and when burnt, left a reſiduum of one part, which had the properties of ſilica. Antimoniated ſilver ore, therefore, contains, in the 100 parts, 12 parts of ſulphur and 1 of ſilica.

When the nitro-muriatic ſolution was diluted with about 20 times its weight of water, a white precipitate appeared; which, when heated to redneſs, became yellow. Its weight was 13. No part evaporated at a red heat: therefore it contained no arſenic. On burning coals, eſpecially when ſoda was added, part was reduced to a metal, having the properties of antimony; and in a pretty high heat, the whole evaporated in a grey ſmoke. Theſe 13 parts were therefore oxyd of antimony: They contain about 10 parts of metallic antimony; and as the ſtate of oxyd was produced by the action of the nitric acid, we may conclude, that antimoniated ſilver ore contains 10 parts of antimony.

The nitric acid ſolution remained ſtill to be examined. It was of a green colour. When a ſolution of common ſalt was poured in, a white precipitate was obtained, which poſſeſſed the properties of muriat of ſilver. When dried, it weighed 87.75 parts; and when reduced, 65.81 parts of pure ſilver were obtained from it. Antimoniated ſilver ore, therefore, contains 65.81 of ſilver.

Into the nitric acid ſolution, thus deprived of the ſilver, he dropped a little of the ſolution of ſulphat of ſoda; but no precipitate appeared. Therefore it contained no lead

He ſuperſaturated it with pure ammonia, on which a grey precipitate appeared. When dried, it weighed 5 parts. This, on burning coals, gave out an arſenical ſmell. It was rediſſolved in nitric acid; ſulphurated alkali occaſioned a ſmutty brown precipitate; and pruſſic alkali a pruſſian blue, which, after torrefaction, was magnetic. Hence he conclude, that theſe 5 parts were a combination of iron and arſenic acid.

The nitric ſolution, which had been ſuperſaturated with ammonia, was blue; he therefore ſuſpected that it contained copper. To diſcover this, he ſaturated it with ſulphuric acid, and put into it a poliſhed plate of iron. The quantity of copper was ſo ſmall, that none could be collected on the iron.

III. Grey Copper Ore.

324 Analyſis of grey copper ore.

Klaproth analyſed this ore as follows:

Three hundred grains of it, not completely freed from its matrix, were reduced to a fine powder; four times their weight of nitric acid was poured on them, and the whole was digeſted. The acid was then poured off, and an equal quantity again digeſted on the reſiduum. The two acid ſolutions were mixed together. The reſiduum was of a yellowiſh grey colour, and weighed 188 grains.

On this reſiduum ſix times its weight of muriatic acid was boiled. The reſiduum was waſhed, firſt with muriatic acid, and afterwards with alcohol, and the waſhings added to the muriatic acid ſolution. The reſiduum, when dried, weighed 105.5 grains. Part of it burned with a blue flame; and was therefore ſulphur. The reſiduum amounted to 80.25 grains, and had the properties of ſilica. When melted with black flux, about $\frac{3}{4}$ths of a grain of ſilver were obtained from it. Thus 300 parts of grey copper ore contain 25.25 gr. of ſulphur, and 79.5 of ſilica.

The muriatic acid ſolution, which was of a light yellow colour, was concentrated by diſtillation, a few cryſtals of muriat of ſilver appeared in it, which contained about $\frac{1}{4}$th grain of ſilver. The ſolution, thus concentrated, was diluted with a great quantity of water; a white precipitate was depoſited, which, when dried, weighed 97.25 grains. It poſſeſſed the properties of oxyd of antimony, and contained 75 grains of antimony. Therefore 300 grains of grey copper ore contain 70 of antimony.

The nitric acid ſolution was of a clear green colour. A ſolution of common ſalt occaſioned a white precipitate, which was muriat of ſilver, and from which 31.5 grains of ſilver were obtained.

A little ſulphat of potaſs, and afterwards ſulphuric acid, were added, to ſee whether the ſolution contained lead; but no precipitate appeared.

The ſolution was then ſuperſaturated with ammonia; a looſe flaky browniſh red precipitate appeared, which, when heated to redneſs, became browniſh black, and weighed $9\frac{1}{4}$th grains. This precipitate was diſſolved in muriatic acid; half a grain of matter remained undiſſolved, which was ſilica. The muriatic acid ſolution, when pruſſic alkali was added, afforded a blue precipitate; and ſoda afterwards precipitated 1.5 grains of alumina. Therefore 300 grains of grey copper ore contain 7.25 grains of iron, and 1.5 of alumina.

Into the nitric ſolution ſuperſaturated with ammonia, and which was of an azure blue colour, a poliſhed plate of iron was put: By this method 69 grains of copper were obtained.

IV. Sulphuret of Tin.

325 Analyſis of ſulphuret of tin.

Klaproth analyſed this ore as follows:*

On 120 grains of the ore reduced to powder, ſix times their weight of nitro-muriatic acid, compoſed of 2 parts of muriatic, and 1 of nitric acid, were poured. There remained undiſſolved 43 grains, which had the appearance of ſulphur; but containing green ſpots, was ſuſpected not to be pure. After a gentle combuſtion, 13 grains remained; 8 of which were diſſolved in nitro-muriatic acid, and added to the firſt ſolution. The remaining 5 were ſeparated by the filtre, and heated along with wax. By this method about a grain of matter was obtained, which was attracted by the magnet; and which therefore was iron. The reſiduum weighed 3 grains, and was a mixture of alumina and ſilica. Thus 120 grains of ſulphuret of tin contain 30 grains of ſulphur, 1 of iron, and 3 of alumina and ſilica.

* *Obſervations on the Foſſils of Cornwall*, p. 48.

The

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The nitro-muriatic solution was completely precipitated by potass. The precipitate was of a greyish green colour. It was washed and dried, and again dissolved in diluted muriatic acid. Into the solution a cylinder of pure tin was put, which weighed exactly 217 grains. The solution became gradually colourless, and a quantity of copper precipitated on the cylinder of tin, which weighed 44 grains. To see whether it was pure, a quantity of nitric acid was digested on it; the whole was dissolved, except one grain of tin. Therefore 120 grains of sulphuret of tin contains 43 grains of copper.

The cylinder of tin now weighed only 128 grains; so that 89 grains had been dissolved. Into the solution a cylinder of zinc was put; upon which a quantity of tin precipitated. When washed and dried, it weighed 130 grains. The tin he melted with tallow and powdered charcoal; and when cold, he washed off the charcoal. Among the tin globules were found some black flocculi of iron, which weighed one grain. Deducting this grain, and the 89 grains of the tin cylinder which had been dissolved, we see that the 120 grains of sulphuret of tin contained 40 grains of tin besides the grain which had been detected in the copper.

V. Plumbiferous Antimoniated Silver Ore.

326 Analysis of plumbiferous antimoniated silver ore.

Klaproth analysed this ore as follows:

He digested 400 grains of it, reduced to a fine powder, first in five times its weight of nitric acid, and then in twice its weight of the same acid. He then diluted this last portion of acid with eight times its weight of water, and continued the digestion. The undissolved residuum, when washed and dried, weighed 326 grains.

On this residuum he boiled muriatic acid repeatedly. The solution, on cooling, deposited acicular crystals. These he carefully separated, and put by. The undissolved residuum weighed 51 grains. It had the properties of sulphur. When burned, it left one grain of silica.

The muriatic acid solution was concentrated to half its former bulk by distillation: this made it deposite more acicular crystals. He continued the distillation as long as any crystals continued to appear. He then collected the whole of these crystals together. They had the properties of muriat of lead. When mixed with twice their weight of black flux, and heated in a crucible lined with charcoal, they yielded $160\frac{1}{8}$ grains of lead.

Sulphuret of ammonia was now added to the muriatic acid solution; an orange-coloured precipitate appeared, which shewed that the solution contained antimony. It was precipitated by a copious effusion of water, and by soda. The oxyd of antimony being reduced to a mass with Spanish soap, mixed with black flux, and heated in a lined crucible, yielded 28.5 grains of antimony.

Into the nitric acid solution, obtained by the first part of the process, a solution of muriat of soda was dropped; a white precipitate was deposited, and over it acicular crystals. These crystals he dissolved, by pouring boiling water on the precipitate. The water was added to the nitric acid solution. The white precipitate was muriat of silver: when heated with twice its weight of soda, it yielded 81.5 grains of silver.

He now concentrated the nitric acid solution by evaporation; and then adding a solution of sulphat of soda, a white precipitate was obtained, which had the properties of sulphat of lead, and weighed 43 grains. It contained 32 grains of pure lead.

He now poured ammonia into the solution; a pale brown precipitate was obtained, which weighed 40 grains, and which appeared to consist of oxyd of iron and alumina. He redissolved it in nitric acid, precipitated the iron by prussic alkali, and the alumina by soda. The alumina after being heated to redness, weighed 28 grains; consequently the oxyd of iron was 12 grains, which is equivalent to 9 grains of iron.

VI. Molybdat of Lead.

Mr Hatchett analysed this ore as follows †:

327 Analysis of molybdat of lead.

On 250 grains of the ore, reduced to a fine powder, he poured an ounce of strong sulphuric acid, and digested the mixture in a strong heat for an hour. When the solution was cool, and had settled, he decanted it off, and washed the undissolved powder with pure water, till it came away tasteless. This operation was repeated twice more; so that three ounces of sulphuric acid were used. All these solutions were mixed together, and filtered.

Four ounces of a solution of carbonat of soda were poured upon the powder which remained undissolved, and which consisted of sulphat of lead. The mixture was boiled for an hour, and then poured off. The powder was then washed, and diluted nitric acid poured on it: The whole was dissolved, except a little white powder, which, when washed, and dried on a filter by the heat of boiling water, weighed seven-tenths of a grain. It possessed the properties of silica.

The nitric acid solution was saturated with pure soda; a white precipitate was obtained, which, when washed, and dried for an hour in a heat rather below redness, weighed 146 grains. It possessed the properties of oxyd of lead.

To see whether this oxyd of lead contained any iron, it was dissolved in diluted nitric acid, and the lead precipitated by sulphuric acid. The solution was then saturated with ammonia; a brown powder precipitated, which, when dried, weighed one grain, and had the properties of oxyd of iron.

The sulphuric acid solution was of a pale blue colour: It was diluted with 16 times its weight of pure water, and then saturated with ammonia. It became of a deep blue colour, and appeared turbid. In 24 hours a pale yellow precipitate subsided, which, when collected on a filter, and dried by a boiling water heat, weighed 4.2 grains. Its colour was yellowish brown. Muriatic acid dissolved it, and prussiat of potass precipitated it from its solution in the state of prussian blue. It was therefore oxyd of iron.

The sulphuric acid solution, saturated with ammonia, was gradually evaporated to a dry salt. This salt was a mixture of molybdat of ammonia and sulphat of ammonia. A strong heat was applied, and the distillation continued till the whole of the sulphat of ammonia was driven off; and to be certain that this was the case, the fire was raised till the retort became red hot. The residuum in the retort was a black blistered mass; three ounces of nitric acid, diluted with water, were poured upon it, and distilled off. The operation was again repeated.

† *Phil. Trans.* lxxxvi. 320.

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peated. By this method the oxyd of molybdenum was converted into a yellow powder, which was yellow acid of molybdenum. It weighed 95 grains.

VII. Grey Ore of Manganese.

Mr Vauquelin analysed this ore as follows ‡.

‡ *Jour. de Min.* N° xvii. p. 12.

328 Analysis of grey ore of manganese.

When 200 grains of it were exposed to a strong heat in a retort, there came over 10 grains of water, and 18 cubic inches of oxygen gas, mixed with a little carbonic acid gas. The mineral now weighed only 176 grains. Therefore the weight of the gas was 14 grains.

On 200 grains of the same mineral muriatic acid was poured, and heat applied. 75 cubic inches of oxy-muriatic acid gas came over, which, though mixed with some carbonic acid gas, enflamed metals when reduced to powder. When no more gas came over, the residuum was boiled. The whole was dissolved, except a white powder, which weighed 12 grains, and which possessed the properties of silica.

Carbonat of potass was poured into the solution; a white precipitate was obtained, which became black by exposure to the air, and weighed 288 grains. Strong nitric acid was boiled on it repeatedly to dryness. It became of a deep black colour, and, when well washed with water and dried, weighed 164 grains. This powder was black oxyd of manganese.

To see whether it contained iron, nitric acid, with a little sugar, was poured upon it, and digested on it. The acid dissolved it completely. Therefore no oxyd of iron was present.

Into the water with which the black oxyd of manganese had been washed, carbonat of potass was poured; a white powder precipitated, which, when dried, weighed 149 grains, and which possessed the properties of carbonat of lime.

VIII. Wolfram.

329 Analysis of wolfram.

Messrs Vauquelin and Hecht analysed this mineral as follows:

On 200 parts of wolfram in powder, three times its weight of muriatic acid were poured, and the mixture boiled for a quarter of an hour: a yellow powder appeared, and the solution was of a brown colour. The acid was allowed to cool, and then carefully decanted off, and the residuum washed. The residuum was then digested for some hours with ammonia, which dissolved a part of it. The residuum was washed, and new muriatic acid again poured over it; then the residuum was digested with ammonia, as before: and the operation was continued till the whole wolfram was dissolved.

All the ammoniacal solutions being joined together, were evaporated to dryness, and the salt which remained was calcined: a yellow powder was obtained: it weighed 134 grains, and was yellow acid of tungsten.

Into the muriatic acid solutions, which were all mixed together, a sufficient quantity of sulphuric acid was poured to decompose all the salts. The solution was then evaporated to dryness; and the salts which were obtained by this evaporation were redissolved in water. A white powder remained, which weighed three grains, and which possessed the properties of silica.

The excess of acid of the solution was saturated with carbonat of potass; the liquor became brown, but nothing precipitated. When boiled, a red powder precipitated, and the brown colour disappeared. The addition of more carbonat of potass caused a farther precipitation of a yellowish powder. This precipitate consisted of the oxyds of iron and manganese combined. Nitric acid was distilled off it repeatedly; it was then boiled in acetous acid. The acetous solution was precipitated by potass. Nitric acid was again distilled off it, and it was again boiled in acetous acid. This process was repeated till nitric acid produced no further change. The different powders which could not be dissolved in the acetous acid were collected, mixed with a little oil, and heated red hot. The powder became black, and was attracted by the magnet. It was therefore oxyd of iron. It weighed 36 grains.

The acetous solution contained the oxyd of manganese: It was precipitated by an alkali, and, when dried, weighed 12.5 grains.

IX. Oxyd of Titanium and Iron.

330 Analysis of oxyd of titanium and iron.

Vauquelin analysed this ore as follows:

A hundred parts of the ore, reduced to a fine powder, and mixed with 400 parts of potass, were melted in a silver crucible for an hour and a half. When cool, the mixture was diluted with water; a powder remained of a brick red colour, which, when washed and dried, weighed 124 parts.

The watery solution had a fine green colour; when an excess of muriatic acid was added, it became red. By evaporation the liquor lost its colour. When evaporated to dryness, a salt remained, which was totally dissolved by water. From this solution carbonat of potass precipitated two parts, which had the properties of oxyd of manganese.

The 124 parts of residuum were boiled in a solution of pure potass for an hour. The solution was saturated with an acid, filtered, and carbonat of potass added, which precipitated three parts. These had the properties of oxyd of titanium.

The remainder of the 124 parts of residuum, which still was undissolved, was boiled with diluted muriatic acid. The liquor became yellow, and deposited 46 parts of a white powder, with a tint of red. This powder was soluble in sulphuric and muriatic acids: from these solutions, it was precipitated of a brick red colour by the infusion of nut galls; of a green colour by sulphuret of ammonia and prussiat of potass; and of a white colour by carbonat of potass and pure ammonia. A rod of tin made these solutions red; a rod of zinc made them violet. These 46 parts, therefore, are oxyd of titanium.

The muriatic solution, from which these 46 parts were deposited, formed, with prussiat of potass, a prussian blue; and ammonia precipitated from it 50 parts, which had the properties of yellow oxyd of iron.

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Potstone, 76.
Prehnite, 72.
Pudding stone, 136.
Pumice, 157.
Puzzolano, 156.
Pyrites, 216.
Pyromachus, 32.
Pyroxen, 87.

Q.

Quartz, 30.
——— elastic, 31.

R.

Realgar, 259.
Red antimonial ore, 251.
——— chalk, 121.
——— copper glass, 208.
——— iron ore, 224.
——— lead ore of Siberia, 289.
Red silver ore, n° 191.
Reddle, 121.
Rock crystal, 30.
Rubellite, 39.
Ruby, 28.
——— balass, 28.
——— bohemian, 30.
——— occidental, 36.
——— octohedral, 28.
——— oriental, 25.
——— spinell, 28.

S.

Sagenite, 283.
Sand, 127.
Sandstone, 131.
Sappare, 74.
Sapphyr, oriental, 25.
——— occidental, 36.
Scapiform iron ore, 225.
Seafroth, 81.
Selenite, 97.
Serpentine, 75.
Shiller spar, 54.
Shistus, argillaceous, 79.
Shorl, 46.
——— green, 73.
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——— red, 39. 283.
Shorlite, 38.
Sienite, 142.
Silex, 32.
Siliceous spar, 78.
Silver, native, 184.
Sinople, 30.
Slate, n° 79.
Smaragdite, 80.
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Sparry iron ore, 227.
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Spinell, 28.
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T.

Talc, 51.
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Till, 129.
Tin pyrites, 231.
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Topaz, ancient, 83.
——— false, 30.
——— occidental, 36.
——— oriental, 25.
——— Saxon, 36.
Tourmaline, 48.
Transparency, 7.
Trap, 146.
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Tufa, tellaceous, 96.
Tungsten, 277.

V.

Vesuvian, 60.
Vitreous silver ore, 187.
——— copper ore, 204.
Volcanic ashes, 158.
Uranitic ochre, 281.

W.

Wacken, 148.
White copper ore, 203.
——— lead spar, 239.
Witherite, 102.
Wolfram, 276.
Woodtin, 232.

Y.

Yanolite, 71.
Yellow chalk, 122.
——— copper ore, 208.

Z.

Zeolite, 66.
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Mingun, ‖ Miquelon

MINGUN *Islands*, on the N. side of the mouth of the river St Lawrence. They have the island Anticosti S. distant 10 leagues. N. lat. 50° 15′, W. long. 63° 25′.—*Morse*.

MINGO-TOWN, an Indian town on the W. bank of the Ohio river, 86 miles N. E. of Will's-Town, by the Indian Path, and 40 south-westerly of Pittsburg. It stands a few miles up a small creek, where there are springs that yield the *petrol*, a bituminous liquid.—*ib.*

MINGOES, an Indian nation who inhabit near the southern branch of the Sciota river. Warriors, 50. —*ib.*

MINISINK, a village in New-Jersey, on the N. W. corner of the State, and on the western side of Delaware river; about 5 miles below Montague, and 57 N. W. of Brunswick.—*ib.*

MINISINK, a township in Orange county, New-York, bounded easterly by the Wallkill, and southerly by the State of New-Jersey. It contains 2,215 inhabitants; of whom 320 are entitled to be electors, and 51 are slaves.—*ib.*

MIQUELON, a small desert island, 8 miles S. W. of Cape May in Newfoundland island. It is the most westerly of what have been called the 3 islands of St Pierre or St Peter, and is not so high as the other two; but its soil is very indifferent, and it is not more than three-fourths of a league in length. There is a passage or channel from the westward along by the N. end of this island into Fortune Bay on the S. coast of Newfoundland. N. lat. 47° 4′, W. long. 55° 55′. It is sometimes called *Meguelon*.—*ib.*

Mirabeau.

MIRABEAU (Honnoré Gabriel, Comte de), well known both by his writings, and the active part which he took in bringing about the French revolution, was born in 1749 of a noble family. Throughout life, he displayed a spirit averse from every restraint, and was one of those unhappy geniuses in whom the most brilliant talents serve only as a scourge to themselves and all around them. It is told by his democratical panegyrists, as a wonderful proof of family tyranny under the old government, that not less than 67 *lettres de cachet* had been obtained by Mirabeau the father against this son and others of his relatives. This story, if true, proves, with at least equal force, what many anecdotes confirm, that, for his share of them, the son was not less indebted to his own ungovernable disposition than to the severity of his parent. He was indeed a monster of wickedness. Debauchery, gaming, impiety, and every kind of sensuality, were not enough for him. He was destitute of decency in his vices; and to supply his expences, Mirabeau. expences, scrupled not to perform tricks which would disgrace a thief-catcher. His father and mother disagreeing, commenced a process of separation; when Mirabeau, just liberated from prison for a gross misdemeanor, was in want of money. He went to his father, sided with him against his mother, on whom he poured a torrent of invectives; and, for 100 guineas, wrote his father's memorial for the court. He then went to his mother; and by a similar conduct got the same sum from her; and both memorials were presented. That the father of such a man should frequently get him shut up in prison, can excite no surprise; for confinement only could withhold him from the perpetration of crimes.

The talents of Mirabeau led him frequently to employ his pen; and his publications form the chief epochas of his life. His first publication was, 1. *Essai sur le Despotisme*, "An Essay on Despotism," in 8vo. Next, in one of his confinements, he wrote, 2. a work in 2 vols 8vo, *On Lettres de Cachet*. 3. *Considerations sur l'Ordre de Cincinnatus*, 8vo. A remonstrance against the order of Cincinnatus, proposed at one time to be established in America. The public opinion in America favoured this remonstrance, and it proved effectual. 4. His next work was in favour of the Dutch, when Joseph II. demanded the opening of the Scheldt, in behalf of the Brabançons. It is entitled, *Doutes sur la Liberté de l'Escant*, 8vo. 5. *Lettre à l'Empereur Joseph II. sur son Réglement concernant l'Emigration;* a pamphlet of forty pages, in 8vo. 6. *De la Caisse d'Escompte;* a volume in 8vo, written against that establishment. 7. *De la Banque d'Espagne*, 8vo; a remonstrance against establishing a French bank in Spain. A controversy arising upon this subject, he wrote again upon it. 8. Two pamphlets on the monopoly of the water company in Paris.

Soon after the publication of these works, he was sent in a public character to the court of Berlin; where he conducted the king's affairs just as he had formerly done those of his father and mother, fully ready to facrifice all parties, and to sell himself to the highest bidder. With such a disposition, he could not long avoid the notice of the Prussian illuminees; and Nicolai Biester, Gedicke, and Leuchsenring, soon became his constant companions. At Brunswick he met with Mauvillon, the worthy disciple of Philo Knigge, and at that time a professor in the Caroline college. This was the man who initiated the profligate Marquis in the last mysteries of illuminism.

Mirabeau was still at Berlin when Frederick II. died. That monarch, as is well known, was a naturalist, who holding this life for his all, encouraged the propagation of infidelity in his dominions, from which resulted the very worst consequences to the peace of society. Of this truth his successor Frederick William was duly sensible; and determined to support the church establishment in the most peremptory manner, consistent with the principles of religious toleration. He published, therefore, soon after his accession, an edict on religion, which is a model worthy of imitation in every country; but it was attacked with the greatest virulence in numberless publications. It was called an unjustifiable tyranny over the consciences of men; the dogmas supported by it were termed absurd superstitions; the king's private character and his religious opinions were ridiculed and scandalously abused. The most daring of Mirabeau. these attacks was a collection of anonymous letters on the constitution of the Prussian states, universally believed to be the composition of Mirabeau, who certainly wrote a French translation, with a preface and notes more impudent than the work itself. The monarch is declared to be a tyrant; the people of the Prussian dominions are addressed as a parcel of tame wretches, crouching under oppression; and the inhabitants of Silesia, represented as still in a worse condition, are repeatedly called upon to rouse themselves, and assert their rights.

About this time he published, 9. An *Essai sur le Secte des Illuminés;* one of the strangest and most impudent books that ever appeared. In it he describes a sect existing in Germany, called the *Illuminated;* and says, that they are the most absurd and gross fanatics imaginable, waging war with every appearance of reason, and maintaining the most *ridiculous superstitions*. He gives some account of these, and of their rituals and ceremonies, as if he had seen them all; yet no such society as he describes ever existed: and Mirabeau employed his powers of deception, merely to screen from observation the real *illuminati*, by holding out to the rulers of states this *ignis fatuus* of his own brain. For a while the essay certainly contributed to blind the eyes of the German princes; and Nicolai, with others of the junto, adopting the whim, called Mirabeau's fanatics *Obscuranten*, and joined with him in placing on the list of *Obscuranten* several persons whom they wished to make ridiculous.

Long before his initiation in the mysteries of illuminism, Mirabeau had been acquainted with all the revolutionary powers of the masonic lodges; nor did he when initiated, undervalue those which flowed, or might flow, from Weishaupt's inventive genius. On his return to France, he began to introduce the new mysteries among some of his masonic brethren. His first associate was the Abbé Talleyrand de Perigord, who had already begun to act the part of Judas in the first order of the church. But to have only introduced the mysteries was not sufficient for the Marquis; he would have teachers come from Germany, who were better versed than he was in the illuminizing arts. Well acquainted with the reasons that had induced the chiefs of the order to defer the conversion of France, he found means to convince them, that the time was now come for the accomplishment of their views; and at his request a deputation was sent by Spartacus to illuminize that great kingdom. See ILLUMINATI, n° 40, 41, *Suppl*.

When the assembly of Notables was convened at Paris, Mirabeau foretold that it would soon be followed by a meeting of the States; and at that period he published a volume against the stockjobbing, then carried to a great height, intitled, 10. *Denonciation de l'agiotage au Roi, et a l'Assemblée de Notables*, 8vo. A *lettre de cachet* was issued against him in consequence of this publication; but he eluded pursuit, and published a pamphlet as a sequel to the book. His next work was against M. Necker, 11. *Lettre á M. de Cretelle, sur l'Administration de M. Necker*, a pamphlet in 8vo. 12. A volume, in 8vo. against the Stadtholdership: *Aux Bataves, sur le Stadthouderat.* 13. *Observations sur la maison de force appelié Bicetre*, an 8vo pamphlet. 14. Another

Mirabeau. Another tract, intitled, *Conseils à un jeune Prince qui sent la nécessité de refaire son education*. 15. He now proceeded to a larger and more arduous work than any he had yet published, on the Prussian monarchy under Frederick the Great: *De la Monarchie Prussienne sous Fréderic le Grand*. 4 vols, 4to, or eight in 8vo. In this work, he undertakes to define precisely how a monarchy should be constituted. When the orders were issued for convening the States general, Mirabeau returned into Provence: and at the same time published, 16. *Histoire Secrette de la Cour de Berlin*, two volumes of letters on the Secret History of the Court of Berlin. This work was condemned by the parliament of Paris, for the unreserved manner in which it delivered the characters of many foreign princes. As the elections proceeded, he offered himself a candidate in his own order at Aix; but he was so abhorred by the noblesse, that they not only rejected him, but even drove him from their presence. This affront settled his measures, and he determined on their ruin. He went to the commons, disclaimed his being a gentleman, set up a little shop in the market-place of Aix, where he sold trifles; and now, fully resolved what line he should pursue, he courted the commons, by joining in all their excesses against the noblesse, and was at last returned a member of the assembly.

In consequence of this, he went to Paris; where the part he took was active, and such as tended, in general, to accelerate all the violences of the revolution. He now published, periodically, 17. his *Lettres à ses Commettans*, Letters to his Constituents, which form, when collected, 5 vols, 8vo. It is supposed, that the fatal measure of the junction of the three orders into one national assembly, was greatly promoted by these letters. The public events of these times, and the part taken in them by Mirabeau, are the subject of general history. He lived to see the constitution of 1789 established, but not to see its consequences—the destruction of the monarchy, the death of the king, and the ruin of all property! He was accused, as well as the duke of Orleans, of hiring the mob which attacked Versailles on the 5th and 6th of October 1789; but with him was also acquitted by the tribunal of the Châtelet. The dominion of his eloquence in the National Assembly had long been absolute, and on the 29th of January 1791, he was elected president. At the latter end of March, in the same year, he was seized by a fever, and died on the 2d of April.

The talents of Mirabeau will not be doubted, though they were certainly rather brilliant than profound. To be noticed, and to lead, were the sole objects of his ambition; and for the attainment of them, he took the side of the discontented, as the best field for his matchless eloquence. Yet there was no man more devoted to the principles of a court than this Marquis, provided he could have a share in the administration; and a share he would have obtained, if any thing moderate would have satisfied him: But he thought nothing worthy of him but a place of active trust, and a high department; stations which all knew him not qualified to fill. Wanting knowledge of great things, he was learned only in the bustling detail of intrigue, and would, at any time, have sacrificed his dearest friend, and the interests of his country, for an opportunity of exercising his brilliant eloquence, and indulging his propensity to satire and lampoon. But the greatest obstacle to his advancement under the old government was the abject worthlessness of his character. Drinking was the only vice in which he did not indulge; and from this he was restrained by his exhausted constitution. To his brother, the Viscount, who was frequently intoxicated, the Marquis one day said, "How can you, brother, so expose yourself?" "What (replied the Viscount)! how insatiable are you? Nature has given you every vice; and having left me only this one, you grudge it me!"

Miragoane, || Mississippi.

MIRAGOANE, a town on the N. side of the south peninsula of the island of St Domingo, and S. side of the Bight of Leogane, at the head of a bay of its name. It is on the road from Jeremie to Port au Prince, about 31 leagues E. by S. of the former, and 23 W. by S. of the latter. N. lat. 18° 27'.—*Morse.*

MIRAMICHI, or *Mirachi*, a port, bay and river on the N. E. coast of New-Brunswick. The port is at the mouth of the river. The entrance into the bay is very wide; it has Point Portage for its northern entrance, and its southern side is formed by Escuminax point, which is 53 miles N. E. of Shediac harbour, and 34 S. E. of the mouth of Nipisighit river, which empties into Chaleur bay. There is a salmon fishery in Miramichi river.—*ib.*

MIRAY *Bay*, on the coast of the island of Cape Breton, is to the S. from Morienne Bay. Large vessels may go up 6 leagues, and have good anchorage, and lie secure from all winds. N. lat. 46° 5', W. long. 59° 49'.—*ib.*

MIREBALAIS, an interior town in the French part of the island of St Domingo, situated nearly 12 leagues N. of Port au Prince, on the road from that city to Varettes; from which last it is 14 leagues south-east.—*ib.*

MISCOTHINS, a small tribe of Indians who inhabit between Lake Michigan and the Mississippi.—*ib.*

MISERY, an isle between Salem and Cape Ann in Massachusetts.—*ib.*

MISKO, an island on the south-west side of Chaleur Bay, at its mouth.—*ib.*

MISSINABE *Lake* is situated in the north part of North-America, in lat. 48° 29' 42" N. and long. 84° 2' 42" W.—*ib.*

Missinabe *House* is situated on the east side of Moose river, 8 miles from Missinabe lake, and 80 W. by S. of Frederick House; and is a station belonging to the Hudson Bay Company.—*ib.*

MISSIQUASH *River*. Nova-Scotia and New-Brunswick provinces are separated by the several windings of this river, from its confluence with Beau Basin (at the head of Chignecto channel) to its rise or main source; and from thence by a due east line to the bay of Verte, in the straits of Northumberland.—*ib.*

MISSISSIPPI *River*. This noble river, which, with its eastern branches, waters five eighths of the United States, forms their western boundary, and separates them from the Spanish Province of Louisiana and the Indian country. Its sources have never been explored; of course its length is unknown. It is conjectured, however, to be upwards of 3,000 miles long. The tributary streams which fall into it from the west and east, are numerous, the largest of which are the Missouri from the west, and the Illinois, Ohio, and Tennessee from the east. The country on both sides of the

Miſſiſſippi, and on its tributary ſtreams, is equal in goodneſs to any in N. America. This river is navigable to St Anthony's Falls without any obſtruction, and ſome travellers deſcribe it as navigable above them. On both ſides of this river are ſalt ſprings or licks, which produce excellent ſalt; and on its branches are innumerable ſuch ſprings. Beſides the coal mines in the upper parts of the Ohio country, there are great quantities of coal on the upper branches of this river. An iſland of conſiderable ſize is formed by its mouths, beſides many ſmaller iſles. Theſe mouths are ſituated between the latitude of 29° and 30° N. and between the longitude of 89° and 90° W.—*ib.*

MISSOURI *River*, in Louiſiana, falls into the Miſſiſſippi from the weſtward, 18 miles below the mouth of the Illinois, 195 above the mouth of the Ohio, and about 1160 miles from the Balize, or mouths of the Miſſiſſippi in the gulf of Mexico. We have not ſufficient knowledge of this river to give any correct account of the extent of its navigation. In Capt. Hutchins's map, it is ſaid to be navigable 1300 miles.—*ib.*

MISSOURIS, one of the Indian nations who inhabit the banks of the above river, having, it is ſaid, 1500 warriors.—*ib.*

MISTAKE *Bay*, a large bay on the weſt ſide of the entrance of Davis's Straits, and to the north of Hudſon's Straits; from which it is ſeparated by a peninſula of the north main on the W. and Reſolution Iſland on the ſouth. It is to the N. E. of Nieva Iſland, and N. W. of Cape Elizabeth.—*ib.*

MISTAKEN *Cape*, the ſouth point of the eaſternmoſt of the Hermit's Iſlands, is about 3 leagues E. N. E. from Cape Horn, at the extremity of S. America. Between theſe, it is ſuppoſed, there is a paſſage into Naſſau Bay.—*ib.*

MISTAKEN *Point*, to the weſtward of Cape Race, at the S. E. point of the Iſland of Newfoundland, and to the eaſtward of Cape Pine, is ſo called becauſe it has been frequently miſtaken by ſeamen for Cape Race when they firſt make the iſland from the ſouthward, though it is 2 leagues W. N. W. from it.—*ib.*

MISTIC, or *Myſtic*, a ſhort river which falls into the north ſide of Boſton harbour, by a broad mouth on the eaſt ſide of the peninſula of Charleſtown. It is navigable for ſloops 4 miles to the induſtrious town of Medford; and is croſſed, a mile above its mouth, by a bridge 130 rods in length, through which veſſels paſs by means of a draw.—*ib.*

MISTINSINS, an Indian nation who inhabit on the ſouthern ſide of the lake of the ſame name in Lower Canada.—*ib.*

MISTISSINNY *Lake*, in Canada, on the S. E. ſide of which is a Canadian Houſe, or ſtation for trade. —*ib.*

MISTRAL, the name of a wind, which is mentioned in almoſt every account that we have of Provence, and which is remarkable for blowing almoſt the whole year from north-weſt or weſt-north-weſt, in a climate where the wind ſhould be variable. It is ſaid to contribute to the ſalubrity of the air, by diſperſing the exhalations of the marſhes and ſtagnant waters, ſo common in the ſouth of Languedoc and Provence; but at times it is alſo very injurious, or at leaſt very troubleſome. It is not, however, on either of theſe accounts that it is introduced into this Work, but for the ſake of the cauſes aſſigned by Sauſſure for its conſtancy, which may be applied to other winds that nearly reſemble it; and which he found might be reduced to three.

"The firſt and moſt effectual cauſe (he ſays) is the ſituation of the Gulf of Lyons, the banks of which are the principal theatre of its ravages. This Gulf, in fact, is ſituated at the bottom of a funnel, formed by the Alps and Pyrenees. All the winds blowing from any point between weſt and north, are forced by theſe mountains to unite in the Gulf. Thus, winds which would not have prevailed but at one extremity of the Gulf, or even much beyond it, are obliged to take this route, after having undergone the repercuſſion of theſe mountains; and the middle of the Gulf, inſtead of the calm which it might have enjoyed, is expoſed to the united efforts of two ſtreams of wind, deſcending in different directions. Hence ariſe thoſe whirlwinds which ſeem to characteriſe the miſtral, and appear to have induced the ancients to call it *Circius, à turbine ejus ac vertigine.* See *Aul. Gellius*, l. ii. cap. 22.

"The ſecond cauſe is, the general ſlope of the grounds, deſcending from all ſides towards the Gulf; which becoming all at once lower and more ſoutherly than the lands extending behind it, is, from theſe joint circumſtances, rendered the hotteſt point of all the adjacent country: and, as the air on the ſurface of the earth always tends from the colder to the warmer regions, the Gulf of Lyons is actually the centre towards which the air from all colder points between eaſt and weſt muſt preſs. This cauſe, then, alone would be productive of winds directed to the Gulf, even if the repercuſſion of the mountains did not exert its influence.

"Finally, it is well known, that in all gulfs the land-winds blow more forcibly than oppoſite to plains and promontories, whatever be the ſituation of thoſe gulfs. I apprehend, indeed, on ſtrict examination (ſays our author), that this cauſe is blended with the preceding; but as the fact is generally admitted, and in ſome caſes can be explained only by reaſons drawn from the effects of heat, it may not improperly, perhaps, be diſtinctly mentioned. It is, at leaſt, neceſſary to ſuppoſe, that ſeveral cauſes produce the miſtral, in order to underſtand why, notwithſtanding the variableneſs of the ſeaſons and temperatures, that wind is ſo ſingularly conſtant in Lower Languedoc and Lower Provence. A very remarkable inſtance of this conſtancy is recorded by the Abbé Papon, in his *Voyage de Provence*, tom. ii. p. 81. He aſſerts, that during the years 1769 and 1770, the miſtral continued for fourteen months ſucceſſively. But the three cauſes which I have ſtated, taken ſeparately, will explain its frequency, and united, will account for its force."

MITCHELL'S *Eddy*, the firſt falls of Merrimack river, 20 miles from its mouth, and 8 above the new bridge which connects Haverhill with Bradford. Thus far it is navigable for ſhips of burden.—*Morſe.*

MITCHIGAMAS, an Indian nation, who with the Piorias inhabit near the ſettlements in the Illinois country.—*ib.*

MIXT ANGLE, or *Figure*, is one contained by both right and curved lines.

Mixt Number, is one that is partly an integer and partly a fraction; as $3\frac{1}{2}$.

Mixt Ratio, or *Proportion*, is when the sum of the antecedent and consequent is compared with the difference of the antecedent and consequent;

$$\text{as if} \begin{cases} 4 : 3 :: 12 : 9 \\ a : b :: c : d \end{cases}$$

$$\text{then} \begin{cases} 7 : 1 :: 21 : 3 \\ a+b : a-b :: c+d : c-d. \end{cases}$$

MOAGES *Islands*, on the N. coast of S. America, in the entrance of the Gulf of Venezuela. They extend from N. to S. and lie west of the Island of Aruba; are 8 or 9 in number, and all, except one, low, flat and full of trees. The southernmost is the largest. —*Morse*.

MOBILE, a large navigable river, formed by two main branches the Alabama, and Tombigbee, in the south-western part of Georgia, just below a considerable island, the south point of which is in about lat. 31° 26′ N. and long. 87° 55′ W. Thence pursuing a south course into West-Florida, the confluent stream enters the Gulf of Mexico, at Mobile Point in lat. 30° 17′ N. 11 leagues below the town of Mobile. Large vessels cannot go within 7 miles of the town. The breadth of the bay is in general about 3 or 4 leagues. Vast numbers of large alligators bask on the shores, as well as swim in the rivers and lagoons. From the north-eastern source of the waters of the Alabama to Mobile Point, at the mouth of Mobile Bay, is, according to the best maps, about 460 miles: large boats can navigate 350 miles, and canoes much farther.—*ib.*

Mobile, a city of West-Florida, formerly of considerable splendor and importance, but now in a state of decline. It is pretty regular, of an oblong figure, and situated on the W. bank of the river. The Bay of Mobile terminates a little to the north-eastward of the town, in a number of marshes and lagoons; which subject the people to fevers and agues in the hot season. It is 33 miles north of Mobile point, about 40 below the junction of the two principal branches of Mobile river, and 30 W. N. W. of Pensacola. There are many very elegant houses here, inhabited by French, English, Scotch, and Irish. Fort Conde, which stands very near the bay, towards the lower end of the town, is a regular fortress of brick; and there is a neat square of barracks for the officers and soldiers. Mobile, when in possession of the British, sent yearly to London skins and furs to the value of from 12 to £15,000 sterling. It surrendered to the Spanish forces in 1780.—*ib.*

MOBJACK *Bay*, sets up N. W. from Chesapeak Bay, into Gloucester county, Virginia, on the north side of York river.—*ib.*

MOCASSIMAH, in Bengal, revenue settled by a division of the produce.

MOCHULKAH, bond or obligation.

MOCOA, a city of Terra Firma, S. America, situated at the main source of Oronoko river, there called Inirchia.—*Morse*.

MOCOMOKO, or *Little Oroncko*, a river to the S. E. of the great river Oronoko, on the east coast of S. America, 4 leagues westward of Amacum.—*ib.*

MODER and *Daughters Islands*, a long island 2 leagues east by south of the Father, or Vaader Island, with 2 small ones, so called, near Cayenne, on the east coast of S. America, not far from the Constables, and in about lat. 5° N. long. 52° W.—*ib.*

MŒRIS, a lake in Egypt, occasionally mentioned in that article (*Encycl.*), and generally supposed the production of human art. Of this, however, Mr Brown says it bears no mark. "The shape, as far as was distinguishable, seems, not inaccurately laid down in D'Anville's map, unless it be, that the end nearest the Nile should run more in a north west and south-east direction. The length may probably be between 30 and 40 miles; the breadth, at the widest part he could gain, was 5000 toises, as taken with a sextant; that is, nearly six miles. The utmost possible extent of circuit must of course be 30 leagues. On the north-east and south is a rocky ridge, in every appearance primeval. In short, nothing can present an appearance more unlike the works of men. Several fishermen, in miserable boats, are constantly employed on the lake. The water is brackish, like most bodies of water under the same circumstances. It is, in the language of the country, *Birket-el-kerun*, probably from its extremities bearing some resemblance to horns.

MOFUSSEL, a relative term, signifying the subordinate lands or districts, opposed to Sudder, which is the head.

MOGHULBUGHKITUM, or *Muhulbucktitum*, a creek which runs westward to Alleghany river, in Pennsylvania. It is passable in flat-bottomed boats to the settlements in Northumberland county. Wheeling is its northern branch.—*Morse*.

MOHACZ, Mohatz, or *Mohoz*, a town in the Lower Hungary, upon the Danube, between the river Sarwiza to the north, and the Drave to the south; four German miles from either, six from Esseck to the north, and nine from Colocoa to the south. This otherwise small place is memorable for two great battles here fought; the first between Lewis king of Hungary and Solyman the Magnificent, in 1526: in which that unfortunate Prince Lewis (being about 20 years old), with 25,000 men, fought 300,000 Turks; when, being overpowered by numbers, 22,000 of the Christian army were slain upon the place; 5000 waggons, eighty great cannon, 600 small ones, with all their tents and baggage, were taken by the victors; and the King, in his flight over the brook Curass, fell into a quagmire, and was swallowed up. After which, Solyman took and slew 200,000 Hungarians, and got such a footing in that kingdom, that he could never be expelled. This fatal battle was fought October 29. The second, in some part, retrieves the loss and infamy of the former. The Duke of Loraine being sent by the Emperor, with express orders to pass the Drave and take Esseck, his highness, July 10, 1687, with great difficulty passed that river, then extremely swelled with rains; but finding the Prime Visier encamped at Esseck, with an army of 100,000 men, so strongly, that it was not possible to attack him in that post without the ruin of the Christian army, he retreated, and repassed it the 23d of the same month; where, upon the 29th, the Prime Visier passed that river at Esseck; and upon August 12th, there followed a bloody fight, in which the Turks lost 100 pieces of cannon, 12 mortars, all their ammunition, provisions, tents, baggage, and treasure, and about 8000 men upon the place of battle, besides what were drowned in paffing the river, which could never be known. After which victory, General Duncwalt, September 30th, found Effeck totally deferted by the Turks, and took poffeffion of it.

MOHAWK *River*, in New York, rifes to the northward of Fort Stanwix, about 8 miles from Black, or Sable river, a water of Lake Ontario, and runs fouthwardly 20 miles to the fort, then eaftward 110 miles, and after receiving many tributary ftreams, falls into Hudfon river, by three mouths oppofite to the cities of Lanfinburgh and Troy, from 7 to 10 miles N. of Albany. The produce that is conveyed down this river, is landed at Schenectady, on its S. bank, and is thence conveyed by land 16 miles, over a barren, fandy, fhrub plain to Albany. It is in contemplation either to cut a canal from Schenectady to the navigable waters of Hudfon river, or to eftablifh a turnpike road between Schenectady and Albany. This fine river is now navigable for boats, from Schenectady, nearly or quite to its fource, the locks and canals round the Little Falls, 56 miles above Albany, having been completed in the Autumn of 1795; fo that boats full loaded now pafs them. The canal round them is nearly ¾ of a mile, cut almoft the whole diftance through an uncommonly hard rock. The opening of this navigation is of great advantage to the commerce of the State. A fhore of at leaft 1000 miles in length, is, in confequence of it, wafhed by boatable waters, exclufive of all the great lakes, and many millions of acres of excellent tillage land, rapidly fettling, are accommodated with water communication for conveying their produce to market. The intervales on both fides of this river, are of various width, and now and then interrupted by the projection of the hills quite to the banks of the river, are fome of the richeft and beft lands in the world. The fine farms which embrace thefe intervales, are owned and cultivated principally by Dutch people, whofe mode of managing them would admit of great improvement. The manure of their barns they confider as a nuifance, and inftead of fpreading it on their upland, which they think of little value, (their meadow lands do not require it) they either let it remain for years in heaps, and remove their barns, when accefs to them becomes difficult, or elfe throw it into the river, or the gullies and ftreams which communicate with it. The banks of this river were formerly thickly fettled with Indians. At the period when Albany was firft fettled, it has been faid by refpectable authority, that there were 800 warriors in Schenectady; and that 300 warriors lived within a fpace which is now occupied as one farm. The Cohoez in this river are a great curiofity. They are 3 miles from its entrance into the Hudfon. The river is about 1000 feet wide; the rock over which it pours, as over a mill dam, extends from S. W. to N. E. almoft in a line from one fide of the river to the other, and is about 40 feet perpendicular height, and including the defcent above, the fall is as much as 60 or 70 feet. About a mile below the falls, is a handfome bridge, finifhed in July, 1795. It is 1100 feet in length, 24 in breadth, and 15 feet above the bed of the river, which for the moft part is rock, and is fupported by thirteen folid ftone pillars. It is a free bridge, and including the expence of cutting through a ledge on the N. E. fide of the river, coft 12,000 dollars. The river immediately below the bridge, divides into three branches, which form feveral large iflands. The branches are fordable at low water, but are dangerous. From the bridge you have a fine view of the Cohoez on the N. W.—*Morfe.*

MOHAWK, a branch of Delaware river. Its courfe from its fource in Lake Uttayantha is S. W. 45 miles, thence S. E. 12 miles, when it mingles with the Popachton branch; thence the confluent ftream is called Delaware.—*ib.*

MOHAWKS, an Indian nation, acknowledged by the other tribes of the Six Nations to be "the true old heads of the confederacy." They were formerly very powerful, and inhabited on Mohawk river. As they were ftrongly attached to the Johnfon family, on account of Sir William Johnfon, a part of them emigrated to Canada with Sir John Johnfon, as early as the year 1776. About 300 of this nation now refide in Upper Canada.—*ib.*

MOHEGAN, fituated between Norwich and New-London, in Connecticut. This is the refidence of the remains of the Mohegan tribe of Indians. A confiderable part of the remains of this tribe lately removed to Oneida with the late Mr Occom.—*ib.*

MOHER, in Bengal, a gold coin, worth about 33 fhillings.

MOHERIR, a writer of accounts.

MOHICCONS, a tribe of Indians who inhabit on a branch of the Sufquehannah, between Chagnet and Owegy. They were reckoned by Hutchins, about 30 years ago, at 100, but by Imlay, in 1773, at only 70 fighting men. They were formerly a confederate tribe of the Delawares. Alfo an Indian tribe, in the N. W. Territory, who inhabit near Sandufky, and between the Sciota and Mufkingum; warriors, 60.—*Morfe.*

MOINEAU, a flat baftion raifed before a curtin when it is too long, and the baftions of the angles too remote to be able to defend one another. Sometimes the moineau is joined to the curtin, and fometimes it is divided from it by a moat. Here mufquetry are placed to fire each way.

MOINS, a river of Louifiana, which empties from the N. W. into the Miffiffippi, in lat. 40 20 N. The Sioux Indians defcend by this river.—*Morfe.*

MOISIE *River*, on the N. fhore of the St Lawrence, is about 3 leagues W. S. W. of Little Saguena river, from which to the W. N. W. within the Seven Iflands, is a bay fo called from thefe iflands.—*ib.*

MOLE (See TALPA, *Encycl.*), is an animal exceedingly troublefome, both to gardeners and farmers; and there are perfons who contrive to make a livelihood by the trade of *mole catching*. Thefe men, it is well known, are generally quacks and cheats; and the fecrets which they fell for extirpating thofe deftructive animals are of very little avail. Even poifon feldom produces any confiderable effect; becaufe the mole, while it does not drink, lives only on roots and worms. Under the word MOLE (*Encycl.*), fome directions will be found for clearing fields of this deftructive animal; but the following are perhaps preferable, as they feem to have been the refult of much experience;

Immediately at day-break, it will be neceffary to make a tour round the garden or meadow, from which it is wifhed to extirpate the moles; for at that time they will be all found at work, as may be feen by the hills newly thrown up. If the perfon is then clofe to the

the hill, he must proceed as the gardeners do, and turn up with a stroke of the spade the hill together with the digger. The passage is then cut through before the animal is aware of the attack; and therefore it has not power to escape. If the mole-hill be fresh, even though the animal may not be throwing up earth, the person ought not to lose his time in waiting, but should immediately proceed to the operation above mentioned.

If you find a fresh hill standing by itself, which seems to shew by its situation that it has no communication with any other, which is always the case when the mole has worked from the surface downwards in endeavouring to procure a more convenient habitation, after the hill has been turned up with the spade, a bucket of water should be poured over the mouth of the passage. By these means the animal, which is at no great distance, will be obliged to come forth, and may be easily caught with the hand.

You may discover also whether a hill has any communication with another, if you apply your ear to it, and then cough or make a loud noise. If it has no communication with the neighbouring hills, you will hear the terrified animal make a noise by its motion. It will then be impossible for it to escape; and you may either pour water into the hole, or turn up the hill with a spade, until the mole is found; for, in general, it never goes deeper into the earth than from fifteen to eighteen inches.

When any of the beds in a garden have been newly watered, the mole, attracted by the coolness and moisture, readily repairs thither, and takes up its residence in them, making a passage at the depth of scarcely an inch below the surface. In that case it may easily be caught. When you see it at work, you need only tread behind the animal with your feet on the passage to prevent its retreat, and then turn up the hill with a spade; by which means you will be sure to catch it.

When you dig after it with a spade, the animal forces its way downwards into the earth in a perpendicular direction, in order that it may the better escape the threatened danger. In that case it will not be necessary to dig long, but to pour water over the place, which will soon make the animal return upwards.

People, in general, are not aware of the great mischief occasioned in fields and gardens by these animals. We are, however, informed by Buffon, that in the year 1740 he planted fifteen or sixteen acres of land with acorns, and that the greater part of them were in a little time carried away by the moles to their subterranean retreats. In many of these there were found half a bushel, and in others a bushel. Buffon, after this circumstance, caused a great number of iron traps to be constructed; by which, in less than three weeks, he caught 1300. To this instance of the devastation occasioned by these animals, we may add the following: In the year 1742 they were so numerous in some parts of Holland, that one farmer alone caught between five and six thousand of them. The destruction occasioned by these animals is, however, no new phenomenon. We are informed by history, that the inhabitants of the island of Tenedos, the Trojans, and the Æolians, were infested by them in the earliest ages. For this reason a temple was erected to Apollo Smynthius, the destroyer of moles. See *Economische Hefte*, Vol. VII. Part 5. and Vol. IX. Part 4.; or *Phil. Magazine*, N° 5.

MOLE, *The*, is situated in the N. W. part of the island of St Domingo, 2 leagues E. of Cape St Nicholas, and is often called by that name. The Mole, though inferior, by a great deal, to Cape Francois and Port au Prince, is the first port in the island for safety in time of war, being strongly fortified both by nature and art. Count D'Estaing, under whose direction these works were constructed, intended to have established here the seat of the French government; but the productions of its dependencies were of too little value to engage his successors to carry his plan into effect; so that it is now no more than a garrison. It has a beautiful and safe port, and is considered as the healthiest situation in St Domingo, by reason of the purity of its springs. The exports from Jan. 1, 1789 to December 31, of the same year, were only 265,615lb. coffee —26,861lb. cotton—2,823lb. indigo, and other small articles to the value of 129 livres. The value of duties on exportation 1,250 dollars 21 cents. It is 4 leagues W. of Jean Rabel, 11 N. W. of Bombarde, 36 W. of Cape Francois, and $17\frac{1}{2}$ W. by S. of Port de Paix. N. lat. 19 50, W. long. 75 48.—*Morse.*

MOLINE's *Gut*, on the S. W. side of the island of St Christopher's in the W. Indies, is the first rivulet to the S. E. of Brimstone Hill, near the mouth of which is anchorage in 5 and 10 fathoms, and a clear shore; but to the eastward of it are some sunken rocks.—*ib.*

MOMENTS, in the new doctrine of infinites, denote the indefinitely small parts of quantity; or they are the same with what are otherwise called infinitesimals and differences, or increments and decrements; being the momentary increments or decrements of quantity considered as in a continual flux.

Moments are the generative principles of magnitude; they have no determined magnitude of their own, but are only inceptive of magnitude.

Hence, as it is the same thing if, instead of these moments, the velocities of their increases and decreases be made use of, or the finite quantities that are proportional to such velocities; the method of proceeding which considers the motions, changes, or fluxions of quantities, is denominated by Sir Isaac Newton, the *method of fluxions*.

Leibnitz, and most foreigners, considering these infinitely small parts, or infinitesimals, as the differences of two quantities, and thence endeavouring to find the differences of quantities, *i. e.* some moments, or quantities indefinitely small, which taken an infinite number of times shall equal given quantities, call these moments differences; and the method of procedure, the differential calculus.

MONA, or *La Guenon*, or *The Mone*, a small island, $11\frac{3}{4}$ leagues S. W. of Point l'Epee, which is the south-westernmost point of the island of St Domingo, and $14\frac{1}{2}$ leagues W. of the S. W. point of the island of Porto Rico. It is 2 leagues from E. to W. and a little more from N. to S. It has several ports for small vessels, plenty of good water, and all that would be necessary for settlements of culture, and the breeding of cattle. Its fruit trees, and particularly the orange, are much extolled. A league and a half N. W. of Mona is a very small island, called Monique, or the Little Monkey. —*Morse.*

MONADNOCK, *Great*, a mountain situated in Cheshire county, New-Hampshire, between the towns of

Jaffray and Dublin, 10 miles N. of the Massachusetts line, and 22 miles E. of Connecticut river. The foot of the hill is 1395 feet, and its summit 3254 feet, above the level of the sea. Its base is 5 miles in diameter, from N. to S. and 3 from E. to W. On the sides are some appearances of subterraneous fires. Its summit is a bald rock.—*ib.*

MONADNOCK, *Upper Great*, a high mountain, in Canaan, in the N. E. corner of the State of Vermont.—*ib.*

MONAHAN, a township in York county, Pennsylvania.—*ib.*

MONDAY *Bay*, on the S. shore of the straits of Magellan, in that part of the straits called the Long Beach, and 4 leagues W. of Pisspot Bay. It is nearly S. of Buckley Point, on the N. side of the strait, and affords good anchorage in 20 fathoms.—*ib.*

MONDAY, a cape in the above Straits, 7 leagues W. N. W. of Cape North. S. lat. 53 12, W. long. 75 20. —*ib.*

MONGEARTS, one of the tribes of wandering Arabs which inhabit the SAHARA, or Great Desert of Africa. Their time is wholly occupied by tending their cattle; and because they are little skilled in the use of arms, *Mongeart* is a term of contempt among the people by whom they are surrounded. Their country, with its produce, will be described under the title SAHARA in this *Supplement;* it is the business of this article merely to exhibit the manners of the people.

They are all Mahometans, and offer up prayers three times a-day, sometimes oftener; but having no mosques, these prayers are never pronounced in public, except when the horde is visited by a priest, who seldom comes but upon account of the children's education. Then all the Arabs assemble at the hour of prayer, place themselves in a line, turn to the east, and, wanting water in the desert, rub their face and arms with sand; while the priest recites aloud the general prayer. It is the same as that which is rehearsed by the public crier in the mosques in civilized countries.

The priests are employed in travelling about the country to instruct the children. There is nothing like force in their education. The little boys meet in the morning of their own accord, at the place of instruction, which is to them a place of recreation. They go there with a small board inscribed with the Arabic characters, and a few maxims of the Koran. The eldest, and the best informed, receive their lessons directly from the priests, and afterwards communicate them to their fellows. They are never corrected; because it would be a crime to beat a child, who, according to the received notions, has not sufficient reason to distinguish good from evil. This lenity extends even to the children of Christians, though in a state of slavery. They are treated in all respects like the children of Arabs; and the man who should be rash enough to strike one of them, would endanger his life. Very different is their treatment of Negro children; who may indeed join in all the amusements of the young Arabs, and even attend the public schools; but if they be guilty of a fault, they are severely punished.

When the child of a Mongeart becomes tired of the places of public instruction, he quits them at pleasure, and, without feeling constraint, or hearing reproach, goes and employs himself in tending his father's flocks: and accordingly there are very few among them who can read. Those who persevere in the study of the Koran are made priests, after having past an examination before the learned elders, and enjoy the greatest public consideration. They have no need of cattle; for those of the nation being theirs, they find their subsistence everywhere.

It is generally at seven or eight years of age that children undergo the painful operation of circumcision. Their head is also shaved, nothing being left but four locks of hair: one of which is cut off in a meeting of the family, at each remarkable action performed by the child. If, at the age of 12 or 13, he kill a wild boar, or other beast of prey, that should fall upon his flock, he loses one of his locks. If, in the passage of a river, a camel be carried away by the stream, and he save it by swimming to its assistance, another is cut off. If he kill a lion, a tiger, or a warrior of an hostile nation, in a surprise or an attack, he is considered as a man, and his head is entirely shaved.

Different from the other Arabs their neighbours, and indeed from the Mahometans in general, the Mongearts trouble no man on account of his religion. The only one which they do not tolerate is the Jewish; and were a Jew to enter their territory, and have the misfortune to be taken, he would certainly be burnt alive.

According to M. Saugnier, the women are much more respected among the Mongearts than among the neighbouring nations; but the evidences which he gives of that respect are very extraordinary.

When a Mongeart is desirous of undertaking the care of a family, he pitches upon the girl that pleases him the most, and asks her of her father without further formality; nor can the latter refuse her, unless the man who pretends to her hand have done something contrary to the laws of the nation. The girl is conducted by her parents to the tent of her future husband, where there is always an abundant repast prepared for the ceremony. Presents are made to the father; but if the son-in-law be poor, his wife's family assist him, and furnish him with the means of increasing his flocks; if, on the contrary, he be rich, and the father poor, he supports the whole family in his own tent. The employment of the wife, thus married, is to prepare the food; to spin the goats and camels hair, of which the tents are made; to milk the cattle; to pick up the necessary supply of wood for the night; and when the hour of repast is come, to wait upon her husband. She then eats by herself what has been left by him and his male slaves. She is, indeed, in no great danger of having a rival brought into the family; for though polygamy be allowed by his religion, the poverty of the Mongeart generally prevents him from taking a plurality of wives. She is, however, liable to be divorced at will when she does not bear boys; but if she have the good fortune to have one or more male children, her husband's regard for her is inconceivable. She has no longer a divorce to fear, has an absolute authority in the tent, and passes her whole time in conversation, sleep, or dancing, as she thinks fit. The captive negresses do all her work, and are no longer assisted in their labour by the Arab's wife, who treats them, on the contrary, with the greatest harshness and arrogance.

When a woman is not agreeable to her husband, or when he is disagreeable to her, they have it in their power to part. The formality in this case consists in

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the wife's retiring to her parents. If the husband be attached to her, he goes thither in quest of her; but if she persist in refusing to return, she is free, and at liberty to marry another. If, however, she have had a child, especially a boy, she has not the same privilege; in that case, if her retreat should last more than eight days it might be punished with death.

When a man beats his wife, it is a sure sign that he is sincerely attached to her, and that he does not mean to part with her; if he content himself with reproaches, the wife thinks herself despised, and infallibly retires to her parents. Hence it is, that in the most trifling disputes the women are cruelly beaten: they prefer it to the complaints that the husband might make to their parents; this proof being the most certain one of a man's fondness for his wife. When a girl marries, she makes up her mind to such treatment, deeming it much more supportable than the humiliations she would otherwise experience from her family, in consequence of her husband's complaints.

The conjugal fidelity of the Mongeart women is incorruptible. Differing in their opinions from many other Mahometans, they believe themselves immortal like the men; but they do not flatter themselves with the possibility of happiness in the other world, unless they shall have been faithful to their husbands in this. Women, who have been false to their husband's bed, will be doomed, they think, to eternal slavery to the more virtuous part of their sex, without ever partaking, in the smallest degree, of their bliss.

Mongeart women often visit one another; and on these occasions, the honour consists in letting the female who comes to see her friend or relation do all the work of the tent. The visitor assumes the management of every thing, dresses the victuals, churns the butter, and keeps herself continually employed; while her friend entertains her with an account of the different affairs of the family or nation. The heartiness of the welcome is measured by the extent of the work submitted to the guest, who generally prepares double the usual quantity of food; so that the Arab is obliged to invite his neighbours to partake of the repast. The slaves are always pleased with these entertainments, a larger portion then coming to their lot. It is the business of the visitor to do the honours; nor will she suffer any body about her to remain dissatisfied.

The laws of hospitality are observed among the Mongearts as among all the wandering Arabs. Indeed they are carried to such a length, that were a man to enter the tent of him whom he had wounded, or even killed, he would there meet with a sacred and inviolable asylum, although surrounded by those who must naturally desire his ruin. The tent of the chief is always that to which strangers, upon their arrival in the horde, are directed. But the chief could not entertain, at his own expence, all the strangers that happen to pass; and therefore every tent in the horde is obliged to furnish him with two pounds of ground barley *per* week, to enable him to maintain the ancient hospitality.

The chiefs of hordes are always the eldest of their families. The difference of wealth is not considered; the chief often having several individuals at his house richer than himself, who nevertheless obey him in every particular. He is, properly speaking, their king: examines their difference with the old men, and judges without appeal. As to himself, he cannot be tried but by the chiefs of several hordes assembled. It is his business to determine the spots where the tents are to be pitched, the moment of departure and the place where the caravan is to stop. If the pasturage do not suffice for the herds of all the horde, it divides, and the chief assigns the ground for the different encampments. They are very often composed of no more than seven or eight tents, according to the quality of the ground they meet with. The tent of the chief is always the largest and most lofty, and is placed in the centre of the divisions. When it is determined upon to quit an encampment, which never happens till the pasture is exhausted, the chief sets off to choose another spot. In these removals the women alone do all the work. Early in the morning they fold up the tent, and load every thing upon the camels backs; they then move slowly on, that the cattle may have time to feed upon the way.

Great respect is paid by the Mongearts to all old men, who enjoy the same prerogatives as the priests, and such Arabs as have visited the tomb of Mahomet at Mecca. Together with the chief they are the judges of the horde, and take cognizance of all offences, the pain of death being the only punishment which they cannot decree. An assembly of several chiefs is the only tribunal which can inflict capital punishment; but as the accused has generally a number of friends, it seldom happens that he is capitally convicted.

A war between two Mongeart tribes seldom happens, and is never bloody: but the different families destroy one another fast enough in their intestine broils. They are all thieves; and indeed theft is a crime only in the day time, being authorised by law during the night, in order to compel them to take care of their cattle. Could they find redress when robbed by night, they would be less vigilant; and their herds and flocks would be more exposed to the wild beasts that over run their country; but being obliged to be on their guard even against their nearest neighbours, they are always ready to repel both the lion and the tiger. Theft, even in the day-time, is so far from being punished, unless detected at the instant of commission, that when any thing is stolen unperceived, it becomes the lawful property of the thief. In vain would the rightful owner recognize it in his neighbour's tent; he cannot reclaim it; it ceases to be his from the moment he has been negligent in its care. Hence arises this people's inclination for rapine; they do not think they commit a crime, and only follow, in this regard, a custom allowed by their laws.

When an Arab is going to market, or on his return from thence, if he do not take the greatest care to keep his journey a secret, he is often attacked. Neighbouring Arabs are desirous of profiting by his industry; and as there are no persons in the country appointed to apprehend robbers, the hope of booty spurs them on to the attack. That they may have nothing to fear, they lie in wait, when the night is coming on, for him whom they mean to pillage. Their intention is never to kill; they only endeavour to surprize, to disarm, and to make themselves masters of every thing that comes in their way. But it sometimes happens, that the man they intend to plunder, being acquainted with the customs of his country, keeps an attentive ear, stands on his guard, fires upon his assailants at the first motion he observes, and then fights desperately with his dagger. The

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report of the musket almost always brings out the neighbouring Arabs, who, in virtue of the laws of hospitality, take the defence of the weaker side. They run up well armed; and then woe to the aggressors, if they do not save themselves by a speedy flight.

The flocks and herds of the Mongearts are composed of nothing but sheep, goats, and camels; all animals patient of thirst. Horses are very scarce in these cantons, none but the possessors of numerous herds being able to keep them; because, for want of water, it is necessary to have milk in sufficient abundance to give it them to drink. Great care is taken to preserve the camel's urine, both to mix with milk, and to wash the different vessels in which they put their food. Detestable as is this mixture of milk and urine, they are often reduced to the use of it; hunger and thirst give a relish to every thing.

The only workmen useful to this nation are blacksmiths or goldsmiths, as they may be called indifferently. The Mongearts not being sufficiently laborious to apply themselves to such occupations, these workmen come from Bilidulgerid, and disperse themselves all over the different parts of the desert. Wherever there are tents they are sure to find work. They are fed for nothing, and receive besides the hire for their labour. They make trinkets for the women, such as ear-rings and bracelets, &c. mend the broken vessels, by rivetting them, and clean the arms. They are generally paid in skins, goats and camels hair, or ostrich feathers, according to their agreement. Those who have silver pay them a tenth part of its weight for any thing wrought out of that metal. On their return they sell what they have earned; four or five excursions at most enabling them to live afterwards at their ease in their own country.

The Mongearts always carry a leathern bag, suspended from their neck, in which they put their tinder, their pipe, and their tobacco. Their daggers are elegant; the hilt is always black, and inlaid with ivory; the blade is crooked, and sharp on either side; the sheath is of brass on one side, and of silver on the other, and of very tolerable workmanship. They wear fabres when they can get them, and prefer those of Spanish make. Their muskets are always highly ornamented; the stock is very small, and inlaid on every side with ivory, and the barrel embossed with brass or silver, according to the opulence of the owner. There is a spring to the lock, covering the priming, to prevent the piece from going off, contrary to the intention of him who carries it. The poor, who do not possess muskets, wear daggers, made like the Flemish knives, with leathern sheaths. They arm themselves also with a thick stick, to the end of which they fix a kind of iron wedge. This weapon is exceedingly dangerous at close quarters. Others carry *zagays*, or slender javelins. In a word, the principal riches of an Arab, and his highest gratifications, are a handsome musket and a good dagger. He prefers them to neatness of apparel; for as to dress, it is indifferent to him whether he be clothed in Guinea blues, woollen stuffs, or goats skins. Their arms being their principal ornament, they take particular care to put the muskets in leathern bags, by way of keeping them in good order, and preserving them from the rust.

All the riches of the Mongearts consist in their herds; and accordingly they take the greatest care to preserve them. If a beast be sick, every thing is done to cure it; no care is spared; it is even treated with more attention than a man: but when it evidently appears that there is no hope of saving its life, they kill and eat it. If it be a camel, the neighbours are called in to partake of the repast; if a goat, the inhabitants of the tent suffice for its consumption. An animal that dies without shedding blood is unclean. Its throat must be cut; the person who kills it turning to the east, and pronouncing beforehand the first words of the general prayer. An animal killed by a wild boar is unclean; nor is it eaten although its blood has been shed, because the wild boar is itself an unclean beast. That species is so numerous in the desart, that they do more mischief than all the other wild beasts together. The Arabs kill as many as they can; but never taste their flesh.

Mongearts, || Monhegan.

Whatever losses an Arab may meet with, he is never heard to complain; he rises superior to poverty, supports hunger, thirst, and fatigue, with patience, and his courage is proof against every event. God will have it so, says he: he employs, however, every means in his power to avert misfortune; and often exposes himself to the greatest dangers to procure matters of no real utility.

When a father of a family dies, all the effects in his tent are seized upon by the eldest son present at his decease. Gold, silver, trinkets, every thing disappears. and the absent children have only an equal share in the division of the cattle and the slaves. The girls are entirely excluded from all participation, and take up their residence with their eldest brother. If the deceased leave children in helpless infancy, the mother takes them with her to her sister's, if she have a sister married; if not, to her own maternal roof. The dead man's possessions, however, are not lost; the chief of the horde takes care of them, and delivers them in equal portions to the heirs, as soon as they are old enough to manage their own property. If an Arab die without male children, his wife returns to her relations, and his brother inherits his effects.

The Mongearts have a rooted abhorrence of the Spaniards, and never fail to massacre every man of that nation who is so unfortunate as to be shipwrecked, on their coasts, while they reserve the women for sale at Morocco. The reason of this hatred is, that the inhabitants of the Canaries make frequent descents on the Mongeart coasts, and carry off men, women, cattle, and every thing that they meet with; and these people, being ignorant of the fate of their countrymen, retaliate by death on all Spaniards that fall into their hands, whilst they treat the British and French as well as they can.

MONGON, on the coast of Peru, on the S. Pacific Ocean, is 10 leagues N. of the harbour of Guarmey, and 4 leagues from Bermejo Island, which lies between the former places. Casma is 4 leagues N. of it. Mongon is known at sea by a great mountain just over it, which is seen farther than any others on this part of the coast.—*Morse.*

MONGON, *Cape*, on the S. side of the island of St Domingo, is 3000 fathoms N. of Point Bahoruco and the river Nayauco, and nearly S. of the little part of Petit Trou.—*ib.*

MONHEGAN, or *Menhegan*, a small island in the Atlantic Ocean, 12 miles south-easterly of Pemaquid Point, in Lincoln co. District of Maine, and in lat. 43 42.

42. North of it are a number of small isles at the mouth of St George's river. Captain Smith landed his party here in 1614. The chimneys and remains of the houses are yet to be seen.—*ib.*

MONETOU *Islands*, in the N. W. Territory, lie towards the E. side of Michigan Lake, towards its N. end, and southward of Beaver Islands.—*ib.*

MONKTON, a township in Addison county, Vermount, E. of Ferrisburg, and contains 450 inhabitants.—*ib.*

MONKTON, a township in Annapolis county, Nova-Scotia, inhabited by Acadians, and a few families from New-England. It lies partly on the bason of Annapolis, and partly on St Mary's Bay, and consists chiefly of wood land and salt marsh. It contains about 60 families.—*ib.*

MONCLOVA, a town of New-Leon, N. America, situated S. E. of Conchos.—*ib.*

MONMOUTH, a large maritime county of New-Jersey, of a triangular shape, 80 miles in length, and from 25 to 40 in breadth; bounded north by part of Raritan Bay, N. W. by Middlesex co. S. W. by Burlington, and E. by the ocean. It is divided into 6 townships, and contains 16,918 inhabitants, including 1596 slaves. The face of the county is generally level, having but few hills. The most noted of these are the high lands of Nevesink and Centre-Hill. A great part of the county is of a sandy soil; but other parts are fertile. There is a very curious cave, now in ruins, at the mouth of Navesink river, 30 feet long and 15 wide, and contains three arched apartments.—*ib.*

MONMOUTH, or *Freehold*, a post-town of New-Jersey, and capital of the above co. situated 22 miles N. E. by E. of Allentown, 34 east of Trenton, 14 S. W. by S. of Shrewsbury, and 64 N. E. by E. of Philadelphia. It contains a court-house and gaol, and a few compact dwelling-houses. This town is remarkable for the battle fought within its limits on the 27th of June, 1778, between the armies of General Washington and Sir Henry Clinton. The latter having evacuated Philadelphia, was on his march to New-York. The loss of the Americans, in killed and wounded, was about 250; that of the British, inclusive of prisoners, was about 350. The British pursued their march the night after, without the loss of their covering party or baggage.—*ib.*

MONMOUTH, a small post-town in Lincoln co. situated on the east side of Androscoggin river, 15 miles W. by S. of Hallowell court-house, 5 westerly of Winthrop, 10 N. E. by N. of Greene, 49 N. of Portland, and 180 N. by E. of Boston.—*ib.*

MONMOUTH *Cape*, on the east side of the Straits of Magellan, about half way from the southern entrance of the second Narrows to the south-east angle of the straits opposite to Cape Forward.—*ib.*

MONMOUTH *Island*, one of the 4 islands of Royal Reach, in the Straits of Magellan, and the second from the westward.—*ib.*

MONNIER (Peter Charles Le), was born at Paris on the 20th of November 1715. The profession of his father, or the rank which he held in society, we have not learned; and we are equally ignorant of the mode in which he educated his son. All that we know is, that young Monnier, from his earliest years, devoted himself to the study of astronomy; and that, when only sixteen years of age, he made his first observation, viz. of the opposition of Saturn. At the age of twenty he was nominated a member of the Royal Academy of Sciences at Paris. In the year 1735 he accompanied Maupertuis in the celebrated expedition to Lapland, to measure a degree of latitude. In 1748 he went to Scotland with Lord Macclesfield, to observe the annular eclipse of the sun, which was most visible in that country; and he was the first astronomer who had the pleasure to measure the diameter of the moon on the disk of the sun.

Louis XV. it is well known, was extremely fond of astronomy, and greatly honoured its professors: he loved and esteemed Le Monnier. I have seen the king himself (says Lalande) come out of his cabinet, and look around for Le Monnier; and when his younger brother was presented to him on his appointment to the office of first physician, his Majesty was pleased to wish him the merit and reputation of his brother the astronomer. All the remarkable celestial phenomena were always observed by the king, in company with Le Monnier. Thus he observed with him, at his chateau of St Hubert, the two celebrated transits of Venus thro' the disk of the sun in the years 1761 and 1769; as appears from the Memoirs of the Royal Parisian Academy of Sciences. It well deserves to be here recorded in what manner the king behaved during these important observations, and how little he disturbed his astronomers (the celebrated La Condamine being likewise permitted to observe the transit in his presence) in this occupation; the proper time for which, if permitted to pass by, could not be recalled. Le Monnier relates in his Dissertation, that "his Majesty perceiving that we judged the last contacts to be of the greatest importance, a profound silence at that moment reigned around us." At the transit of Venus in 1769, the king allowed the Marquis de Chabert, an intelligent and expert naval officer, who was just returned from a literary voyage to the Levant, to assist at the observation. In a court like that of Louis XV. so scrupulously observant of etiquette, these will be allowed to have been most distinguished marks of honour, and of royal favour and condescension.

In the year 1750, Le Monnier was ordered to draw a meridian at the royal Chateau of Bellevue, where the king frequently made observations. The monarch on this occasion rewarded him with a present of 15,000 livres; but Le Monnier applied this sum of money likewise in a manner that redounded to the honour of his munificent sovereign and of his country, by procuring new and accurate instruments, with which he afterwards made his best and most remarkable observations. In 1742, the king gave him in Paris *Rue de la Poste*, a beautiful free dwelling, where, till the breaking out of the revolution, he resided, and pursued his astronomical labours, and where his instruments in part yet remain. Some of them the present French government has, at the instance of Lalande, purchased for the National Observatory. In 1751, the king presented him with a block of marble, eight feet in height, six feet in breadth, and fifteen inches in thickness, to be used for fixing his mural quadrant of five feet. This marble wall, together with the instruments appended to it, turns on a large brass ball and socket, by which the quadrant may be directed from south to north; thus

Monnier. ferving to rectify the large mural quadrant of eight feet, which is immoveably made faft to a wall towards the fouth.

With thefe quadrants Le Monnier obferved, for the long period of forty years, the moon with unwearied perfeverance at all hours of the night. It is requifite, to be a diligent aftronomer, to be able to conceive to what numberlefs inconveniences the philofopher is expofed during an uninterrupted feries of lunar obfervations. As the moon during a revolution may pafs through the meridian at all hours of the day or night; the aftronomer who, day after day, profecutes fuch obfervations, muft be prepared at all, even the moft inconvenient, hours, and facrifice to them his fleep and all his enjoyments. How fecluded from all the pleafures of focial intercourfe, and how fatiguing fuch a mode of life is, thofe aftronomers, indeed, know not who then only fet their pendulum clocks in motion, when fome of the eclipfes of the fun, moon, or of the fatellites of Jupiter, are to be viewed. At this time, and in the prefent ftate of the fcience, thefe are juft the moft infignificant obfervations; and an able aftronomer, well fupplied with accurate inftruments, may *every day*, if he take into his view the whole of his profeffion, make more important and more neceffary obfervations.

Le Monnier was Lalande's preceptor, and worthy of fuch a fcholar; and he promoted his ftudies by his advice, and by every other means in his power. Le Monnier's penetrating mind, indeed, prefaged in young Lalande, then only fixteen years old, what in the fequel has been fo fplendidly confirmed. In his twentieth year, he became, on the recommendation of his preceptor, a member of the Royal Academy: and in 1752 he was propofed by him as the fitteft perfon to be fent to Berlin, to make with La Caille's, who had been fent to the Cape of Good Hope, correfpondent obfervations, for the purpofe of determining the parallaxes of the moon, then but imperfectly known. Le Monnier lent his pupil for this expedition his mural quadrant of five feet. His zeal for aftronomy knew no bounds. For this reafon Lalande, in his *Notice des Travaux du C. Le Monnier*, fays of himfelf: " *Je fuis moi-meme le principal refultat de fon zele pour l'aftronomie.*"

Le Monnier was naturally of a very irritable temper: as ardently as he loved his friends, as eafily could he be offended; and his hatred was then implacable. Lalande, as he himfelf expreffes it, had the misfortune to incur the difpleafure of his beloved preceptor; and he never after could regain his favour. But Lalande's gratitude and refpect for him always continued undiminifhed, and were on every occafion with unremitting conftancy publicly declared: patiently he endured from him undeferved ill treatment; fo much did he love and efteem his inftructor and mafter to the day of his death. " I have not ceafed to exclaim (writes Lalande), as Diogenes exclaimed to his mafter Antifthenes, You cannot find a ftick ftrong enough to drive me away from you!" Monnier.

What a noble trait in the character of Lalande, who in 1797 wrote likewife an eulogium on Le Monnier in the ftyle of a grateful pupil, penetrated with fentiments of profound veneration and efteem for his beloved mafter; but Le Monnier would not read it. This is not the place to give a circumftantial account of this intricate quarrel; we fhall only further remark, that Lalande was the warm friend and admirer of the no lefs eminent aftronomer La Caille, whom Le Monnier mortally hated. An intimate friendfhip likewife fubfifted between Le Monnier and D'Alembert; but Lalande had no friendly intercourfe with the latter.

Among the fcholars of Le Monnier may likewife be reckoned Henwart, the celebrated geometrician and profeffor of mathematics at Utrecht; who, in a letter to Von Zach, aftronomer to the Duke of Saxe Gotha, dated the 26th of May 1797, fays, " Le Monnier is a penetrating and philofophical aftronomer: I learned much from him in Paris; though I lodged with the late De l'Ifle, where I frequently made obfervations in company with Meffier. Le Monnier was the friend of D'Alembert; and confequently an oppofer of Lalande."

This great man, who had, for fome years, ceafed to exift either for the fcience of aftronomy, or for the comfort of his friends, died at Lizeaux, in the province of Normandy, in 1799, aged 84 years. He left behind him fome valuable manufcripts, and a number of good obfervations; with refpect to which he had always been very whimfical, and of which in his latter years he never would publifh any thing. He had by him a feries of lunar obfervations, and a multitude of obfervations of the ftars, for a catalogue of the ftars, which he had announced fo early as the year 1741; among which was twice to be found the new planet Uranus: (See *Lalande's Aftronomie, Tables*, p. 188, (A). The more he was requefted to communicate his obfervations, the more obftinate he became; he even threatened to deftroy them. At the breaking out of the revolution, Lalande was greatly alarmed for the fafety of thefe papers; he wifhed to preferve them from deftruction, and made an attempt to get them into his poffeffion; but all his endeavours were in vain. He was only able to learn, that Le Monnier had hidden them under the roof of his houfe. Le Monnier having been firft feized with a fit of the apoplexy fo early as the 10th of November 1791, Lalande apprehended, left, if no one except himfelf fhould know where he had hidden his papers, the infirm old man might perhaps have himfelf forgot it. He hopes, however, that La Grange, who married his fecond daughter, may have fome information concerning them. Le Monnier left behind him no fon.

MON-

(A) Such is the French and German account of his difcovery of this planet; but our readers have been very inattentive, if they have not perceived, in various articles of this Work, complete proofs of the plagiarifm of our neighbours on the Continent, from the celebrated philofophers and divines of England. As it is extremely probable that, half a century hence, a claim may be put in for Le Monnier's difcovery of the Georgium Sidus *(Uranus)*, fimilar to that which in 1757 the editor of Abbé St Real's works put in for that Abbé being the author of Leflie's *Short Method with the Deifts* (fee Leslie in this *Suppl.*), we think it our duty to declare, that in 1800 there was no evidence whatever on which to found that claim, and that the difcovery was then univerfally allowed to have been made by Herfchel.

MONOCACY, a river which after a S. S. W. courfe, empties into the Patowmac, about 50 miles above Georgetown.—*Morse*.

MONOMIAL, in algebra, is a fimple or fingle nominal, confifting of only one term; as a or $a x$, or $a^2 b x^3$, &c.

MONONGAHELA *River*, a branch of the Ohio, is 400 yards wide at its junction with the Alleghany at Pittfburg. It is deep, gentle and navigable with batteaux and barges beyond Red Stone Creek, and ftill further with lighter craft. It rifes at the foot of the Laurel Mountain in Virginia, thence meandering in a N. by E. direction, paffes into Pennfylvania, and receives Cheat river from the S. S. E. thence winding in a N. by W. courfe, feparates Fayette and Weftmoreland from Wafhington county, and paffing into Alleghany county, joins the Alleghany river at Pittfburgh and forms the Ohio. It is 300 yards wide 12 or 15 miles from its month, where it receives the Youghiogany from the fouth-eaft, which is navigable with batteaux and barges to the foot of Laurel hill. Thence to Red Stone, at Fort Byrd, by water is 50 miles, by land 30. Thence to the mouth of Cheat river, by water 40 miles, by land 28; the width continuing at 300 yards, and the navigation good for boats. Thence the width is about 200 yards to the weftern fork 50 miles higher, and the navigation frequently interrupted by rapids; which, however, with a fwell of 2 or 3 feet, become very paffable for boats. It then admits light boats, except in dry feafons, 65 miles further, to the head of Tygart's Valley, prefenting only fome fmall rapids and falls of one or 2 feet perpendicular, and leffening in its width to 20 yards. The weftern fork is navigable in the winter, towards the northern branch of the Little Kanhaway, and will admit a good waggon road to it. From the navigable waters of the fouth-eafternmoft branch of the Monongahela, there is a portage of 10 miles to the fouth branch of Patowmac river. The hills oppofite Pittfburg on the banks of this river, which are at leaft 300 feet high, appear to be one folid body of coal.—*Morse*.

MONONGALIA, a county in the N. W. part of Virginia, about 40 miles long and 30 broad, and contains 4,768 inhabitants; including 154 flaves.—*ib*.

MONOTRIGLYPH, a term in architecture, denoting the fpace of one triglyph between two pilafters, or two columns.

MONPOX, a city of Terra Firma, about 75 miles S. E. by E. of Tolu.—*Morse*.

MONSEAG *Bay*, in Lincoln county, Diftrict of Maine, is feparated from Sheepfcut river, by the ifland of Jeremyfquain.—*ib*.

MONSELEMINES, are a people which inhabit that part of BILIDULGERID (fee *Encycl.*) that borders on the territories of the Emperor of Morocco. They are a mixed race, being defcended from the ancient Arabs and fugitive Moors; and they occupy a fpace of land, of which the limits are indicated by lofty columns placed at intervals towards the defart. The territory extends from about 30 leagues beyond Cape Non, to the diftance of 20 leagues from St Croix or Agader. Though of different qualities, it is, for the moft part, very fertile, and produces the neceffaries of life with little cultivation. The plains are watered by an infinite number of ftreams, and abound with palm, date, fig, and almond trees. The gardens produce excellent grapes, which are dried by the Arabs, and converted into brandy by the Jews. Great quantities of oil, wax, and tobacco, appear in the public markets.

More induftrious and more laborious than their neighbours, the Monfelemine nation cultivates the earth. The chiefs of families choofe the ground moft fit for cultivation. Its furface is turned flightly over with a kind of hoe, and then the feed is fown upon it: the field is furrounded with bufhes, to mark the fpot, and to preferve it from the cattle of the wandering Arabs. When the crop is ripe, which is generally at the end of Auguft, three months after the fowing of the feed, it is cut about fix inches from the ear, and formed into little bundles; during which time every one labours without intermiffion from morning to night. The corn is brought before the tent, thrafhed, winnowed, and placed in the magazines. When the harveft is over, they fet fire to the long ftubble, and abandon the field for two or three years. Their magazines are large holes in the earth, formed like the fruftum of a cone, the infides of which are hardened by burning wood in them, before the half winnowed corn be depofited. When filled with corn, they are covered with planks placed clofe to each other; over which a layer of earth is laid level with the foil, to prevent it from being difcovered by enemies. In thefe magazines every one fhares in proportion to the number of men he employed in the common labour.

The inhabitants of the plains remain by the cultivated fields in feed time, and return at the time of harveft. During the intervals they wander in all directions with their cattle, taking only neceffaries along with them, and having recourfe to the magazines when they require a fupply. The more opulent people, and the artizans who are engaged in fedentary occupations, dwell in towns, which are all fituated upon the declivity of hills. Their houfes are built of ftone and earth, according to the Moorifh conftruction, low and covered with floping terraces; yet they are fo much injured by the heavy rains which prevail for three months of the year, as to be rendered uninhabitable in 15 or 20 years. Thofe who refide in towns are generally weavers, fhoemakers, goldfmiths, potters, &c. and have no cattle; but the more opulent perfons have flocks and herds of cows, horfes, camels, fheep, goats, befides poultry, which are kept by their flaves at a diftance from the towns. In the towns they take two meals a day; one at ten o'clock, and the other at the fetting of the fun, though the inhabitants of the country only eat in the evening. In the towns they fleep in mats upon the floors of their apartments, and make ufe of linen; but the inhabitants of the country fleep upon terraces in the open air. The paftoral families of the country practife hofpitality like thofe of the defart, and make the traveller pay nothing for his entertainment. In the towns this practice is impoffible, as the concourfe of ftrangers, efpecially on market-days, would foon impoverifh the inhabitants. In this manner hofpitality is always extinguifhed among a trading and commercial people. It is only where the fuperfluity of commodities runs neceffarily to wafte, that it is ever practifed in a great extent; but where every commodity can find a market,

every

Monfelemines.

every kind of property acquires a definite value, and will be preferved with the fame care as money.

By M. Saugnier the government of the Monfelemines is faid to be republican; but he writes inconfiftently about it. In one place, he fays that they choofe their chiefs annually; in another, that in the time of war they choofe from the natives or fugitive Moors indifcriminately, chiefs, whofe authority lafts no longer than the campaign, during which it is abfolute; and he afterwards reprefents their government as a kind of theocracy, during war as well as peace. But we muft follow him in his detail, as it has been well arranged in a late anonymous publication, entitled, *An Hiftorical Sketch of Difcoveries in Africa.*

At the end of each campaign, he fays the chief gives an account of his actions to the affembled aged men, and is rewarded or punifhed according to his conduct; after which his fucceffor is appointed, and he ferves in the army he commanded as an undiftinguifhed individual. The country is populous, and would be ftill more fo, were it not for the continual wars which its inhabitants are obliged to fupport againft the Emperor of Morocco. The liberty they enjoy imparts energy and courage to their character, and renders their arms invincible to the Moors. They confider it as the moft invaluable poffeffion, and defend it to the laft extremity. The nature of the country, furrounded on every fide by fteep and arid mountains, contributes to fruftrate the efforts of their enemies. The Monfelemine, richer than the fubject of Morocco, is always well clothed and armed. He pays no tribute, enjoys the fruit of his labour and commerce, and, as no contributions are requifite for the charges of the ftate, whatever he acquires is his own. The fugitive Moors are never armed, except when they go to battle; but the natives go continually armed, whether they refide in the country, refort to the markets, attend the affemblies of the nation, or pay vifits.

As the Monfelemine territory is the retreat of the rich Moors, who wifh to fly from the tyranny of the Emperor of Morocco, they are too well acquainted with the Moorifh cuftoms to be furprifed by that prince. No fooner does a Moorifh army take the field, than the inhabitants of the country cantons mount their horfes, and occupy the paffes of the mountains; while the women and flaves, efcorted by a fufficient number of warriors, retire to the interior parts of the country, or, if they be hard preffed, to the defart. Among the paftoral tribes there are many that addict themfelves entirely to arms, and ferve as cavalry in the time of war. During peace they efcort caravans, or exercife themfelves in military evolutions, and the management of their horfes. Being almoft always on horfeback, and wearing no boots, they have a callous lump on that part of the leg that comes in contact with the iron of the ftirrup. Their horfes, which they break in an admirable manner, are the beft in the world: as they are treated with great care by their mafters, they know them, and are obedient to their voice, and will admit no ftranger to mount them.

The Monfelemines derive their origin and name from Mofeilama, a contemporary of Mahomet, and, in their love of liberty, as well as in many of their cuftoms, refemble the Arabs of remoter times. They refpect the prophet like other Mahometans; but neither believe that he was infallible, nor that his defcendants are all infpired by God, nor that their will fhould be a law, nor that fuch faith is neceffary in order to be a good Mahometan. Their priefts are refpected, and in old age generally become the civil judges of the nation; but the influence of the high prieft is almoft defpotic. Though he has no troops, he may command the nation; and war and peace depend upon his will. Though he has no property, every thing is at his difpofal: he requires nothing from any one, and yet all are inclined to give. He adminifters juftice according to the opinion of his counfel, without pretending to be infpired by the prophet.

On Friday the Monfelemines affemble in their mofques to pray: this is likewife the day of their principal market, when their merchandize is expofed to fale in the public fquares, where the old men judge without appeal, when difputes arife. Different from their neighbours of Morocco and Sahara, the Monfelemines never attempt to make profelytes. Their Chriftian flaves are treated with humanity; but they owe this to the avarice of their mafters. Thefe deteft Chriftians, but they love money, and are afraid left ficknefs or death fhould deprive them of the ranfom of the flave, or of the advantage of his labour. Among the inhabitants of the defart, a Chriftian, that adopts the religion of Mahomet, is admitted as a citizen and member of the family, and is prefented with cattle to form an eftablifhment. The Monfelemines pay more attention to the value of their property than the fituation of the infidel. A Chriftian who enters a mofque at Morocco is put to death, or forced to affume the turban. The Monfelemines would turn him civilly out, and content themfelves with impofing the higheft poffible fine. Among the Moors, a Chriftian difcovered in an intrigue with a woman of that nation fuffers death, or fubmits to converfion; but the Monfelemines prefer money to religion. From them the Chriftian has nothing to fear: the woman alone is punifhed, being put into a fack, and thrown into the fea. If a Chriftian flave among the neighbouring nations defends himfelf againft his mafter, he is punifhed with death; but money faves him among the Monfelemines; he would at moft receive a flight correction.

The Jews are allowed the free exercife of their religion among the Monfelemines, but are treated with the fame indignity as among other Mahometan tribes. A Jew is not permitted to carry arms; and if he fhould make ufe of them againft an Arab, he would be punifhed with death, and probably involve his family in his fate. The Jews inhabit the towns only, where they follow trade and various arts, but are not allowed to cultivate the earth.

Polygamy is permitted, as in other Mahometan countries; but the fituation of the women is more refpectable, and they are not fo much fecluded as among the Moors. They mingle more in fociety, walk at large, and vifit their friends; neither are their apartments fo inviolable. Among the Monfelemines, that degrading picture of humanity is never feen which fometimes occurs in Morocco, a woman drawing the plough with an afs, a mule, or fome other beaft of burden. More happy than the women of the Sahara, and treated with greater

Monson, Monte.

greater attention by their husbands, they are more humane in their dispositions. Like other Arab women, they stain the edges of their eyelids black with henna, and paint their faces red and yellow. Their children are brought up with great care, and are not obliged to exhibit proofs of their courage before they can be considered as men, as is the custom in the desart. Avarice is the principal defect in the character of the Monselemines. They hoard their money with the utmost care, bury it in the earth, and in many cases die without discovering their secret even to their children. Misers, says M. Saugnier, should go to that country, where they would learn means of economy; which would shew them, that, in comparison with the Monselemines, they are themselves perfect prodigals.

The medicinal applications of the Monselemines, which differ not from those of the MONGEARTS and other inhabitants of the desart, are extremely simple, but appear sufficiently complex from the mummery of the priests, who are the depositories of their medical science. Flesh wounds are cauterised with a hot iron, and then covered with herbs dipped in turtles oil and tar. In headachs, a compress is applied with such violence that the blood starts from the forehead. In internal diseases, the general remedies are regimen, rest, and a few maxims of the Koran mysteriously applied to the affected parts.

MONSON, a township in Hampshire county, Massachusetts, E. of Brimfield, and 80 miles south-west by west of Boston. It was incorporated in 1760, and contains 1331 inhabitants.—*Morse.*

MONSIES, the third tribe in rank of the Delaware nation of Indians.—*ib.*

MONTAGUE, a township in Hampshire co. Massachusetts, on the E. bank of Connecticut river, between Sunderland and Wendel, about 18 miles north of Northampton, and 97 miles west by north of Boston. It was incorporated in 1753, and contains 906 inhabitants. A company was incorporated in 1792 to build a bridge over the river here. The work has not yet been completed.—*ib.*

MONTAGUE, the northernmost township in New-Jersey, is situated in Sussex co. on the east side of Delaware river, about 5 miles N. E. of Minisink, and 17 north of Newtown. It contains 543 inhabitants, including 25 slaves.—*ib.*

MONTAGUE, the largest of the small islands in Prince William's Sound, on the N. W. coast of North-America.—*ib.*

MOTAUK *Point*, the eastern extremity of Long-Island, New-York. A tract here, called *Turtle Hill*, has been ceded to the U. States for the purpose of building a light-house thereon.—*ib.*

MONTE *Christ*, a cape, bay, town, and river, on the north side of the island of St Domingo. The cape is a very high hill, in the form of a tent, called by the French, *Cape la Grange*, or *Barn*. It is situated in lat. 19 54 30 N. and in long. 74 9 30 W. of Paris. A strip of level land joins it to the territory of Monte Christ, and it is owing to this that the cape has been taken for an island. It is 14 leagues N. E. by E. of Cape Francois, where it may be seen in a clear day, with the naked eye. After doubling this cape, we find the bay of Monte Christ running nearly S. W. It is formed by Cape la Grange, on one side, and Pointe des Dunes (Down Point) on the other; about 6,500 fathoms asunder. The bay is about 1,400 fathoms deep, and its winding is nearly 4 leagues. About 900 fathoms from the cape, descending the bay, we find the little island of Monte Christ, 350 fathoms from the shore. One may fail between the two, with 2, 4, and 5 fathoms water; and about 250 fathoms further on, is anchorage in from 6 to 10 fathoms. A league and a quarter from Cape la Grange, is a battery intended to protect a landing place, of 100 fathoms wide, which is below, and opposite the town of Monte Christ. The town of Monte Christ, standing at 800 fathoms from the sea side, rises in an amphitheatre on the side of the coast, which is very high all round this bay. The town is 200 fathoms square, which space is divided into 9 parts, cut by two streets running from E. to W. and two others from N. to S. It was founded in 1533, abandoned in 1606, and now but a poor place, destitute of every resource but that of cattle raised in its territory, and sold to the French. The town and territory contain about 3,000 souls. There is a trifling garrison at Monte Christ. About a league from the battery, following the winding of the bay, is the river of Monte Christ, or more properly, the river Yaqui. The land round the town is barren and sandy; and the river contains great numbers of crocodiles. Monte Christ is a port well known to American smugglers, and carries on a great commerce from its vicinity to the French plantations. In the time of peace, all the produce of the plain of Mariboux situated between Port Dauphin and Mancenille Bay, is shipped here, and in a war between France and Britain, it used to be a grand market, to which all the French in the north part of the island sent their produce, and where purchasers were always ready.—*ib.*

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MONTE *Christ*, a chain of mountains which extend parallel to the north coast of the island of St Domingo, from the bay of Monte Christ, to the bay of Samana on the E. Two large rivers run in opposite directions along the southern side of this chain. The river Monte Christ or Yaqui in a W. by S. direction, and Yuna river in an E. by S. course to the bay of Samana. They both rise near La Vega, and have numerous branches.—*ib.*

MONTEGO *Bay* is on the N. side of the island of Jamaica, 20 miles E. by N. of Lucea harbour, and 21 W. of Martha Brae. This was formerly a flourishing and opulent town: it consisted of 225 houses, 33 of which were capital stores, and contained about 600 white inhabitants. The number of topsail vessels which cleared annually at this port were about 150, of which 70 were capital ships; but in this account are included part of those which entered at Kingston. This fine town was almost totally destroyed by an accidental fire, in July, 1795; the damage was estimated at £200,000 sterling.—*ib.*

MONTEREY BAY, in North California, was visited in 1786 by La Perouse, who places it in 36° 58′ 43″ N. Lat. and 124° 40′ W. Long. from Paris. It is formed by New-year Point to the north, and by that of Cyprus to the south; has an opening of eight leagues in this direction, and nearly six of depth to the eastward, where the land is sandy and low. The sea breaks there as far as the foot of the sandy downs with which the coast is surrounded, with a roaring which may be heard more than a league off. The lands north and

south

Monterey. fouth of this bay are high, and covered with trees. Thofe fhips which are defirous of touching there ought to follow the fouth coaft, and after having doubled the Point of Pines, which ftretches to the northward, they get fight of the prefidency, and may come to an anchor in ten fathoms within it, and a little within the land of this point, which fhelters from the winds from the offing. The Spanifh fhips, which propofe to make a long ftay at Monterey, are accuftomed to bring up within one or two cables lengths of the land, in fix fathoms, and make faft to an anchor, which they bury in the fand of the beach; they have then nothing to fear from the foutherly winds, which are fometimes very ftrong; but, as they blow from the coaft, do not expofe them to any danger. The two French frigates, which our author commanded, found bottom over the whole bay, and anchored four leagues from the land, in 60 fathoms, foft muddy ground; but there is a very heavy fea, and it is only an anchorage fit for a few hours, in waiting for day, or the clearing up of the fog. At full and change of the moon it is high water at half paft one o'clock: the tide rifes feven feet; and as this bay is very open, the current in it is nearly imperceptible. It abounds with whales; a genus of fifhes, of which our *fcientific* voyagers knew fo little, that they were furprifed at their fpouting water!

The coafts of Monterey Bay are almoft continually enveloped in fogs, which caufe great difficulty in the approach to them. But, for this circumftance, there would be few more eafy to land upon; there is not any rock concealed under water that extends a cable's length from the fhore; and if the fog be too thick, there is the refource of coming to an anchor, and there waiting for a clear, which will enable you to get a good fight of the Spanifh fettlement, fituated in the angle formed by the fouth and eaft coaft. The fea was covered with pelicans. Thefe birds, it feems, never go farther than five or fix leagues from the land; and navigators, who fhall hereafter meet with them during a fog, may reft affured that they are within that diftance of it.

A lieutenant-colonel, whofe refidence is at Monterey, is governor of the Californias: the extent of his government is more than 800 leagues in circumference, but his real fubjects confift only of 282 cavalry, whofe duty it is to garrifon five fmall forts, and to furnifh detachments of four or five men to each of the 25 miffions, or parifhes, eftablifhed in old and new California. So fmall are the means which are adequate to the reftraining about 50,000 wandering Indians in this vaft part of America, among whom, nearly 10,000 have embraced Chriftianity. Thefe Indians are, in general, fmall and weak (A), and difcover none of that love of liberty and independence which characterifes the northern nations, of whofe arts and induftry they are alfo deftitute. Their colour very nearly approaches that of the negroes whofe hair is not woolly; the hair of thefe people is ftrong, and of great length; they cut it four or five inches from the roots. Several among them have a beard; others, according to the miffionary fathers, have never had any; and this is a queftion which is even undecided in the country. The governor, who had travelled a great way into the interior of thefe lands, and who had paffed 15 years of his life among the favages, affured our author, that thofe who had no beards had plucked them up with bivalve fhells, that ferved them as pincers: the prefident of the miffions, who had refided an equal length of time in California, maintained the contrary;—it was difficult, therefore, for travellers to decide between them." The difficulty, furely, was not great. By their own account, the governor had travelled much farther into the country than the miffionary; and his report being confirmed by the evidence of their own fenfes, was intitled to unlimited credit. Monterey.

Thefe Indians are extremely fkilful in drawing the bow; they killed, in the prefence of the French, the fmalleft birds: it is true, they difplay an inexpreffible patience in approaching them; they conceal themfelves, and, as it were, glide along near to the game, feldom fhooting till within 15 paces. Their induftry in hunting the larger animals is ftill more admirable. Peroufe faw an Indian, with a ftag's head fixed upon his own, walk on all-fours, as if he were browfing the grafs; and he played this pantomime to fuch perfection, that all the French hunters would have fired at him at 30 paces, had they not been prevented. In this manner they approach herds of ftags within a very fmall diftance, and kill them with a flight of arrows.

Before the Spanifh fettlements, the Indians of California cultivated nothing but maize, and almoft entirely lived by fifhing and hunting. There is not any country in the world which more abounds in fifh and game of every defcription: hares, rabbits, and ftags are very common there; feals and otters are alfo found there in prodigious numbers; but to the northward, and during the winter, they kill a very great number of bears, foxes, wolves, and wild cats. The thickets and plains abound with fmall grey tufted partridges, which, like thofe in Europe, live in fociety, but in large companies of three or four hundred; they are fat, and extremely well flavoured. The trees ferve as habitations to the moft delightful birds; and the ornithologifts of the voyage ftuffed a great variety of fparrows, titmice, fpeckled wood-peckers, and tropic birds. Among the birds of prey are found the white-headed eagle, the great and fmall falcon, the gofs hawk, the fparrow hawk, the black vulture, the large owl, and the raven. On the ponds and fea-fhore are feen the wild duck, the grey and white pelican with yellow tufts, different fpecies of gulls, cormorants, curlews, ring-plovers, fmall fea water hens, and herons; together with the bee-eater, which, according to moft ornithologifts, is peculiar to the old continent.

The country about Monterey Bay is inexpreffibly fertile. The crops of maize, barley, corn, and peafe, cannot be equalled but by thofe of Chili; the European cultivators can have no conception of a fimilar fertility; the medium produce of corn is from feventy to eighty for one; the extremes fixty and a hundred. Fruit trees are ftill very rare there, but the climate is extremely fuitable to them: it differs a little from that of the fouthern French provinces. The foreft trees are, the ftone-pine, cyprus, evergreen oak, and occidental plane tree. There is no underwood; and a verdant carpet,

(A) The chief furgeon of the expedition fays they are *ftrong*, but ftupid.

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pet, over which it is very agreeable to walk, covers the ground. There are alſo vaſt ſavannahs, abounding with all ſorts of game.

Perouſe writes with great reſpect of the wiſe and pious conduct of the Spaniſh miſſionaries at Monterey, who ſo faithfully fulfil the purpoſe of their inſtitution. Totally unlike the monks at Conception in Chili (ſee that article in this *Suppl.*), they have left the lazy life of a cloiſter, to give themſelves up to cares, fatigues, and ſolicitudes of every kind. They invited the officers of the frigates to dine with them at their monaſtery, contiguous to which ſtands the Indian village, conſiſting of about 50 cabins, which ſerve as dwelling-places to 740 perſons of both ſexes, compriſing their children, which compoſe the miſſion of Saint Charles, or of Monterey. Theſe cabins are the moſt miſerable that are to be met with among any people; they are round, ſix feet in diameter, by four in height; ſome ſtakes, of the ſize of an arm, fixed in the earth, and which approach each other in an arch at the top, compoſe the timber work of it; eight or ten bundles of ſtraw, very ill arranged over theſe ſtakes, defend the inhabitants, well or ill, from the rain and wind; and more than half of this cabin remains open when the weather is fine; their only precaution is to have each of them two or three bundles of ſtraw at hand by way of reſerve.

All the exhortations of the miſſionaries have never been able to procure a change of this general architecture of the two Californias. The Indians ſay, that they like plenty of air; that it is convenient to ſet fire to their houſes when they are devoured in them by too great a quantity of fleas; and that they can build another in leſs than two hours. The independent Indians, who as hunters ſo frequently change their places of abode, have a ſtronger motive.

The monks gave the moſt complete information reſpecting the government of this ſpecies of religious community; for no other name can be given to the legiſlation they have eſtabliſhed. They are ſuperiors both in ſpiritual and temporal affairs: the products of the land are entirely entruſted to their adminiſtration. There are ſeven hours allotted to labour in the day, two hours to prayers, and four or five on Sundays and feſtivals, which are altogether dedicated to reſt and divine worſhip. Corporal puniſhments are inflicted on the Indians of both ſexes who neglect pious exerciſes; and ſeveral ſins, the puniſhment of which in Europe is reſerved only to Divine Juſtice, are puniſhed with chains or the ſtocks.

The Indians, as well as the miſſionaries, riſe with the ſun, and go to prayers and maſs, which laſt an hour; and during this time there is cooked in the middle of the ſquare, in three large kettles, barley meal, the grain of which has been roaſted previous to being ground; this ſpecies of boiled food, which the Indians call *atole*, and of which they are very fond, is ſeaſoned neither with ſalt nor butter, and to us would prove a very inſipid meſs. Every cabin ſends to take the portion for all its inhabitants in a veſſel made of bark: there is not the leaſt confuſion or diſorder; and when the coppers are empty, they diſtribute that which ſticks to the bottom to the children who have beſt retained their leſſons of catechiſm. This meal continues three quarters of an hour, after which they all return to their labours; ſome go to plough the earth with oxen, others to dig the garden; in a word, every one is employed in different domeſtic occupations, and always under the ſuperintendance of one or two of the religions.

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The women are charged with little elſe but the care of their houſewifery, their children, and roaſting and grinding the ſeveral grains: this laſt operation is very long and laborious, becauſe they have no other means of doing it but by cruſhing the grain in pieces with a cylinder upon a ſtone. M. de Langle, being a witneſs of this operation, made the miſſionaries a preſent of his mill; and a greater ſervice could not have been rendered them, as by theſe means four women would in a day perform the work of a hundred, and time enough will remain to ſpin the wool of their ſheep, and to manufacture coarſe ſtuffs.

At noon the dinner was announced by the bell; the Indians quitted their work, and ſent to fetch their rations in the ſame veſſels as at breakfaſt: but this ſecond meſs was thicker than the firſt; there was mixed in it corn and maize, and peaſe and beans; the Indians name it *pouſſole*. They return again to their labour from two o'clock till four or five; afterwards they attend evening prayers, which continue near an hour, and are followed by a new ration of *atole* like that at breakfaſt. Theſe three diſtributions are ſufficient for the ſubſiſtence of the far greater number of Indians; and this very economical ſoup might perhaps be very profitably adopted in our years of ſcarcity; ſome ſeaſoning would certainly be neceſſary to be added to it, their whole knowledge of cookery conſiſting in being able to roaſt the grain before it is reduced into meal. As the Indian women have no veſſels of earth or metal for this operation, they perform it in large baſkets made of bark, over a little lighted charcoal; they turn theſe veſſels with ſo much rapidity and addreſs, that they effect the ſwelling and burſting of the grain without burning the baſket, though it is made of very combuſtible materials.

The corn is diſtributed to them every morning; and the ſmalleſt diſhoneſty, when they give it out, is puniſhed by whipping: but it is very ſeldom, indeed, they are expoſed to it. Theſe puniſhments are adjudged by Indian magiſtrates, called *caciques*; there are in every miſſion three of them, choſen by the people from amongſt thoſe whom the miſſionaries have not excluded: but theſe caciques are like the governors of a plantation, paſſive beings, blind executors of the will of their ſuperiors; and their principal functions conſiſt in ſerving as beadles in the church, and their maintaining order and an air of contemplation. The women are never whipped in public, but in an incloſed and ſomewhat diſtant place, leſt perhaps their cries might inſpire too lively a compaſſion, which might ſtimulate the men to revolt; theſe laſt, on the contrary, are expoſed to the view of all their fellow-citizens, that their puniſhment may ſerve as an example. In general they aſk pardon; in which caſe the executioner leſſens the force of his laſhes, but the number of them is never receded from.

The rewards are particular ſmall diſtributions of grain, of which they make little thin cakes, baked on burning coals: and on the great feſtivals the ration is in beef; many of them eat it raw, eſpecially the fat, which they eſteem equal to the beſt butter or cheeſe. They ſkin all animals with the greateſt addreſs; and when they are fat, they make, like the ravens, a croaking of

pleaſure

pleasure, devouring, at the same time, the most delicate parts with their eyes.

They are frequently permitted to hunt and fish on their own account; and on their return they generally make the missionaries some present in game and fish; but they always proportion the quantity to what is absolutely necessary for them, always taking care to increase it if they hear of any new guests who are on a visit to their superiors. The women rear fowls about their cabins, the eggs of which they give their children. These fowls are the property of the Indians, as well as their clothes, and other little articles of household furniture, and those necessary for the chace. There is no instance of their having robbed each other, though their fastenings to the doors consist only of a simple bundle of straw, which they place across the entrance when all the inhabitants are absent.

The men in the missions have sacrificed much more to Christianity than the women; because they were accustomed to polygamy, and were even in the custom of espousing all the sisters of a family. The women, on the other hand, have acquired the advantage of exclusively receiving the caresses of one man only. With this, however, it would appear that they are not satisfied; for the religious have found it necessary to constitute themselves the guardians of female virtue. At an hour after supper, they have the care of shutting up, under lock and key, all those whose husbands are absent, as well as the young girls above nine years of age; and during the day they are entrusted to the superintendance of the matrons. So many precautions are still insufficient; for our voyagers saw men in the stocks, and women in irons, for having deceived the vigilance of these female arguses, who had not been sufficiently sharp-sighted.

The converted Indians have preserved all the ancient usages which their new religion does not prohibit; the same cabins, the same games, the same dresses: that of the richest consists of an otter's skin cloak, which covers their loins, and descends below their groin; the most lazy have only a simple piece of linen cloth, with which they are furnished by the mission, for the purpose of hiding their nakedness; and a small cloak of rabbit's skin covers their shoulders, which is fastened with a pack-thread under the chin; the head and the rest of the body is absolutely naked; some of them, however, have hats of straw, very neatly matted. The women's dress is a cloak of deer skin, ill tanned; those of the missions have a custom of making a small boddice, with sleeves, of them: it is their only apparel, with a small apron of rushes, and a petticoat of stag's skin, which covers their loins, and descends to the middle of the leg. The young girls, under nine years of age, have merely a simple girdle; and the children of the other sex are quite naked.

The independent savages are very frequently at war; but the fear of the Spaniards makes them respect their missions; and this, perhaps, is not one of the least causes of the augmentation of the Christian villages. Their arms are the bow, and arrow pointed with a flint very skilfully worked: these bows are made of wood, and strung with the sinews of an ox. Our author was assured, that they neither eat their prisoners, nor their enemies killed in battle; that, nevertheless, when they had vanquished, and put to death on the field of battle, chiefs, or very courageous men, they have eaten some pieces of them, less as a sign of hatred or revenge, than as a homage which they paid to their valour, and in the full persuasion that this food would be likely to increase their own courage. They scalp the vanquished as in Canada, and pluck out their eyes; which they have the art of preserving free from corruption, and which they carefully keep as precious signs of their victory. Their custom is to burn their dead, and to deposit their ashes in morais.

MONTEVIDEO, a bay and town of La Plata or Paraguay, in S. America, situated on the northern side of La Plata river, in lat. 34 30 S. It lies E. of Buenos Ayres, and has its name from a mountain which overlooks it, about 20 leagues from Cape Santa Maria at the mouth of the Plata.—*Morse.*

MONTGOMERY, a new county in the Upper district of Georgia.—*ib.*

MONTGOMERY, a county of New-York, at first called Tryon, but its name was changed to Montgomery in 1784, by act of the Legislature. It consisted of 11 townships, which contained 28,848 inhabitants, according to the census of 1791. Since that period the counties of Herkemer and Otsego have been erected out of it. It is now bounded N. and W. by Herkemer, E. by Saratoga, S. by Schoharie, and S. W. by Otsego county. By the State census of 1796, it is divided into 8 townships; and of the inhabitants of these 3,379 are qualified electors. Chief town, Johnston.—*ib.*

MONTGOMERY, a township in Ulster county, New-York, bounded easterly by New-Windsor and New-burgh, and contains 3,563 inhabitants, including 236 slaves. By the State census of 1796, 497 of the inhabitants were qualified electors.—*ib.*

MONTGOMERY, a fort in New-York State, situated in the High Lands, on the W. bank of Hudson's river, on the N. side of Popelop's creek, on which are some iron-works, opposit St Anthony's Nose, 6 miles S. of West-Point, and 52 from New-York city. The fort is now in ruins. It was reduced by the British in October, 1777.—*ib.*

MONTGOMERY, a township in Franklin county, Vermont.—*ib.*

MONTGOMERY, a township in Hampshire county, Massachusets, 100 miles from Boston. It was incorporated in 1780, and contains 449 inhabitants.—*ib.*

MONTGOMERY, a county in Pennsylvania, 33 miles in length, and 17 in breadth, N. W. of Philadelphia county. It is divided into 26 townships, and contains 22,929 inhabitants, including 114 slaves. In this county are 96 grist-mills, 61 saw-mills, 4 forges, 6 fulling-mills, and 10 paper-mills. Chief town, Norristown.—*ib.*

MONTGOMERY, a township in the above county. There is also a township of this name in Franklin county.—*ib.*

MONTGOMERY, a county in Salisbury district, N. Carolina, containing 4,725 inhabitants, including 834 slaves.—

MONTGOMERY, a county of Virginia, S. of Botetourt county. It is about 100 miles in length, and 44 in breadth, and contains some lead mines. Chief town, Christiansburg.—*ib.*

MONTGOMERY *Court-House* in Virginia, is 28 miles from Anson court-house, 46 from Wythe court-house, Montgomery, ‖ Montreal.

and 40 from Salisbury. It is on the post-road from Richmond to Kentucky. A post-office is kept here.—*ib.*

Montgomery, a county of Maryland, on Patowmac river. It contains 18,003 inhabitants, including 6030 slaves.—*ib.*

Montgomery *Court House*, in the above county, is 28 miles S. E. by S. of Frederickstown, 14 N. by W. of Georgetown on the Patowmac, and 35 south-westerly of Baltimore.—*ib.*

Montgomery, a new county in Tennessee State, Mero district. This and Robertson county, are the territory formerly called *Tenessee County*, the name of which ceases since the State has taken that name.—*ib.*

MONTMORIN, a new town on the north bank of Ohio river, 18 miles below Pittsburg, situated on a beautiful plain, very fertile, and abounding with coal.—*ib.*

MONTPELIER, a township in Caledonia county, Vermont, on the N. E. side of Onion river. It has 118 inhabitants, and is 43 miles from Lake Champlain.—*ib.*

MONTREAL, the second city in rank in Lower Canada, stands on an island in the river St Lawrence, which is 10 leagues in length and 4 in breadth, and has its name from a very high mountain about the middle of it, which it seems to overlook like a monarch from his throne; hence the French called it *Mont-real* or *Royal Mountain*. While the French had possession of Canada, both the city and island of Montreal belonged to private proprietors, who had improved them so well that the whole island had become a delightful spot, and produced every thing that could administer to the convenience of life. The city, around which is a very good wall, built by Louis XIV. of France, forms an oblong square, divided by regular and well formed streets; and when taken by the British, the houses were built in a very handsome manner; and every house might be seen at one view from the harbour, or from the southernmost side of the river, as the hill on the side of which the town stands falls gradually to the water. Montreal contains about 600 houses, few of them elegant; but since it fell into the hands of the British in 1760, it has suffered much from fire. A regiment of men are stationed here, and the government of the place borders on the military. It is about half a league from the south shore of the river, 170 miles south-west of Quebec, Trois Rivieres being about half way; 110 north by west of Crown Point; 308 north by west of Boston, and 350 north by east of Niagara. North lat. 45 35, west long. 73 11. The river St Lawrence is about 3 miles wide at Montreal. There is an island near the middle of the river opposite the city, at the lower end of which is a mill with 8 pair of stones, all kept in motion, at the same time, by 1 wheel. The works are said to have cost £11,000 sterling. A large mound of stone, &c. built out into the river, stops a sufficiency of water to keep the mill in continual motion. And what is very curious, at the end of this mound or dam, vessels pass against the stream, while the mill is in motion. Perhaps there is not another mill of the kind in the world.—*ib.*

Montreal, a river which runs north eastward into lake Superior, on the southern side of the lake.—*ib.*

Montreal *Bay* lies towards the east end of lake Superior, having an island at the north-west side of its entrance, and north-east of Caribou island.—*ib.*

Montrouis, ‖ Moore's.

MONTROUIS, a town in the west part of the island of St Domingo, at the head of the Bight of Leogane, 5 leagues south-east of St Mark, and 15 north-west of Port au Prince.—*ib.*

MONTSERRAT, one of the Caribbee islands, and the smallest of them in the Atlantic Ocean. Columbus discovered it in 1493. It is of an oval form, 3 leagues in length, and as many in breadth, containing about 30,000 acres of land, of which almost ⅔ds are very mountainous, or very barren. The cultivation of sugar occupies 6,000 acres; cotton, provision and pasturage have 2,000 acres allotted for each. No other tropical staples are raised. The productions were, on an average, from 1784 to 1788, 2,737 hhds. of sugar, of 16 cwt. each, 1,107 puncheons of rum, and 275 bales of cotton. The total exports from Montserrat and Nevis in 1787 were in value £214,141 : 16 : 8, of which the value of £13,981 : 12 . 6 was exported to the American States. The inhabitants of Montserrat amount to 1,300 whites, and about 10,000 negroes. The first settlers, in 1632, were Irishmen, and the present inhabitants are chiefly their descendants, or other natives of Ireland since settled there, by which means the Irish language is preserved there even among the negroes. The island is surrounded with rocks, and the riding before it is very precarious and dangerous on the approach of a tornado, having no haven. It has only 3 roads, viz. Plymouth, Old Harbour, and Ker's Bay; where they are obliged to observe the same methods as at St Christopher's in loading or unloading the vessels. It lies 30 miles south-west of Antigua; the same distance south-east of Nevis, and is subject to Great-Britain. N. lat. 16 47, west long. 62 12.—*ib.*

MONTSIOUGE, a river or bay in Lincoln county, District of Maine, which communicates with the rivers Sheepscut and Kennebeck.—

MONTVILLE, a township in New-London county, Connecticut, about 10 miles N. of New-London city. It has 2,053 inhabitants.—*ib.*

MONUMENT *Bay*, on the east coast of Massachusetts, is formed by the bending of Cape Cod. It is spacious and convenient for the protection of shipping.—*ib.*

MOORE, a county of N. Carolina, in Fayette district. It contains 3,770 inhabitants, including 371 slaves. Chief town, Alfordston.—*ib.*

Moore *Court-House*, in the above county, where a post-office is kept, is 38 miles from Randolph court-house, and 40 from Fayetteville.—*ib.*

MOOREFIELD, in New-Jersey, 13 miles easterly of Philadelphia.—*ib.*

MOORE *Fort*, a place so called in S. Carolina, is a stupendous bluff, or high perpendicular bank of earth, on the Carolina shore of Savannah river, perhaps 90 or 100 feet above the common surface of the water, exhibiting the singular and pleasing spectacle to a stranger, of prodigious walls of parti-coloured earths, chiefly clays and marl, as red, brown, yellow, blue, purple, white, &c. in horizontal strata, one over the other. A fort formerly stood here, before the erection of one at Augusta, from which it stood a little to the north-east. The water now occupies the spot on which the fort stood.—*ib.*

Moore's *Creek* is 16 miles from Wilmington, in N. Carolina. Here Gen. M'Donald, with about 2,000 royalists, were defeated (after a retreat of 80 miles, and a desperate engagement) by Gen. Moore, at the head of 800 continentals. Gen. M'Donald and the flower of his men were killed.—*ib.*

MOORFIELDS, a post-town and the capital of Hardy county, Virginia, situated on the east side of the south branch of Patowmac river. It contains, a court-house, a gaol, and between 60 and 70 houses. It is 25 miles from Romney, 75 from Winchester, and 180 from Richmond.—*ib.*

MOORS, in common language, are the natives of Morocco, of whom an account is given under that title in the *Encyclopædia*; but there is another people, a mixed race, called also Moors, who lead a wandering and pastoral life in the habitable parts of the Great Desert, and in the countries adjacent to it. Of the origin of these Moorish tribes, as distinguished from the inhabitants of Barbary, nothing farther seems to be known than what is related by John Leo the African; whose account may be abridged as follows:

Before the Arabian conquest, about the middle of the seventh century, all the inhabitants of Africa, whether they were descended from Numidians, Phœnicians, Carthaginians, Romans, Vandals, or Goths, were comprehended under the general name of *Mauri* or Moors. All these nations were converted to the religion of Mahomet, during the Arabian empire under the Kaliphs. About this time many of the Numidian tribes, who led a wandering life in the desert, and supported themselves upon the produce of their cattle, retired southward across the Great Desart, to avoid the fury of the Arabians; and by one of those tribes, says Leo (that of Zanhaga), were discovered, and conquered, the Negro nations on the Niger. By the Niger, is here undoubtedly meant the river of Senegal which in the Mandingo language is called *Basing*, or the Black River.

To what extent these people are now spread over the African continent, it is difficult to ascertain. There is reason to believe, that their dominion stretches from west to east, in a narrow line or belt, from the mouth of the Senegal (on the northern side of that river) to the confines of Abyssinia. Mr Park describes them as resembling, in complexion, the Mulattoes of the West Indies, and as having cruelty and low cunning pictured in their countenances. "From the staring wildness in their eyes (says he), a stranger would immediately set them down as a nation of lunatics. The treachery and malevolence of their character are manifested in their plundering excursions against the Negro villages. Oftentimes, without the smallest provocation, and sometimes under the fairest professions of friendship, they will suddenly seize upon the Negroes cattle, and even on the inhabitants themselves. The Negroes very seldom retaliate. The enterprising boldness of the Moors, their knowledge of the country, and, above all, the superior fleetness of their horses, make them such formidable enemies, that the petty Negro states, which border upon the desert, are in continual alarm while the Moorish tribes are in the vicinity, and are too much awed to think of resistance.

"Like the roving Arabs, the Moors frequently remove from one place to another, according to the season of the year, or the convenience of pasturage. In the month of February, when the heat of the sun scorches up every sort of vegetation in the desert, they strike their tents, and approach the Negro country to the south; where they reside until the rains commence, in the month of July. At this time, having purchased corn, and other necessaries from the Negroes, in exchange for salt, they again depart to the northward, and continue in the desert until the rains are over, and that part of the country becomes burnt up and barren.

"This wandering and restless way of life, while it inures them to hardships, strengthens, at the same time, the bonds of their little society, and creates in them an aversion towards strangers, which is almost insurmountable. Cut off from all intercourse with civilized nations, and boasting an advantage over the Negroes, by possessing, though in a very limited degree, the knowledge of letters, they are at once the vainest and proudest, and perhaps the most bigotted, ferocious, and intolerant, of all the nations on the earth; combining in their character the blind superstition of the Negro, with the savage cruelty and treachery of the Arab." But for them Mr Park would have accomplished the utmost object of his mission, and have reached Tombuctoo, and even Houssa, with no other danger than what arises necessarily from the climate, from wild beasts, and from the poor accommodation afforded in the huts of the hospitable Negroes. The wandering Moors, however, have all been taught to regard the Christian name with inconceivable abhorrence; and to consider it nearly as lawful to murder a European as it would be to kill a dog. It is, therefore, much less surprising that our traveller did not proceed farther along the banks of the Niger, than that he escaped the snares of so relentless a people.

MOOSE *River*, rises in Misinabe lake, a short distance from Michipicoten river, a water of lake Superior, and pursues a north-eastern course, receiving, about 12 miles from its mouth, a large south branch, and empties into the southern part of James's Bay, N. America, by the same mouth with Abbitibee river. Moose Fort, and a factory are situated at the mouth of this river, N. lat. 51 16, west long. 81 51; and Brunswick House is on its west bank about lat. 50 30. Round the bottom of James's Bay, from Albany Fort and river, on the west side, to Rupert's river on the east side, the woods afford large timber trees of various kinds, as oak, ash, besides the pine, cedar, spruce, &c. Up Moose river beyond Brunswick house is a fall of 50 feet, above which it is deep and navigable for a great distance; the soil and the climate above the fall are said to be very good.—*Morse.*

Moose *River*, a short stream in Grafton county, New-Hampshire, which runs north-easterly from the White Mountains into Amariscoggin river.—*ib.*

MOOSEHEAD *Lake*, or *Moose Pond*, in Lincoln county, District of Maine, is an irregular shaped body of water, which gives rise to the eastern branch of Kennebec river, which unites with the other, above Norridgewock, about 20 miles south of the lake. The lake is said to be three times as large as Lake George. There are very high mountains to the north and west of the lake; and from these the waters run by many channels into the St Lawrence.—*ib.*

MOOSEHILLOCK, the highest of the chain of mountains in New-Hampshire, the White Mountains excepted. It takes its name from its having been formerly a remarkable range for moose, and lies 70 miles west

west of the White Mountains. From its N. W. side proceeds Baker's river, a branch of Pemigewasset, which is the principal branch of Merrimack. On this mountain snow has been seen from the town of Newbury, Vermont, on the 30th of June and 31st of August; and on the mountains intervening, snow, it is said, lies the whole year.—*ib.*

MOOSE *Island*, on the coast of the District of Maine, at the mouth of Schoodick river, contains about 30 families. On the south end of this island is an excellent harbour suitable for the construction of dry docks. Common tides rise here 25 feet.—*ib.*

MORANT *Keys*, off the island of Jamaica, in the West-Indies. N. lat. 17 47, W. long. 75 35.—*ib.*

MORANT *Point*, the most easterly promontory of the island of Jamaica. On the N. side of the point is a harbour of the same name. From Point Morant it is usual for ships to take their departure that are bound through the Windward Passage, or to any part of the W. end of the island of St Domingo. N. lat. 17 58, W. long. 76 10.—*ib.*

MORANT *Harbour, Port*, is about 4 leagues westward of Point Morant, on the south coast of the island of Jamaica. Before the mouth of it is a small island, called Good Island, and a fort on each point of the entrance.—*ib.*

MORANT *River*, is 2 leagues westward of the west point of Point Morant. The land here forms a bay, with anchorage along the shore.—*ib.*

MORENA, a cape on the coast of Chili, S. America, is in lat. 23 45 S. and 15 leagues N. E. of Cape George. The bay between these capes seems very desirable to strangers to go in; but in a N. W. wind is very dangerous, because the wind blows right on the shore, and makes a very heavy sea in the road. Here is a very convenient harbour, but exceedingly narrow, where a good ship might be careened.—*ib.*

MORENA MORRO, on the coast of Chili, S. America, in lat. 23 S. and 20 leagues due S. of the north point of the bay of Atacama.—*ib.*

MORE, a township in Northumberland county, Pennsylvania.—*ib.*

MORELAND, the name of two townships of Pennsylvania; the one in Philadelphia county, the other in that of Montgomery.—*ib*

MORGAN *District*, in N. Carolina, is bounded W. by the State of Tennessee, and S. by the State of S. Carolina. It is divided into the counties of Burke, Wilkes, Rutherford, Lincoln, and Buncomb; and contains 33,292 inhabitants, including 2,093 slaves. —*ib.*

MORGANTOWN, a post-town and the chief town of the above district, is situated in Burke county near Catabaw river. Here are about 30 houses, a court-house and gaol. It is 45 miles from Wilkes, 46 from Lincolntown, 113 from Salem, and 661 from Philadelphia. N. lat. 35 47.—*ib.*

MORGANTOWN, a post-town of Virginia, and shire-town of Monongalia county, is pleasantly situated on the east side of Monongahela river, about 7 miles S. by W. of the mouth of Cheat river; and contains a court-house, a stone gaol, and about 40 houses. It is 30 miles from Brownsville, 24 from Union-Town, in Pennsylvania, 76 from Cumberland in Maryland, and 329 from Philadelphia.—*ib.*

MORGANS, a settlement in Kentucky, 38 miles E. of Lexington, and 18 N. E. of Boonsborough.—*ib.*

MORGANZA, a town now laying out in Washington county, Pennsylvania, situated in, and almost surrounded by the E. and W. branches of Charter's river, including the point of their confluence; 13 miles S. of Pittsburg, and on the post-road from thence to Washington, the county town, distant 10 miles. Boats carrying from 2 to 300 barrels of flour, have been built at Morganza, laden at the mill tail there, and sent down the Chartiers into the Ohio, and so to New-Orleans. By an act of the legislature of Pennsylvania, the *Chartiers*, from the Ohio upwards as far as Morganza, is declared to be a high-way. This town is surrounded by a rich country, where numbers of grist and saw mills are already built; and the lands in its environs well adapted to agriculture and grazing; and is spoken of as a country that is or will be the richest in Pennsylvania. Morganza, from its situation and other natural advantages, must become the centre of a great manufacturing country; especially as considerable bodies of iron ore, of a superior quality, have been already discovered in the neighbourhood, and have been assayed. The high waving hills in this country are, from the quality of the soil, convertible into the most luxuriant grazing lands, and are already much improved in this way. These hills will be peculiarly adapted to raise live stock, and more particularly the fine long-wooled breed of sheep; such as that of the Cotswold hills in England, whose fleeces sell for 2*s.* sterling per pound; when others fetch only 12*d* or 15*d.* The wheat of this country is said to weigh, generally, from 62 to 66lb. and the bushel of 8 gallons. From hence, considerable exports are already made to New-Orleans, of flour, bacon, butter, cheese, cider, and rye and apple spirits. The black cattle raised here are sold to the new settlers, and to cattle merchants, for the Philadelphia and Baltimore markets; many have also been driven to Niagara and Detroit, where there are frequent demands for live stock, which suffer much in those northern countries, from hard winters, failure in crops, and other causes.—*ib.*

MORGUE *Fort*, or *Fortaleza de Morgue*, on the south shore of the entrance of Baldivia Bay, on the coast of Chili, on the South Pacific Ocean. The channel has from 9 to 6 fathoms.—*ib.*

MORIENNE, a bay on the E. coast of the island of Cape Breton, near Miray Bay from which it is separated only by Cape Brule. It is a tolerably deep bay.—*ib.*

MORINDA, is a plant, of which a very meagre description has been given in the *Encyclopædia*, though it is of much importance in oriental commerce. It is cultivated to a great extent in the province of *Malwa* in the East Indies, where it furnishes a valuable dye-stuff; and is thus described by William Hunter, Esq; in the fourth volume of the Asiatic Researches:

"It is a tree of a middling size; the *root* branchy; the *trunk* columnar, erect, covered with a scabrous bark. *Branches*, from the upper part of the trunk, scattered; of the structure of the trunk. *Leaves* (seminal) oval, obtuse, entire (mature), opposite, decussated, ovate, pointed at both ends, smooth, with very short petioles. *Stipules*, lanced, very small, withering. *Peduncles*, from the axils of the leaves, solitary, bearing an aggregate flower.

flower. *Calyx*, common receptacle roundish, collecting the sessile flowers into an irregular head. *Perianth*, most entire, scarce observable above. *Coral*, one petalled funnel form. *Tube*, cylindric: *Border*, five cleft; the *divisions* lanced. *Stamen*: *Filaments*, five thread-form, arising from the tube, and adhering to it through two-thirds of their length, a little shorter than the tube. *Anthers*, linear, erect. *Pistil*. *Germ*. beneath, four-celled, containing the rudiments of four seeds. *Style*, thread-form longer than the stamens. *Stigma*, two cleft, thickish. *Pericarp*, common, irregular, divided on the surface into irregular angular spaces: composed of berries, pyramidal, compressed on all sides by the adjacent ones, and concreted with them; lopped; containing towards the base a fleshy pulp. *Seeds*, in each berry four; towards the point oblong, externally convex, internally angular."

The species here described is the *morinda arborea pedunculis solitariis* of Linnæus. It grows best in a black rich soil, free from stones, in situations moderately moist, not too high, yet sufficiently elevated to prevent the rain water from stagnating, and where a supply of water can be had for the dry months. As the colouring matter, for which alone it is valuable, resides chiefly in the bark of the root, the small twigs, which contain little wood, bear a higher price than the larger pieces. The natives employ it in dyeing a pale red, or clay colour; which Mr Hunter says is more valuable for its durability than for its beauty. They likewise use it in dyeing a dark purple or chocolate colour: but for the process, in both cases, we must refer to the original memoir.

MORION, in botany, a name given by the ancients to a kind of nightshade. See SOLANUM, *Encycl.*

MORION, in ancient mineralogy, a name given to one of the semipellucid gems, more commonly called *pramnion*. It is a stone appearing externally of a fine deep black; but when held up against a candle, or against the sun-beams, it gives a very beautiful red in different degrees.

MORO *Castle* is on the point or headland on the E. side of the channel of the Havannah, in the N. W. part of the island of Cuba, and is the first of two strong castles for the defence of the channel against the approach of an enemy's ships. It is a kind of triangle, fortified with bastions, on which are mounted about 60 pieces of cannon, 24 pounders. From the castle there also runs a wall or line mounted with 12 long brass cannon, 36 pounders; called, by way of eminence, "The twelve Apostles:" and at the point, between the castle and the sea, there is a tower where a man stands and gives signals of what vessels approach.—*Morse.*

MOROKINNEE, or *Morotinnee*, in the island of Mowee, one of the Sandwich Islands, in the N. Pacific Ocean, is in lat. 20 29 N. and long. 126 27 west. —*ib.*

MOROSQUILLO *Bay* is to the southward of Carthagena, on the coast of the Spanish Main, and in the bight of the coast coming out of Darien Gulf, on the eastern shore.—*ib.*

MOROTOI, or *Morokoi*, one of the Sandwich Islands in the Pacific Ocean, is about 2½ leagues W. N. W. of Mowee Island, and has several bays on its S. and W. sides. Its W. point is in lat. 21 20 N. and long. 157 14 W. and is computed to contain 36,000 inhabitants. It is 7 leagues S. E. of Woahoo Island.—*ib.*

MORRIS, a county on the northern line of New-Jersey, west of Bergen county. It is about 25 miles long, and 20 broad, is divided into 5 townships, and contains about 156,809 acres of improved, and 30,429 acres of unimproved land. The eastern part of the county is level, and affords fine meadows, and good land for Indian corn. The western part is more mountainous, and produces crops of wheat. Here are seven rich iron mines, and two springs famous for curing rheumatic and chronic disorders. There are also 2 furnaces, two slitting and rolling-mills, 35 forges and fire-works, 37 saw-mills and 45 grist mills. There are in the county 16,216 inhabitants, of whom 636 are slaves.—*ib.*

MORRISSINA, a village in West-Chester county, New-York, contiguous to Hell Gate, in the Sound. In 1790 it contained 133 inhabitants, of whom 30 were slaves. In 1791, it was annexed to the township of West-Chester.—*ib.*

MORRISTOWN, a post-town and capital of the above county, is a handsome town, and contains a Presbyterian and Baptist church, a court-house, an academy, and about 50 compact houses; 19 miles N. W. of Newark, and about 100 N. E. of Philadelphia. The head quarters of the American army, during the revolution war, was frequently in and about this town.—*ib.*

MORRISVILLE, a village in Pennsylvania, situated in Bucks county on the W. bank of Delaware river, one mile from Trenton, 9 from Bristol, and 29 from Philadelphia. A post-office is kept here.—*ib.*

MORRIS *Bay*, on the W. coast of the island of Antigua, in the West-Indies. It cannot be recommended to ships to pass this way, as there is in one place S. from the Five Islands only 2 fathoms water. Vessels drawing more than 9 feet water must not attempt it.—*ib.*

MORROPE, a town on the road between Quito and Lima, in S. America. It contains between 70 and 80 houses, containing about 160 families, all Indians: near it runs the river Pozuelos, the banks of which are cultivated and adorned with trees. Morrope is 28 or 30 leagues distant from Sechura, all that way being a sandy plain, the track continually shifting.—*ib.*

MORTIER's *Rocks*, on the S. coast of Newfoundland Island. N. lat. 47, W. long. 54 55.—*ib.*

MORTO *Island*, on the coast of Peru, so called by the Spaniards, from its striking resemblance to a dead corpse, extended at full length. It is also called *St Clara*. It is about 5 leagues N. N. E. from the river Tumbez; and is 2 miles in length, and 27 leagues from Guayaquil.—*ib.*

MORTON *Bay*, on the N. W. coast of the island of Nevis, in the West-Indies, is near the Narrows, or channel between that island and St Christopher's, to the N. W. of which there is from 3 to 8 fathoms, according to the distance from shore.—*ib.*

MORUES *Bay*, on the southern shore of the river St Lawrence, southward of Gaspee Bay, and west of Bonaventura and Miscan islands.—*ib.*

MORUGO, a small river to the west and north-west of the gulf of Essequibo, on the coast of Surrinam, in S. America.—*ib.*

MOSE, or *Villa del Mose*, a town on the bank of the river

river Tabasco, in the bottom of Campeachy Gulf, to which small barges may go up. Great quantities of cocoa are shipped here for Spain; which brings a great many sloops and small vessels to the coast.—*ib.*

MOSES *Point*, a head or cape of land, on the E. side of the entrance into Bonavista Bay, on the E. coast of Newfoundland Island. It is to the southward of the rocks called Sweers, and 5 miles south-west of Cape Bonavista.—*ib.*

MOSHAIRA, or MOSHAHEREH, pension or allowance in Bengal.

MOSLEY's, a place on Roanoke river, 9 miles below St Tammany's, and 3 above Eaton's. The produce of the upper country is brought to these places, and sent from thence by waggons to Petersburg in Virginia.—*Morse.*

MOSQUITO *Country*, a district of Mexico, having the North Sea on the N. and E. Nicaragua on the S. and Honduras on the W. The natives are tall, well made, strong, and nimble of foot. They are implacable enemies to the Spaniards, who massacred a vast number of their people when they invaded Mexico, and will join with any European nation against the Spaniards. They are very dextrous in striking fish, turtles and mannaties. Many of the natives sail in British vessels to Jamaica.—*ib.*

MOSQUITO *Bay*, or *Muskito*, is at the S. E. extremity of the island of St Christopher's, and on the larboard side of the channel of the Narrows, from the S. W. going round the point along the shore, within the reef to the northward. The coast is here lined with rocks, and at a small distance is from 4 to 6 fathoms, on the W. N. W. side of Booby Island.—*ib.*

MOSQUITO, or *Musquito Cove*, on the W. side of the island of Antigua, and southward of Five Islands Harbour.—*ib.*

MOSQUITO *Island*, one of the small Virgin Islands, in the West Indies, near the N. coast of Virgin Gorda, on which it is dependent. N. lat. 18 25, W. long. 63 15.—*ib.*

MOSQUITO *Point* is the larboard point of the channel into Port Royal Bay in Jamaica, where the powder magazines are situated, and on which is a battery of 80 guns, for the defence of the channel, which is here very narrow. Round the point to the north-westerly, is a spacious bay or bason, into which comes the river of Spanish Town.—*ib.*

MOSQUITO *Point*, at the entrance of the river Essequibo, on the coast of Dutch Guiana, S. America; round which, as soon as ships are within, they are directed to run S. E. and then due S. and come to an anchor before the first village.—*ib.*

MOSS, the name given in Scotland, and we believe also in some parts of England, to what is more properly called a *morass*, a *fen*, or a *bog*. On the formation of these mosses some conjectures have been hazarded in the *Encyclopædia*, where the reader will likewise find a copious account of the method which has for many years been successfully employed to convert the MOSS OF KINCARDINE into an arable soil, or rather to remove the substance called *moss* or *peat* from the rich soil which is found below it. A method, however, has been invented by Mr John Smith of Swindrig-muir, in the shire of Ayr, for *actually* converting the substance called moss into a vegetable mould, which has been found by experience to carry rich crops of corn, hay, potatoes, &c. Of this gentleman's practice we have the following account in a small pamphlet published in Edinburgh, 1798, by Fairbairn and Dickson.

"The first thing to be done is to mark off, and cut out, proper main or master drains, in order to carry off the superfluous water, taking care to preserve the greatest possible level; which drains are so constructed as to divide the field into inclosures from six to ten Scotch acres. If the moss hangs or declines, the inclosures may be of any dimension whatever. The dimensions of these drains when first made are eight feet wide, by four and a half feet deep, declining to two and a half feet at bottom, and cost at the rate of one shilling per fall of eighteen and a half feet, running measure. The ridges are then to be marked off regularly, six or seven yards broad, formed with the spade in the manner following.

"In the centre of each ridge, a space of about 20 inches is allowed to remain untouched, on each side of which a furrow is opened, and turned upon the untouched space, so as completely to cover it (like what is called the feering of a gathered ridge). Thus begun, the work is continued, by cutting with the spade, in width about 12 inches, and turning it over to appearance as if done with a plough, until you come to the division furrow, which should be two feet wide, cut out and thrown upon the sides of the ridges. The depth of the division furrow is to be regulated by circumstances, according as the moss is wet or dry, but so as to answer the purpose of as it were bleeding the moss, and conducting the water to the main drains.

"It may be here observed, that the success of the aftercrops depends very much upon a proper formation of the ridges. They must not be made too high in the middle, for there they will be too dry like a peat, upon which the lime cannot act, and near the furrows they will be too wet, which is equally prejudicial; they should therefore be constructed with a gentle declivity to the furrows, so as the rain which falls may rather filtrate through the ridge to the furrows than run quickly off the surface.

"The next operation is to top-dress the ridges with lime, at the rate of from four to eight chalders per acre. Five Winchester bushels make a boll, and eight bolls a chalder of shell lime, producing sixteen bolls powdered lime. The quicker the lime is put on after being slacked the better.

"The proper season to prepare the moss for a first crop is early the preceding summer; in that case the lime, aided by the heat, the after rains, and the winter frosts, makes considerable progress in the process of putrefaction, consequently forms a mould to receive the seed.

"Though oats have sometimes succeeded as a first crop, potatoes have been found greatly preferable. The method of planting them is simple, and attended with little expence. The moss, prepared by ridges, and limed as before described, beds for the potatoes are, in the spring, marked off across the ridges, five or six feet broad, with intermediate spaces of about two feet, as furrows or trenches. The beds are covered over with a thin stratum of dung, about eighteen single horse carts to an acre, the cuttings of the potatoes are laid or placed upon the beds, about ten or twelve inches asunder, and the whole covered over with a thin stratum turn of mofs from the intermediate trenches, which is followed by another covering from the trenches when the potatoe plants make their firft appearance; the covering in whole four or five inches. In this ftate they remain without any hoeing till the crop is taken up. The produce on Mr Smith's mofs has never been lefs than from forty to fifty bolls of excellent potatoes, eight Winchefter bufhels to the boll, and the bufhel a little heaped.

"When the potatoe crop is removed, the ridges are again formed as before defcribed, and the divifion furrow cleared out. In performing this part of the work, it will naturally occur, that a great part of the manured furface will be buried in filling up the trenches between the potatoe beds: but that is not the cafe; the workman makes two cuts with the fpade, at eighteen inches diftance, upon the fide of the trench; another, one foot from the edge of it, as deep as the trench; which, inftead of turning over, he preffes a foot forward into the trench, which is continued the length of it; and when he comes to the other fide he does the fame, making both meet, and fo proceeds; fo that no part of the manured furface is thrown down, and the ridge is left in the fame form as before the lazy-beds* were made.

* This is a vulgar Scottifh phrafe for beds of a particular kind of potatoe.

"When the potatoe crop is taken off, and the ridges formed as before defcribed, they remain in that ftate till fpring, when oats are fown (a wet or dry feafon has from experience been found a matter of indifference), and harrowed in with a fmall harrow drawn by two men. Four men with eafe harrow at leaft one acre one rood per day, two and two by turns with the harrow, and the other two in the interim with fpades, fmoothing the inequalities, breaking and dividing the mould, and clearing out the divifion furrows; which laft in all operations upon mofs are effentially neceffary. The early or hot feed oats are always preferred for feed. The late or cold feed runs too much to ftraw, falls down, and becomes floomy, confequently the grain is of mean quality, and unproductive in meal.

"The produce of the firft crop of oats after potatoes is feldom lefs than ten bolls per acre, the Linlithgow boll of fix Winchefter bufhels, and confiderably more has been known; as good grain in quality, and meals as well as any in the country. It has been fold when growing, what is called upon the foot, including the ftraw, from eight to ten pounds per acre. To prepare for a fecond crop of oats, the ridges muft be dug acrofs, and turned over in the manner before defcribed, and the divifion furrows cleared out as foon as convenient after the firft crop is removed.

"Such is the effect of lime in confolidating mofs, aided by the draining, that often after the fecond, and always after the third year, it can be ploughed by horfes within two bouts or ftiches of the divifion furrow; and alfo harrowed by horfes, and the crops taken off by carts.

"Five and often fix confecutive crops of oats are taken, without any other manure than what it received the firft year for potatoes, without any apparent figns of it being exhaufted. The produce of the firft two crops of oats has been mentioned to be ten bolls, and the third, fourth, fifth, and fixth, produce from fix to ten bolls per acre. The mofs is now turned into a feeming rich dark brown mould; and what renders it lefs productive of corn crops the fourth, fifth, and fixth years is, its naturally running into fweet and luxuriant graffes. The foft meadow grafs, the daify, fome plaintain, but principally the white clover, are the moft prevalent graffes; or more probably it may be afcribed to thefe crops being ploughed, in place of being dug with the fpade, as the former years were. Along with the fifth or fixth crop of oats, rye-grafs is fown, which, with the natural graffes in general, produce an abundant crop of hay.

"If the mofs in the original ftate has been wet and fpongy, it will be found to have fubfided fome feet after the third or fourth year's operation has been performed; but care muft always be taken to deepen, clear out, and keep clear the main drains and the divifion furrows, to prevent a fuperabundance of moifture, which would infallibly be the cafe were they neglected in confequence of the fubfidence of the mofs. Indeed mofs of all forts will fubfide lefs or more, in proportion as it has been dry or wet in its original ftate; at the fame time, as ftated before, care muft be taken not to lay it too dry, but to keep in a proper degree of temperature between thefe two extremes."

By having recourfe to the pamphlet from which this extract has been made, the reader may fatisfy himfelf of the real advantages of this fpecies of agriculture. The author calculates, with much apparent fairnefs, the expence of improvement, and the value of each crop, and concludes that no wafte can be improved with equal advantage as mofs. It muft not, however, be concealed, that we have heard practical farmers, who feemed to be acquainted with the fubject, give it as their opinion that this mode of cultivation anfwers only in moffes of no great depth; though our author affirms that it has with great fuccefs been practifed by Mr Smith in moffes of the depth of 14 feet.

MOTION IN FLUIDS. When in the publication of this *Supplement* we had arrived at the title FLUIDS, we were ftruck with the importance given, in fome of the journals, to *The Experimental Refearches of* Venturi *concerning the Principle of the lateral communication of Motion in Fluids applied to the Explanation of various Hydraulic Phenomena.* Of thefe refearches we intended to lay an abridged account before our readers under the prefent title; but having examined the work with fome attention, we find in it hardly any thing of confequence which the mechanical philofopher may not learn from our articles RESISTANCE *of Fluids* and RIVER in the *Encyclopædia.* That our readers, however, may find fomething under a title to which we rafhly referred them, we fhall, in the words of Nicholfon's Journal of Natural Philofophy, &c. inform them what Venturi's work contains.

"This author, who is profeffor of experimental philofophy at Modena, has introduced an horizontal current of water into a veffel filled with the fame fluid at reft. This ftream entering the veffel with a certain velocity, paffes through a portion of the fluid, and is then received in an inclined channel, the bottom of which gradually rifes until it paffes over the border or rim of the veffel itfelf. The effect is found to be, not only that the ftream itfelf paffes out of the veffel through the channel, but carries along with it the fluid contained in the veffel; fo that after a fhort time no more of the fluid remains than was originally below the aperture at which the ftream enters. This fact is adopted as a principle

Motion.

principle or primitive phenomenon by the author, under the denomination of the lateral communication of motion in fluids, and to this he refers many important hydraulic facts. He does not undertake to give an explanation of this principle, but shows that the mutual attraction of the particles of water is far from being a sufficient cause to account for it.

The first phenomenon which the author proposes to explain by this established principle, is the emission of a fluid through different adjutages applied to the reservoir which contains it. It is known that the vein of fluid which issues from an orifice or perforation through a thin plate, becomes contracted, so as to exhibit a section equal to about 0,64 of the orifice itself, supposed to be circular; and that the place of the greatest contraction is usually at the distance of one semi-diameter of the orifice itself. If a small adjutage be adapted to the orifice, having its internal cavity of the same conoidal form as the fluid itself affects in that interval, the expenditure is the same as by the simple orifice. But if at the extremity of this adjutage a cylindric tube be affixed, of a greater diameter than that of the contracted vein, or a divergent conical tube, the expence of fluid increases, and may exceed the double of that which passes through the aperture in the thin plate, though the adjutage possess an horizontal or even ascending direction.

By the interposition of a small adjutage, adapted to the form of the contracted vein, Venturi ascertained, in the first place, that there is an increase of velocity in the tubes he employed, though the velocity of emission itself be less than that of the stream which issues from a hole in a thin plate. He afterwards proves, by the fact, that the interior velocity and expenditure of fluid, which is increased through tubes, even in the horizontal or ascending direction, is owing to the pressure of the atmosphere. If the smallest hole be made in the side of the tube near the place of contraction of the vein, the increased expenditure does not take place; and when a vertical tube is inserted in such a hole, the lower end of which tube is immersed in water or mercury, it is found that aspiration takes place, and the water or mercury rises; and this aspiration in conical tubes is less in proportion, as the place of insertion of the upright tube is more remote from the section where the greatest contraction would have taken place. And, lastly, the difference between the expenditure of fluid, through an orifice made in a thin plate, and that which is observed through an additional tube, does not take place in vacuo.

The influence of the weight of the atmosphere on the horizontal or ascending flux being thus established, the author considers it as a secondary cause, referable to, and explicable by, his principle of the lateral communication of motion in fluids. In conical divergent tubes, for example, the effect of this lateral communication is, that the central cylindrical jet, having for its basis the section of the contracted vein, carries with it the lateral fluid which would have remained stagnant in the enlarged part of the cone. Hence a vacuum tends to be produced in this enlarged part which surrounds the central cylindric stream; the pressure of the atmosphere becomes active to supply the void, and is exerted on the surface of the reservoir, so as to increase the velocity of the fluid at the interior extremity of the tube.

The author proves, that the velocity or total expenditure of fluid through an aperture of given dimension, may be increased by a proper adjutage in the proportion of 24 to 10: he applies this result to the construction of the funnels of chimneys. He determines the loss of emitted fluid, which may be sustained by sinuosity in pipes. He shews by experiment, that a pipe which is enlarged in any part affords a much less quantity of fluid than if it were throughout of a diameter equal to that of its smallest section. This, as he remarks, is a circumstance to which sufficient attention has not been paid in the construction of hydraulic machines. It is not enough to avoid elbows and contractions; for it sometimes happens that, by an intermediate enlargement, the whole of the advantage arising from other judicious dispositions of the parts of the machine is lost.

There are two causes of the increase of expenditure through descending pipes. The first is owing to the lateral communication of motion which takes place in descending pipes, in the same manner as in those which possess an horizontal situation; the second arises from the acceleration by gravity which takes place in the fluid while it falls through the descending tube. This second kind of augmentation was known to the ancients, though they possessed no good theory nor decisive experiments respecting it. The author endeavours to establish a theory on the principle of virtual ascension combined with the pressure of the atmosphere. His deductions are confirmed by experiment, in which he has succeeded so far as to separate the two causes of augmentation, and assigned to each their respective degree of influence.

Professor Venturi then proceeds to different objects of enquiry, to which his principle seemed applicable. He gives the theory of the water blowing machine (see *Water Blowing Machine* in this *Suppl.*), and he determines by calculation the quantity of air which one of these machines can afford in a given time. He observes, that the natural falls of water in the mountains always produce a local wind; and he even thinks, that the falling streams in the internal parts of mountains are in some instances the cause of the winds which issue from caves. He proves, by the facts, that it is possible, in certain instances, to carry off, without any machinery, the waters from a spot of ground, though it may be situated on a lower level than that of the channel which is to receive the water.

The whirlpools, or circular eddies of water so frequent in rivers, are, according to the theory of our author, the effect of motion communicated from the parts of the current which are most rapid, to those lateral parts which are least so. In the application of this principle, he points out the circumstances adapted to produce such eddies at the surface or at the bottom of rivers. He concludes, that every movement of this kind destroys a part of the force of the current, and that in a channel through which water constantly flows, the height of this fluid will be greater than it would have been if the dimensions of the channel had been uniformly reduced to the measure of its smallest section.

There is another kind of whirling motion somewhat different in its nature from these last. It is produced in the water of a reservoir, when it is suffered to flow through an horizontal orifice. The author deduces the theory of these vortices from the doctrine of central forces. The form of the hollow funnel, which in this case opens through the fluid of the reservoir, is a curve of the 64th species of the lines of the third order, enumerated by Newton. Theory and experiment both unite here in proving, that it is not only possible, but that there really exists in nature a vortex, the concavity of which is convex towards the axis, and of which the revolutions of its different parts follow the ratio of the square of the distance from the centre. Daniel Bernoulli was in the wrong, in his Hydrodynamics, to reproach Newton for having supposed a vortex to be moved according to this law.

In the last place, the author considers that lateral communication of motion which takes place in the air as well as in the water. This is the cause of such local and partial winds as sometimes blow contrary to the direction of the general wind. It is by virtue of the same principle, that the resonant vibration, excited laterally in the extremity of an organ pipe, is communicated to the whole column of air contained in the pipe itself.

From the same principle, the author deduces the augmentation of force which sound receives in conical divergent tubes, compared with those of a cylindrical form. On this occasion, he points out the remarkable differences which appear to take place between the resonant vibrations of air contained in a tube, and the sonorous pulsations propagated through the open atmosphere. See *Speaking Trumpet*, Encycl.

In an appendix, Venturi relates different experiments which he has made to determine the convergence and velocity of the fluid filaments which press forward to issue out of a reservoir by an orifice through a thin plate. He proves, by a very clear experiment, that the contraction of the vein is made at a greater distance from the orifice under strong than under weak pressures. He explains why, in a right-lined orifice, the sides of the contracted vein correspond with the angles of the orifice and the angles with the sides. He examines the expenditure through a tube, the extremity of which is thrust into the reservoir itself, according to the method of Borda in the Memoirs of the Academy of Sciences for the year 1766."

For a full account of the author's experiments, and his deductions from them, we refer the reader either to the original work, intitled, *Recherches expérimentales sur le Principe de la Communication latérale du Mouvement dans les Fluides, appliqué à l'Explication de différens Phenomènes hydrauliques. Par le Citoyen J. B. Venturi, Professeur de Physique expérimentale à Modène, Membre de la Société Italienne, &c. &c. A Paris chez Houel et Ducros, Rue du Bacq,* N° 940—*Theophile Barrois, Rue Haute-feuille,* N° 22. *Ann.* VI. 1797—or to the 2d and 3d vol. of the valuable Journal from which this abstract is taken.

MOTTE *Isle*, a small island in Lake Champlain, about 8 miles in length and 2 in breadth distant 2 miles W. of North Hero Island. It constitutes a township of its own name in Franklin county, Vermont, and contains 47 inhabitants.—*Morse*.

MOUCHA, *La*, a bay on the coast of Chili, on the W. coast of S. America.—*ib*.

MOULTONBOROUGH, a post-town in Strafford county, New-Hampshire, situated at the N. W. corner of Lake Winnipiseogee, 18 miles E. by N. of Plymouth, and 48 N. W. by N. of Portsmouth. This township was incorporated in 1777, and contains 565 inhabitants.—*ib*.

MOUNT BETHEL, *Upper* and *Lower*, two townships in Northampton county, Pennsylvania.—*ib*.

MOUNT DESERT, an island on the coast of Hancock county, District of Maine, about 15 miles long and 12 broad. It is a valuable tract of land, intersected in the middle by the waters flowing into the S. side from the sea. There are two considerable islands on the south-east side of Mount Desert Island, called Cranberry Islands, which assist in forming a harbour in the gulf which sets up on the south side of the island. In 1790, it contained 744 inhabitants. The northerly part of the island was formed into a township called Eden, in 1796. The south-easternmost part of the island lies in about lat. 44 12 N. On the main land, opposite the north part of the island, are the towns of Trenton and Sullivan. It is 335 miles north-east of Boston.—*ib*.

MOUNT HOLLY, a village in Burlington county, New-Jersey, situated on the northern bank of Ancocus Creek, about 7 or 8 miles south-east of Burlington.—*ib*.

MOUNT HOPE *Bay*, in the northeast part of Narraganset Bay.—*ib*.

Mount Hope, a small river of Connecticut, a head branch of the Shetucket, rising in Union.—*ib*.

MOUNT JOY, the name of two townships in Pennsylvania, the one in Lancaster the other in York county.—*ib*.

Mount Joy, a Moravian settlement in Pennsylvania, 16 miles from Litiz.—*ib*.

MOUNT PLEASANT, a township in West-Chester county, New-York, situated on the east side of Hudson river; bounded southerly by Greensburg, and northerly and easterly by Philipsburg. It contains 1,924 inhabitants, of whom 275 are qualified electors, and 84 slaves. Also the name of a township in York county, Pennsylvania.—*ib*.

Mount Pleasant, a village of Maryland, situated partly in each of the counties of Queen Ann and Caroline, about 11 miles east of the town of Church Hill.—*ib*.

MOUNT TOM, a noted mountain on the west bank of Connecticut river, near Northampton. Also the name of a mountain between Litchfield and Washington, in Connecticut.—*ib*.

MOUNT VERNON, the seat of George Washington, late President of the United States. It is pleasantly situated on the Virginia bank of Patowmac river, in Fairfax county, Virginia, where the river is nearly 2 miles wide; 9 miles below Alexandria; 4 above the beautiful seat of the late Col. Fairfax, called Bellevoir; 127 from Point Look Out, at the mouth of the river, and 280 miles from the sea. The area of the mount is 200 feet above the surface of the river; and, after furnishing a lawn of five acres in front, and about the same in rear of the buildings, falls off rather abruptly on those two quarters. On the north end it subsides gradually into extensive pasture grounds; while on the south it slopes more steeply, in a short distance, and terminates with the coach-house, stables, vineyard, and nurseries. On either wing is a thick grove

grove of different flowering foreft trees. Parallel with them, on the land fide, are two fpacious gardens, into which one is led by two ferpentine gravel walks, planted with weeping willows and fhady fhrubs. The manfion houfe itfelf appears venerable and convenient. The fuperb banqueting-room has been finifhed fince the General returned home from the army. A lofty portico, 96 feet in length, fupported by 8 pillars, has a pleafing effect when viewed from the water; the whole affemblage of the green-houfe, fchool-houfe, offices, and fervants' halls, when feen from the land fide, bears a refemblance to a rural village; efpecially as the lands on that fide are laid out fomewhat in the form of Englifh gardens, in meadows and grafs-grounds, ornamented with little copfes, circular clumps, and fingle trees. A fmall park on the margin of the river, where the Englifh fallow deer and the American wild deer are feen through the thickets, alternately with the veffels as they are failing along, add a romantic and picturefque appearance to the whole fcenery. On the oppofite fide of a fmall creek to the northward, an extenfive plain, exhibiting corn-fields and cattle grazing, affords in fummer a luxuriant landfcape; while the blended verdure of wood-lands and cultivated declivities, on the Maryland fhore, variegates the profpect in a charming manner. Such are the philofophic fhades to which the Commander in chief of the American army retired in 1783, at the clofe of a victorious war; which he again left in 1789, to dignify with his unequalled talents, the higheft office in the gift of his fellow-citizens; and to which he again retreated in 1797 loaded with honours, and the benedictions of his country, to fpend the remainder of his days as a private citizen, in peace and tranquillity.—*ib.*

Mount Vernon, a plantation in Lincoln county, Diftrict of Maine, in the neighbourhood of Sidney and Winflow.—*ib.*

MOUNT WASHINGTON, in the upper part of the ifland of New-York.—*ib.*

Mount Washington, one of the higheft peaks of the White Mountains, in New-Hampfhire.—*ib.*

Mount Washington, the fouth-wefternmoft townfhip of Maffachufetts, in Berkfhire county, 150 miles W. by S. of Bofton. It was incorporated in 1779, and contains 67 inhabitants.—*ib.*

MOURZOUK, the capital of Fezzan in Africa, is fituated on a fmall river, and fupplied with water from a multitude of fprings and wells. Being formerly built of ftone, it ftill retains the appellation of a Chriftian town; and the medley which it prefents to the eye, of the vaft ruins of ancient buildings, and the humble cottages of earth and fand that form the dwelling of its prefent Arab inhabitants, is fingularly grotefque and ftrange. It is furrounded by a high wall, which not only affords the means of defence, but enables the government to collect, at its three gates, a tax on all goods (provifions excepted) that are brought for the fupply of its people. A caravan fets out annually from Mefurata to this place; and hence the Fezzaners themfelves difpatch every year a caravan to Cafhna and another to Bornou. For the latitude of Mourzouk, fee Fezzan in this *Suppl.* Dr Brookes, in his Gazetteer, places it in 15° 5′ E. Long.

MOUSE *Harbour*, at the E. fide of the ifland of St John's, and at the S. W. angle of the gulf of St Lawrence, is between Eaft Point and Three rivers, and goes in with a fmall creek that is moderately fpacious within.—*Morse.*

MOUSOM, a fmall river of York county, Diftrict of Maine, which falls into the ocean between Wells and Arundel.—*ib.*

MOWAZZEF, in Bengal, fixed revenue.

MOWEE, one of the Sandwich Ifles, next in fize to, and N. W. of, Owhyhee. A large bay of a femicircular form; oppofite to which are the iflands Tahoorowa and Morokinnee. It is about 162 miles in circumference, and is thought to contain nearly 70,000 inhabitants.—*Morse.*

MOYAMENSING, a townfhip in Philadelphia county, Pennfylvania.—*ib.*

MOZART, the celebrated German mufician, was born at Salzburg in the year 1756. His father was alfo a mufician of fome eminence, but not to be compared with the fon; of whom we have the following account in one of the monthly mifcellanies, taken by Mr Bufhby from fome biographical fketches by two eminent German profeffors.

At the age of three years, young Mozart, attending to the leffons which his fifter, then feven years old, was receiving at the harpfichord, he became captivated with harmony; and when fhe had left the inftrument, he would inftantly place himfelf at it, find the thirds, found them with the livelieft joy, and employ whole hours at the exercife. His father, urged by fuch early and ftriking indications of genius, immediately began to teach him fome little airs; and foon perceived that his pupil improved even beyond the hopes he had formed of him. Half an hour was generally fufficient for his acquiring a minuet or a little fong, which, when once learned, he would of himfelf perform with tafte and expreffion.

At the age of fix years he had made fuch a progrefs as to be able to compofe fhort pieces for the harpfichord, which his father was obliged to commit to paper for him. From that time nothing made any impreffion upon him but harmony; and infantine amufements loft all their attractions unlefs mufic had a fhare in them. He advanced from day to day, not by ordinary and infenfible degrees, but with a rapidity which hourly excited new furprife in his parents—the happy witneffes of his progrefs.

His father returning home one day with a ftranger, found little Mozart with a pen in his hand. "What are you writing," faid he? "A concerto for the harpfichord," replied the child. "Let us fee it (rejoined the father); it is a marvellous concerto without doubt." He then took the paper, and faw nothing at firft but a mafs of notes mingled with blots of ink by the mal-addrefs of the young compofer, who, unfkilled in the management of the pen, had dipped it too freely in the ink; and having blotted and fmeared his paper, had endeavoured to make out his ideas with his fingers; but on a clofer examination, his father was loft in wonder; and his eyes delighted and flowing with tears, became rivetted to the notes. "See (exclaimed he to the ftranger) how juft and regular it all is! but it is impoffible to play it; it is too difficult." "It is a concerto (faid the child), and muft be practifed till one can play it. Hear how this part goes." He then fat down to perform it; but was not able to execute the paffages with fufficient fluency to do juftice to his own ideas.

Mozart. ideas. Extraordinary as his manual facility was universally allowed to be for his age, it did not keep pace with the progrefs of his knowledge and invention. Such an inftance of intellectual advancement, in a child only fix years of age, is fo far out of the common road of nature, that we can only contemplate the fact with aftonifhment, and acknowledge, that the poffible rapidity of mental maturation is not to be calculated.

In the year 1762, his father took him and his fifter to Munich, where he performed a concerto before the elector, which excited the admiration of the whole court; nor was he lefs applauded at Vienna, where the emperor called him the *little forcerer*.

His father gave him leffons only on the harpfichord; but he privately taught himfelf the violin; and his command of the inftrument afforded the elder Mozart the utmoft furprife, when he one day at a concert took a fecond violin, and acquitted himfelf with more than paffable addrefs. True genius fees no obftacles. It will not therefore excite our wonder, if his conftant fuccefs in whatever he attempted begot an unbounded confidence in his own powers; he had even the *laudable* hardihood to undertake to qualify himfelf for the *firft* violin, and did not long remain fhort of the neceffary proficiency.

He had an ear fo correct, that he felt the moft minute difcordancy; and fuch a fondnefs for ftudy, that it was frequently neceffary to take him by force from the inftrument. This love of application never diminifhed. He every day paffed a confiderable time at his harpfichord, and generally practifed till a late hour at night. Another characteriftical trait of real genius; always full of its object, and loft as it were in itfelf.

In the year 1763 he made, with his father and fifter, his firft grand mufical journey. He vifited Paris; and was heard by the French court in the chapel-royal at Verfailles, where his talent on the organ was admired even more than on the harpfichord. At Paris the mufical travellers gave two concerts, which procured them the higheft reputation, and the diftinction of public portraits. It was here that a fet of fonatas for the harpfichord, fome of his earlieft compofitions, were engraved and publifhed.

From Paris they went to London, where they alfo gave two concerts, confifting of fymphonies compofed by young Mozart, who even at that early age fang alfo with much expreffion, and practifed publicly with his fifter. Mozart played already at fight, and in a concert, at which the king was one of his auditors, a bafs being placed before him as a *ground*, immediately applied to it a moft beautiful melody. Thofe who are beft acquainted with the extent of fuch a tafk, will be the moft aftonifhed at fuch mature familiarity with the intricacies of the fcience, and fuch prompt and ready invention in fo juvenile a mind.

From London, where Mozart alfo publifhed fix fonatas for the harpfichord, the mufical family went to Holland, thence again to France, and in 1766 returned to Salzburg. There this extraordinary youth remained more than a year in perfect repofe: devoting the whole of his time to the ftudy of compofition, the principles of which he fcrutinized with the depth and penetration of confirmed manhood. Emmanuel Bach, Haffe, and Handel, were his chief guides and models; though he by no means neglected the old Italian mafters.

In 1768 he again vifited Vienna, where Jofeph II. Mozart. engaged him to fet to mufic a comic opera, entitled, *La Finta Semplice*, which obtained the approbation of Haffe and Metatafio. At the houfe of the prince of Kaunitz, it often happened that the firft Italian air which came to hand would be given him, that in the prefence of the company he might add to it accompaniments for numerous inftruments; which he would write in the firft ftyle of excellence, and without the leaft premeditation. This is at once a proof with what acutenefs of obfervation he had liftened to the mufic of the beft mafters; how intimate he had already rendered himfelf with the characters, capacities, and effects of the different inftruments; and what fkill he had acquired in that abftrufe art of mixed combination which, while it calculates the conjoint effect of founds, as they regard the eftablifhed laws of harmony, accommodates the different parts to the fcales, tones, and powers of the refpective inftruments by which they are to be executed. It was at this time alfo that, although but twelve years of age, he compofed the mufic for the confecration of the church of orphans, at the performance of which he himfelf prefided.

In 1769 Mozart again returned to Salzburg, where he became *maitre de concert*. Not having yet feen Italy, in December of the fame year he fet out for that feat of the fine arts. Thofe talents which had already excited the admiration of Germany, France, and England, now awakened in that land of mufical tafte the moft lively enthufiafm.

In 1771 he had no fooner given perfonal proofs of his genius, than *la fcrittura* for the following carnival was conferred upon him. He vifited Bologna, then as famous for harmonic excellence as Naples, where the celebrated theorift Martini was amazed to fee a German boy work and execute the theme of a fugue which he prefented to him, in the extraordinary ftyle in which Mozart acquitted himfelf. He next went to Florence. Florence even enhanced the eulogiums which Bologna had lavifhed upon him.

During the holy week he arrived at Rome, and affifted at the *Miferere* in the Sixtine chapel; which performance is juftly confidered as the *ne plus ultra* of vocal mufic. This circumftance claims particular notice, as inducing a proof of another faculty of his mind, only to be equalled by thofe wonderful powers which he had already demonftrated. He was prohibited from taking a copy of this *Miferere*, and therefore piqued himfelf on retaining it in his memory. Having heard it with attention, he went home, made out a manufcript from recollection, returned the next day to the chapel, heard the piece a fecond time, corrected the rough draught, and produced a tranfcript which furprifed all Rome. This *Miferere* formed a *fcorer* numerous in its parts, and extremely difficult of execution. His mind had embraced and retained the whole!

He foon after received from the Pope the order of the gilt fpur; and at Bologna was complimented, by an unanimous decifion, with the title of *Member and Mafter of the Phil-harmonic Academy*. As a proof, *pro-forma*, of his qualifications for this academical honour, a fugue, for four voices, in the church ftyle, was required of him, and he was fhut up alone in his chamber. He completed it in half an hour, and received his diploma. This evinced that he poffeffed an imagination conftantly

Mozart. conſtantly at his command, and that his mind was ſtored with all the riches of his beloved ſcience.

The opera which he compoſed for Milan was called *Mithridates*. This piece procured him *la ſcrittura* for the grand opera of the carnival of 1773, which was his *Lucio Silla*. At length, after a tour of fifteen months, he returned to Salzburg.

In 1771 Mozart viſited Paris; but not reliſhing the muſic of that capital, he ſoon quitted it, and returned to his domeſtic comforts. In 1781, at the requeſt of the elector of Bavaria, he compoſed the opera of *Idomeneo* for the carnival of that year. The general merit of this opera is ſo great, that it might ſerve alone for the baſis of a diſtinguiſhed reputation. At his twenty-fifth year he was invited to Vienna, where he continued ſpreading, as from a centre, the taſte of his compoſitions through all Germany, and the luſtre of his name over the whole of Europe.

Of all the virtuoſi of the piano forte who then crowded Vienna, Mozart was much the moſt ſkilful. His finger was extraordinarily rapid and taſteful, and the execution of his left hand exceeded every thing that had before been heard. His touch was replete with delicacy and expreſſion; and the profound ſtudy he had beſtowed on his art, gave his performance a ſtyle the moſt brilliant and finiſhed. His compoſitions had a rapid circulation; and in every new piece the connoiſſeurs were ſtruck with the originality of its caſt, the novelty of the paſſages, and the energy of the effect.

Joſeph II. ſolicitous for the perfection of the German opera, engaged Mozart to compoſe a piece. He accordingly produced *L'enlevement du Serail;* performed for the firſt time in 1782. It excited the jealouſy of the Italian company, who therefore ventured to cabal againſt it. The emperor, addreſſing himſelf to the compoſer, ſaid, "It is *too fine* for our ears, my dear Mozart, and moſt *charmingly crowded* with notes." "Preciſely what it ought to be," replied the ſpirited muſician, who juſtly ſuſpected that this remark had been ſuggeſted to Joſeph by the envious Italians. "Though I cannot deſcribe, as an auricular evidence, (ſays the faithful author of the biography), the applauſes and the admiration which this opera produced at Vienna, yet I have witneſſed the enthuſiaſm it excited at Prague among all the connoiſſeurs, as well as among thoſe whoſe ears were leſs cultivated. It was ſaid, that all which had been heard before was not muſic: it drew the moſt overflowing audiences: every body was amazed at its new traits of harmony, and at paſſages ſo original, and till then ſo unheard from wind inſtruments."

The cautious reader will perhaps heſitate to admit, in its fulleſt extent, this account by the author of the biography; but even after an allowance for ſome exaggeration, the moſt phlegmatic will grant that much muſt have been atchieved by this great maſter, to afford a baſis for ſo glowing a picture of the merit and ſucceſs of *L'enlevement du Serail*. During the compoſition of this opera, he married Mademoiſelle Weber, a diſtinguiſhed virtuoſa; and the piece was ſuppoſed to owe to this felicitous circumſtance much of that endearing character, that tone of tenderneſs, and that expreſſion of the ſofter paſſions, which form its principal attractions.

"The Marriage of Figaro," which was in the higheſt repute at all the theatres, was in the year 178[illegible] transformed into an Italian opera; and Mozart, at the inſtance of the emperor, ſet it to muſic. This piece was highly received everywhere, and kept poſſeſſion of the theatre at Prague during almoſt the whole of the winter in which it firſt appeared: numerous extracts were made from it, and the ſongs and dances of Figaro were vociferated in the ſtreets, the gardens, and the taverns. Mozart came that very winter to Prague, and performed in public on the piano forte. His auditors at all times liſtened to him with admiration; but whenever he played extempore, and indulged the ſpontaneous and uninterrupted ſallies of his fancy, which he ſometimes would for more than half an hour, every one was ſeized with the moſt enthuſiaſtic raptures, and acknowledged the unrivalled reſources of his imagination. About this time the manager of the theatre contracted with him for the compoſition of a new opera, which, when produced, was called *Il diſſoluto Punito*, or *Don Giovanni*. His reputation was now ſo exalted, that the Bohemians piqued themſelves on the circumſtance that this opera was compoſed for their entertainment.

But this fame, this great and univerſal applauſe, had not yet produced to the admired artiſt any ſolid advantages; he had obtained no place, no ſettled income; but ſubſiſted by his operas, and the inſtructions and occaſional concerts which he gave. The profits of theſe proved inſufficient for the ſtyle which he was obliged to ſupport; and his finances became much deranged. The critical ſituation in which he now found himſelf, made him reſolve to quit Vienna, and ſeek an aſylum in London; to which metropolis he had often been invited; but Joſeph nominating him *compoſiteur de la chambre*, though, with a very inadequate ſalary, he was induced to accept it; and Germany had the advantage of retaining him.

It is lamentable that premature genius too rarely enjoys a long career: The acceleration of nature in the mental powers ſeems to hurry the progreſs of the animal œconomy, and to anticipate the regular cloſe of temporal exiſtence.

In the year 1791, Mozart, juſt after he had received the appointment of *Maitre de chapelle* of the church of St Peter, and when he was only thirty-five years of age, paid the laſt tribute; and left the world at once to admire the brilliancy, and lament the ſhortneſs of his earthly ſojournment.

Indefatigable, even to his death, he produced, during the laſt few months of his life, his three great maſter pieces *La Flutte Enchantée*, *La Clemence de Titus*, and a *Requiem*, his laſt production. *La Flute Enchantee* was compoſed for one of the theatres at Vienna; and no dramatic *Olio* could ever boaſt a greater ſucceſs. Every air ſtruck the audience with a new and ſweet ſurpriſe; and the *tout enſemble* was calculated to afford the deepeſt and moſt varied impreſſions. This piece had, in fact, ſo great a number of ſucceſſive repreſentations, that for a long time it was unneceſſary to conſult the opera-bill; which only announced a permanent novelty. And the airs ſelected from it, and repeated throughout the empire, as well in the cottage as in the palace, and which the echoes have reſounded in the moſt diſtant provinces, favoured the idea that Mozart had actually the deſign to enchant all Germany with his *Flute Enchantée*.

La

Mozart.

La Clemence de Titus was requested by the states of Bohemia for the coronation of Leopold. The composer began it in his carriage during his route to Prague, and finished it in eighteen days.

Some circumstances attending the composition of the piece which we have already mentioned as the last effort of his genius, are too interesting to be omitted. A short time before his death, a stranger came to him with the request that he would compose, as speedily as possible, a *requiem* for a catholic prince, who, perceiving himself on the verge of the grave, wished, by the execution of such a piece, to soothe his mind, and familiarise it to the idea of his approaching dissolution. Mozart undertook the work; and the stranger deposited with him as a security 400 ducats, though the sum demanded was only 200. The composer immediately began the work, and during its progress felt his mind unusually raised and agitated. He became at length so infatuated with his *requiem*, that he employed not only the day, but some hours of the night in its composition. One day, while he was conversing with Madame Mozart on the subject, he declared to her that he could not but be persuaded that it was for himself he was writing this piece. His wife, distressed at her inability to dissipate so melancholy an impression, prevailed on him to give her the *score*. He afterwards appearing somewhat tranquillized, and more master of himself, she returned the *score* to him, and he soon relapsed into his former despondency. On the day of his death he asked for the *requiem*, which was accordingly brought to his bed: "Was I not right (said he), when I declared that it was for myself I was composing this funeral piece?" And the tears trickled from his eyes. This production of a man, impressed during its composition with a presentiment of his approaching death, is *unique* in its kind, and contains passages which have frequently drawn tears from the performers.

Only one complaint escaped him during his malady: "I must quit life (said he), precisely at the moment when I could enjoy it, free from care and inquietude; at the very time when, independent of sordid speculations, and at liberty to follow my own principles and inclinations, I should only have to write from the impulses of my own heart: and I am torn from my family just when in a situation to serve it." Mozart, at the time of his death, was considerably involved in debt; but Vienna and Prague disputed the honour of providing for his widow and children.

The countenance of this great master did not indicate any thing uncommon. He was small of stature; and, except his eyes, which were full of fire, there was nothing to announce superiority of talent. His air, unless when he was at the harpsichord, was that of an absent man. But when he was performing, his whole physiognomy became changed: a profound seriousness recalled and fixed his eyes; and his sentiments were expressed in every movement of his muscles. Never has a musician more successfully embraced the whole extent of his art, and shone with greater lustre in all its departments. His great operas, no less than his most simple songs; his learned symphonies as well as his airy dances—all carry the stamp of the richest imagination, the deepest sensibility, and the purest taste. All his works develope the originality of his genius; and imply a mind great and exalted; an imagination which strikes out for itself a new course. He therefore merits to be ranked with that small number of original geniuses, those *phænomena splendida*, who form an epoch in their art, by carrying it to perfection, or giving it an unknown career.

It is in the employment of wind instruments that Mozart displays his greatest powers. His melody is always simple, natural, and full of force; and expresses with precision the sentiments and individual situations of his personages. He wrote with extraordinary facility. "*La Clemence de Titus*," the reader will recollect, cost him the study of but eighteen days; and his *requiem*, which is equal in length to an opera, was produced in four weeks. It is also worthy of remark, that the overture to his *Don Giovanni* was not begun till the night before the piece was to be performed. At midnight, after having devoted the evening to amusement, he locked himself up in his study, and composed it in a few hours. His memory was wonderfully retentive, as we may judge from his copying by recollection the *miserere* at Rome. But a fact equally astonishing is, that, soon discovering the eagerness of people to procure his works, and fearful that they might be pirated, it was his constant custom to transcribe from the *scores* of his sonatas only a part for one hand, and at the public performance to supply the other by memory.

He very early began to display that true dignity of an artist which renders him indifferent to the praises of those who are unqualified to judge. The commendations of the ignorant great he never considered as fame. His hearers, whether the wealthy or the titled, must have acquired some credit for their judgment before he could be ambitious of their applause. Indeed he entertained so just a sense of scientific elevation and importance, that he would insist upon respect. And the least noise or idle babble, while he was at the instrument, excited a displeasure which he was too indignant to conceal. Once, to the honour of his feelings, he suddenly rose from his seat, and left his inattentive auditory to experience the keen though silent reproach of insulted genius.

His mind was by no means unlettered; nor was it embellished with one science alone. He was master of several languages, and had made considerable progress in the mathematics. He was honest, mild, generous, full of frankness; and with his friends had an air at once amiable, gay, and free from the least tincture of pedantry.

Far from viewing with envy the success of others, a weakness too closely interwoven in the general nature of man, he was always just to the talents of his fellow professors; and valued and respected merit wherever he found it; a clearer proof of which cannot be adduced than the following circumstance: At a concert, where a new piece composed by the celebrated Joseph Haydn was performed, a certain musician, who never discovered any thing worthy of praise except in his own productions, did not fail to criticise the music; exclaiming to Mozart, "There now! there again! why, that is not what *I* should have done:" "No; neither should I (replied Mozart); but do you know why? Because neither you nor I should have been able to conceive it."

MUCAROS *Island*, near the N. coast of Cuba Island, in the W. Indies, which with Island Verde, lies opposite to the Cape Quibannano.—*Morse.*

MUD *Island*, in Delaware river, is 6 or 7 miles below the city of Philadelphia; whereon is a citadel, and a fort which commands the river. On a sand bar, a large pier has been erected, as the foundation for a battery, to make a cross fire.—*ib.*

MUD *Lake*, in the State of New-York, is small, and lies between Seneca and Crooked Lakes. It gives rise to a north branch of Tioga river.—*ib.*

MUGERAS *Islands*, otherwise called *Men-Eaters* or *Women-Eaters Islands*, are 10 leagues S. of Cape Catoche, on the E. coast of the peninsula of Yucatan. On the south of them, towards the land, is good anchorage in from 7 to 8 fathoms, and clean ground.—*ib.*

MULATRE, *Point*, in the island of Dominica, in the W. Indies. N. lat. 15 16 west long. 61 21.—*ib.*

MULATTO *Point*, on the west coast of S. America is the S. cape of the port of Ancon, 16 or 18 miles north of Cadavayllo river.—*ib.*

MULHEGAN *River*, in Vermont, rises in Lewis, and empties into Connecticut river, at Brunswick.—*ib.*

MULLICUS *River*, in New-Jersey, is small, and has many mills and iron-works upon it, and empties into Little Egg Harbour Bay, 4 miles easterly of the town of Leeds. It is navigable 20 miles for vessels of 60 tons.—*ib.*

MUMBO-JUMBO, a strange bugbear employed by the Pagan Mandingoes (see MANDINGO, *Suppl.*) for the purpose of keeping their women in subjection. Polygamy being allowed among these people, every man marries as many wives as he can conveniently maintain; and the consequence is, that family quarrels sometimes rise to such a height, that the husband's authority is not sufficient to restore peace among the ladies. On these occasions, the interposition of *Mumbo-Jumbo* is called in; and it is always decisive. This strange minister of justice, who is either the husband himself, or some person instructed by him, disguised in a sort of masquerade habit, made of the bark of trees, and armed with the rod of public authority, announces his coming by loud and dismal screams in the woods near the town. He begins the pantomime at the approach of night; and as soon as it is dark, he enters the town, and proceeds to the *Bentang* or market-place, at which all the inhabitants immediately assemble.

It may easily be supposed that this exhibition is not much relished by the women; for as the person in disguise is entirely unknown to them, every married female suspects that the visit may possibly be intended for herself; but they dare not refuse to appear when they are summoned; and the ceremony commences with songs and dances, which continue till midnight, about which time Mumbo fixes on the offender. This unfortunate victim being thereupon immediately seized, is stripped naked, tied to a post, and severely scourged with Mumbo's rod, amidst the shouts and derision of the whole assembly; and it is remarkable, that the rest of the women are the loudest in their exclamations on this occasion against their unhappy sister. Daylight puts an end to this indecent and unmanly revel. It is truly astonishing that the women should be deluded by so clumsey an imposture, and that the men should so faithfully keep their own secret. That the women are deluded seems evident; for Mr Park assures us, that the dress of Mumbo is suffered to hang on a tree at the entrance of each town; which could hardly be the case, if the women were not persuaded that it is the dress of some supernatural being.

MUNCY, a creek which empties into the Susquehannah from the N. E. about 23 miles N. of the town of Northumberland.—*Morse.*

MUNSHY, a Persian secretary or writer.

MUNSIES, DELAWARES, and SAPCONES, three Indian tribes, who inhabit at Diagho, and other villages up the N. branch of Susquehannah river. About 20 years ago, the two first could furnish 150 warriors each, and the Sapcones 30 warriors.—*Morse.*

MUNSUB, in the language of Bengal, a dignity or command conferred by the emperor.

MUNSUBDAR, a dignitary or commander.

MURFREESBOROUGH, a post-town of N. Carolina, and capital of Gates county. It is situated on Meherrin river, and contains a few houses, a court-house, gaol, and tobacco ware-house. It carries on a small trade with Edenton, and the other sea-port towns. It is 3 miles from Princeton, 12 from Winton, 50 N. by W. of Edenton, and 422 S. W. of Philadelphia.—*Morse.*

MURGA MORGA *River*, on the coast of Chili in S. America, is southward of the S. point of Quintero Bay, and not far from the entrance into Chili river. It is not navigable, but is very good to water in.—*ib.*

MURRAY (William), afterwards Earl of Mansfield and Lord Chief Justice of England, was the fourth son of David Viscount Stormont. He was born on the 2d day of March 1705 at Perth, in the kingdom of Scotland, of which kingdom his father was a peer. His residence in Scotland, however, was of short duration; for he was carried up to London at the early age of three years. Hence his total exemption from the peculiarities of the dialect of his native country.

At the age of fourteen he was admitted as a king's scholar of Westminster school; and during his residence in that seminary, says his contemporary Bishop Newton, he gave early proofs of his uncommon abilities, not so much in his poetry, as in his other exercises; and particularly in his declamations, which were sure tokens and prognostics of that eloquence which grew up to such maturity and perfection at the bar, and in both houses of parliament. At the election in May 1723, he stood first on the list of those gentlemen who were sent to Oxford, and was entered of Christ Church, June the 18th, in that year. In the year 1727 he had taken the degree of B. A. and on the death of King George the First, was amongst those of the university who composed verses on that event.

In April 1724 he was admitted a student at Lincoln's Inn, though he still continued to reside in the university; where, on the 26th of June 1730, he took the degree of M. A. and soon afterwards left Oxford, determined to make the tour of Europe, before he should devote himself seriously to business. About this period he wrote two letters to a young nobleman on the study of ancient and modern history, which are published by his biographer Mr Holliday, and shew how amply his own mind was then stored with general literature.

On his return to England he commenced his legal studies; but proceeded not in the way then usually adopted, Murray. adopted, of labouring in the chambers of a special pleader, or copying (to use the words of Blackstone) the trash of an attorney's office. Being blessed with the powers of oratory in their highest perfection, and having soon an opportunity of displaying them, he very early acquired the notice of the chancellor and the judges, as well as the confidence of the inferior practisers. How much he was regarded in the house of lords, Pope's well-known couplet will prove:

Grac'd as thou art with all the power of words,
So known, so honour'd at the house of lords.

The graces of his elocution, however, produced their usual effect with a certain class of people, who would not believe that such bright talents could associate with the more solid attainments of the law, or that a man of genius and vivacity could be a profound lawyer. As Pope observed at that time,

The Temple late two brother sergeants saw,
Who deem'd each other oracles of law;
With equal talents these congenial souls,
One lull'd the exchequer, and one stunn'd the rolls;
Each had a gravity would make you split,
And shook his head at Murray as a wit.

It is remarkable that this ridiculous prejudice accompanied Lord Mansfield to the end of his judicial life, in spite of daily proofs exhibited in the court of King's Bench and in the House of Lords, of very profound knowledge of the abstrusest points of jurisprudence. Lord Chesterfield has given his sanction to this unfounded opinion. In a letter to his son, dated Feb. 12. 1754, he says, "The present Solicitor General Murray has less law than many lawyers, but he has more practice than any, merely upon account of his eloquence, of which he has a never-failing stream."

In the outset of Lord Mansfield's life, it will be the less surprising, that a notion should have been entertained of his addicting himself to the pursuits of Belles Lettres too much, when the regard shewn to him by Mr Pope, who despotically ruled the regions of literature at that period, is considered. That great Poet seemed to entertain a particular affection for our young lawyer, and was eager to shew him marks of his regard. He addressed to him his imitation of the 6th Epistle of the First Book of Horace; and even condescended to become his master in the art of elocution. "Mr Murray (says his biographer) was one day surprised by a gentleman of Lincoln's Inn, who could take the liberty of entering his rooms without the ceremonious introduction of a servant, in the singular act of practising the graces of a speaker at a glass, while Pope sat by in the character of a friendly preceptor. Mr Murray, on this occasion, paid that poet the handsome compliment of, *Tu es mihi Mæcenas* (A)."

Whatever propensities this sprightly lawyer might have towards polite literature, he did not permit them to divert his attention from his profession. He soon distinguished himself in an extraordinary manner, as may be seen by those who are conversant with, or chuse to refer to the Books of Reports. In the year 1736, the murder of Captain Porteous by a mob in Edinburgh, after he had been reprieved, occasioned a censure to fall on that city, and a bill of pains and penalties was brought into Parliament against the Lord Provost and the corporation; which, after various modifications, and a firm and unabated opposition in every stage of its progress, passed into a law. In both Houses Mr Murray was employed as an advocate, and so much to the satisfaction of his clients, that afterwards, in September 1743, he was presented with the freedom of Edinburgh in a gold box, professedly, as it was declared, for his signal services by his speeches to both Houses of Parliament in the conduct of that business.

On the 24th of November 1738, he had married Lady Elizabeth Finch, daughter of the Earl of Winchelsea, and in the month of November 1742, was appointed Solicitor General in the place of Sir John Strange, who resigned (B). He likewise was chosen to represent the town of Boroughbridge in Parliament, for which place he was also returned in 1747 and 1754.

In the month of March 1746-7 he was appointed one of the managers for the impeachment of Lord Lovat by the House of Commons, and it fell to his lot to observe on the evidence previous to the Lords giving their judgment. This task he executed with so much candour, moderation, and gentleman-like propriety, that Lord Talbot, at the conclusion of his speech, paid him the following compliment: "The abilities of the learned manager who just now spoke, never appeared with greater splendour than at this very hour, when his candour and humanity has been joined to those great abilities which have already made him so conspicuous, that I hope one day to see him add lustre to the dignity of the first civil employment in this nation." Lord Lovat himself also bore testimony to the abilities of his adversary: "I thought myself (says his lordship) very much loaded by one Murray (C), who your Lordships know was the bitterest evidence there was against me. I have since

(A) It is thus that eminence is attained even by genius, and Mr Murray was properly employed; though we do not clearly perceive the use of the glass, when his master was watching all his gestures.

(B) On this occasion a doggrel poem was published by one Morgan, a person then at the bar, entitled, "The Causidicade," in which all the principal lawyers were supposed to urge their respective claims to the post. At the conclusion it is said,

Then Murray, prepar'd with a fine panegyric
In praise of himself, would have spoke it like Garrick;
But the President stopping him said, "As in truth
"Your worth and your praise is in every one's mouth,
"'Tis needless to urge what's notoriously known,
"The office, by merit, is your's all must own;
"The voice of the public approves of the thing,
"Concurring with that of the Court and the King."

(C) One of the evidences against him.

Murray.

ſince ſuffered by another Mr Murray, who, I muſt ſay with pleaſure, is an honour to his country, and whoſe eloquence and learning is much beyond what is to be expreſt by an ignorant man like me. I heard him with pleaſure, though it was againſt me. I have the honour to be his relation, though perhaps he neither knows it nor values it. I wiſh that his being born in the North may not hinder him from the preferment that his merit and learning deſerve."

During the time that Mr Murray continued in office, he ſupported, with great ability, the adminiſtration with which he was connected; and, of courſe, rendered himſelf obnoxious to thoſe who were in oppoſition. Nothing, however, could be urged either againſt his public conduct or his private life; but he was involved in ſome trouble by an ill-deviſed tale, concurring with the known principles of the family of Stormont, to make him ſuſpected of Jacobitiſm. Of this affair, a full and particular account is given by the late Lord Melcombe in the following words:

"Meſſrs Murray, Fawcett, and Stone, were much acquainted, if not ſchool-fellows, in earlier life. Their fortune led them different ways; Fawcett's was to be a country lawyer and recorder of Newcaſtle. Johnſon, now Biſhop of Glouceſter, was one of their aſſociates.

On the day the King's birth day was kept, they dined at the Dean of Durham's at Durham; this Fawcett, Lord Ravenſworth, Major Daviſon, and one or two more, who retired after dinner into another room. The converſation turning upon the late Biſhop of Glouceſter's preferments, it was aſked who was to have his prebend of Durham? The Dean ſaid, that the laſt news from London was, that Dr Johnſon was to have it: Fawcett ſaid, he was glad that Johnſon got off ſo well, for he remembered him a Jacobite ſeveral years ago, and that he uſed to be with a relation of his who was very diſaffected, one Vermon, a mercer, where the Pretender's health was frequently drunk. This paſſing among a few familiar acquaintance, was thought no more of at the time: it ſpread, however, ſo much in the North (how I never heard accounted for), and reached town in ſuch a manner, that Mr Pelham thought it neceſſary to deſire Mr Vane, who was a friend to Fawcett, and who employed him in his buſineſs, to write to Fawcett, to know if he had ſaid this of Johnſon, and if he had, if it was true.

"This letter was written on the 9th of January; it came to Newcaſtle the Friday following. Fawcett was much ſurpriſed; but the poſt going out in a few hours after its arrival, he immediately acknowledged the letter by a long, but not very explicit, anſwer. This Friday happened to be the club day of the neighbouring gentlemen at Newcaſtle. As ſoon as Lord Ravenſworth, who was a patron and employer of Fawcett, came into the town, Fawcett acquainted him with the extraordinary letter he had received; he told him that he had already anſwered it; and being aſked to ſhew the copy, ſaid he kept none; but deſired Lord Ravenſworth to recollect if he held ſuch a converſation at the Deanry of Durham the day appointed for the birth-day. Ravenſworth recollected nothing at all of it: they went to the club together, and Ravenſworth went the next morning to ſee his mother in the neighbourhood, with whom he ſtaid till Monday; but this thing of ſuch conſequence lying upon his thoughts, he returned by Newcaſtle. He and Fawcett had another converſation; and in endeavouring to refreſh each other's memory about this dreadful delinquency of Johnſon, Fawcett ſaid he could not recollect poſitively at ſuch a diſtance of time, whether Johnſon drank theſe healths, or had been preſent at the drinking of them, but that Murray and Stone had done both ſeveral times. Ravenſworth was exceſſively alarmed at this with relation to Stone, on account of his office about the prince; and thus the affair of Johnſon was quite forgotten, and the epiſode became the principal part. There were many more conferences between Ravenſworth and Fawcett upon this ſubject, in which the latter always perſiſted that Stone and Murray were preſent at the drinking, and did drink thoſe healths. It may be obſerved here, that when he was examined upon oath, he ſwore to the year 1731 or 1732, at lateſt. Fawcett comes up as uſual about his law buſineſs, and is examined by Meſſrs Pelham and Vane, who never had heard of Murray or Stone being named: he is aſked, and anſwers only with relation to Johnſon, never mentioning either of the others; but the love of his country, his king, and poſterity, burned ſo ſtrongly in Ravenſworth's boſom, that he could have no reſt till he had diſcovered this enormity. Accordingly, when he came to town, he acquainted the miniſtry and almoſt all his great friends with it, and inſiſted upon the removal of Stone. The miniſtry would have ſlighted it as it deſerved; but as he perſiſted, and had told ſo many of it, they could not help laying it before the king, who, though he himſelf ſlighted it, was adviſed to examine it; which examination produced this moſt injudicious proceeding in parliament.*"

This is Lord Melcombe's account; and the ſame author informs us, that Mr Murray, when he heard of the committee being appointed to examine this idle affair, ſent a meſſage to the king, humbly to acquaint him, that if he ſhould be called before ſuch a tribunal on ſo ſcandalous and injurious an account, he would reſign his office, and would refuſe to anſwer. It came, however, before the Houſe of Lords, 22d January 1753, on the motion of the Duke of Bedford.

* Lord Melcombe's Diary, p. 220.

The debate was long and heavy, ſays Lord Melcombe; the Duke of Bedford's performance moderate enough; he divided the Houſe, but it was not told, for there went below the bar with him the Earl Harcourt, Lord Townſhend, the Biſhop of Worceſter, and Lord Talbot only. The Biſhop of Norwich and Lord Harcourt both ſpoke, not to much purpoſe; but neither of them in the leaſt ſupported the Duke's queſtion.

Upon the whole, Lord Melcombe concludes, "It was the worſt judged, the worſt executed, and the worſt ſupported point that I ever ſaw of ſo much expectation."

The King, his late Majeſty, viewed it in its true light; and is reported to have ſaid, "Whatever they were when Weſtminſter boys, they are now my very good friends." He was likewiſe, as we have been informed by a gentleman connected with the family of Stormont, ſo delighted with Mr Murray's ſpeech in his own vindication, that he deſired to have a copy of it, as a model of dignified and candid eloquence. Fawcett, the original author of the ſtory, ſeems indeed to have been a very ſneaking knave, totally unworthy of credit. Biſhop Johnſon, who was overlooked in the turmoil,

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turmoil, excited by the supposed guilt of Murray and Stone (see Stone, in this *Suppl.*), went to Fawcett's chambers in the Temple, and desired an interview. Being told by the servant that his master was not at home, he renewed his visit very early next morning, and declared his resolution to wait till Mr Fawcett should rise, the laundress having inadvertently confessed that he was still in bed. Fawcett, upon this, left his thorny pillow with reluctance; for something sharper than thorns (says Mr Holliday) awaited him, which he could not now possibly avoid. The result of the interview produced expressions of deep contrition, together with a letter, addressed to the Lord Bishop of Gloucester, acknowledging, in the most explicit terms, that his Lordship was innocent of the charge which he had been the instrument of bringing against him.

On the advancement of Sir Dudley Rider to the chief justiceship of the King's Bench in 1754, Mr Murray succeeded him as attorney general; and on his death, November 1756, again became his successor as chief justice, when he was created Baron of Mansfield, in the county of Nottingham, with remainder to the heirs male of his body lawfully begotten.

As soon as Lord Mansfield was established in the King's Bench, he began to make improvements in the practice of that court. On the 12th of November, four days after he had taken his seat, he made a very necessary regulation, observing, "Where we have no doubt, we ought not to put the parties to the delay and expence of a farther argument; nor leave other persons, who may be interested in the determination of a point so general, unnecessarily under the anxiety of suspence."

The anxiety of suspence, from this period, was no longer to be complained of in the court of King's Bench. The regularity, punctuality, and dispatch of the new chief justice, afforded such general satisfaction, that they, in process of time, drew into that court most of the causes which could be brought there for determination.

Sir James Burrows says, "I am informed, that at the sittings for London and Middlesex only, there are not so few as 800 causes set down in a year, and all disposed of. And though many of them, especially in London, are of considerable value, there are not more, upon an average, than between 20 and 30 ever heard of afterwards in the shape of special verdicts, special cases, motions for new trials, or in arrest of judgment. Of a bill of exceptions there has been no instance (I do not include judgments upon criminal prosecutions; they are necessary consequences of the convictions). My reports give but a very faint idea of the extent of the whole business which comes before the court: I only report what I think may be of use as a determination or illustration of some matter of law. I take no notice of the numerous questions of fact which are heard upon affidavits (the most tedious and irksome part of the whole business). I take no notice of a variety of contestations, which, after having been fully discussed, are decided without difficulty or doubt. I take no notice of many cases which turn upon a construction so peculiar and particular, as not to be likely to form a precedent for any other case. And yet, notwithstanding this immensity of business, it is notorious, that, in consequence of method, and a few rules which have been laid down to prevent delay (even where the parties themselves would willingly consent to it), nothing now hangs in court. Upon the last day of the very last term, if we exclude such motions of the term as by desire of the parties went over of course as peremptories, there was not a single matter of any kind that remained undetermined, excepting one case relating to the proprietary Lordship of Maryland, which was professedly postponed on account of the present situation of America. One might speak to the same effect concerning the last day of any former term for some years backward."

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The same author also informs us, that, excepting two cases, there had not been, from the 6th of November 1756 to the time of his then present publication, 26th May 1776, a final difference of opinion in the court in any case, or upon any point whatsoever. "It is remarkable, too (he adds), that, excepting those two cases, no judgment given during the same period has been reversed, either in the exchequer chamber or in parliament: and even these reversals were with great diversity of opinion among the judges." Of the two cases here mentioned, one was the famous question concerning literary property, which the majority of the judges of the court of King's Bench held to be permanent; and in support of which opinion, such arguments were urged by the chief justice, as have not yet perhaps been completely answered.

The ill success of the war, which had lately been begun, occasioned a change in the administration; and the conflicts of contending parties rendered it impracticable for the crown, at that juncture, to settle a new ministry. In order, therefore, to give pause to the violence of both sides, Lord Mansfield was induced to accept the post of chancellor of the exchequer on the 9th of April 1757; which he held until the 2d of July in the same year. During this interval, he employed himself, with great success, to bring about a coalition; which being effected, produced a series of events, which raised the glory of Great Britain to the highest point at which it has ever been seen. In the same year he was offered, but refused, the office of Lord High Chancellor; and in November 1758, he was elected a governor of the charter house, in the room of the Duke of Marlborough, then lately deceased.

For several years after this period, the tenor of Lord Mansfield's life was marked only with a most sedulous discharge of the duties of his office. In 1760 Geo. II. died, and the new reign commenced with alterations in the administration; which gave rise to a virulent spirit of opposition, conducted with a degree of violence and asperity never known at any former time. As a friend to the then administration, Lord Mansfield was marked out for a more than ordinary share of malicious invective. It is in allusion to this, that Warburton, after tracing the rise and progress of the irreligion and licentiousness which then prevailed, and observing that, amid such general corruption, the pure administration of public justice still afforded a cheerful consolation to thinking men, proceeds thus:

"But the evil genius of England would not suffer us to enjoy it long; for, as if envious of this last support of government, he hath now instigated his blackest agents to every extent of their malignity; who, after the most villainous insults on all other orders and ranks in society, have at length proceeded to calumniate even the

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the king's ſupreme court of juſtice, under its ableſt and moſt unblemiſhed adminiſtration. After this, who will not be tempted to deſpair of his country, and ſay with the good old man in the ſcene,

——" *Ipſi ſi cupiat ſalus*
" *Servare, prorſus non poteſt, hanc Familiam* (D) !"

A change of adminiſtration again took place in 1765, which introduced the Marquis of Rockingham and his friends to govern the country; and the meaſures then adopted not agreeing with Lord Mansfield's ſentiments, he, for the firſt time, became an opponent of government. On the bill for repealing the ſtamp act, he ſpoke, and divided againſt it; and is ſuppoſed to have had ſome ſhare in the compoſition of the proteſts on that occaſion, though he did not ſign them. In the ſame year, he is ſaid to have animadverted, with no ſmall degree of ſeverity, on the incautious expreſſions of Lord Camden, on the affair of prohibiting the exportation of corn, that it was but a 40 days tyranny at the outſide (E).

In 1767, the Diſſenters cauſe was determined, in which Lord Mansfield delivered a ſpeech, which has ſince been printed, and ſhews his Lordſhip to have been a ſteady friend to religious toleration, as well as to the rights of the eſtabliſhed church. The conſcientious Diſſenters themſelves laviſhed upon that ſpeech the higheſt praiſe; whilſt others of them, in the ſucceeding year, deluged the public prints with torrents of abuſe on the Chief Juſtice. In that year was the general election. Mr Wilkes returned from abroad, became a candidate for the city of London, and afterwards was choſen repreſentative for the county of Middleſex. Having been outlawed ſome years before, he now applied for a reverſal of that proceeding. On the 8th of June, the conſideration of it came before the court of King's Bench; when the judges delivered their opinions very fully, and were unanimous that the outlawry was illegal, and muſt be reverſed. On this occaſion Lord Mansfield took the opportunity of entering into a full ſtatement of the caſe, and a juſtification of his own conduct. The reader will find the caſe reported by Sir James Burrow; from whom we ſhall extract the following, which appears to have been the moſt important part of his Lordſhip's ſpeech:

" It is fit to take ſome notice of the various terrors hung out; the numerous crowds which have attended, and now attend, in and about the hall, out of all reach of hearing what paſſes in court; and the tumults which in other places have ſhamefully inſulted all order and government. Audacious addreſſes in print dictate to us, from thoſe they call the people, the judgment to be given now, and afterwards upon the conviction. Reaſons of policy are urged, from danger to the kingdom, by commotions and general confuſion.

" Give me leave to take the opportunity of this great and reſpectable audience, to let the whole world know all ſuch attempts are vain. Unleſs we have been able to find an error which will bear us out to reverſe the outlawry, it muſt be affirmed. The conſtitution does not allow reaſons of ſtate to influence our judgment: God forbid it ſhould! We muſt not regard political conſequences, how formidable ſoever they may be; we are bound to ſay, *Fiat Juſtitia, ruat Cælum.* The conſtitution truſts the king with reaſons of ſtate and policy: He may pardon offences; it is his to judge whether the law or the criminal ſhould yield. We have no election. None of us encouraged or approved the commiſſion of either of the crimes of which the defender is convicted: none of us had any hand in his being proſecuted. As to myſelf, I took no part (in another place) in the addreſſes for that proſecution. We did not adviſe or aſſiſt the defender to fly from juſtice; it was his own act, and he muſt take the conſequences. None of us have been conſulted, or had any thing to do with the preſent proſecution. It is not in our power to ſtop it; it was not in our power to bring it on. We cannot pardon. We are to ſay what we take the law to be. If we do not ſpeak our real opinions, we prevaricate with God and our own conſciences.

" I paſs over many anonymous letters I have received: thoſe in print are public; and ſome of them have been brought judicially before the court. Whoever the writers are, they take the wrong way. I will do my duty unawed. What am I to fear? That *mendax infamia* from the preſs, which daily coins falſe facts and falſe motives? The lies of calumny carry no terror to me. I truſt, that my temper of mind, and the colour and conduct of my life, have given me a ſuit of armour againſt theſe arrows. If, during this king's reign, I have ever ſupported his government, and aſſiſted his meaſures, I have done it without any other reward than the conſciouſneſs of doing what I thought right. If I have ever oppoſed, I have done it upon the points themſelves, without any collateral view [illegible] honour the king, and reſpect the people. But many things acquired by the favour of either are, in my account, objects not worth ambition. I wiſh popularity; but it is that popularity which follows, not that which is run after.—It is that popularity which, ſooner or later, never fails to do juſtice to the purſuit of noble ends by noble means. I will not do that which my conſcience tells me is wrong upon this occaſion, to gain the huzzas of thouſands, or the daily praiſe of all the papers which come from the preſs. I will not avoid doing what I think is right, though it ſhould draw on me the whole artillery of libels, all that falſehood and malice can invent, or the credulity of a deluded populace can ſwallow. I can ſay with a great magiſtrate, upon an occaſion, and under circumſtances not unlike, '*Ego hoc animo ſemper fui, ut invidiam virtute partam, gloriam, non invidiam putarem.*'

" The threats go further than abuſe: Perſonal violence is denounced. I do not believe it: it is not the genius of the worſt men of this country in the worſt of times. But I have ſet my mind at reſt. The laſt end that can happen to any man never comes too ſoon, if he

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(D) See the dedication of the 5th edition of the Divine Legation of Moſes, which deſerves to be read at preſent with peculiar attention, as the work of a man of gigantic talents, deeply read in law as well as in the [illegible]gy.

(E) The ſpeeches in the debate were never printed; but the ſubſtance of them all was conſolidated in a pamphlet publiſhed at the time, intitled, " A ſpeech againſt the ſuſpending and diſpenſing prerogative," 8vo. Since reprinted in Debrett's Debates, Vol. IV. p. 384.

he fails in support of the law and liberty of his country (for liberty is synonymous to law and government). Such a shock, too, must be productive of public good: It might awake the better part of the kingdom out of that lethargy which seems to have benumbed them; and bring the mad part back to their senses, as men intoxicated are sometimes stunned into sobriety.

"Once for all, let it be understood, that no endeavours of this kind will influence any man who at present sits here. If they had any effect, it would be contrary to their intent: Leaning against their impression might give a bias the other way. But I hope, and I know, that I have fortitude enough to resist even that weakness. No libels, no threats, nothing that has happened, nothing that can happen, will weigh a feather against allowing the defendant, upon this and every other question, not only the whole advantage he is intitled to from substantial law and justice, but every benefit from the most critical nicety of form, which any other defender could claim under the like objection. The only effect I feel is an anxiety to be able to explain the grounds upon which we proceed; so as to satisfy all mankind, that a flaw of form given way to in this case, could not have been got over in any other."

In January 1770, Lord Mansfield again was offered the Great Seal, which was given to Mr Charles York: and in Hilary Term 1771, he a third time declined the same offer, and the Seal was entrusted to Lord Bathurst.

The year 1770 was also memorable for various attacks made on his Lordship's judicial character, in both the Houses of Lords and Commons. In one of these, the propriety of a direction given to the jury in the case of the king and Woodfal was called in question; which occasioned his Lordship to produce to the House a copy of the unanimous opinion of the court of King's Bench in that cause; which, after being much canvassed and opposed, was suffered to stand its ground without being over-ruled.

On the 19th of October 1776, his Lordship was advanced to the dignity of an Earl of Great Britain, by the title of the Earl of Mansfield, and to his male issue; and for want of such issue, to Louisa Viscountess Stormont, and to her heirs male by David Viscount Stormont her husband. The same title, in 1792, was limited to Lord Stormont himself; who afterwards succeeded to it.

We come now to a period of his Lordship's life, which furnishes an event disgraceful to the age and country in which the fact was committed. An union of folly, enthusiasm, and knavery, had excited alarms in the minds of some weak people, that encouragements were given to the favourers and professors of the Roman Catholic faith inconsistent with religion and true policy. The act of Parliament, which excited the clamour, had passed with little opposition, and had not received any extraordinary support from Lord Mansfield. The minds of the public were inflamed by artful misrepresentations; the rage of a popular mob was soon directed towards the most eminent persons. Accordingly, in the night between Tuesday the 6th and Wednesday the 7th of June 1780, his Lordship's house in Bloomsbury Square was attacked by a party of rioters, who, on the Friday and Tuesday preceding, had, to the amount of many thousands, surrounded the avenues of both Houses of Parliament, under pretence of attending Lord George Gordon when he presented the petition from the Protestant Association. On Tuesday evening the prison of Newgate had been thrown open, all the combustible part reduced to ashes, and the felons let loose upon the public. It was after this attempt to destroy the means of securing the victims of criminal justice that the rioters assaulted the residence of the chief magistrate of the first criminal court in the kingdom; nor were they dispersed till they had burnt all the furniture, pictures, books, manuscripts, deeds, and, in short, every thing which fire could consume in his Lordship's house; so that nothing remained but the walls, which were seen next morning almost red hot from the violence of the flames, presenting a melancholy and awful ruin to the eyes of the passengers. For a fuller account of those dreadful riots, see BRITAIN, n° 644. *Encyclopædia*.

So unexpected was this daring outrage on order and government, that it burst on Lord Mansfield without his being prepared in the slightest manner to resist it. He escaped with his life only, and retired to a place of safety, where he remained until the 14th of June, the last day of term, when he again took his seat in the court of King's Bench. "The reverential silence (says Mr Douglas) which was observed when his Lordship resumed his place on the Bench, was expressive of sentiments of condolence and respect, more affecting than the most eloquent address the occasion could have suggested.

"The amount of that part of Lord Mansfield's loss which might have been estimated, and was capable of a compensation in money, is known to have been very great. This he had a right to recover against the *hundred*. Many others had taken that course; but his Lordship thought it more consistent with the dignity of his character not to resort to the indemnification provided by the legislature. His sentiments, on the subject of a reparation from the state, were communicated to the Board of Works in a letter, dated 18th July 1780, written in consequence of an application which they had made to him (as one of the principal sufferers), pursuant to directions from the treasury, founded on a vote of the House of Commons, requesting him to state the nature and amount of his loss. In that letter, after some introductory expressions of civility to the surveyor general, to whom it was addressed, his Lordship says, 'Besides what is irreparable, my pecuniary loss is great. I apprehended no danger, and therefore took no precaution. But how great soever that loss may be, I think it does not become me to claim or expect reparation from the state. I have made up my mind to my misfortune, as I ought, with this consolation, that it came from those whose object manifestly was general confusion and destruction at home, in addition to a dangerous and complicated war abroad. If I should lay before you any account or computation of the pecuniary damage I have sustained, it might seem a claim or expectation of being indemnified. Therefore you will have no further trouble upon this from, &c.—*Mansfield*.'"

From this time the lustre of Lord Mansfield continued to shine with unclouded brightness until the end of his political life, unless his opposition to the measures of the present administration, at the early period of their appointment, shall be thought to detract, in some small degree, from his merit. It is certain many of his admirers ſaw, with concern, a connection with the opponents of government at that juncture, ſcarce compatible with the dignity of the chief juſtice of Great Britain. At length infirmities preſſed upon him, and he became unable to attend his duty with the ſame punctuality and aſſiduity with which he had been accuſtomed. It has been ſuppoſed, that he held his office after he was diſabled from executing the duties of it, from a wiſh to ſecure the ſucceſſion of it to a very particular friend. Be this as it may, the chief juſtice continued in his office until the month of June 1788, when he ſent in his reſignation.

From this period the bodily powers of his Lordſhip continued to decline; his mental faculties, however, remained without decay almoſt to the laſt. During this time he was particularly inquiſitive and anxious about the proceedings in France, and felt his ſenſibility, in common with every good man, wounded by the horrible inſtance of democratic infatuation in the murder of the innocent Louis XVI. He lived juſt long enough to expreſs his ſatisfaction at the check given to the French by the Prince of Cobourg in March 1793; on the 20th of which month, after continuing ſome days in a ſtate of inſenſibility, he departed this life, at the age of 88 years.

"In his political oratory (ſays a writer of the preſent times), he was not without a rival; no one had the honour of *ſurpaſſing* him; and let it be remembered, that his competitor was PITT.

"The rhetorician that addreſſed himſelf to Tully in theſe memorable words—*Demoſthenes tibi præripuit ne primus eſſes Orator, tu illi ne ſolus*—anticipated their application to Mansfield and Pitt. If the one poſſeſſed Demoſthenean fire and energy, the other was at leaſt a Cicero. Their oratory differed in ſpecies, but was equal in merit. There was, at leaſt, no ſuperiority on the ſide of Pitt. Mansfield's eloquence was not, indeed, of that daring, bold, declamatory kind, ſo irreſiſtibly powerful in the momentary buſtle of popular aſſemblies; but it was poſſeſſed of that pure and Attic ſpirit, and ſeductive power of perſuaſion, that delights, inſtructs, and eventually triumphs. It has been very beautifully and juſtly compared to a river, that meanders through verdant meads and flowery gardens, reflecting in its cryſtal boſom the varied objects that adorn its banks, and refreſhing the country through which it flows.

"To illuſtrate his oratory by example, would require voluminous tranſcripts from the records of Parliament; and it is unneceſſary, as we can appeal to living recollection.

"Having added weight and dignity to the offices of attorney and ſolicitor general, his reputation as a ſpeaker, a lawyer, and a politician, elevated him to the peerage, and the exalted poſt of chief juſtice of England. He aſcended to the dignities of ſtate by rapid ſtrides: they were not beſtowed by the caprice of party favour or affection. They were (as was ſaid of Pliny) liberal diſpenſations of power upon an object that knew how to add new luſtre to that power, by the rational exertion of his own.

"Here we can ſpeak of this great man within our own recollection; and however party prejudices may adopt their different favourites, and each contend in detracting from the merit of the other, it is, we believe, generally underſtood, that precedence is allowed the Earl of Mansfield, as the firſt magiſtrate that ever ſo pre-eminently graced that important ſtation. The wiſdom of his deciſions, and unbiaſſed tenor of his public conduct, will be held in veneration by the ſages of the law, as long as the ſpirit of the conſtitution, and juſt notions of equity, continue to have exiſtence. No man has ever, in an equal degree, poſſeſſed that wonderful ſagacity in diſcovering chicanery and artifice, and ſeparating fallacy from truth, and ſophiſtry from argument, ſo as to hit the exact equity of the caſe. He ſuffered not juſtice to be ſtrangled in the nets of form.

"His memory was aſtoniſhing—he never took notes, or, if he did, ſeldom or ever conſulted them." His references to expreſſions which fell from him in the courſe of the debate, or his quotations from books, were ſo faithful, that they might have been ſaid to have been repeated *verbatim*. The purpoſes to which he employed theſe amazing talents were ſtill more extraordinary: if it was the weak part of his opponent's arguments that he referred to, he was ſure to expoſe its fallacy, weakneſs, or abſurdity, in the moſt poignant ſatire, or hold it up in the moſt ridiculous point of view. If, on the contrary, it were a point on which his adverſaries laid their chief ſtreſs, he ſtated the words correctly; collected their obvious meaning, conſidered the force of the ſeveral arguments that had or might have been raiſed upon them, with a preciſion that would induce an auditor almoſt to ſuppoſe that he had previouſly conſidered the whole, and that his ſpeech was the reſult of much previous ſtudy.

"It may be ſaid of Mansfield as of Virgil, that if he had any faults, they might be conſidered in the ſame manner with thoſe of ſome eminent fixed ſtar, which, if they exiſt at all, are above the reach of human obſervation. The luminous æther of his life was not obſcured by any ſhade dark enough to be denominated a defect. On account of his deſcent, local prejudices and propenſities were imputed to him, and his conduct, on that account, examined with a microſcopic eye; but the optic through which it was viewed poſſeſſed a party tinge, equally odious and deceptive.

"His political principles were ever conſiſtent; and to preſerve conſiſtency in ſuch ſtations and in ſuch times as occupied the life of Mansfield, conſtitutes an ordeal ſtrongly impreſſive of virtue. It has been ſaid that he wanted ſpirit. Is the uniform oppoſition of popular opinion, and apparently the contempt of it, any proof of the aſſertion? His ſpeech and conduct in the affair of Wilkes's outlawry, when popular prejudice ran in torrents, illuſtrate each other. He deſpiſed (to borrow an expreſſion of his own) that muſhroom popularity that is raiſed without merit, and loſt without a crime. He diſdained being the ſlave of popular impulſe, or to acknowledge the ſhouts of a mob for the trumpet of fame."

He had a mind too great to be aſhamed of revering the ordinances of religion; and as, after the moſt impartial inquiry, he was a firm believer of the truth and importance of Chriſtianity, he frequented the church regularly, and received the holy ſacrament on the higher feſtivals. Mr Halliday has publiſhed a ſermon, which he ſays was dictated by Lord Mansfield to his friend biſhop Johnſon, and preached by that prelate before the Houſe of Lords. It is a very ſerious and appropriate diſcourſe; but judging upon internal evidence, we ſhould

not

Muscle, Museum.

not have supposed it the composition of the eloquent and argumentative chief justice of England. His Lordship's will, which was written with his own hand, upon little more than half a sheet of paper, begins with the following elegant and pious paragraph, with which we shall conclude this sketch of his character:

"When it shall please Almighty God to call me to that state, to which, of all I now enjoy I can carry only the satisfaction of my own conscience, and a full reliance upon his mercy through Jesus Christ, I desire that my body may be interred as privately as may be: and out of respect for the place of my early education, I should wish it to be in Westminster Abbey." It was interred in Westminster Abbey, in the same vault with the Countess (who had died April 10. 1784), between the late Earl of Chatham and Lord Robert Manners.

MUSCLE *Bank*, at the entrance into Trinity Bay or harbour, in the direction of S. W. on the E. coast of Newfoundland Island.—*Morse*.

Muscle *Bay*, in the Straits of Magellan, in S. America, is half way between Elizabeth's Bay, and York Road; in which there is good anchorage with a westerly wind.—*ib.*

Muscle *Bay*, or *Messillones*, on the coast of Chili or Peru, in S. America, 5 leagues S. by W. of Atacama. —*ib.*

Muscle *Shoals*, in Tennessee river, about 250 miles from its mouth, extend about 20 miles, and derive their name from the number of shell-fish found there. At this place the river spreads to the breadth of 3 miles, and forms a number of islands; and the passage is difficult, except when there is a swell in the river. From this place up to the Whirl, or Suck, where the river breaks through the Great Ridge, or Cumberland Mountain, is 250 miles, the navigation all the way excellent.—*ib.*

MUSCONECUNK, a small river of New-Jersey, which empties into the Delaware 6 miles below Easton. —*ib.*

MUSEUM, in the language of the present day, is a building in which are deposited specimens of every object that is in any degree curious, whether such objects be natural or artificial. What the word *museum* expressed originally, has been told under that title in the *Encyclopædia*.

A complete museum contains collections of preserved beasts, birds, fishes, reptiles, &c.; models of machines; rare manuscripts; and indeed specimens of every thing necessary to illustrate physical science, to improve art, to aid the antiquarian in his researches, and to exhibit the manners and customs of men in distant ages and nations. As natural objects of uncommon size or beauty, and other rare productions, were, in the earliest periods, consecrated to the gods, the temples were, of course, the first repositories of such collections, or, in other words, the first *Museums*. This, we think, has been completely proved by Professor Beckmann.*

* Inventions, vol. ii. p. 44.

"When Hanno (says he) returned from his distant voyages, he brought with him to Carthage two skins of the hairy women whom he found on the Gorgades islands, and deposited them as a memorial in the temple of Juno, where they continued till the destruction of the city. The horns of a Scythian animal, in which the Stygian water that destroyed every other vessel could be contained, were sent by Alexander as a curiosity to the temple of Delphi, where they were suspended, with an inscription, which has been preserved by Ælian. The monstrous horns of the wild bulls which had occasioned so much devastation in Macedonia, were, by order of King Philip, hung up in the temple of Hercules. The unnaturally formed shoulder bones of Pelops were deposited in the temple of Elis. The horns of the so called Indian ants were shewn in the temple of Hercules at Erythræ; and the crocodile found in attempting to discover the sources of the Nile was preserved in the temple of Isis at Cæsarea. A large piece of the root of the cinnamon tree was kept in a golden vessel in one of the temples at Rome, where it was examined by Pliny. The skin of that monster which the Roman army in Africa attacked and destroyed, and which probably was a crocodile, an animal common in that country, but never seen by the Romans before the Punic war, was, by Regulus, sent to Rome, and hung up in one of the temples, where it remained till the time of the Numantine war (A). In the temple of Juno, in the island of Melita, there were a pair of elephants teeth of extraordinary size, which were carried away by Masinissa's admiral, and transmitted to that prince, who, though he set a high value upon them, sent them again back, because he heard they had been taken from a temple. The head of a basilisc was exhibited in one of the temples of Diana; and the bones of that sea monster, probably a whale, to which Andromeda was exposed, were preserved at Joppa, and afterwards brought to Rome. In the time of Pausanias, the head of the celebrated Calydonian boar was shewn in one of the temples of Greece; but it was then destitute of bristles, and had suffered considerably by the hand of time. The monstrous tusks of this animal were brought to Rome, after the defeat of Anthony, by the Emperor Augustus, who caused them to be suspended in the temple of Bacchus. Apollonius tells us, that he saw in India some of those nuts which in Greece were preserved in the temples as curiosities."

Though these curiosities were preserved in the temples for purposes very different from those for which our collections are made, there can be no doubt but that they contributed to promote the knowledge of natural history. If it be true, as Pliny and Strabo inform us, that Hippocrates availed himself of the accounts which were hung up in the temple of Æsculapius of different diseases, and of the medicines and mode of treatment by which they were cured; it will easily be believed, that the natural historians availed themselves, in a similar manner, of the various rare objects which were preserved in the temples of the other gods. This, we see, Pliny actually did.

Suetonius informs us, that Augustus had, in his palace, a collection of natural curiosities; and it is well known that Alexander gave orders to all huntsmen, bird-catchers, fishermen, and others, to send to Aristotle whatever rare animals they could procure. M. Beckmann

(A) We think, with the translator of Beckmann's History, that this animal was not the crocodile, but the *Boa constrictor*. See Boa and Serpent, *Encycl.*

Museum. mann ſeems to be of opinion, that the firſt private muſeum was formed by Apuleius, who, next to Ariſtotle and his ſcholar Theophraſtus, certainly examined natural objects with the greateſt ardour and judgment; who cauſed animals of every kind, and particularly fiſh, to be brought to him either dead or alive, in order to deſcribe their external and internal parts, their number and ſituation, and to determine their characteriſing marks, and eſtabliſh their real names; who undertook diſtant journeys to become acquainted with the ſecrets of nature; and who, on the Getulian mountains, collected petrefactions, which he conſidered as the effects of Deucalion's flood.

The principal cauſe why collections of natural curioſities were ſcarce in ancient times, muſt have been the ignorance of naturaliſts in regard to the proper means of preſerving ſuch bodies as ſoon ſpoil or corrupt. Some methods were indeed known and practiſed, but they were all defective and inferior to that by ſpirit of wine, which prevents putrefaction, and which, by its perfect tranſparency, permits the objects which are covered by it to be at all times viewed and examined. Theſe methods were the ſame as thoſe employed to preſerve proviſions, or the bodies of great men deceaſed. They were put into ſalt brine or honey, or were covered over with wax. Thus the hippopotamus, deſcribed by Columna, was ſent to him from Egypt preſerved in ſalt. The body of Ageſipolis King of Sparta, who died in Macedonia, was ſent home in honey; the celebrated purple dye of the ancients was preſerved freſh for many years by the ſame means; and at this day, when the Orientals are deſirous of tranſporting fiſh to any diſtance, they cover them over with wax.

In thoſe centuries which are uſually called the middle ages, the Profeſſor finds no traces of what can be called a muſeum, except in the treaſuries of emperors, kings, and princes, where, beſides articles of great value, curioſities of art, antiquities, and relics, one ſometimes found ſcarce and ſingular foreign animals, which were dried and preſerved. Such objects were to be ſeen in the old treaſury at Vienna; and in that of St Denis was exhibited the claw of a griffin, ſent by a king of Perſia to Charlemagne; the teeth of the hippopotamus, and other things of the like kind. In theſe collections, the number of the rarities always increaſed in proportion as a taſte for natural hiſtory became more prevalent, and as the extenſion of commerce afforded better opportunities for procuring the productions of remote countries. Menageries were eſtabliſhed to add to the magnificence of courts, and the ſtuffed ſkins of rare animals were hung up as memorials of their having exiſted. Public libraries alſo were made receptacles for ſuch natural curioſities as were from time to time preſented to them; and as in univerſities the faculty of medicine had a hall appropriated for the diſſection of human bodies, curioſities from the animal kingdom were collected there alſo by degrees; and it is probable that the profeſſors of anatomy firſt made attempts to preſerve different parts of animals in ſpirit of wine, as they were obliged to keep them by them for the uſe of their ſcholars; and becauſe in old times dead bodies were not given up to them as at preſent, and were more difficult to be obtained. Private collections appear for the firſt time in the 16th century; and there is no doubt (ſays our author) that they were formed by every learned man who at that period applied to the ſtudy of natural hiſtory.

Muſhroom, Muſk-tree.

MUSHROOM, a fungus, of which ſome of the principal ſpecies have been deſcribed in the *Encyclopædia* under the generic name AGARICUS. There is, however, one ſpecies not mentioned there—the *Boletus hirſutus* of Bulliard, which is certainly worthy of notice, ſince one of the French chemiſts has lately extracted from it a bright, ſhining, and very durable yellow dye. This pretty large muſhroom grows commonly on walnut and apple-trees. Its colouring-matter is contained in abundance, not only in the tubular part, but alſo in the parenchyma of the body of the muſhroom. In order to extract it, the muſhroom is pounded in a mortar, and the liquor thence obtained is boiled for a quarter of an hour in water. An ounce of liquor is ſufficient to communicate colouring-matter to ſix pounds of water. When the liquor has been ſtrained, the ſtuff to be dyed is put into it, and boiled for a quarter of an hour. All kinds of ſtuff receive this colour and retain it; but on linen and cotton it is leſs bright. This colour may be modified, in a very agreeable manner, by the effect of mordants.

The proceſs ſucceeded beſt on ſilk. When this ſubſtance, after being dyed, is made to paſs through a bath of ſoft ſoap, it acquires a ſhining golden yellow colour, which has a perfect reſemblance to the yellow of that ſilk employed to imitate embroidery in gold, and which has hitherto been brought from China and ſold at a dear rate, as the method of dyeing it is unknown in Europe. The yellow colour extracted from this muſhroom may be employed alſo with advantage for painting in water-colours as well as in oil.

MUSKINGUM, that is, *Elk's Eye*, a navigable river of the N. W. Territory. It is 250 yards wide at its confluence with the Ohio, 172 miles below Pittſburg, including the windings of the Ohio, though in a direct line it is but 90 miles. At its mouth ſtands Fort Harmar and Marietta. Its banks are ſo high as to prevent its overflowing, and it is navigable by large batteaux and barges to the Three Legs, 110 miles from its mouth, and by ſmall boats to the lake at its head, 45 miles farther. From thence, by a portage of about one mile, a communication is opened to Lake Erie, through Cayahoga, a ſtream of great utility, navigable the whole length, without any obſtruction from falls. From Lake Erie, the avenue is well known to Hudſon's river in the State of New York. The land on this river and its branches is of a ſuperior quality, and the country abounds in ſprings and conveniences fitted to ſettlements remote from ſea navigation, viz. ſalt-ſprings, coal, free-ſtone, and clay. A valuable ſalt ſpring has been very lately diſcovered, 8 miles from this river, and 50 from Marietta, called the *Big Spring*. Such a quantity of water flows, as to keep 1000 gallons conſtantly boiling. Ten gallons of this water will, as experiment has proved, afford a quart of ſalt of ſuperior quality to any made on the ſea-coaſt. —*Morse*.

MUSQUAKIES *Indians* inhabit the ſouthern waters of Lake Michigan, having 200 warriors.—*ib.*

MUSQUATIONS, an Indian tribe inhabiting near Lake Michigan.—*ib.*

MUSKITTO *Cove*, in N. America, lies in lat. 64 55 13, and in long. 53 3 45 W.—*ib.*

MUSQUITO *River* and *Bay* lie at a small distance north of Cape Canaverel, on the coast of E. Florida. The banks of Musquito river towards the continent abound in trees and plants common to Florida, with pleasant orange groves; whilst the narrow stripes of land towards the sea, are mostly sand-hills.—*ib.*

MUSQUITONS, an Indian nation in the neighbourhood of the Piankeshaws and Outtagomies.—*ib.*

MUTSUDDIES, in Bengal, writers, accountants, officers of government.

MUZCOORET, allowances to zemindars in land or money. See ZEMINDAR, *Suppl.*

MYERSTOWN, a village of Dauphin county, Pennsylvania, situated on the N. side of Tulpehockon creek, a few miles below the canal. It contains about 25 houses, and is 32 miles east by north of Harrisburg, and 77 from Philadelphia.—*Morse.*

MYNOMANIES, or *Minomanies*, an Indian tribe, who with the tribes of the Chipewas and Saukeys, live near Bay Puan, and could together furnish, about 20 years ago, 550 warriors. The Minomanies have about 300 fighting men.—*ib.*

MYRTLE *Island*, one of the Chandeleurs or Myrtle islands, in Nassau Bay, on the coast of Florida, on the west side of the peninsula.—*ib.*

N.

NAAMAN's *Creek*, a small stream which runs S. easterly into Delaware river, at Marcus Hook. —*Morse.*

NABOB, or NOWAB, a title of courtesy given in India to Mahomedans high in station, particularly provincial governors.

NAB's *Bay*, near the western limit of Hudson's Bay, known by the name of the Welcome Sea. Cape Eskimaux is its southern point or entrance.—*Morse.*

NACO, a town of New-Spain, in the province of Honduras, 50 miles north-west of Valadolid.—*ib.*

THE SUN's NADIR, is the axis of the cone projected by the shadow of the earth: so called, because that axis being prolonged, gives a point in the ecliptic diametrically opposite to the sun.

NAHANT *Point* forms the N. E. point of Boston harbour, in Massachusetts; 9 miles E. N. E. of Boston. N. lat. 42 27, W. long. 70 57.—*Morse.*

NAHUNKEAG, a small island in Kennebeck river, 38 miles from the sea, signifies, in the Indian language, the land where eels are taken.—*ib.*

NAIB, a deputy.

NAIN, a Moravian settlement, which was established in 1763, on Lehigh river, in Pennsylvania.—*Morse.*

NAIN, a settlement of the Moravians on the coast of Labrador, near the entrance of Davis's Straits, being S. S. W. of Cape Farewell. It was begun under the protection of the British government, but is now deserted.—*ib.*

NAKED, in architecture, as the naked of a wall, &c. is the surface, or plane, from whence the projectures arise; or which serves as a ground to the projectures.

NAMASKET, a small river which empties into Narraganset Bay.—*Morse.*

NANCOWRY, or SOURY, as it is sometimes called, is one of the Nicobar isles, and situated nearly in the centre of the cluster (See NICOBAR, *Encycl.*). Its length may be about eight miles, and its breadth nearly equal. The island of Comerty, which is near it, is more extensive, but does not perhaps contain more solid land, being excavated by a very large bay from the sea. The space between these two islands forms a capacious and excellent harbour, the eastern entrance of which is sheltered by another island, called Trikut, lying at the distance of about a league. The inlet from the west is narrow, but sufficiently deep to admit the largest ships when the wind is fair.

The Danes have long maintained a small settlement at this place, which stands on the northern-most point of Nancowry, within the harbour. A serjeant and three or four soldiers, a few black slaves, and two rusty old pieces of ordnance, compose the whole of their establishment. They have here two houses; one of which, built entirely of wood, is their habitation; the other, formerly inhabited by their missionaries, serves now for a storehouse.

These islands are in general woody, but contain likewise some portions of clear land. From the summits of their hills the prospects are often beautiful and romantic. The soil is rich, and probably capable of producing all the various fruits and vegetables common to hot climates. The natural productions of this kind, which mostly abound, are cocoa nuts, *papias*, plantains, limes, tamarinds, beetle nuts, and the *melóri*, a species of breadfruit; yams, and other roots are cultivated and thrive; but rice is here unknown. The *mangostain* tree, whose fruit is so justly extolled, grows wild; and pine-apples of a delicious flavour are found in the woods.

Of all the Nicobar isles Nancowry and Comerty are said to be the best peopled; the population of both being supposed to amount to eight hundred. The natives of Nancowry and of the Nicobar islands in general, live in villages on the sea-shore, and never erect their habitations inland (A). Their houses are of a circular form, and are covered with elliptical domes, thatched with grass

(A) The great Nicobar island is perhaps an exception, where, it is said, a race of men exists, who are totally different in their colour and manners. They are considered as the *Aborigines* of the country. They live in the interior parts among the mountains, and commit frequent depredations on the peaceable inhabitants of the coasts.

Nancowry. grafs and the leaves of cocoa nut. They are raifed upon piles to the height of fix or eight feet above the ground; the floor and fides are laid with planks, and the afcent is by a ladder. In thofe bays or inlets which are fheltered from the furf, they erect them fometimes fo near the margin of the water as to admit the tide to flow under, and wafh away the ordure from below.

In front of their villages, and a little advanced in the water, they plant beacons of a great height, which they adorn with tufts made of grafs, or the bark of fome tree. Thefe objects are difcernible at a great diftance, and are intended probably for landmarks; their houfes, which are overfhadowed by thick groves of cocoa nut trees, feldom being vifible from afar.

The Nicobareans, though indolent, are in general robuft and well-limbed. Their features are fomewhat like the Malays, and their colour is nearly fimilar. The women are much inferior in ftature to the men, but more active in all domeftic affairs. Contrary to the cuftom of other nations, the women fhave the hair of their heads, or keep it clofe cropt, which gives them an uncouth appearance, in the eyes of ftrangers at leaft.

The inhabitants of Nancowry perform, every year, a very extraordinary ceremony in honour of the dead. It is thus defcribed by Lieutenant Colebrooke:

"On the anniverfary of this feftival, if it can be fo called, their houfes are decorated with garlands of flowers, fruits, and branches of trees. The people of each village affemble, dreft in their beft attire, at the principal houfe in the place, where they fpend the day in a convivial manner; the men, fitting apart from the women, fmoke tobacco, and intoxicate themfelves; while the latter are nurfing their children, and employed in preparations for the mournful bufinefs of the night. At a certain hour of the afternoon, announced by ftriking the *Goung*, the women fet up the moft difmal howls and lamentations, which they continue without intermiffion till about fun-fet; when the whole party get up, and walk in proceffion to the burying-ground. Arrived at the place, they form a circle around one of the graves, when a ftake, planted exactly over the head of the corpfe, is pulled up. The woman who is neareft of kin to the deceafed, fteps out from the crowd, digs up the fkull, and draws it up with her hands. At fight of the bones, her ftrength feems to fail her; fhe fhrieks, fhe fobs; and tears of anguifh abundantly fall on the mouldering object of her pious care. She clears it from the earth, fcrapes off the feftering flefh, and laves it plentifully with the milk of frefh cocoa-nuts, fupplied by the byftanders; after which fhe rubs it over with an infufion of faffron, and wraps it carefully in a piece of new cloth. It is then depofited again in the earth, and covered up; the ftake is replanted, and hung with the various trappings and implements belonging to the deceafed. They proceed then to the other graves; and the whole night is fpent in repetitions of thefe difmal and difguftful rites.

"On the morning following, the ceremony is concluded by an offering of many fat fwine; when the facrifice made to the dead affords an ample feaft to the living: they befmear themfelves with the blood of the flaughtered hogs, and fome, more voracious than others, eat the flefh raw. They have various ways, however, of dreffing their meat, but always eat it without falt. A kind of pafte made of the *mellori*, ferves them for bread: and they finifh their repaft with copious potations of *taury*, an inebriating liquor."

Nanjemy, ‖ Nanfemond.

The Nicobareans are hofpitable and honeft, and are remarkable for a ftrict obfervance of truth, and for punctuality in adhering to their engagements. Such crimes as theft, robbery, and murder, are unknown in thefe iflands; but they do not want fpirit to revenge their injuries, and will fight refolutely, and flay their enemies, if attacked or unjuftly dealt with. Their only vice, if this failing can be fo called, is inebriation; but in their cups they are generally jovial and good-humoured. It fometimes, however, happens at their feafts, that the men of different villages fall out; and the quarrel immediately becomes general. In thefe cafes they terminate their differences in a pitched battle; where the only weapons ufed are long fticks, of a hard and knotty wood. With thefe they drub one another moft heartily, till, no longer able to endure the conflict, they mutually put a ftop to the combat, and all get drunk again.

NANJEMY *River*, a fhort creek which empties into the Patowmac in Charles county, Maryland, fouthweftward of Port Tobacco river.—*Morse*.

NANKAR, ancient allowance to zemindars in land or money.

NANKEEN, or Nan-king, is a well-known cotton ftuff, which derives its name from the ancient capital of China (See Nan-king, *Encycl.*). It is, however, according to Van Braam, manufactured at a great diftance from that city, in the diftrict of *Fong kiang fou*, fituated in the fouth-eaft of the province of *Kiang-nam* upon the fea-fhore. The colour of nankeen is natural, the down of which it is made being of the fame yellow tinge with the cloth. The colour, as well as fuperior quality of this cotton, feems to be derived from the foil; for it is faid that the feeds of the nankeen cotton degenerate in both particulars when tranfplanted to another province, however little different in its climate. The common opinion, that the colour of the ftuff is given by a dye, occafioned an order from Europe, fome years ago, to dye the pieces of nankeen of a deeper colour than they had at that period; and the reafon of their being then paler than formerly is as follows:

Shortly after the Americans began to trade with China, the demand increafed to nearly double to quantity it was poffible to furnifh. To fupply this deficiency, the manufacturers mixed common white cotton with the brown; this gave it a pale caft, which was immediately remarked; and for this lighter kind no purchafer could be found, till the other was exhaufted. As the confumption is grown lefs during the laft three years, the mixture of cotton is no longer neceffary, and nankeen is become what it was before. By keeping them two or three years, it even appears that they have the property of growing darker. This kind of ftuff muft be acknowledged to be the ftrongeft yet known. Many perfons have found that clothes made of it will laft three or four years, although for ever in the wafh. This it is that makes them the favourite wear for breeches and waiftcoats both in Europe and America. The white nankeen is of the fame quality, and is made of white cotton as good as the brown, and which alfo grows in Kiang-nam.

NANSEMOND, a county of Virginia, on the S.

side of James's river, and W. of Norfolk county, on the N. Carolina line. It is about 44 miles in length, and 24 in breadth, and contains 9010 inhabitants, including 3,817 slaves.—*Morse.*

NANSEMOND, a short river of Virginia, which rises in Great Dismal Swamp, and pursuing a N. then a N. E. direction, empties into James's river, a few miles W. of Elizabeth river. It is navigable to Sleepy Hole, for vessels of 250 tons; to Suffolk, for those of 100 tons; and to Milner's, for those of 25 tons.—*ib.*

NANTASKET *Road*, may be considered as the entrance into the channels of Boston harbour; lies S. of the light-house, near Rainsford or Hospital Island. A vessel may anchor here in from 7 to 5 fathoms in safety. Two huts are erected here with accommodations for shipwrecked seamen.—*ib.*

NANTIKOKE, a navigable river of the eastern shore of Maryland, empties into the Chesapeak Bay. —*ib.*

NANTIKOKES, an Indian nation who formerly lived in Maryland, upon the above river. They first retired to the Susquehannah, and then farther north. They were skilled in the art of poisoning; by which shocking art nearly their whole tribe was extirpated, as well as some of their neighbours. These, with the Mohickons and Conoys, 20 years ago inhabited Utsanango, Chagnet and Owegy, on the E. branch of the Susquehannah. The two first could at that period furnish 100 warriors each; and the Conoys 30 warriors.—*ib.*

NANTMILL, *East* and *West*, two townships in Chester county, Pennsylvania.—*ib.*

NANTUCKET *Island*, belonging to the State of Massachusetts, is situated between lat. 41 13 and 41 22 30 N. and between 69 56 and 70 13 30 west long. and is about 8 leagues southward of Cape Cod, and lies eastward of the island of Martha's Vineyard. It is 15 miles in length, and 11 in breadth, including Sandy Point; but its general breadth is 3½ miles. This is thought to be the island called *Nauticon* by ancient voyagers. There is but one bay of any note, and that is formed by a long sandy point, extending from the E. end of the island to the N. and W. (on which stands a light-house, which was erected by the State in 1784) and on the north side of the island as far as Eel Point. This makes a fine road for ships, except with the wind at N. W. when there is a heavy swell. The harbour has a bar of sand, on which are only 7½ feet of water at ebb tide, but within it has 12 and 14 feet. The island constitutes a county of its own name, and contains 4,620 inhabitants, and sends one representative to the general court. There is a duck manufactory here, and 10 spermaceti works. The inhabitants are, for the most part, a robust and enterprising set of people, mostly seamen and mechanics. The seamen are the most expert whale-men in the world. The whale fishery originated among the white inhabitants in the year 1690, in boats from the shore. In 1715, they had 6 sloops, 38 tons burden, and the fishery produced 1100l. sterling. From 1772, to 1775, the fishery employed 150 sail from 90 to 180 tons, upon the coast of Guinea, Brazil, and the West-Indies; the produce of which amounted to 167,000l. sterl. The late war almost ruined this business. They have since, however, revived it again, and pursue the whales even into the great Pacific Ocean. There is not here a single tree of natural growth; they have a place called The Woods, but it has been destitute of trees for these 60 years past. The island had formerly plenty of wood. The people, especially the females, are fondly attached to the island, and few wish to migrate to a more desirable situation. The people are mostly *Friends*, or Quakers. There is one society of Congregationalists. Some part of the E. end of the island, known by the name of *Squam*, and some few other places, are held as private farms. At present, there are near 300 proprietors of the island. The proportional number of cattle, sheep, &c. put out to pasture, and the quantity of ground to raise crops, are minutely regulated; and proper officers are appointed, who, in their books debit and credit the proprietors accordingly. In the month of June, each proprietor gives in to the clerks the number of his sheep, cattle, and horses, that he may be charged with them in the books; and if the number be more than he is entitled to by his rights, he hires ground of his neighbours who have less. But, if the proprietors all together have more than their number, the overplus are either killed or transported from the island.

In the year 1659, when Thomas Macy removed with his family from Salisbury in Essex county, to the W. end of the island, with several other families, there were nearly 3,000 Indians on the island, who were kind to strangers, and benevolent to each other, and lived happily until contaminated by the bad example of the whites, who introduced rum; and their number soon began to decrease. The whites had no material quarrel or difficulty with them. The natives sold their lands, and the whites went on purchasing till, in fine, they have obtained the whole, except some small rights, which are still retained by the natives. A mortal sickness carried off 222 of them in 1764; and they are now reduced to 4 males, and 16 females.—*ib.*

NANTUCKET, (formerly *Sherburne*) a post-town, capital and port of entry in the above island. The exports in the year ending Sept. 30, 1794, amounted to 20,517 dollars. It is 60 miles S. E. of New-Bedford, 123 S. W. of Boston, and 382 E. N. E. of Philadelphia.—*ib.*

NANTUCKET *Shoal*, a bank which stretches out above 15 leagues in length, and 6 in breadth, to the S. E. from the island of its name.—*ib.*

NANTUXET *Bay*, New-Jersey, is on the eastern side of Delaware Bay, opposite Bombay Hook.—*ib.*

NAPLES-YELLOW, called also *Neapolitan earth*, in Italian *Giallolino*; and in French *Jaune de Naples*, is a beautiful pigment, concerning which we have much information from the indefatigable Beckmann. "It has (says he) the appearance of an earth, is of a pale orange-yellow colour, ponderous, granulated, exceedingly friable, does not effloresce, nor become moist when exposed to the air, but when applied to the tongue seems to adhere to it. When reduced to a fine powder, it remains for some time suspended in water, but soon deposits itself at the bottom in the form of a slime. When boiled with water, the water, at least sometimes, is observed to have a somewhat saline taste. It does not effervesce with acids, but is in part dissolved by aqua regia (nitro-muriatic acid). In the fire it emits no sulphureous vapour, is difficult to be fused, and by that operation undergoes no material change, only that its colour becomes somewhat redder. When fused with colourless glass, it gives it a milk-white colour, a sure proof that

Naples.

that it contains no iron; and, with inflammable substances, there is obtained from it a regulus which has the appearance of a mixture of lead and antimony.

"This article is brought from Naples for the most part in the form of an earthy crust about three or four lines in thickness, and it sometimes retains the form of the vessel in which it has hardened. It can be procured also as a fine powder, as the colourmen keep it sometimes ready pounded for use."

About the nature of the substance called Naples yellow there has been much diversity of opinion. Most of those who have written about it, consider it as originating from fire, and as a volcanic production of Mount Vesuvius or Mount Ætna; others have pronounced it to be a natural ochre. Guettard thought it rather a kind of bole; but Pott approached nearest the truth, by asserting it to be an artificial preparation*. Fougeroux is entitled to the merit of having proved this, and of having shewn the possibility of preparing it. According to his experiments, Naples yellow will be obtained, if you boil for seven or eight hours, first over a slow and then over a strong fire, a mixture finely pulverised of twelve parts of pure white lead, one part of alum, one part of sal ammoniac, and three parts of diaphoretic antimony† (white oxyd of antimony by nitre). But before Fougeroux, who may have obtained an account of the process during his travels through Italy, a more certain process was published in the year 1758, by Giambattista Passeri, in his interesting work on the painting of earthen-ware‡. The articles to be employed, according to this author, are, "one pound of antimony, a pound and a half of lead, one ounce of *alume di feccia*, and the same quantity of common salt." I am inclined (says M. Beckmann) to think that this receipt was not unknown to Fougeroux, and that he considered *alume di feccia* to be alum. Professor Leonhardi, a man of very sound learning, has translated this expression by the word alum. I will, however, freely confess, that I consider *alume di feccia* not to mean alum, but salt of tartar, or potash. Passeri says, that the proportions may be varied different ways; and he gives six other receipts, in which he does not mention *alume di feccia*, but only *feccia*; and this word certainly means *weinhefen* or winestone (tartar). Professor Leonhardi himself seems to confirm this opinion, by saying, that Vairo, professor of chemistry at Naples, has translated "the ashes of wine lees" (*cineres infectorii*) by the words *alume di feccia*.

* *Lithogeognosie*, v. ii. p. 15.

† *Mem. of the Acad. of Sciences*, 1766.

‡ *In Nuova raccolta d'opuscoli scientifici*, t. iv.

After Fougeroux's paper was printed, De la Lande published a receipt which he had received from the well-known prince San Severo, and in which lead and antimony only are employed; but no mention is made either of alum, tartar, or any other salt. This receipt is as follows:

Take lead well calcined and sifted, with a third part of its weight of antimony pounded and sifted also. Mix these substances well together, and sift them again through a piece of silk. Then take large flat earthen dishes, not varnished, cover them with white paper, and spread out the powder upon them to the depth of about two inches. Place these dishes in a potter's furnace, but only at the top, that they may not be exposed to too violent a heat. The reverberation of the flame will be sufficient. The dishes may be taken out at the same time as the earthen-ware, and the substance will then be found hard, and of a yellow colour. It is then pounded on a piece of marble with water, and afterwards dried for use.

Naples || Nardus.

The enamel-painters in Germany prepare a yellow glazing, not very different from the real Naples yellow, by a prescription, according to which, "one pound of antimony, six ounces of red lead, and two ounces of white sand, are to be fused together. The produce, which appears quite black, is to be pounded, and then fused again; and this process is to be repeated till the whole mass becomes thoroughly yellow. Half a pound of this mass is to be mixed with two ounces of red lead, and afterwards fused; and by this tedious process an orange-yellow pigment will be obtained."

All artists who speak of the use of Naples yellow, give cautions against applying iron to it, as the colour by these means becomes greenish, or at least dirty. For this reason, it must be pounded on a stone, and scraped together with an ivory spatula. It is employed chiefly in oil painting, because the colour is softer, brighter, and richer than that of ochre, yellow lead, or orpiment, and because it far exceeds these pigments in durability. It is employed in particular when the yellow ought to have the appearance of gold, and in this respect it may be prepared with gum water, and used as a water colour. A still greater advantage of it is, that it is proper for enamel painting, and on that account may be employed on porcelain or earthen ware (A). Professor Beckmann, however, recommends to artists to examine whether the oxyd prepared from wolfram, by boiling in the muriatic acid, which has a beautiful yellow colour, might not be used in the same manner as Naples yellow.

NARDUS. Under this generic term we have, in the *Encyclopædia*, given, from the *Philosophical Transactions*, a description of the plant or grass which Dr Blane considers as the spikenard of the ancients. It is our duty, in this place, to inform our readers, that Sir William Jones, in the 2d and 4th volumes of the *Asiatic Researches*, seems to have completely proved that the spikenard of Dioscorides and Galen, or *Nardus Indica*, was a very different plant from the Andropogon of Dr Blane, and that it grows in a country far distant from *Mackran*. The proofs brought by the illustrious president of the Asiatic Society, in support of his own opinion, are too numerous and circumstantial to be introduced into such a work as this. We shall therefore only give one of them; which though, when separated from the rest, it loses much of its force, must be allowed, even singly, to have great weight.

The true Indian spikenard is confessedly called by the Arabs *Sumbulu'l Hind*; for so they translate the name of it in Dioscorides. Now (says Sir William) I put a fair and plain question severally to three or four Mussulman physicians: "What is the Indian name of the plant which the Arabs call *Sumbulu'l Hind*?" They all answered, but some with more readiness than others, *Jútámansí*. After a pretty long interval, I shewed

(A) In the Memoirs of the Academy of Sciences for 1767, Fougeroux has proved that the giallolino prepared by him produced on porcelain a much more beautiful colour than the Naples yellow sold in the shops.

Nardus, ‖ Nares.

shewed them the spikes (as they are called) of *Jatámansí*, and asked, what was the Arabic name of that Indian drug? They all answered readily, *Sumbulu'l Hind*. The same evidence may be obtained in this country by any other European who seeks it; and if among twelve native physicians, versed in Arabian and Indian philology, a single man should, after due consideration, give different answers, I will cheerfully submit to the Roman judgment of *non liquet*. But the *Játámansí** evidently belongs to the natural order which Linnæus calls *aggregate*; with the following *characters:*

* Plate XXX.

Calyx, scarce any; *margin*, hardly discernible. *Corolla*, one petal; *tube* somewhat gibbous; *border* five cleft. *Stamina*, three *Anthers*. *Pistula*, *Germ* beneath; one *Style* erect. *Seed*, solitary, crowned with a pappus. *Root*, fibrous. *Leaves*, hearted, fourfold; *radical* leaves peticled.

It appears therefore (continues the learned author) to be the Protean plant Valerian, a sister of the Mountain and Celtic Nard, and of a species which I should describe in the Linnean style, *Valeriana Játámansí floribus triandris, foliis cordatis quaternis, radicalibus petiolatis.* The radical leaves, rising from the ground, and enfolding the young stem, are plucked up with a part of the root, and being dried in the sun or by an artificial heat, are sold as a drug, which, from its appearance, has been called spikenard. The Játámansí is a native of the most remote and hilly parts of India, such as Ne'pa'l, Marang Butan, near which Ptolemy fixes the native soil of the *Nardus Indica*. It grows erect above the surface of the ground, resembling an ear of green wheat; and when recent, it has a faint odour, which is greatly increased by the simple process of drying it.

NARES (James), doctor of music, an eminent composer and teacher in that science, under whom some of the first musicians of the present day received the whole or part of their education, was the son of Mr Nares, who was, for many years, steward to Montague and Willoughby, earls of Abingdon. He was born, as well as his brother, the late Mr Justice Nares, at Stanwell in Middlesex; the former in 1715, the latter in 1716. His musical education he commenced under Mr Gates, then master of the royal choristers; and completed it under the celebrated Dr Pepusch. Thus prepared, he officiated, for some time, as deputy to Mr Pigott, organist of Windsor; but on the resignation of Mr Salisbury, organist of York, in 1734, was chosen to succeed him, being then only nineteen. It is related, on undoubted authority, that, when the old musician first saw his intended successor, he said, rather angrily, "What! is that child to succeed me?" which being mentioned to the organist-elect, he took an early opportunity, on a difficult service being appointed, to play it throughout half a note below the pitch, which brought it into a key with seven sharps; and went through it without the slightest error. Being asked why he did so? he said, that "he only wished to shew Mr Salisbury what a child could do." His knowledge in all branches of his profession was equal to his practical skill in this instance; and, during his residence at York, where he was abundantly employed as a teacher, and where he married, Mr Nares, by his good conduct, as well as professional merit, obtained many powerful friends. Among the foremost of these was Dr Fontayne, the respectable and venerable dean of York; who, when Dr Green died, towards the latter end of 1755, exerted his interest so successfully, that he obtained for him the united places of organist and composer to his majesty. He removed therefore to London in the beginning of 1756; and, about the same time, was created doctor in music at Cambridge.

Biog. Dict. new edit.

On the resignation of Mr Gates, in 1757, Dr Nares obtained also the place of master of the choristers; which having been, for a long time, without increase, notwithstanding the increase of expences attending it, was, by royal favour, augmented about 1775, first with the salary of the violist; and, on the revival of that place for Mr Crosdill, in 1777, with that of lutanist, which was annexed to it for ever. It was in this situation that Dr Nares superintended the education of many pupils, who have since become famous; particularly Dr Arnold, who, though with him only for a short time, was highly distinguished by him for talents and application. The anthems and services which Dr Nares produced, as composer to the royal chapel, were very numerous; many of them have since been printed, and many which exist only in manuscript still continue to be performed in the choirs with much effect. Having been originally a musician rather by accident than choice, with very strong talents and propensities also for literature, Dr Nares was particularly attentive to express the sense of the words he undertook to set; and was the first who attempted to compose the Te Deum for the choir-service, in such a manner as to set off the sentiments it contains to advantage. Before his time, it had been set rather to a regular strain of chaunt than to any expressive melodies. The merits of Dr Nares were not overlooked by his royal patrons, whom he had occasionally the honour to attend in private, though not a part of his regular duty. To manifest his respect and gratitude for them, he composed his dramatic ode, entitled The Royal Pastoral, the words of which were written by Mr Bellamy, author of a book, entitled Ethic Amusements.

In July 1780, Dr Nares was obliged, by declining health, to resign the care of the choristers, in which place he was succeeded by Dr Ayrton, his pupil and valued friend. In his sixty eighth year, a constitution, never robust, gave way, and he died on February 10. 1783. Testimony has been borne to the merits of Dr Nares by several writers, but more particularly by Mr Mason, in his preface to a book of anthems, printed for the use of York Cathedral; and in his late Essays on Church Music, page 138. The late Lord Mornington, so well known for musical talents, frequently consulted him; and Sir John Hawkins derived advantage from his acquaintance, in the progress of his History of Music. Throughout life, he was not less respected as a man than admired as a musician; he had a vivacity that rendered his society always pleasing; and a generous contempt for every thing base, that manifested itself on all proper occasions, and very justly commanded esteem.

His printed works are these: 1. Eight Sets of Lessons for the Harpsichord; dedicated to the Right Hon. Willoughby Earl of Abingdon. Printed in 1748; reprinted in 1757. 2. Five Lessons for the Harpsichord, with a Sonata in score for the Harpsichord or Organ; dedicated to the Right Honourable the Countess of Carlisle;

Carlisle; published in 1758 or 1759. 3. A Set of Easy Lessons for the Harpsichord, three in number; with a dedication to the public, signed J. N. 4. A Treatise on Singing, small size. 5. Il Principio; or A regular Introduction to playing on the Harpsichord or Organ. This was the first set of progressive lessons published on a regular plan. 6. The Royal Pastoral, a Dramatic Ode; dedicated to his Royal Highness the Prince of Wales; printed in score, with an overture and choruses. 7. Catches, Canons, and Glees; dedicated to the late Lord Mornington. 8. Six Fugues, with Introductory Voluntaries for the Organ or Harpsichord. 9. A Concise and Easy Treatise on Singing, with a Set of English Duets for Beginners. A different work from the former small treatise. 10. Twenty Anthems, in score, for one, two, three, four, and five Voices. Composed for the Use of his Majesty's Chapels Royal, 1778. 11. Six Easy Anthems, with a favourite Morning and Evening Service, left for publication at his death, and published in 1788, with a portrait and a concise account of the author. Of these compositions the following short character is given by an eminent musician, to whom they are all well known: "The lessons are composed in a masterly and pleasing style; free from those tricks and unmeaning successions of semitones, to which a good ear and sound judgment never can be reconciled. The treatises on singing contain duets composed for the use of the children of the royal chapels, superior to any thing yet published; and such as every teacher ought to peruse. His catches, canons, and glees, are natural and pleasing; especially the glee to all Lovers of Harmony, which gained the prize medal at the catch-club in 1770. The Royal Pastoral is composed throughout in a very masterly manner; particularly the choruses, with which each part concludes. This ode, containing 108 pages, was written, and all the vocal and instrumental parts transcribed for performing, within twelve days. The six fugues, with introductory voluntaries for the organ, contain the strongest proofs of ingenuity and judgment; few, if any, have ever been written that can be preferred to them. In both sets of the anthems, the same characteristics appear; and the service of the latter very justly acquired the title of *favourite;* nor can there be any doubt that the works of this author will be admired as long as a taste for music shall subsist."

NARRAGANSET *Bay*, Rhode-Island, makes up from south to north, between the main land on the east and west. It embosoms many fruitful and beautiful islands, the principal of which are Rhode-Island, Canonicut, Prudence, Patience, Hope. Dyers, and Hog Islands. The chief harbours are Newport, Wickford, Warren, Bristol, and Greenwich, besides Providence and Patuxet; the latter is near the mouth of Patuxet river, which falls into Providence river. Taunton river and many smaller streams fall into this capacious bay. It affords fine fish, oysters and lobsters in great plenty.—*Morse.*

NARRAGUAGUS *Bay*. A part of the bay between Goldsborough and Machias, in Washington county, District of Maine, goes by this name. From thence for the space of 60 or 70 miles, the navigator finds, within a great number of fine islands, a secure and pleasant ship-way. Many of these islands are inhabited and make a fine appearance. A river of the same name falls into the bay.—*ib.*

NARRAGUAGUS, a post-town, situated on the above bay, 16 miles northeast of Goldsborough, 63 east of Penobscot, 9 from Pleasant river, and 673 from Philadelphia.—*ib.*

NARROWS, *The*. The narrow passage from sea, between Long and Staten Islands into the bay which spreads before New-York city, formed by the junction of Hudson and East rivers, is thus called. This strait is 9 miles south of the city of New-York.—*ib.*

NARROWS, *The*, a strait, about 3 miles broad, between the islands of Nevis and St Christopher's Islands, in the West-Indies.—*ib.*

NASH, a county of Halifax district, containing 7,393 inhabitants, of whom 2,009 are slaves. There is a large and valuable body of iron-ore in this county; but only one bloomery has yet been erected.—*ib.*

NASH *Court-House*, in N. Carolina, where a post-office is kept, 28 miles from Tarborough, and as far from Lewisburg.—*ib.*

NASHAUN, or *Naushawn*, one of the Elizabeth Isles, the property of the Hon. James Bowdoin, Esq. of Boston, situated at the mouth of Buzzard's Bay, and 3 miles from the extremity of the peninsula of Barnstable county. Considerable numbers of sheep and cattle are supported upon this island; and it has become famous for its excellent wool and cheese. Here Capt. Bartholomew Gosnold landed in 1602, and took up his abode for some time.—*ib.*

NASHUA *River*, is a considerable stream in Worcester county, Massachusetts, and has rich intervale lands on its banks. It enters Merrimack river at Dunstable. Its course is north-north-east.—*ib.*

NASHVILLE, the chief town of Mero District in the State of Tennessee, is pleasantly situated in Davidson county, on the south bank of Cumberland river, where it is 200 yards broad. It was named after Brig. Gen. Francis Nash, who fell on the 4th of Oct. 1777, in the battle of Germantown. It is regularly laid out, and contains 75 houses, a court-house, an academy, and a church for Presbyterians, and one for Methodists. It is the seat of the courts held semi-annually for the district of Mero, and of the courts of pleas and quarter sessions for Davidson county. It is 185 miles west of Knoxville, 66 from Big Salt Lick garrison, 190 S. by W. of Lexington in Kentucky, 635 W. by S. of Richmond in Virginia, and 1015 W. S. W. of Philadelphia. N. lat. 36, W. long. 87 8.—*ib.*

NASKEAG *Point*, in Lincoln county, District of Maine, is the eastern point of Penobscot Bay.—*ib.*

NASSAU *Bay*, or *Spirito Santo*, is a large bay on the coast of West-Florida, about 70 miles from north to south. It has 4 islands on a line for 50 miles from S. W. to N. E. with openings between them a mile or two wide. The most northerly is called Myrtle Island, between which, and the continent, is the entrance of the bay. The bay is 15 miles broad from Myrtle Island to a row of islands running parallel with the main land, and another bay between them stretching 50 or 60 miles to the south, as far as one of the smaller mouths of the Mississippi.—*ib.*

NASSAU *Bay*, an extensive bay of the ocean, on the S. coast of Terra del Fuego island, at the S. extremity

mity of S. America. It is to the E. of Falfe Cape Horn, which forms the weftern limit of the bay; Cape Horn being the S point of the fouthernmoft of the Hermit's Iflands, a groupe of iflands which lie off the coaft oppofite to this bay. This bay is large and open, well fheltered from the tempefts of the ocean. It is capable of holding a fleet of fhips, and though there are fmall iflands near its entrance, all the dangers are vifible, and fhips may fail freely between them, or on each fide of them.—*ib.*

NASSAU *Cape*, on the coaft of Surrinam, or N. E. coaft of S. America, is to the N. N. W. of Effequibo gulf, and the E. point of the entrance into the river Pumaron. It is in about lat. 7. 40 N. and long. 59 30 W.—*ib.*

NASSAU *Cape*, on the N. fhore of Terra Firma, S. America.—*ib.*

NASSAU, a fmall town in Dauphin county, Pennfylvania. It contains a German church, and about 35 houfes. It is alfo called *Kempftown.*—*ib.*

NASSAU *Ifland*, at the mouth of Byram river, in Long-Ifland Sound.—*ib.*

NASSAU *Road*, on the coaft of Weft-Florida, lies W. of Mobile Bay, 5 leagues to the northward of Ship Ifland, and within the north end of the Chandeleurs or Myrtle Iflands. It is one of the beft roads for large veffels on the whole coaft of Florida. It affords good fhelter from winds that blow on fhore, has no bar, and is eafy of accefs. Veffels, however, muft not go within ½ of a mile of the infide of the ifland, it being fhoal near that diftance from the fhore. Veffels may go round the north end of it from the fea in 5½ and 6 fathoms, at ½ a mile from the fhore, and afterwards muft keep in 4½ and 5 fathoms till the north point bears N. N. E. about 2 miles, where they can anchor in 4 fathoms good holding ground, fheltered from afterly and foutherly winds: this is neceffary for all effels frequenting the coaft of Florida, as eafterly winds are very frequent- There is frefh water to be got any where on the Chandeleurs by digging; and there is a kind of well at the north end, near an old hut. There is no wood to be found here but drift wood, of which there is great plenty along fhore. Naffau Road was firft difcovered by Dr Daniel Cox, of New-Jerfey, who named it fo in honour of the reigning prince, William III. He alfo gave the name of Myrtle Iflands to thofe afterwards call Chandeleurs, by the French, from the candles made of the Myrtle wax, with which thefe iflands abound.—*ib.*

NASSAU *River*, on the coaft of Eaft-Florida, has a bar generally about 8 feet water, but is fubject to fhifting. The tides are about 7 feet at low fpring tides. An E. S E. moon makes high water here, as alfo in moft places along the coaft.—*ib.*

NASSAU, the chief town of Providence Ifland, one of the Bahamas, and the feat of government. N. lat. 25 3. It is the only port of entry except at Turk's Ifland.—*ib.*

NATA, a town and bay in the province of Terra Firma, S. America. The bay of Nata lies on the S. coaft of the Ifthmus of Darien, and on the North Pacific Ocean. From hence and the adjacent parts, provifions are fent for the fupply of the inhabitants of Panama, which city is 67 miles N. E. of Nata. The bay is fpacious and deep, but is not ufed by fhips, but in cafes of neceffity, as they are liable to be embayed by the winds that blow frequently at E. upon the fhore. The bay extends to the ifland Iguenas. N. lat. 8 12, W. long. 81 12.—*ib.*

NATA POINT, or *Chama*, or *Chaumu Cape*, is at the W. point of the gulf of Panama, from whence the coaft trends W. to Haguera Point 7 leagues. All fhips bound to the N. W. and to Acapulco make this point. It is alfo called the S. point of the bay, which lies within on the W. fide of this great Gulf of Panama. —*ib.*

NATACHQUOIN *River*, a large river of the coaft of Labrador, in N. America, to the weftward of Nafquirou river, under Mount Joli, where it forms a foutherly cape in lat. 50 25 N. and long. 60 45 W. The little Natachquoin is to the W. S. W. of this.—*ib.*

NATAL, a cape and town, on the S. fhore of the Rio Grande, on the N. E. coaft of Brazil in S. America, is to the S. W. of the 4 fquare fhoal, at the mouth of the entrance of that river, which contains fome dangerous rocks. On this point is the Caftle of the Three Kings, or Fortaleza des Tres Magos. The town of Natal is 3 leagues from the caftle, before which is good anchorage for fhips, in from 4 to 5 fathoms, and well fecured from winds.—*ib.*

NATCHEZ, a powerful nation of Indians who formerly inhabited the country on the E. fide of the Miffiffippi. Fort Rofalie is fituated in the country which they poffeffed, in lat. 31 40. Nothing now remains of this nation but the name, by which the country continues to be called. The Creeks or Mufcogulges rofe upon the ruins of this nation. The French completed their deftruction in 1730. The Natchez or Sun Set Indians, are a part of the Creek confederacy which they joined after they left Louifiana.—*ib.*

NATCHITOCHES. A tract of country in Louifiana, on the river Rouge, or Red river, bears this name. The French had a very confiderable poft on this river called Natchitoches. It was a frontier on the Spanifh fettlements, being 20 miles from the fort of Adayes, and 70 leagues from the confluence of the Rouge with the Miffiffippi.—*ib.*

NATICK, an ancient townfhip in Middlefex county, Maffachufetts, fituated upon Charles river, 18 miles S. W. of Bofton, and 10 N. W. of Dedham. Its name in the Indian language fignifies "The place of hills." The famous Mr Eliot formed a religious fociety here; and in 1670, there were 50 Indian communicants. At his motion, the General Court granted the land in this town, containing about 6000 acres, to the Indians. Very few of their defcendants, however, now remain. It was incorporated into an Englifh diftrict in 1761, and into a townfhip in 1781; and now contains 615 inhabitants —*ib.*

NATEENAT, an Indian village on Nootka Sound, on the N. W. coaft of N. America. It has a remarkable cataract, or water-fall, a few miles to the northward of it. N. lat. 48 40, W. long. from Greenwich 124 6.—*ib.*

NAUDOWESIES, an Indian nation inhabiting lands between Lakes Michigan and Superior. Warriors, 500.—*ib.*

NAUGATUCK *River*, a north-eaftern branch of

Navigators.

Housatonic river in Connecticut. A great number of mills and iron-works are upon this stream and its branches.—*ib.*

NAVIGATORS ISLANDS, an archipelago in the South Sea, discovered by Bougainville, who gave to them that name, because the natives do not pass between the different villages, which are all built in creeks and bays, but in their canoes. The Navigators Islands are ten in number; namely, *Opoun*, *Leoné*, *Fanfoué*, MAOUANA, *Oyolava*, *Calinassé*, *Pola*, *Shika*, *Ossamo*, and *Ouera*.

We have already given an account of the soil and productions of MAOUANA; and as the other islands of this cluster are equally fertile, we need not go over the same ground again. It may be proper, however, to observe, that in some of them the sugar-cane was found growing spontaneously, though its juice contained less of the saccharine substance than the sugar cane of the West Indies, which our voyagers attributed to its growing in a richer soil and in the shade. According to Perouse, the Navigators Islands are situated about the 14th degree of south latitude, and between the 171st and 175th degrees of longitude west from Paris. In Oyolava the smoke was seen hovering over a village as over a large European town; and the number of canoes which from that island surrounded the frigates was immense. These are very ticklish vessels, and would be absolutely useless to any body but such excellent swimmers as the islanders, who are no more surprised or uneasy at their oversetting than we are at the fall of a hat. Taking up the canoe on their shoulders, they empty it of water, and then get in again, with the certainty of having the same operation to perform a second time in half an hour. Sometimes they join two canoes together by means of a cross piece of wood, in which they make a step to receive the mast; and in this way they are less liable to be overset, sometimes performing a long voyage without any such accident. It is needless to add, that these canoes are very small, generally containing only five or six persons, though some few of them may contain as many as fourteen.

The natives of the Navigators Islands are tall and well made. Their usual height is five feet nine, ten, and eleven inches; but their stature is less astonishing than the colossal proportions of the different parts of their bodies. "Our curiosity (says Perouse), which often led us to measure them, gave them an opportunity of making frequent comparisons of their bodily strength with ours. These comparisons were not to our advantage; and we perhaps owe our misfortunes (see MAOUANA in this *Suppl.*) to the idea of individual superiority resulting from repeated trials. Their countenances often appeared to express a sentiment of disdain, which I hoped to destroy, by ordering our arms to be used in their presence: but my end could only have been gained by directing them against human victims; for otherwise they took the noise for sport, and the trial for a diversion.

"Among these Indians a very small number is below the height indicated above. I have, however, measured several who were only five feet four inches, but these are the dwarfs of the country; and although their stature resembles ours, their strong and nervous arms, their broad chests, and their legs and thighs, are of a very different proportion.

"The men have the body painted or tatowed, so that any one would suppose them clad, although they go almost naked. They have only a girdle of sea-weeds encircling their loins, which comes down to their knees, and gives them the appearance of the river gods of fabulous history, whom it is customary to depict with rushes round their waist. Their hair is very long. They often twist it round their heads, and thus add to their native ferocity of countenance, which always expresses either surprise or anger. The least dispute between them is followed by blows of sticks, clubs, or paddles, and often, without doubt, costs the combatants their lives. They are almost all covered with scars, which can only be the consequence of their individual quarrels. The stature of the women is proportioned to that of the men. They are tall, slender, and not without grace; but they lose, while yet in their prime, those elegant forms, of which nature has not broken the mould among this barbarous race, but of which she appears to leave them in possession only for a moment, and with reluctance. Among a great number of women that I had an opportunity of seeing, I only observed three really pretty. The gross effrontery of the rest, the indecency of their motions, and the disgusting offers which they made of their favours, rendered them fit mothers and wives for the ferocious beings that surrounded us." Our author gives the following instance of indecent manners, which is, perhaps, without a parallel.

The young and prettiest females soon attracted the attention of several Frenchmen, who in spite of the Commodore's prohibition, endeavoured to form a connection with them, and were successful. The looks of the Europeans expressing desires which were soon divined, some old women undertook the negociation. The altar was prepared in the handsomest hut in the village, all the blinds were let down, and the inquisitive were excluded. The victim was then laid in the arms of an old man, who exhorted her, during the ceremony, to moderate the expression of her pain; while the matrons sang and howled: the ceremony being performed in their presence, and under the auspices of the old man, who served at once as priest and altar. All the women and children in the village were round the house, gently lifting up the blinds, and seeking to enjoy the sight through the smallest crevices in the mats. Whatever former navigators may have said, Perouse was convinced that, in the Navigators Islands at least, the young girls, before they are married, are mistresses of their persons, and that they are not dishonoured by their complaisance. It is even more than probable, that in marrying they are called to no account concerning their past conduct; but he had no doubt that they are obliged to be more reserved when provided with a husband.

These people cultivate certain arts with success. Under the article MAOUANA mention has been made of the elegant form which they give to their huts. It is not with such folly as is commonly supposed that they disdain our instruments of iron; for they finish their work very neatly with tools made of a very fine and compact species of basaltes in the form of an adze. For a few glass beads they sold to Perouse large three-legged dishes of a single piece of wood, and so well polished that they seemed to have been laid over with a coat of the

Navigators.

the fineſt varniſh. It would take an European workman ſeveral days to produce one of theſe diſhes, which, for want of proper inſtruments, muſt coſt an Indian ſeveral months labour. They ſet, however, ſcarcely any value upon them, becauſe they ſet little upon the time they employ. The fruit trees and nutritious roots that grow ſpontaneouſly around them, inſure to them their ſubſiſtence, as well as that of their hogs, dogs, and fowls; and if they ſometimes ſtoop to work, it is to procure enjoyments rather agreeable than uſeful. They manufacture very fine mats, and ſome paper ſtuffs. Our author remarked two or three of them, whom he took for chiefs, with a piece of cloth tied round their waiſt like a petticoat, inſtead of a girdle of weeds. It is compoſed of real thread, prepared no doubt from ſome filamentous plant like the nettle or flax; and is manufactured without a ſhuttle, the threads being abſolutely laid over one another like thoſe of their mats. This cloth, which has all the ſuppleneſs and ſolidity of ours, is very fit for the ſails of their canoes; and appeared far ſuperior to the paper ſtuff of the Society and Friendly Iſlands, which they manufacture alſo. Their canoes are well conſtructed, and furniſh a good proof of the ſkill with which they work in wood. For a few glaſs beads they gave to the Frenchmen, among other things, a wooden veſſel filled with cocoa nut oil, exactly of the ſhape of our earthen pots, and ſuch as no European would undertake to faſhion by any other means than a turning lathe. Their ropes are round, and twiſted like watch chains of ribbon: their mats are very fine; but their ſtuffs are inferior to thoſe of the Eaſter and Sandwich Iſlands.

Perouſe derives the natives of thoſe iſlands, whoſe colour, he ſays, nearly reſembles that of the Algerines and other nations on the coaſt of Barbary, from the Malays; and as we do not vouch for the truth of his theory, though we admit it to be ingenious, we ſhall give the reaſoning by which he ſupports it in his own words.

"We did not at firſt diſcover (ſays he) any identity between their language and that of the natives of the Society and Friendly Iſlands, of which we had vocabularies; but a more mature examination convinced us, that they ſpeak a dialect of the ſame language. A fact which tends to prove it, and which confirms the opinion of the Engliſh concerning the origin of theſe people, is, that a young domeſtic, a native of the province of Tagayan in the north of Manilla, underſtood and explained to us the greater part of their words. It is well known that the Tagayan, the Talgal, and the generality of languages ſpoken in the Philippines, are derived from the Malay: a language more diffuſed than were thoſe of the Greeks and Romans, and common to the numerous tribes that inhabit the iſlands of the great Pacific Ocean. It appears to me evident, that all theſe different nations are the progeny of Malay colonies, which, in ſome age extremely remote, conquered the iſlands they inhabit. I ſhould not even wonder, if the Chineſe and Egyptians, whoſe antiquity is ſo much vaunted, were mere moderns in compariſon of the Malays. But however this may be, I am ſatisfied that the aborigines of the Philippine Iſlands, Formoſa, New Guinea, New Britain, the New Hebrides, the Friendly Iſlands, &c. in the ſouthern hemiſphere, and thoſe of the Marianna and Sandwich iſlands in the northern, were that race of woolly headed men ſtill found in the interior of the iſlands of Luconia and Formoſa. They were not to be ſubjugated in New Guinea, New Britain, and the New Hebrides; but being overcome in the more eaſtern iſlands, which were too ſmall to afford them a retreat in the centre, they mixed with the conquering nation. Thence has reſulted a race of very black men, whoſe colour is ſtill ſeveral ſhades deeper than that of certain families of the country, probably becauſe the latter have made it a point of honour to keep their blood unmixed. I was ſtruck with theſe two very diſtinct races in the Iſlands of Navigators, and cannot attribute to them any other origin.

"The deſcendants of the Malays have acquired in theſe iſlands a degree of vigour and ſtrength, a lofty ſtature, and a Herculean form, which they do not inherit from their forefathers, but which they owe, without doubt to an abundance of food, to a mild climate, and to the influence of different phyſical cauſes which have been conſtantly acting during a long ſeries of generations. The arts which they perhaps brought with them may have been loſt for want of materials and inſtruments to practiſe them; but the identity of language, like Ariadne's clue, enables the obſerver to follow all the windings of this new labyrinth. The feudal government is alſo preſerved here: that government which little tyrants may regret; which was the diſgrace of Europe for ſeveral centuries; and of which the Gothic remains are ſtill to be found in our laws, and are the medals that atteſt our ancient barbariſm: that government, which is the moſt proper to keep up a ferocity of manners, becauſe the ſmalleſt diſputes occaſion wars of village againſt village, and becauſe wars of this nature are conducted without magnanimity, and without courage. Surpriſes and treachery are employed by turns; and in theſe unfortunate countries, inſtead of generous warriors, nothing is to be found but baſe aſſaſſins (A). The Malays are ſtill the moſt perfidious nation of Aſia: and their children have not degenerated, becauſe the ſame cauſes have led to and produced the ſame effects. It may be objected, perhaps, that it muſt have been very difficult for the Malays to make their way from weſt to eaſt, to arrive at theſe different iſlands;

(A) This was written under the old government of France by a man who, like other declaimers in the cauſe of liberty, forgot the excellencies, and inſiſted only on the defects of the feudal inſtitutions. Had Perouſe, however, returned to Europe, and witneſſed the *philoſophic* government of his country, he would have perceived, that *liberty* and *equality*, and *the rights of man*, are as well calculated to generate baſe aſſaſſins, as the Gothic remains of that government by which he ſuppoſed Europe to have been ſo long diſgraced. He might even have lived to regret, that his lot was not caſt among the bold and ferocious inhabitants of Maouana; for the treachery and cruelty of theſe people bears no proportion, even in his affecting narrative, to the ſyſtematic cruelty of thoſe who decreed, that the end ſanctifies the means, and that nothing, however atrocious in the eſtimation of antiquated moraliſts, is to be omitted, which contributes to elevate the mean above the noble.

islands; but the westerly winds blow as frequently as the easterly in the vicinity of the equator, along a zone of seven or eight degrees from north to south, where the wind is so variable, that it is hardly more difficult to navigate east than west. Besides, these different conquests may not have been effected at the same time: the people in question may, on the contrary, have spread themselves by little and little, and gradually have introduced that form of government which still exists in the peninsula of Malacca, at Java, Sumatra, and at Borneo, as well as in all the other countries subject to that barbarous nation."

NAVARRE, a province of New-Mexico, on the N. E. side of the Gulf of California, which separates it from the peninsula of California, on the S. W.—*Morse.*

NAVASIA, a small island in the Windward Passage, or strait between Cuba and Hispaniola in the West-Indies. Thither the inhabitants of Jamaica come in boats to kill guaras, an amphibious creature that breeds plentifully at the roots of old trees. They are in the shape of a lizard, with scales, and some are 3 feet in length. Their flesh is firm and white, and said by seamen to make good broth.—*ib.*

NAVAZA, a small barren island in the West-Indies, not very high, is steep all round, and lies in lat. 18 20 N. It is 21 leagues W. S. W. ½ W. of the E. end of Jamaica, and 11 leagues from Tiburon, in the island of St Domingo.—*ib.*

NAVESINK *Harbour*, on the sea-coast of Monmouth county, New-Jersey, lies in lat. 40 24 N. having Jumping Point on the north, and is 2½ miles S. of the N. end of Sandy Hook island; and its mouth is 5 miles from the town of Shrewsbury. The small river of its name falls into it from the W. and rises in the same county. Navesink Hills extend N. W. from the harbour on the Atlantic Ocean, to Rariton Bay; and are the first land discovered by mariners when they arrive on the coast. They are 600 feet above the level of the sea, and may be seen 20 leagues off.—*ib.*

NAVIDAD, a town of Mechoacan a province of Mexico, with a harbour on the N. Pacific Ocean, is 156 miles W. of Mexico city. N. lat. 18 51, W. long. 111 10.—*ib.*

NAVIRES, or *Cas de Navires Bay*, in the island of Martinico, in the West-Indies.—*ib.*

NAVY, a township in Orleans county, in Vermont.—*ib.*

NAVY *Hall*, in Lower Canada, stands on the south side of Lake Ontario, at the head and west side of Niagara river, which last separates it from Fort Niagara, on the E. side, in the State of New-York. It is 20 miles N. by W. of Fort Erie, and 23 S. E. by S. of York.—*ib.*

NAVY *Island* lies in the middle of Niagara river, whose waters separate it from Fort Slusher, on the east bank of the river, and the same waters divide it from Grand Island, on the S. and S. E. It is about one mile long, and one broad, and is about 13 miles N. by E. of Navy Hall.—*ib.*

NAZARETH, a beautiful town in Northampton county, Pennsylvania, inhabited by Moravians, or United Brethren. It is situated 10 miles north of Bethlehem, and 63 N. by W. of Philadelphia. It is a tract of good land, containing about 5,000 acres, purchased by the Rev. G. Whitfield, in 1740, and sold 2 years after to the brethren. They were however obliged to leave this place the same year, where it seems they had made some settlements before. Bishop Nitchman arrived from Europe this year (1740) with a company of brethren and sisters, and purchased and settled upon the spot which is now called Bethlehem. The town of Nazareth stands about the centre of the manor, on a small creek which loses itself in the earth about a mile and a half E. of the town. It was regularly laid out in 1772, and consists of 2 principal streets which cross each other at right angles, and form a square in the middle, of 340 by 200 feet. The largest building is a stone house, erected in 1755, named Nazareth Hall, 98 feet by 46 in length, and 54 in height. The lower floor is formed into a spacious hall for public worship, the upper part of the house is fitted up for a boarding school, where youth, from different parts, are under the inspection of the minister of the place and several tutors, and are instructed in the English, German, French and Latin languages; in history, geography, book-keeping, mathematics, music, drawing, and other sciences. The front of the house faces a large square open to the south, adjoining a fine piece of meadow ground, and commands a most delightful prospect. Another elegant building on the E. of Nazareth Hall is inhabited by the single sisters, who have the same regulations and way of living as those at Bethlehem. Besides their principal manufactory for spinning and twisting cotton, they have lately begun to draw wax tapers. At the south-west corner of the aforesaid square, in the middle of the town, is the single brethren's house, and on the E. S. E. corner a store. On the southernmost end of the street is a good tavern. The dwelling-houses are, a few excepted, built of lime-stone, one or two stories high, inhabited by tradesmen and mechanics, mostly of German extraction. The inhabitants are supplied with water conveyed to them by pipes from a fine spring near the town. The situation of the town, and the salubrious air of the adjacent country, render this a very agreeable place. The number of inhabitants in the town and the farms belonging to it, (Shoeneck included) constituting one congregation, and meeting for divine service on Lord's days and holidays, at Nazareth Hall, was in the year 1788, about 450.—*ib.*

NAZER, NAZR, NEZER, NUZZER, NUZZERANA; a present from an inferior; fees of office.

NEBULOUS, or CLOUDY, a term applied to certain fixed stars which shew a dim hazy light; being less than those of the sixth magnitude, and therefore scarcely visible to the naked eye, to which at best they only appear like little dusky specks or clouds. Through a moderate telescope, these nebulous stars plainly appear to be congeries or clusters of several little stars.

NECESSITY, *Fort*, in Virginia, is situated in the Great Meadow, within 4 miles of the W. bounds of Maryland, and on the north side of the head water of Red Stone Creek, which empties from the E. into the Monongahela, in N. lat. 39 43, about 26 miles from the spot where this fort was erected. It is 238 miles E. by N. of Alexandria, and 258 north-west of Fredericksburgh. This spot will be forever famous in the history of America, as one of the first scenes of Gen. WASHINGTON's abilities as a commander. In 1753, it was only a small unfinished intrenchment, when Mr Washington, then

then a colonel, in the 22d year of his age, was sent with 300 men towards the Ohio. An engagement with the enemy ensued, and the French were defeated. M. de Villier, the French commander, sent down 900 men besides Indians, to attack the Virginians. Their brave leader, however, made such an able defence with his handful of men, in this unfinished fort, as to constrain the French officer to grant him honourable terms of capitulation.—*Morse.*

NECKAR Isle, a small barren island, or rather rock, discovered by Perouse in the Pacific Ocean. Though its sterility renders it of no importance in itself, its exact situation must be interesting to navigators, who are therefore obliged to the French Commodore for having ascertained its latitude to be 23° 34′ north, and its longitude to be 165° 52′ west from Paris. From the soundings the *Neckar* seemed to be only the top or nucleus of a much more considerable island, which, probably from being composed of a soft and dissoluble substance, the sea had gradually washed away. In proportion as the frigates left the shore, the depth, which at the distance of a mile was very little, gradually increased, till, at the distance of about ten miles, no bottom was found with a line of 150 fathoms; and over the whole of that space the bottom consisted of coral and broken shells.

NEDDICK, *Cape*, or *Neddock*, lies between York river and Well's Bay on the coast of York county, District of Maine.—*Morse.*

Neddick *River, Cape*, in the above county, is navigable about a mile from the sea, and at full tide only for vessels of any considerable burden, it having a bar of sand at its mouth, and at an hour before and after low water, this rivulet is generally so shallow, as to be fordable within a few rods of the sea.—*ib.*

NEEDHAM's *Point*, on the S. W. angle of the island of Barbadoes in the West-Indies, is to the S. easterly from Bridgetown, having a fort upon it called Charles Fort.—*ib.*

Needham, a township in Norfolk county, Massachusetts, 11 miles from Boston. It is about 9 miles in length and 5 in breadth, and is almost encompassed by Charles river. The lower fall of the river, at the bridge between Newton and Needham is about 20 feet in its direct descent. Here the river divides Middlesex from Norfolk county. It was incorporated in 1711, and contains 1130 inhabitants. A slitting and rolling mill has lately been erected here.—*ib.*

NEEHEEHEOU, one of the Sandwich islands, about 5 leagues to the westward of Atooi, and has about 10,000 inhabitants. Its place of anchorage is in lat. 21 50 N. and long. 160 15 W. Sometimes it is called *Neheeow*, or *Oneeheow*.—*ib.*

NEGADA, or *Anegada*, one of the Caribbee islands in the West-Indies. It is low and desart, encompassed with shoals and sand-banks. It is called Negada, from its being mostly overflown by high tides. It is 50 miles north-west of Anguilla, and abounds with crabs. N. lat. 18 6. W. long. 63 5.—*ib.*

NEGRIL *Harbour, North*, at the W. end of the island of Jamaica, has North Negril Point on the north, which is the most westerly point of the island of Jamaica. N. lat. 18 45, W. long. 78.—*ib.*

NEGRO *Cape* and *Harbour*, at the south-west extremity of Nova-Scotia.—*ib.*

Negro *Point*, on the E. coast of Brazil, is 3 leagues at S. S. E. from the Rio Grande, and 14 from Cape St Rocque.—*ib.*

Negro *River* is the western boundary of Guiana in S. America.—*ib.*

Negro *Fort*, in Amazonia, stands on the north side of Amazon river in S. America, just below the junction of its great branches the Purus and Negro, in the 4th degree of north latitude, and about the 60th of W. longitude.—*ib.*

NELSON, a county of Kentucky, Chief town, Bairdstown.—*ib.*

Nelson's *Fort*, a settlement on the W. shore of Hudson's Bay, situated at the mouth of a river of the same name, 250 miles south-east of Churchill Fort, and 600 north-west of Rupert's Fort, in the possession of the Hudson's Bay Company. It is in lat. 57 12 north, and long. 92 42 west. The shoals so called are said to be in lat. 57 35 north, and long. 92 12 west, and to have high water at full and change days at 20 minutes past 8 o'clock.—*ib.*

Nelson's *River* is the N. W. branch of Hayes river, on the W. shore of Hudson's Bay, which is separated into two channels by Hayes Island, at the mouth of which Nelson's Fort is situated.—*ib.*

NENAWEWHCK *Indians* inhabit near Severn river, south of Severn lake.—*ib.*

NEOMINAS *River*, on the coast of Peru, is 12 or 14 leagues to the N. W. of Bonaventura river. It is a large river, and empties into the ocean by 2 mouths. The shore is low, but there is no landing upon it, as it is inhabited only by savages whom it would not be very safe to trust, as their peaceable or hostile disposition towards Europeans cannot be easily known. The coast, though in the vicinity of the most flourishing Spanish colonies, remains unfrequented and wild. Palmas Island is opposite to this river, being low land, and having several shoals about it; and from hence to Cape Corientes is 20 leagues to the N. W. The river and island are in lat. about 4 30 N.—*ib.*

NEPAL, a kingdom of India, situated to the north-east of the city of Patna, at the distance of ten or twelve days journey. Within the distance of four days journey from Nepal the road is good in the plains of Hindostan, but in the mountains it is bad, narrow, and dangerous. At the foot of the hills the country is called *Teriani*; and there the air is very unwholesome from the middle of March to the middle of November; and people in their passage catch a disorder called in the language of that country *aul*; which is a putrid fever, and of which the generality of people, who are attacked with it, die in a few days; but on the plains there is no apprehension of it. Although the road be very narrow and inconvenient for three or four days at the passes of the hills, where it is necessary to cross and recross the river more than fifty times, yet, on reaching the interior mountain before you descend, you have an agreeable prospect of the extensive plain of Nepal, resembling an amphitheatre covered with populous towns and villages: the circumference of the plain is about 200 miles, a little irregular, and surrounded by hills on all sides, so that no person can enter or come out of it without passing the mountains.

There are three principal cities in the plain, each of which was the capital of an independent kingdom; the principal

Nepal.

principal city of the three is situated to the northward of the plain, and is called *Cat'hmandu:* it contains about 18,000 houses; and this kingdom, from south to north, extends to the distance of twelve or thirteen days journey as far as the borders of Tibet, and is almost as extensive from east to west. The king of Cat'hmandu has always about 50,000 soldiers in his service. The second city to the south-west of Cat'hmandu is called *Lelit Pattan;* it contains near 24,000 houses. The third principal city to the east of Lelit Pattan is called *B'hatgan:* it contains about 12,000 families; and is the metropolis of a district which extends towards the east to the distance of five or six days journey; and borders upon another nation, also independent, called *Ciratas*, who profess no religion. Besides these three principal cities, there are many other large and less considerable towns or fortresses; one of which is *Timi*, and another *Cipoli*, each of which contains about 8000 houses, and is very populous. All those towns, both great and small, are well built; the houses are constructed of brick, and are three or four stories high; their apartments are not lofty; they have doors and windows of wood well worked and arranged with great regularity. The streets of all their towns are paved with brick or stone, with a regular declivity to carry off the water. In almost every street of the capital towns there are also good wells made of stone, from which the water passes through several stone canals for the public benefit. In every town there are large square varandas well built, for the accommodation of travellers and the public: these varandas are called *Pali;* and there are also many of them, as well as wells, in different parts of the country for public use. There are also, on the outside of the great towns, small square reservoirs of water, faced with brick, with a good road to walk upon, and a large flight of steps for the convenience of those who choose to bathe.

The religion of Nepal is of two kinds: the more ancient is professed by many people who call themselves *Baryesu;* they pluck out all the hair from their heads; their dress is of coarse red woollen cloth, and they wear a cap of the same: they are considered as people of the religious order, and their religion prohibits them from marrying, as it is with the Lamas of Tibet, from which country their religion was originally brought; but in Nepal they do not observe this rule, except at their discretion. They have large monasteries, in which every one has a separate apartment or place of abode. They observe also particular festivals, the principal of which is called *Yatra* in their language, and continues a month or longer according to the pleasure of the king. The ceremony consists in drawing an idol, which at Lelit Pattan is called *Baghero*, in a large and richly ornamented car, covered with gilt copper: round about the idol stand the king and the principal Baryesus; and in this manner the vehicle is almost every day drawn thro' some one of the streets of the city by the inhabitants, who run about beating and playing upon every kind of instrument their country affords, which make an inconceivable noise.

The other religion, the more common of the two, is that of the Brahmens, and is the same as is followed in Hindostan, with the difference that, in the latter country the Hindus being mixed with the Mahommedans, their religion also abounds with many prejudices, and is not strictly observed; whereas in Nepal, where there are no Musselmans (except one Cashmirian merchant), the Hindu religion is practised in its greatest purity: every day of the month they class under its proper name, when certain sacrifices are to be performed and certain prayers offered up in their temples: the places of worship are more in number in their towns than are to be found in the most populous and most flourishing cities of Christendom; many of them are magnificent according to their ideas of architecture, and constructed at a very considerable expence; some of them have four or five square cupolas, and in some of the temples two or three of the extreme cupolas, as well as the doors and windows of them, are decorated with gilt copper.

In the city of Lelit Pattan the temple of Baghero is more valuable, on account of the gold, silver, and jewels it contains, than even the house of the king. Besides the large temples, there are also many small ones, which have stairs, by which a single person may ascend, on the outside all around them; and some of those small temples have four sides, others six, with small stone or marble pillars polished very smooth, with two or three pyramidal stories, and all their ornaments well gilt, and neatly worked according to their ideas of taste. On the outside of some of their temples there are great square pillars of single stones from twenty to thirty feet high, upon which they place their idols superbly gilt. The greatest number of their temples have a good stone staircase in the middle of the four squares, and at the end of each flight of stairs there are lines cut out of stone on both sides: around about their temples there are also bells, which the people ring on particular occasions; and when they are at prayers, many cupolas are also quite filled with little bells hanging by cords in the inside about the distance of a foot from each other, which make a great noise on that quarter where the wind conveys the sound. There are not only superb temples in their great cities, but also within their castles.

To the eastward of Cat'hmandu, at the distance of about two or three miles, there is a place called *Tolu*, by which there flows a small river, the water of which is esteemed holy, according to their superstitious ideas, and thither they carry people of high rank, when they are thought to be at the point of death: at this place there is a temple, which is not inferior to the best and richest in any of the capital cities. They also have it on tradition, that at two or three places in Nepal valuable treasures are concealed under ground: one of those places they believe is Tolu; but no one is permitted to make use of them except the king, and that only in cases of necessity. Those treasures, they say, have been accumulated in this manner: When any temple had become very rich from the offerings of the people, it was destroyed, and deep vaults dug under ground one above another, in which the gold, silver, gilt copper, jewels, and every thing of value, were deposited. This was found to be actually the case when the missionary, from whose memoir this account of Nepal is taken, was at Cat'hmandu. One of the kings, or pretenders to the crown, who were then at war with each other, being in the utmost distress for want of money to pay his troops, ordered the vaults at Tolu to be opened; and found in the first vault more money, besides silver and gold idols, than he had immediate occasion for.

To the westward also of the great city of Lelit Pattan, at the distance of only three miles, is a castle called *Banga*, in which there is a magnificent temple. No one of the missionaries ever entered into this castle; because the people who have the care of it, have such a scrupulous veneration for the temple, that no person is permitted to enter it with his shoes on; and the missionaries, unwilling to shew such respect to their false deities, never entered it. The author of this memoir, however, who acted as physician to the commandant, was of course admitted within the castle, and got a sight of the celebrated temple, which he declares, that for magnificence he believes superior to every thing in Europe.

Besides the magnificence of the temples, which their cities and towns contain, there are many other rarities. At Cat'hmandu, on one side of the royal garden, there is a large fountain, in which is one of their idols called *Narayan*. This idol is of blue stone, crowned and sleeping on a mattrass also of the same kind of stone, and the idol and the mattrass appear as floating upon the water. This stone machine is very large, being about 18 or 20 feet long, and broad in proportion, but well worked, and in good repair.

In a wall of the royal palace of Cat'hmandu, which is built upon the court before the palace, there is a great stone of a single piece, which is about fifteen feet long, and four or five feet thick; on the top of this great stone there are four square holes at equal distances from each other; in the inside of the wall they pour water into the holes; and in the court side, each hole having a closed canal, every person may draw water to drink. At the foot of the stone is a large ladder, by which people ascend to drink; but the curiosity of the stone consists in its being quite covered with characters of different languages cut upon it. Some lines contain the characters of the language of the country, others the characters of Tibet, others Persian, others Greek, besides several others of different nations; and in the middle there is a line of Roman characters, which appears in this form, AVTOMNEW INTER LHIVERT; but none of the inhabitants have any knowledge how they came there, nor do they know whether or not any European had ever been in Nepal before the missionaries, who arrived there only the beginning of the eighteenth century. They are manifestly two French names of seasons, with an English word between them.

There is also to the northward of the city of Cat'hmandu a hill called *Simbi*, upon which are some tombs of the Lamas of Tibet, and other people of high rank of the same nation. The monuments are constructed after various forms: two or three of them are pyramidal, very high, and well ornamented; so that they have a very good appearance, and may be seen at a considerable distance. Round these monuments are remarkable stones covered with characters, which probably are the inscriptions of some of the inhabitants of Tibet whose bones were interred there. The natives of Nepal not only look upon the hill as sacred, but imagine it is protected by their idols; and from this erroneous supposition never think of stationing troops there for the defence of it, although it be a post of great importance, and only at a short mile's distance from the city. During the hostilities, however, which prevailed when our author was in the country, this sacred hill was fortified by one of the armies, who, in digging their ditches among the tombs, found considerable pieces of gold, with a quantity of which metal the corpses of the grandees of Tibet are always interred.

The kingdom of Nepal our author believes to be very ancient, because it has always preserved its peculiar language and independence. It was completely ruined, however, about thirty or forty years ago by the dissensions of its nobles, who, on the death of their sovereign, and, as it would seem, the extinction of the royal line, could not agree in their choice of a proper successor. The consequence was, that different sovereigns were set up by the nobles of different districts; and these waged war with each other, with a degree of treachery and savage atrocity that has hardly a parallel in the annals of the world. Even the Brahmens, whom we are accustomed to consider as a mild and innocent people, were, in the civil wars of Nepal, guilty of the meanest and basest villanies: they brought about treaties between the rival sovereigns, and then encouraged him whom they favoured, to massacre the adherents of the other in cold blood.

NEPEAN *Island*, a small island of the South Pacific Ocean, opposite to Port Hunter on the south coast of Norfolk Island.—*Morse.*

NEPEAN *Sound*, an extensive water on the northwest coast of N. America, having a number of islands in it, in some charts called Princess Royal Islands. It opens eastward from Cape St James, the southernmost point of Washington's or Queen Charlotte's Islands. Fitzhugh's Sound lies between it and Queen Charlotte's Sound to the southward.—*ib.*

NEPONSET, a river of Massachusetts, originates chiefly from Muddy and Punkapog Ponds, in Stoughton, and Mashapog Pond in Sharon, and after passing over falls sufficient to carry mills, unites with other small streams, and forms a very constant supply of water, for the many mills situated on the river below, until it meets the tide in Milton, from whence it is navigable for vessels of 150 tons burden to Boston Bay, distant about 4 miles. There are 6 paper-mills, besides many others of different kinds, on this small river.—*ib.*

NERUKA, a port in the island of Cape Breton, where the French had a settlement.—*ib.*

NESBIT's *Harbour*, on the coast of New-Britain, in N. America, where the Moravians formed a settlement in 1752; of the first party some were killed, and others were driven away. In 1764, they made another attempt under the protection of the British government, and were well received by the Esquimaux, and by the last account the mission succeeded.—*ib.*

NESCOPECK *River* falls into the N. E. branch of Susquehannah river, near the mouth of the creek of that name, in Northumberland county, Pennsylvania, and opposite to the town of Berwick, 160 miles N. W. of Philadelphia, and in lat. 41 3. An Indian town, called Nescopeck, formerly stood near the scite of Berwick.—*ib.*

NETHERLANDS, *New*, is the tract now included in the States of New York, New-Jersey, and part of Delaware and Pennsylvania, and was thus named by the Dutch. It passed first by conquest and afterwards by treaty into the hands of the English.—*ib.*

NEUS, a river of N. Carolina, which empties into Pamlico

Pamlico Sound below the town of Newbern. It is navigable for sea vessels 12 miles above Newbern; for scows 50 miles, and for small boats 200 miles.—*ib.*

NEUSTRA *Sennora, Baia de*, or *Our Lady's Bay*, on the coast of Chili, on the S. Pacific Ocean, in S. America, is 30 leagues from Copiapa, and 20 S. S. W. of Cape George. It is indifferent riding in this bay, as the N. W. winds blow right in, and the gusts from the mountains are very dangerous.—*ib.*

NEVERSINK *Creek*, a stream in the Hardenbergh Patent, in Ulster county, New-York. On an island in this creek Mr Baker having cut down a hollow beech tree, in March, 1790, found near two barrels full of chimney swallows in the cavity of the tree. They were in a torpid state, but some of them being placed near a fire, were presently reanimated by the warmth, and took wing with their usual agility.—*ib.*

NEVIL *Bay*, on the west shore of Hudson's bay, is nearly due west a little northerly from Cape Digges and Maniel island at the entrance into the bay. North lat. 62 30, west long. 95.—*ib.*

NEVIS, an island less than a league south-easterly of the peninsula of St Christopher's, one of the Caribbees. This beautiful little spot is nothing more than a single mountain rising like a cone in an easy ascent from the sea; the circumference of its base not exceeding 8 British leagues. This island was doubtless produced by some volcanic eruption, for there is a hollow crater near the summit still visible; which contains a hot spring, strongly impregnated with sulphur, and sulphur is frequently found in substance, in the neighbouring gullies and cavities of the earth. The island is well watered, and the land in general fertile. Four thousand acres of canes are annually cut, which produce an equal number of hogsheads of sugar. The island, small as it is, is divided into 5 parishes. It has one town, *Charlestown*, which is a port of entry, and the seat of government; where is also a fort called Charles Fort. There are two other shipping places, viz. Indian Castle and New-Castle. Nevis contains 600 whites and 10,000 blacks. It was first settled by the English in 1628, under the protection of Sir Thomas Warner. It is said, that, about the year 1640 the island contained 4,000 whites, and some writers say that before the year 1688 it had 30,000 inhabitants. The invasion of the French about that time, and some epidemic disorders strangely diminished the number. Charlestown, the capital, lies in lat. 17 15 N. and long. 62 35 W. There are several rocks and shoals on the coast, particularly on the south-west side, but ships ride between them in tolerable safety, the hurricane seasons excepted, when they are obliged to put off to sea, and run into Antigua, if possible.—*ib.*

NEW-ALBION, a name given to a country of indefinite limits, on the western coast of N. America, lying north of *California*.—*ib.*

NEW, a river of N. Carolina, which empties, after a short course, into the ocean, through New River Inlet. Its mouth is wide and shoal. It abounds with mullet during the winter season.—*ib.*

NEW-ANDALUSIA, a province of Terra Firma, S. America, lying on the coast of the North Sea, opposite to the Leeward Islands; bounded by the river Oroonoko on the west. This country is called Paria by some writers. Its chief town is St Thomas. Some gold mines were discovered here in 1785.—*ib.*

NEW-ANDOVER, a settlement in York county, District of Maine, which contains, including Hiram and Potterfield, 214 inhabitants.—*ib.*

NEW-ANTICARIA, a town of New-Spain, 34 leagues northward of Acapulco.—*ib.*

NEW-ANTIGUERA, an episcopal city of New-Spain, in the province of Guaxaca, erected into a bishoprick by Paul III. 1547. It has a noble cathedral, supported by marble pillars.—*ib.*

NEWARK, a township in Essex county, in Vermont.—*ib.*

NEWARK *Bay*, in New-Jersey, is formed by the confluence of Passaick and Hackensack rivers from the north, and is separated from that part of North river opposite to New-York city, by Bergen Neck on the E. which neck, also, with Staten Island on the S. of it, form a narrow channel from the bay to North river eastward. Newark Bay also communicates with Rariton Bay, at the mouth of Rariton river, by a channel in a S. by W. direction along the western side of Staten Island. The water passage from New-York to Elizabeth-Town Point, 15 miles, is through this bay.—*ib.*

NEWARK, a post-town of New-Jersey and capital of Essex county, is pleasantly situated at a small distance west of Passaick river, near its mouth in Newark Bay, and nine miles west of New-York city. It is a handsome and flourishing town, celebrated for the excellence of its cyder, and is the seat of the largest shoe manufacture in the State: the average number made daily throughout the year, is estimated at about 200 pairs. The town is of much the same size as Elizabeth-Town, and is 6 miles N. of it. There is a Presbyterian church of stone, the largest and most elegant building of the kind in the State. Besides these is an Episcopal church, a court-house and gaol. The academy, which was established here in June, 1792, promises to be a useful institution. In Newark and in Orange which joins it on the N. W. there are 9 tanneries, and valuable quarries of stone for building. The quarries in Newark, would rent, it is said, for £1000 a year, and the number of workmen limited. This town was originally settled by emigrants from Brandford, Connecticut, as long ago as 1662.—*ib.*

NEWARK, a village in Newcastle county, Delaware, situated between Christiana and White Clay Creeks, 9 miles west of New-Castle, and 10 south-westerly of Wilmington.—*ib.*

NEWARK, a town lately laid out by the British in Upper Canada, on the river which connects Lakes Erie and Ontario, directly opposite Niagara town and fort.—*ib.*

NEW-ATHENS, or *Tioga Point*, stands on the post-road from Cooperstown to Williamsburgh, in Luzerne county, Pennsylvania, on the point of land formed by the confluence of Tioga river with the E. branch of Susquehannah river, in lat. 41 54 and long. 76 32 W. and about 3 miles S. of the New-York line; 20 miles S. E. by E. of Newtown in New-York, 14 S. W. of Owego, and 116 S. W. of Cooperstown.—*ib.*

NEW-BARBADOES, a township in Bergen county, New-Jersey.—*ib.*

NEW-BEDFORD, a post-town and port of entry in in Briſtol county, Maſſachuſetts, ſituated on a ſmall bay which ſets up north from Buzzard's Bay, 58 miles S. of Boſton. The townſhip was incorporated in 1787, and is 13 miles in length and 4 in breadth; bounded E. by Rocheſter, W. by Dartmouth, of which it was originally a part, and S. by Buzzard's Bay. *Acckuſnutt* was the Indian name of New-Bedford; and the ſmall river of that name, diſcovered by Goſnold in 1602, runs from north to ſouth through the townſhip, and divides the villages of Oxford and Fairhaven from Bedford village. A company was incorporated in 1796, for building a bridge acroſs this river. From the head to the mouth of the river is 7 or 8 miles. Fairhaven and Bedford villages are a mile apart, and a ferry conſtantly attended is eſtabliſhed between them. The harbour is very ſafe, in ſome places 17 or 18 feet of water; and veſſels of 3 or 400 tons lie at the wharves. Its mouth is formed by Clark's Neck on the W. ſide, and Sconticutt Point on the other. An iſland between theſe points renders the entrance narrow; in 5 fathoms water. High water at full and change of the moon 37 minutes after 7 o'clock. Dartmouth is the ſafeſt place to lie at with an eaſterly wind; but at New-Bedford you will lie ſafe at the wharves. The river has plenty of ſmall fiſh, and a ſhort way from its mouth they catch cod, baſs, black fiſh, ſheeps head, &c. The damage done by the Britiſh to this town in 1778 amounted to the value of £97,000. It is now in a flouriſhing ſtate. In the townſhip are a poſt-office, a printing-office, 3 meetings for Friends, and 3 for Congregationaliſts, and 3313 inhabitants. The exports to the different States and to the Weſt-Indies for one year, ending September 30, 1794, amounted to 82,085 dollars. It is 357 miles N. E. by E. of Philadelphia.—*ib.*

NEWBERN, one of the eaſtern maritime diſtricts of N. Carolina, bounded E. and S. E. by the Atlantic, S. W. by Wilmington, W. by Fayette, N. W. by Hillſborough, N. by Halifax, and N. E. by Edenton diſtrict. It comprehends the counties of Carteret, Jones, Craven, Beaufort, Hyde, Pitt, Wayne, Glaſgow, Lenoir, and Johnſton; and contains 55,540 inhabitants, including 15,900 ſlaves.—*ib.*

NEWBERN, the capital of the above diſtrict, is a poſt-town and port of entry, ſituated in Craven county, on a flat, ſandy point of land, formed by the confluence of the rivers Neus on the N. and Trent on the ſouth. Oppoſite to the town, the Neus is about a mile and a half, and the Trent three-quarters of a mile wide. Newbern is the largeſt town in the State, contains about 400 houſes, all built of wood except the palace, the church, the gaol, and two dwelling-houſes, which are of brick. The palace was erected by the province before the revolution, and was formerly the reſidence of the governors. It is large and elegant, two ſtories high, with two wings for offices, a little advanced in front towards the town; theſe wings are connected with the principal building by a circular arcade. It is much out of repair; and the only uſe to which this once handſome and well furniſhed building is now applied, is for ſchools. One of the halls is uſed for a ſchool, and another for a dancing-room. The arms of the king of Great-Britain ſtill appear in a pediment in front of the building. The Epiſcopalian church is a ſmall brick building, with a bell. It is the only houſe for public worſhip in the place. The court-houſe is raiſed on brick arches, ſo as to render the lower part a convenient market place; but the principal marketing is done with the people in their canoes and boats at the river ſide. In September, 1791, near one-third of this town was conſumed by fire. It carries on a conſiderable trade to the Weſt-Indies and the different States in tar, pitch, turpentine, lumber, corn, &c. The exports in 1794 amounted to 69,615 dollars. It is 149 miles from Raleigh, 99 S. W. of Edenton, 103 N. E. by N. of Wilmington, 238 S. of Peterſburgh in Virginia, and 501 S. W. of Philadelphia. N. lat. 35 20, W. long. 77 25. —*ib.*

NEW-BISCAY, a province in the audience of Galicia, in Old-Mexico or New-Spain. It is ſaid to be 100 leagues from E. to W. and 120 from north to ſouth. It is a well watered and fertile country. Many of the inhabitants are rich, not only in corn, cattle, &c. but alſo in ſilver mines, and ſome of lead.—*ib.*

NEW-BOSTON, a townſhip in Hillſborough county, New-Hampſhire, about 70 miles weſterly of Portſmouth. It was incorporated in 1763, and contains 1202 inhabitants.—*ib.*

NEW-BRAINTREE, a townſhip in Worceſter county, Maſſachuſetts, conſiſting of about 13,000 acres of land, taken from Braintree, Brookfield, and Hardwick, and was incorporated in 1751. It contains 940 inhabitants, moſtly farmers, and lies 19 miles north-weſt of Worceſter, and 66 north-weſt of Boſton. —*ib.*

NEW-BRITAIN, a townſhip in Buck's county, Pennſylvania.—*ib.*

NEW-BRUNSWICK, in the State of New-York is ſituated on Paltz Kill, about 8 miles S. W. of New-Paltz, and 69 north-weſterly of New-York city.—*ib.*

NEW-BRUNSWICK, a Britiſh province in N. America, the north-weſt part of Nova-Scotia; bounded weſt by the Diſtrict of Maine, from which it is ſeparated by the river St Croix, and a line drawn due north from its ſource to the Canada line; north by the ſouthern boundary of the province of Lower Canada, until it touches the ſea-ſhore at the weſtern extremity of Chaleur Bay; then following the various windings of the ſea-ſhore to the Bay of Verte, in the ſtraits of Northumberland; on the S. E. it is divided from Nova-Scotia by the ſeveral windings of the Miſſiquaſh river, from its confluence with Beau Baſon (at the head of Chegnecto channel) to its main ſource; and from thence by a due eaſt line to the Bay of Verte. The northern ſhores of the Bay of Fundy conſtitute the remainder of the ſouthern boundary. All iſlands included in the above limits belong to this province. According to Arrowſmith's map, it extends from lat. 45 7 to 47 15 N. and from long. 64 to 69 50 W. It is about 260 miles long and 170 broad. The chief towns are St John's, at the mouth of the river of the ſame name; St Annes, the preſent ſeat of government, 80 miles up the river; and Frederickſtown, a few miles above St Annes. The chief rivers are St John's, Merrimichi, Petiteodiac, Memramcook, Riſtigouche, and Nipiſiguit. The coaſt of this province is indented with numerous bays and commodious harbours; the chief are Chaleur, Merrimichi, Verte, which laſt is ſeparated from the Bay of Fundy by a narrow iſthmus of about 18 miles wide; Bay of Fundy, which extends 50 leagues into the country; Chegnecto Bay, at the head of the Bay of Fundy; Paſſamaquoddy Bay, bordering

Newbergh, || Newbury.

bordering upon the District of Maine. At the entrance of this bay is an island granted to several gentlemen in Liverpool, in Lancashire, who named it Campo Bello. At a very considerable expense they attempted to form a settlement here, but failed. On several other islands in this bay there are settlements made by people from Massachusetts. Here are numerous lakes, as yet without names. Grand Lake, near St John's river, is 30 miles long and 8 or 10 broad; and in some places 40 fathoms deep.—*ib.*

NEWBERGH, a township in Ulster county, New-York, bounded easterly by Hudson's river, and southerly by New-Windsor, and contains 2365 inhabitants; of whom 373 are electors, and 57 slaves. The compact part of the town is neatly built, and pleasantly situated on the west bank of the Hudson, 66 miles north of New-York, opposite Fish-Kill Landing, 7 miles from Fish Kill, 13 from Goshen, and 14 south from Poughkeepsie. It consists of between 50 and 60 houses and a Presbyterian church, situated on a gentle ascent from the river. The country northward is well cultivated, and affords a rich prospect. Vessels of considerable burden may load and unload at the wharves, and a number of vessels are built annually at this busy and thriving place.—*ib.*

NEWBURY, a county of Ninety-Six district, S. Carolina, which contains 9,342 inhabitants, of whom 1,144 are slaves. Newbury court-house is 45 miles from Columbia, and 32 from Laurens court-house. —*ib.*

NEWBURY, a township in York county, Pennsylvania. —*ib.*

NEWBURY, the capital of Orange county, Vermont, pleasantly situated on the west side of Connecticut river, opposite to Haverhill, in Grafton county, New-Hampshire, and from which it is 5 miles distant. It contains about 50 houses, a gaol, a court-house, and a handsome church for Congregationalists with a steeple, which was the first erected in Vermont. The court-house stands on an eminence, and commands a pleasing prospect of what is called the Great Oxbow of Connecticut river, where are the rich intervale lands called the Little Cos. Here a remarkable spring was discovered, about 20 years since, which dries up once in two or three years. It has a strong smell of sulphur, and throws up continually a peculiar kind of white sand; and a thick yellow scum rises upon the water when settled. This is the more noticeable as the water of the ponds and rivers in Vermont are remarkably clear and transparent. It is 130 miles north-east of Bennington, and 417 N. E. by N. of Philadelphia. N. lat. 44 5. Number of inhabitants 873.—*ib.*

NEWBURY, a township in Essex county, Massachusetts, incorporated in 1635; situated on the southern bank of Merrimack river, and contains 3,972 inhabitants. It formerly included Newbury-Port, and with Merrimack river encircles it. It is divided into five parishes, besides a society of Friends, or Quakers. Dummer academy, in this township, is in a flourishing state; it was founded by Lieut. Gov. Dummer in 1756, opened in 1763, and incorporated in 1782. The inhabitants are principally employed in husbandry. The land, particularly in that part of the town which lies on Merrimack river, and is here called *Newbury-Newtown*, is of a superior quality, under the best cultivation, and is said by travellers to be little inferior to the most improved parts of Great-Britain. Some of the high lands afford a very extensive and variegated view of the surrounding country, the rivers, the bay, and the sea-coast from Cape Ann to York, in the District of Maine. Some few vessels are here owned and employed in the fishery, part of which are fitted out from Parker river. It rises in Rowley, and after a course of a few miles, passes into the sound which separates Plumb-Island from the main land. It is navigable about two miles from its mouth. A woollen manufactory has been established on an extensive scale in Byefield parish, and promises to succeed. This township is connected with Salisbury by Essex Merrimack bridge, about 2 miles above Newbury Port, built in 1792. At the place where the bridge is erected, an island divides the river into two branches: an arch of 160 feet diameter, 40 feet above the level of high water, connects this island with the main on the opposite side. The whole length of the bridge is 1030 feet; its breadth 34; its contents upwards of 6000 tons of timber. The two large arches were executed from a model invented by Mr Timothy Palmer, an ingenious housewright in Newbury-Port. The whole is executed in a style far exceeding any thing of the kind hitherto essayed in this country, and appears to unite elegance, strength and firmness. The day before the bridge was opened for the inspection of the public, a ship of 350 tons passed under the great arch. There is a commodious house of entertainment at the bridge, which is the resort of parties of pleasure, both in summer and winter.—*ib.*

Newbury-Port.

NEWBURY-PORT, a port of entry, and post-town in Essex county, Massachusetts; pleasantly situated on the S. side of Merrimack river, about 3 miles from the sea. In a commercial view it is next in rank to Salem. It contains 4837 inhabitants, although it is, perhaps, the smallest township in the State, its contents not exceeding 640 acres. It was taken from Newbury, and incorporated in 1764. The churches, 6 in number, are ornamented with steeples; the other public buildings are the court-house, gaol, a bank, and 4 public school-houses. To the honour of this town, there are in it 10 public schools, and 3 printing-offices. Many of the dwelling-houses are elegant. Before the war there were many ships built here; but some years after the revolution, the business was on the decline: it now begins to revive. The Boston and Hancock continental frigates, were built here, and many privateers, during the war. The harbour is safe and capacious, but difficult to enter. The Marine Society of this town, and other gentlemen in it, have humanely erected several small houses, on the shore of Plumb-Island, furnished with fuel and other conveniences, for the relief of shipwrecked mariners. Large quantities of rum are distilled in Newbury-Port, there is also a brewery; and a considerable trade is carried on with the West-Indies and the southern States. Some vessels are employed in the freighting business, and a few in the fishery. In Nov. 1790, there were owned in this port, 6 ships, 45 brigantines, 39 schooners, and 28 sloops; making in all, 11,870 tons. The exports for a year, ending Sept. 30, 1794, amounted to 363,380 dollars. A machine for cutting nails, has been lately invented by Mr Jacob Perkins of this town, a gentleman of great mechanical

New-Caledonia, ‖ New-Castle.

chanical genius, which will turn out, if necessary, 200,000 nails in a day. Newbury-Port is 40 miles north-north-east of Boston, 22 south-by-west of Portsmouth, 12 N. of Ipswich, and 389 north-east of Philadelphia. The harbour has 10 fathoms water: high water at full and change 15 minutes after 11 o'clock. The light house on Plumb-Island lies in 42 47 north latitude, and in 70 47 west longitude.—*ib.*

NEW CALEDONIA, the name given by the Scotch to the ill-fated settlement which that nation formed on the Isthmus of Darien, and on the south-west side of the gulf of that name. It is situated eastward of the narrowest part of the isthmus, which is between Panama and Porto Bello, and lies south east of the latter city. The settlement was formed in 1698. —*ib.*

NEW-CANTON, a small town lately established in Buckingham county, Virginia, on the south side of James's river, 70 miles above Richmond. It contains a few houses, and a ware-house for inspecting tobacco. —*ib.*

NEW-CASTLE, the most northern county of Delaware State. It is about 40 miles in length and 20 in breath, and contains 19,686 inhabitants, including 2,562 slaves. Here are two snuff-mills, a slitting-mill, 4 paper-mills, 60 for grinding different kinds of grain, and several fulling-mills. The chief towns of this county are Wilmington and New-Castle. The land in it is more broken than any other part of the State. The heights of Christiana are lofty and commanding. —*ib.*

New Castle, a post-town, and the seat of justice of the above county. It is situated on the west side of Delaware river, 5 miles south of Wilmington and 33 S. W. of Philadelphia. It contains about 70 houses, a court house and gaol; a church for Episcopalians and another for Presbyterians. This is the oldest town on Delaware river, having been settled by the Swedes, about the year 1627, who called it *Stockholm*, after the metropolis of Sweden. When it fell into the hands of the Dutch, it received the name of *New-Amsterdam;* and the English, when they took possession of the country, gave it the name of *New-Castle*. It was lately on the decline; but now begins to flourish. Piers are to be built, which will afford a safe retreat to vessels, during the winter season. These, when completed, will add considerably to its advantages. It was incorporated in 1672, by the governor of New-York, and was for many years under the management of a bailiff and six assistants. N. lat. 39 38.—*ib*,

New-Castle, a township in West-Chester county, New-York, taken from North-Castle in 1791, and incorporated. In 1796, there were 151 of the inhabitants qualified electors.—*ib.*

New-Castle, a small town in the county of Rockingham, New Hampshire, was incorporated in 1693, and contains 534 inhabitants.—*ib.*

New-Castle, a small post-town in Lincoln county, District of Maine, situated between Damascotte and Skungut rivers. It is 10 miles E. by N. of Wiscasset, 66 N. E. of Portland, and 192 N. by E. of Boston. The township contains 896 inhabitants.—*ib.*

New-Castle, a post-town of Hanover county, Virginia, situated at the mouth of Assequin creek, on the S. W. side of Pamunky river, and contains about 36 houses. It is 54 miles N. W. of Williamsburgh, 24 N. E. of Richmond, and 297 from Philadelphia.—*ib.*

New-Chester, ‖ New-England.

NEW-CHESTER, a township in Grafton county, New-Hampshire, situated on the W. side of Pemigewasset river. It was incorporated in 1778, and contains 312 inhabitants. It is about 13 miles below the town of Plymouth.—*ib.*

NEW-CONCORD, formerly called *Gunthwaite*, a township in Grafton county, New-Hampshire, on Amonoosuck river, and was incorporated in 1768, and contains 147 inhabitants.—*ib.*

NEW-CORNWALL, a township in Orange county, New-York; bounded northerly by Ulster county, and easterly by Hudson's river and Haverstraw. It contains 4,225 inhabitants, inclusive of 167 slaves.—*ib.*

NEW-DUBLIN, a township in Lunenburg county, Nova-Scotia; situated on Mahone Bay; first settled by Irish, and afterwards by Germans.—*ib.*

NEW-DURHAM, in Strafford county, New-Hampshire, lies on the east coast of Winnepisseoga Lake, west of Merry Meeting Bay, nearly 40 miles north-west of Portsmouth. Incorporated in 1762, having 554 inhabitants.—*ib.*

NEW ENGLAND, the north-eastern grand division of the United States of America, lies in the form of a quarter of a circle around the great bay, or part of the Atlantic Ocean, which sets up to the north-west between Cape Cod and Cape Sable. It contains the states of Vermont, New-Hampshire, Maine, (belonging to Massachusetts) Massachusetts Proper, Rhode-Island and Providence Plantations, and Connecticut; and is situated between 41° and 48° north latitude and 1° 30′ and 10° 15′ east longitude from Philadelphia. Its extreme length from the north-east corner of Maine, to the south-west corner of Connecticut, is about 626 miles: its breadth is very unequal, from fifty to two hundred miles. It contains about 72,000 square miles. Situation and Extent.

New England is bounded north, by Lower Canada; east, by the British province of New Brunswick and the Atlantic Ocean; south, by the same Ocean and Long-Island sound; and west, by the state of New-York. Its west line begins at the mouth of Byram river, which empties into Long-Island sound, at the south-west corner of Connecticut, N. lat. 41°, runs a little to the east of north till it strikes the 45th degree of latitude, and then curves to the north-east along the highlands, till it reaches about the 48th degree of north latitude. Boundaries.

In April 1614, Capt. John Smith with two ships, commenced a voyage of discovery to the northern coasts of America: he first made the Island of Monahigan, then computed to be in latitude 43° 30′, where he built seven boats, in one of which, with 8 men, he ranged the coast from Penobscot to Cape Cod, entered and surveyed what is now called Massachusetts Bay, and made his observations on other parts of the coast. After his return to England, he wrought these surveys and observations into a map, which he presented to Charles Prince of Wales, (afterwards King Charles I.) with a request that he would give a name to this newly explored country. Accordingly he gave his own name to the river which divides Boston from Charlestown, and to the whole country that of New England. Discovery.

At this period New England was thickly inhabited by

New-England.

by various tribes of Indians. Two years after (1616) a most distressing mortal sickness, by some supposed to have been the small pox; by others the yellow fever; spread through the country, and swept off a large portion of its inhabitants. From an account given to the first settlers at Plymouth, on their arrival, by an intelligent Indian, it appears, that "by this pestilence and a ferocious war, the number of Indians had been so diminished, that not more than *one in twenty* remained; and that on the spot first occupied by the fathers of New England, now the town of Plymouth, though before very populous, every human being died of the pestilence." This account was easily credited from the extent of the uncultivated fields, and the number of graves and human bones which appeared.

Depopulation of New-England by a mortal pestilence.

Belknap's Biog. vii. p. 210.

An extraordinary occurrence relative to this pestilence has been mentioned by the historian above named as follows.—"A French ship had been wrecked on Cape Cod; the men were saved with their provisions and goods. The natives kept their eyes on them till they found an opportunity to kill all but 3 or 4, and divide their goods. The captives were sent from one tribe to another as slaves. One of them learned so much of their language as to tell them that "God was angry with them for their cruelty, and would destroy them and give their country to another people." They answered that "they were too many for God to kill." He replied that "if they were ever so numerous, God had many ways to kill them of which they were then ignorant." Afterwards when this new and extraordinary pestilence came among them, they remembered the man's words, and when the Plymouth settlers arrived at Cape Cod, the few survivors imagined that the other part of his prediction would soon be accomplished."

Curious account of this pestilence.

Ibid. p. 208, 209.

From the year 1614 till 1620, an advantageous trade was carried on with the natives along the coast, but no settlements were made in any part of New England.

First settlement of New England.

The first settlement of New England by a civilized and christian people was the effect of religious persecution. Soon after the commencement of the reformation in England, in the year 1534, the Protestants were divided into two parties; one the followers of LUTHER, and the other of CALVIN. The former had chosen gradually, and almost imperceptibly, to recede from the church of Rome; while the latter, more zealous, and convinced of the importance of a thorough reformation, and at the same time possessing much firmness, and high notions of religious liberty, were for effecting a thorough change at once. Their consequent endeavours to expunge from the church all the inventions which had been brought into it since the days of the Apostles, and to introduce the "Scripture purity" acquired for them the name of PURITANS. From these the inhabitants of New England descended. The reasons assigned for leaving their own country, and settling a wilderness were "that the ancient faith, and true worship, might be found inseparable companions in their practice; and that their posterity might be undefiled in religion." Letter of the ministers of N. E. to Mr J. Duey, in Mather's Apology, App.

The first company that came to New England planted themselves at Plymouth. They were a part of the Rev. Mr Robinson's congregation, which, for 12 years before, had lived in Holland for the sake of enjoying liberty of conscience. They came over to America in the year 1620.

It was their intention to have settled at the mouth of Hudson's river; but the Dutch, intending to plant a colony there of their own, privately hired the master of the ship to contrive delays in England, and then to conduct them to these northern coasts, and there, under the pretence of shoals and winter, to discourage them from venturing to the place of destination. This is confidently asserted by the historians of that time. Although Cape Cod harbour, in which they first anchored, was good, the country around was sandy and barren. These were discouraging circumstances; but the season being far advanced, they prudently determined to make the best of their present situation. As they were not within the limits of the patent and consequently not under the jurisdiction of the Virginia company, and having some factious persons among them in the capacity of servants, who possessed a portion of the modern spirit of *liberty and equality*, and who had intimated that when on shore they should be under no government, and that one man would then be as good as another, the more judicious thought it necessary to establish a separate government for themselves. Accordingly, before they landed, having on their knees devoutly given thanks to God for their safe arrival, they formed themselves into a body-politic, under the following *covenant* or *contract*, which they all subscribed, and made the basis of their government. "In the name of God, amen. We whose names are underwritten, the loyal subjects of our Dread Sovereign Lord, King James, by the grace of God, of Great Britain, France and Ireland, king, defender of the faith, &c.—Having undertaken for the glory of God and the advancement of the christian faith, and honour of our king and country, a voyage, to plant the first colony in the northern parts of Virginia; Do by these presents solemnly, and mutually, in the presence of God, and of one another, covenant and combine ourselves together into a civil body-politic, for our better ordering and preservation and furtherance of the ends aforesaid; and by virtue hereof to enact, constitute, and frame such just and equal laws, ordinances, acts, constitutions, and offices, from time to time, as shall be thought most meet and convenient for the general good of the colony; unto which we promise all due submission and obedience: In witness whereof, we have hereunder subscribed our names at Cape Cod, the 11th of November; in the year of the reign of our Sovereign Lord King James, of England, France and Ireland, the eighteenth, and of Scotland the fifty-fourth: Anno Domini, 1620."

Disingenuous conduct of the Dutch.

Form of civil contract.

This instrument was signed by 24 heads of families, with the number in their respective families annexed, and 17 single men, making in the whole 101 souls.

Afterwards by an unanimous vote, they chose JOHN CARVER their governor for one year.

John Carver first Governor.

Having thus established and organized their government, in its form truly republican, their next object was to fix on a convenient place for settlement. In doing this, they were obliged to encounter numerous difficulties, and to suffer incredible hardships. Many of them were sick in consequence of the fatigue of a long voyage. Their provisions were bad; the season uncommonly

Difficulties encountered by the colonists.

uncommonly cold, the Indians, though afterwards friendly, were now hoſtile; and they were unacquainted with the coaſt. Theſe difficulties they ſurmounted, and on the 22d of December, (Gregorian ſtyle) they were all ſafely landed at a place which, in grateful commemoration of Plymouth in England, the town which they laſt left in their native land, they called PLYMOUTH. The *rock* on which they firſt ſtepped aſhore is called the *foreſather's rock*. A part of it has been drawn up to be preſerved in the centre of the town; the remainder is buried in a wharf.

New-England.

Settled at Plymouth.

The day of their landing is now annually kept as a feſtival in Plymouth and Boſton.

Plymouth is the oldeſt Engliſh town in New England.

In ſome of the excurſions of the immigrants in ſearch of a ſuitable place to ſettle, they found buried ſeveral baſkets of Indian corn, to the amount of 10 buſhels, which fortunately ſerved them for planting the next ſpring. They made diligent enquiry for the owners, whom they ſound, and afterwards paid them the full value of the corn. The acquiſition of this corn was always regarded as a particular favour of divine Providence, without which, the colony could not have ſubſiſted.

Fortunate diſcovery of ſeed corn.

Before the end of November, Suſanna, the wife of William White, was delivered of a ſon, whom they called *Peregrine*. He is ſuppoſed to have been the firſt child, of European extract, born in New England. He died at Marſhfield July 1704, in the 84th year of his age.

Firſt child born.

The whole company that landed conſiſted of but 101 ſouls; their ſituation was diſtreſſing, and their proſpects truly diſmal and diſcouraging. Their neareſt neighbours, except the natives, were the Dutch ſettlers at Albany and Bergen, a French ſettlement at Port Royal, and one of the Engliſh at Virginia: the neareſt of theſe was 200 miles from them, and utterly incapable of affording them any relief in a time of famine or danger. Wherever they turned their eyes diſtreſs was before them. Perſecuted for their religion in their native land; grieved for the profanation of the holy ſabbath, and other licentiouſneſs in Holland; fatigued by their long and boiſterous voyage; diſappointed, through the treachery of their commander, of their expected country; forced on a dangerous and inhoſpitable ſhore in the advance of a cold winter; ſurrounded with hoſtile barbarians, without any hope of human ſuccour in caſe of an attack; denied the aid or favour of the court of England; without a patent; without a public promiſe of a peaceable enjoyment of their religious liberties—worn out with toil and ſufferings, without convenient ſhelter from the rigour of the weather:—Such was the ſituation and ſuch the proſpects of theſe pious, ſolitary, chriſtians. And to add to their diſtreſſes, a general and very mortal ſickneſs prevailed among them which ſwept off forty-ſix of their number, before the opening of the next ſpring. To ſupport them under theſe trials, they had need of all the aids and comforts which chriſtianity affords, and theſe were ſufficient. The free and unmoleſted enjoyment of their religion reconciled them to their humble and lonely ſituation. They bore their hardſhips with unexampled patience, and perſevered in their pilgrimage of almoſt unparalleled trials, with ſuch reſignation and calmneſs, as gave proof of great piety, and unconquerable virtue. Immediately after landing, they began to lay out the town into ſtreets, and lots, and to erect buildings, for their accommodation. They firſt erected a ſtore houſe with a thatched roof, in which they depoſited, under a guard, their whole ſtock of ammunition and proviſions. On the 14th of Jan. the thatched roof of the ſtore houſe accidentally caught fire and was conſumed; but by the timely exertions of the people, the lower part of the building with its contents, which were indiſpenſible to the ſupport of the infant colony, was preſerved.

Situation and proſpects of the coloniſts.

On the 3d of November 1620, King James, being informed that an extenſive country in America had lately been depopulated by a mortal ſickneſs, and that no part of it was then inhabited by the ſubjects of any chriſtian prince, and being deſirous to advance the chriſtian religion, and extend the boundaries of his own dominions, ſigned a patent, incorporating the duke of Lenox, the marqueſſes of Buckingham and Hamilton, the earls of Arundel and Warwick, Sir Francis Gorges, with thirty-four others and their ſucceſſors, ſtiling them, "The council eſtabliſhed at Plymouth, in the county of Devon, for the planting, ruling, ordering, and governing, of New England in America."

The council of Plymouth eſtabliſhed and New-England granted them.

To this council he granted all that part of America which lies between the 40th and 48th degrees of north latitude. They were inveſted with powers of juriſdiction over the country, and authorized to exclude all others from trading within their boundaries, and from fiſhing in the neighbouring ſeas. This charter was the great *civil baſis* of all the ſubſequent grants and patents, to the ſettlers of New England.

"This charter, (ſays the correct hiſtorian of Maſſachuſetts) from the omiſſions of ſeveral powers neceſſary to the future ſituation of the colony, ſhows how inadequate the ideas of the parties were to the important conſequences which were about to follow from ſuch an act. The governor, with the aſſiſtants and freemen of the company, it is true, were empowered to make all laws not repugnant to thoſe of England; but the power of impoſing fines, impriſonment or other lawful correction, is expreſsly given in the manner of other corporations of the realm; and the general circumſtances of the ſettlement, and the practice of the times, can leave us no doubt that this body-politic was viewed rather as a trading company, reſiding within the kingdom, than what it very ſoon became, a foreign government exerciſing all the eſſentials of ſovereignty over its ſubjects."

Minot's Hiſt. Maſſ.

As early as March 1621, Maſaſſoit, one of the moſt powerful ſagamores of the neighbouring Indians, with ſixty attendants, made a viſit to the Plymouth ſettlers; and entered into a formal and very friendly treaty with them, wherein they agreed to avoid injuries on both ſides, to puniſh offenders—to reſtore ſtolen goods—to aſſiſt each other in all juſtifiable wars—to promote peace among their neighbours, &c. Maſaſſoit and his ſucceſſors for fifty years inviolably obſerved this treaty. The Engliſh are much indebted to this chief for his friendſhip, and his memory will ever be reſpected in New England.

Treaty with Maſaſſoit.

The Narraganſets, diſliking the conduct of Maſaſſoit, declared war againſt him, which occaſioned much confuſion and fighting among the Indians. The Plymouth colony interpoſed in favour of Maſaſſoit, their good ally,

War with the Narraganſet Indians.

New-England.

ally, and terminated the dispute to the terror of their enemies. Even Canonicus himself, the terrific sachem of the Narragansets, sued for peace.

Death of Gov. Carver.

In April of this year George Carver, while engaged in labour, with the rest of the settlers, was seized with a pain in his head, which shortly after deprived him of his senses, and, in a few days, of his life, to the great grief of these afflicted people. He was buried with all the honours in their power to bestow.

Character.

Of this gentleman the following character is given by his biographer. "He was a man of great prudence, integrity, and firmness of mind. He had a good estate in England which he left in the emigration to Holland and America. He was one of the foremost in action, and bore a large share of sufferings in the service of the colony, who confided in him as their friend and father. Piety, humility, and benevolence, were eminent traits in his character; and it is particularly remarked that in the time of general sickness, which besel the colony, and with which he was affected, after he had himself recovered, he was assiduous in attending the sick, and performing the most humiliating services for them, without any distinction of persons or characters."

Belknap.

William Bradford chosen Governor.

He was succeeded by William Bradford, then in the thirty-third year of his age, a man of "wisdom, piety, fortitude, and goodness of heart," and on these accounts much respected and beloved by the people. Isaac Allerton was chosen his assistant in the administration of government. One of the first official acts of Gov. Bradford was to send an embassy to Masassoit. His objects were to explore the country, to carry presents, and confirm the league with that chief; to survey his situation and strength, to establish a friendly intercourse, and to procure seed corn for the next season.

Embassy to Masassoit.

Edward Winslow and Stephen Hopkins, with Squanto for their guide, composed this embassy. This sachem lived about 40 miles southward of Plymouth. As they passed through the country, they observed the marks of the ravages which the pestilence had made a few years before. They were received with friendship, and accomplished the business of their mission to the satisfaction of the governor.

Friendly disposition of the Indians.

The prudent and upright conduct of the Plymouth colony towards the Indians, secured their friendship and alliance. Through the influence of Masassoit, nine of the petty sachems in his neighbourhood, who were jealous of the new colonists, and disposed to give them trouble, came to Plymouth, and voluntarily subscribed the following instrument of submission to the king of England, viz. "Sept. 13th A. D. 1621. Know all men by these presents, that we whose names are underwritten, do acknowledge ourselves to be the loyal subjects of King James, king of Great Britain, France and Ireland, defender of the faith, &c. In witness whereof, and as a testimonial of the same, we have subscribed our names or marks as followeth:

Instrument of their submission.

Ohquamehud,	Nattawahunt,	Quadequina,
Cawnacome,	Caunbatant,	Huttamoiden,
Obbatinua,	Chickatabak,	Apannow."

Hobbamack, another of these subordinate chiefs, came and took up his residence at Plymouth, where he continued as a faithful guide and interpreter as long as he lived. The Indians of the island of Capawock, which had now obtained the name of Martha's or Martin's Vineyard, also sent messengers of peace." These transactions are so many proofs of the peaceful and benevolent disposition of the Plymouth settlers.

Belknap.

Massachusetts Bay explored.

In September (1621) governor Bradford sent ten men, with Squanto, in a shallop to explore the bay, now called Massachusetts; they found that the islands in this bay had been cleared of wood, that they had been planted, but were now almost without inhabitants.

An accession to the colony.

In November, a ship with thirty-five passengers arrived from England. Unfortunately for the little colony, the ship was short of provisions, and the colonists, out of their scanty pittance, were obliged to victual her home. In consequence, before the next spring, they were reduced to great straits, and obliged for some time to subsist on fish and spring water. To heighten their distresses the Narraganset chief, Canonicus, threatened the peace of the colony by a message sent in "the emblematical style of the ancient Scythians, viz. a bundle of arrows bound with the skin of a serpent."—The governor returned the skin filled with powder, and ball, which had the desired effect. Afraid of its contents, the chief returned it unopened and remained quiet.

Belknap.

About this time a part of the colony of Virginia was surprised, and massacred by the Indians. From this circumstance, and the hostile disposition of the Narragansets, the colonists, feeble as they were from famine, found it expedient to fortify their town; accordingly they surrounded it with a stockade and four flankarts, divided their company into four squadrons and alternately kept guard day and night. Their guns were mounted on a kind of citadel erected on the top of the town hill, with a flat roof; the lower story of which served them for a place of worship.

First duel in New-England.

The practice of *duelling*, which has never prevailed in New England, was introduced by two servants, who quarrelled, and fought with *sword* and *dagger*. Both were wounded, neither of them mortally. For this disgraceful conduct, they were formally tried before the whole company, and sentenced to have "their heads and feet tied together, and so to remain twenty-four hours, without meat or drink." In consequence of their penitence, a part of their punishment was remitted.

The summer of 1622 being dry, and the harvest scanty, the colonists were obliged to seek a supply from the Indians. Governor Bradford, with the friendly and faithful Squanto for his guide and interpreter, made an excursion for this purpose; during which, Squanto fell sick and died. On his death bed he requested the governor to pray for him, that he might "go to the Englishman's God in heaven." This Indian deserves to have his name recorded with honour, in the history of New England: he was one of the twenty Indians who were perfidiously taken by Capt. Thomas Hunt, in 1614, and carried to Malaga, and sold as slaves for life. Thence he escaped to London, and afterwards returned to his native country, with the Plymouth colony. Forgetting the perfidy of those, who, by artifice, made him a prisoner, and a slave, he became a hearty friend of the English, and so continued till his death, rendering them in various ways, most essential services.

Death of Squanto.

Governor Bradford was treated with great respect

New-England.

Belknap.

by the several tribes which he visited, and the trade was conducted on both sides, with confidence and justice. He purchased in the whole, 28 hhds. of corn, for which he paid in goods received from England.

The right to the lands, settled by the English colonists, was early purchased from or given by, the Indian proprietors. How great a part of New England was thus fairly obtained from the Indians, cannot be ascertained. There is evidence to believe, however, that a large proportion of the soil was purchased, at what was then considered an equitable price.

Winslow and Hamden visit Massassoit who is sick.

In the spring of 1623, Massassoit fell sick, and sent intelligence of it to the governor, who immediately sent Mr Winslow, and *Mr John Hamden*, (the same man who afterwards distinguished himself, by his opposition to the arbitrary, and unjust demands of Charles I.) to pay him a visit. They carried with them presents, and some cordials for his relief. Their visit and presents were very consolatory to the venerable chief, and were the means of his recovery.

He discovers a conspiracy of the Indians.

Belknap.

In return for their kindness, he informed them of a dangerous conspiracy among the neighbouring Indians, the object of which was, the total extirpation of the English. By means of this timely discovery, and the consequent spirited exertions, of the governor, whose wise plans were executed by the brave Capt. Standish, the colony was once more saved from destruction.

John Peirce obtains a patent for the colonists from the Council of Plymouth.

His disingenuous conduct, and subsequent misfortunes.

The "contract," entered into by the colonists at Cape Cod, on their arrival, was intended only as a temporary substitute for legal authority from their sovereign. Accordingly as soon as they were informed of the establishment of the "council at Plymouth, for planting New England," before mentioned, they applied for, and obtained a patent. It was taken out, in the name of John Pierce, in trust for the colony. "When he saw that they were well seated, and that there was a prospect of success to their undertaking, he went, without their knowledge, but in their name, and solicited the council for another patent of greater extent; intending to keep it to himself, and allow them no more than he pleased, holding them as his tenants, to sue and be sued at his courts. In pursuance of this design, having obtained a patent, he bought a ship, which he named the Paragon; loaded her with goods, took on board upwards of sixty passengers, and sailed from London, for the colony of New Plymouth. In the Downs he was overtaken by a tempest, which so damaged the ship that he was obliged to put her into dock; where she lay several weeks, and her repairs cost him one hundred pounds. In December 1622, he sailed a second time, having on board one hundred and nine persons; but a series of tempestuous weather, which continued fourteen days, disabled his ship, and forced him back to Portsmouth. These repeated disappointments proved so discouraging to him, that he was easily prevailed upon by the company of adventurers to assign his patent to them, for five hundred pounds. The passengers came over in other ships."

Belknap's Biog. vol. ii. p. 234.

Charter attacked.

In the year 1624, the charter of the Plymouth Council was attacked by the British Parliament, and some vigorous resolutions were passed in the House of Commons, which so far deprived the Council of their resources, that, it seems, they no longer thought it practicable to settle a plantation, though it appointed a governor general for New England. In consequence the patentees prudently concluded to divide the country among themselves.

Patentees divide the country among themselves.

Accordingly, in the presence of King James, they drew lots for the shares that each one was to possess, as his exclusive property; the royal confirmation was to be obtained to each particular portion. This was not however immediately given, and they continued a few years longer to act as a body-politic, and to make grants of different portions of the country to various societies.

Neat cattle first imported into New England.

In March 1624, Mr Winslow, who had been previously sent to England for the purpose, arrived with a supply of clothing, and brought with him a *bull* and *three heifers*, which were the first neat cattle imported into New England. None of the domestic animals were found in America, by the first European settlers.

Situation of the colony.

At the close of this year, the Plymouth colony consisted of 180 persons only, who lived in 32 dwelling houses. Their stock consisted of the cattle brought over by Mr Winslow, a few goats and a plenty of swine and poultry. Their town half a mile in compass, was impaled. On a high mount in the town, they had erected a fort of wood, lime, and stone, and a handsome watch tower.

Death of Rev. Mr. Robinson.

The year following, (March 1625) that truly venerable and good man, the Rev. Mr Robinson, whose memory is precious in New England, died at Leyden, in the 50th year of his age, greatly lamented, both in Holland and by that part of his congregation who had settled at Plymouth. In a few years after, part of his people who had remained with him in Holland, removed, and joined their brethren at Plymouth.

Mr Bradford surrendered this patent to the general court, at their request, in 1640.

Extent of the patents. Title.

In 1629, when the plantation consisted of about 300 souls, a patent of larger extent than the one which Pierce had obtained and relinquished, was solicited by Isaac Allerton, and taken out in the name of "William Bradford, his heirs, associates, and assigns."* This patent confirmed their title, (as far as the crown of England could confirm it) to a tract of land, bounded on the east and south, by the Atlantic ocean, and by lines drawn west from the rivulet of Conohasset, and north from the river of Narraganset, which lines meet in a point, comprehending all the country called Pokanokit. To this tract they supposed they had a prior title from the depopulation of a great part of it by a pestilence, from the gift of Massassoit, his voluntary subjection to the crown of England, and his having protection of them. In a declaration published by them in 1636, they asserted their "lawful right in respect of vacancy, donation, and purchase of the natives,"† which, together with their patent from the crown through the council of New England, formed "the warrantable ground, and foundation of their government, of making laws, and disposing of lands."(A)

* Hazard's Hist. Col. vol. i. p. 298.

† Hazard i. 401.

In

(A) In 1639, after the termination of the Piquod war, Massassoit, who had then changed his name to Woosamequen, brought his son Mooanam to Plymouth, and desired that the league which he had formerly made, might be renewed, and made inviolable. The sachem and his son voluntarily promised, "for themselves and their successors, that they would not needlessly, nor unjustly raise any quarrels, or do any wrong to other

New-England.

Grant on Kennebeck River.

In the same patent was granted, a large tract bordering on the river Kennebeck, where they had carried on a traffic with the natives for furs, as they did also at Connecticut river, which was not equally beneficial because they had the Dutch for rivals.* The fur trade was found to be much more advantageous than the fishery. Sometimes they exchanged corn of their own growth for furs; but European coarse cloths, hard ware, and ornaments, were good articles of trade, when they could command them.

* Hutch. ii. 469. Prince 157.

The company in England, with which they were connected, did not supply them in plenty. Losses were sustained by sea; the returns were not adequate to their expectations; they became discouraged; threw many reflections on the planters, and finally refused them any farther supplies;† but still demanded the debt due from them, and would not permit them to connect themselves in trade with any other persons. The planters complained to the council of New England, but obtained no redress. After the expiration of the seven years, (1628) for which the contract was made, eight of the principal persons in the colony, with four of their friends in London, became bound for the balance; and from that time took the whole trade into their own hands. These were obliged to take up money at an exorbitant interest, and to go deeply into trade at Kennebeck, Penobscot, and Connecticut; by which means, and their own great industry and economy, they were enabled to discharge the debt, and pay for the transportation of thirty-five families of their friends from Leyden, who arrived in 1629."

† Bradford's Letters Hist. Col. viii. p. 29, 36, 60.

Difference between the trading company in England and the planters.

Belknap's Biog. vol. ii. 235, &c.

Persecution of the Puritans.

The persecution of the Puritans in England, under Archbishop Laud, now raged with unrelenting severity, and while it caused the destruction of thousands in England, proved to be a principle of life and vigour to the infant colonies in New England. Among other expedients for vexing the Puritans (who were now composed both of the dissenters from the established church, and the opposers of despotic monarchy;) "a system of sports and recreations on the Lord's day which had been originated in the last reign, was revived and established by the king. This measure was directly calculated both to obviate the objections of the Roman Catholics to the suppression of feasts and revels, and to wound the feelings of the Puritans, and embarrass their clergy; as they were remarkable for a strict attention to the fourth commandment, still so decently observed by their descendants. The magistrates had found these sports which consisted of dancing, leaping, vaulting, and various other games, to be introductory of profanation, and attempted to suppress them; but so great was the zeal of the court to root out Puritanism, which, from the strict observation it enjoined of the Lord's day, they conceived, tended to diminish the feast days of the church; that the representations of the magistrates were overruled, and the order establishing the book of sports was directed to be read in every parish. This was a net to entangle the clergy, and many lost their livings, for conscientiously refusing to read the order. In short, it became evident, in the star-chamber language of the Earl of Dorset, that to be guilty of drunkenness, uncleanness, or any less fault, might be pardonable; but that the sin of Puritanism and non-conformity was without forgiveness."

Systems of sports established.

Minot's continuation of Hist. of Mass. p. 13.

Such being the situation of affairs in England, several men of eminence, who were the friends and protectors of the Puritans, entertained a design of settling in New England, if they should fail in the measures they were pursuing for the establishment of the liberty, and the reformation of the religion of their own country. They solicited and obtained grants in New England and were at great pains in settling them. Among these patentees, were the Lords Brook, Say, and Seal, the Pelham's, the Hampden's, and the Pym's; names which afterwards appeared with great eclat. Sir Mathew Boynton, Sir William Constable, Sir Arthur Haslerig, and Oliver Cromwell, were actually on the point of embarking for New England; when Archbishop Laud unwilling that so many objects of his hatred should be removed out of the reach of his power, applied for, and obtained, an order from the court to put a stop to these transportations. "Restrictions were laid upon their escape, and whilst some had fled to foreign countries, others were not so furtunate as to obtain this dreadful privilege, but were detained as hostages for the good conduct of their brethren abroad." However, he was not able to prevail so far as to hinder New England from receiving vast additions, as well of the clergy, who were silenced and deprived of their living for non-conformity, as of the laity, who adhered to their opinions. As in all countries where persecution rages, so here, the wisest, most wholesome, and most useful members of the community, were compelled to leave their country. "Multitudes, (said Dr Owen, speaking of these times) of pious and peaceable Protestants, were driven by the severities of their persecutors to leave their native country, and seek a refuge for their lives and liberties, with freedom for the worship of God, in a wilderness, in the ends of the earth."—By such people New England was first settled. A body of men more remarkable for their piety, and morality, and more respectable for their wisdom, never perhaps commenced the settlement of any other country.

O. Cromwell and others contemplate a removal to New-England. Prevented by Apb. Laud.

Minot.

Character of the first settlers of New England.

As early as 1626, a few people from Plymouth, conducted by Mr Roger Conant, commenced a settlement on Naumkeag river. Discouraged by the difficulties they had to encounter, they had determined to quit America and return to England; but, encouraged by the Rev. Mr White, of Dorchester in England, who, with other influential characters that were desirous of providing an asylum in America, for the persecuted non-conformists, assured them, if they would remain, that they should receive a patent, supplies, and friends,

Massachusetts settled.

natives to provoke them to war against the colony, and that they would not give, sell or convey any of their lands, territories, or possessions whatever, to any person or persons whomsoever, without the privity or consent of the government of Plymouth, other than to such as the said government should send or appoint. The whole court did then ratify and confirm the aforesaid league, and promise, to the said Woosamequen, his son and successors, that they would defend them against all such as should unjustly rise up against them, to wrong or oppress them."—Morton's Memorial p. 150.

New-England.

friends, relinquished their design, and concluded to wait the event. Accordingly, on the 19th of March 1627, Sir Henry Roswell, and several other gentlemen, in the vicinity of Dorchester, purchased of the council of Plymouth, all that part of New England, included within a line drawn from the Atlantic ocean, 3 miles south of Charles river, and 3 miles north of the Merrimac to the South sea. But as the council gave them no powers of government, they afterwards obtained a charter of incorporation, from Charles I. constituting them a body-politic, by the name of the "Governor and Company of Massachusetts Bay in New England," with powers as extensive as any other corporation in England. The charter recited the grant of American territory to the council of Plymouth in 1620. It re-granted Massachusetts Bay to Henry Roswell and others. The whole executive power of the corporation was vested in a governor, deputy governor, and eighteen assistants; and until the annual election of the company could commence, the governor, deputy governor, and eighteen assistants were specified. The governor, and seven, or more assistants, were authorised to meet in monthly courts, for dispatching such business as concerned the company or settlement. But the legislative powers of the corporation, were vested in a more popular assembly, composed of the governor, deputy governor, the assistants, and freemen of the company. This assembly to be convened on the last Wednesday of each of the four annual terms, by the title of "the General Court," was empowered to enact laws and ordinances for the good of the body-politic, and the government of the plantation, and its inhabitants; provided they should not be repugnant to the laws and statutes of England. This assembly was empowered to elect their governor, deputy governor, and other necessary officers, and to confer the freedom of the company. The company was allowed to transport persons, merchandize, weapons, &c. to New England, exempt from duty for the term of seven years; and emigrants were entitled to all the privileges of Englishmen. Such are the general outlines of the charter. Under this charter Mathew Cradock was elected the first governor, and Thomas Goff, deputy governor; Capt. John Endicott, who, the year before (1627) had gone over with one hundred persons to Salem to prepare the way for the settlement of a permanent colony, was appointed, by the Plymouth company, governor for the plantation.

Purchased of the Plymouth council.

March 4, 1628.] Charter obtained.

Its contents.

H. Adams's Hist. N. Eng. p. 27. Cradock appointed Governor.

Hutchinson.

In May 1628, about two hundred persons, with the Rev. Messrs Skelton, Higginson, and Bright, embarked for New England, and arrived at Naumkeag, now Salem, on the 29th of June. The whole colony under governor Endicott, now consisted of about 300 souls; 100 of whom, the same year removed to Charlestown. Messrs Skelton and Higginson remained at Salem, where they formed, and were ordained over, the first church in that town; Mr Bright removed with the migrants to Charlestown.

First church formed in Salem.

The situation of the persecuted puritans in England became more and more intolerable, and interested numbers of respectable, and wealthy people, in their behalf, and converted them to their principles. Several more of consequence in the nation, had formed a resolution to emigrate to Massachusetts, provided they should be permitted to carry the charter with them. They were aware of the inconvenience of being governed, in a new and distant country, different in most respects from England, by men, over whom they had no controul. They insisted therefore that the charter should be transmitted with them, and that the corporate powers which it conferred should in future be executed in New England. Though the legality of the proposed measure was questioned, yet the importance of engaging men of wealth and influence in the enterprize, induced Gov. Cradock, who entered fully into their views, to call a general court Aug. 29th 1629, to whom he submitted the question; whereupon it was unanimously resolved "that the patent shall be transferred, and the government of the corporation removed from London to Massachusetts Bay." The members of the corporation who remained in England, were, by agreement, to retain a share in the trading stock, and the profits of it, for seven years; but it does not appear that any dividend was ever made, or that any trade was carried on for the company.

New England.

Charter to be transferred to Massachusetts.

Chalmers, p. 151.

On the 20th of October 1629, the company proceeded to a new choice, of officers to consist of such persons as had determined to go over with the charter. John Winthrop was elected governor, John Humphry deputy governor, Sir Richard Saltonstall and seventeen other assistants. The deputy governor and several of the assistants, never came to America. Their places were supported by a new choice. Thomas Dudley was chosen deputy governor in place of Mr Humphreys.

John Winthrop governor.

In the spring of 1630, these officers, with about 1500 emigrants, embarked at various ports in England, in eleven vessels fitted at the expence of more than £21,000 sterling, having their charter on board, and after a tedious voyage, they arrived at Salem in June, and at Charlestown the beginning of July. In consequence, the 8th day of this month, was celebrated in all the plantations in New England as a day of public thanksgiving to God, "for all his goodness, and wonderful works to them."

Fifteen hundred colonists embark for New England.

Prince's Chronology, p. 211.

But there were several circumstances which operated as drawbacks, upon the joys of this occasion. An extensive and formidable conspiracy of the Indians, as far as Narraganset, for the purpose of extirpating the English colonists, had been, but a few months before, discovered to the inhabitants of Charlestown, by John Sagamore, in season, however, to prevent its horrid execution. The alarm and terror which this event had occasioned, had hardly subsided.—Of three hundred persons, who were previously at Salem and Charlestown, eighty had died the preceding winter. There was not corn enough to supply their necessities for a fortnight; and their other provisions, in consequence of their long voyage, were reduced to scanty pittance. They were obliged to let their servants (who had cost them from fifteen to twenty pounds each), go free, and provide for themselves. Under all these disadvantages they had a few months to prepare shelter and food for a long and cold winter. To increase their calamities, a mortal sickness soon commenced its ravages among them, and before December, two hundred of their number had died. Among these was Lady Arabella, who "came from a paradise of plenty and pleasure in the family of a noble Earl, into a wilderness of wants," Mr Johnson, her husband, highly esteemed for his piety

Indian conspiracy.

Scarcity.

Mortality among the colonists.

New-England.

ety and wisdom," and one of the assistants, and Mr Rossiter another of the assistants.—To console them under their severe distresses, Mr Wilson preached to them on the subject of Jacob's behaviour, who was not disheartened by the death of his nearest friends on the way, when God called him to remove. This worthy minister was liberal, almost to an extreme, in administering to the relief of the necessitous, he was indeed at all times a father to the poor; and even the wretched Indians often tasted of his bounty.

Part of the colonists return.

Discouraged by such calamities, and gloomy prospects, about an hundred persons who had lately arrived, of "weaker minds," and not of the best characters, returned to England in the vessels which brought them over. The return of these was considered as no loss to the plantation. This new accession to the Massachusetts colony collected, some from the west of England, but chiefly from the vicinity of London, were of all trades and occupations, necessary for planting a new country. As there were not buildings sufficient to accommodate such a number of people, the artificers among them erected tents, and temporary booths for their accommodation.

First Christians gathered in Charlestown and Boston.

Prince's Chron. p. 243.

As the great object of these christian pilgrims, in leaving their native country, and settling this wilderness, was to "enjoy the ordinances of the gospel and worship the Lord Jesus Christ according to his own institutions," Gov. Winthrop, Lieut. Gov. Dudley, Mr Johnson, and the Rev. Mr Wilson, on the 30th of July, 1630, entered into a formal and solemn covenant with each other, and thus laid the foundation of the church in Charlestown and Boston. On the 27th of August following, Mr Wilson was ordained pastor of the church at Charlestown. This was the first ordination that took place in Massachusetts.

ibid. p. 247.

First court of assistants held at Charlestown.

On the 23d of August 1630, the first court of assistants was held at Charlestown on board the Arabella, consisting of Gov. Winthrop, deputy Gov. Dudley, and Sir Richard Saltonstall, Messrs Ludlow, Rossiter, Newell, T. Sharp, Pynchon, and Bradstreet, assistants. This court was formed for the determination of great affairs, civil and criminal Justices of the Peace, invested with the same authority as like magistrates in England, and other officers, were appointed for the preservation of tranquillity. The first question that came before them was, "how the ministers should be maintained?" On the proposal of Messrs Wilson and Phillips, the court ordered that houses should be built for them at the public charge, and the governor, and Sir Richard Saltonstall, were appointed to carry the order into effect. It was at the same time ordered that Mr Phillips's salary should be £30, a year, and Mr Wilson's £20, "till his wife should come over." Thomas Morton, of Mount Wollaston, who had stolen a boat from the Indians, was ordered to be brought before them for trial, without delay.—Carpenters, joiners, bricklayers, sawyers, and thatchers, were ordered to take no more than two shillings a day, under penalty of ten shillings, to giver or taker," and Mr Bradstreet was chosen Secretary.

ibid. 246, 247.

Second court.

Morton tried and sentenced.

On the 7th of September, a second court was held at Charlestown, before which Morton was tried, condemned, and sentenced to be set in the *bilbows*, and afterwards to be sent prisoner to England by the ship called the *Gift*, now returning thither; that all his goods shall be seized to defray the charges of his transportation, payment of his debts, and to give satisfaction to the Indians for a canoe he had unjustly taken from them; and that his house be burnt down to the ground, in sight of the Indians for their satisfaction, for the many wrongs he had done them." All persons were forbidden to plant within the limits of their patent, without leave from the court; those persons who had set down at Agawara were ordered to remove; Trimountain they named *Boston*, Mattapan *Dorchester*, and the town on Charles River *Watertown*.

Prince, p. 248.

Watertown, Boston, and Roxbury settled.

Before the following winter, Sir Richard Saltonstall, with Mr Phillips and others removed, and formed a plantation at *Watertown*; the greater part of the church in Charlestown, with Mr Wilson, removed and settled in Boston. Another company, with Mr Pynchon at their head, settled at Roxbury.

Plan of a fortified town, formed but relinquished.

On the 6th of December the governor and assistants met, and agreed to fortify the Boston Neck; but the design was relinquished shortly after, and instead of a fortification in this place, they concluded to build, the next spring, a fortified town, on the spot, near where Harvard University has since been established, then called Newtown. In the spring following, the governor accordingly began to erect a house; and the deputy governor finished his, and removed his family. But the neighbouring Indians manifesting a friendly disposition, the apprehensions of danger lessened, and the plan of a fortified town was relinquished. The governor settled at Boston, and the deputy governor removed to Roxbury.

Hutchinson, vol. I. p. 28.

Alarming Scarcity.

As the winter approached, provisions became extremely scarce; the people were compelled to subsist on clams, muscles, groundnuts, and acorns, and even these were procured with great difficulty, while the snow covered the ground. These trials discouraged many; and when it was announced that "the governor had the last batch of bread in the oven," they almost despaired of receiving seasonable relief. They were moreover full of fears, lest a ship which had been dispatched to Ireland for provisions, had either been cast away, or taken by pirates. But God, in his good providence, sent them timely relief. In their trouble, they had appointed a day to seek the Lord by fasting and prayer. Before the day came, the ship, with provisions, competent to their necessities, arrived, and they changed the day of fasting into a day of thanksgiving.

Mr. Abbot's M. S. notes.

Third court holden.

After a winter of great sufferings the court convened in the spring 1631, and ordained, "that the governor and assistants shall, in future, be chosen by the freemen alone; that none should be admitted to the freedom of the company but such as were chosen members, who had certificates from their ministers that they were of orthodox principles; and that none but freemen should vote at elections, or act as magistrates or jurymen." This extraordinary law continued in force, till the writ of *quo warranto*, in 1684, annihilated the government which enacted it.

Chalmers, p. 153.

Good effects of the scarcity.

The distresses endured the preceding season induced the colonists to pay great attention to the raising of provisions for their future support. To encourage a spirit so laudable and necessary, the court enacted "That Indian corn should be deemed a legal tender in discharge of debts." A great part of the cattle which had been imported from England had died; and a milch-cow

was

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was now valued at twenty-five to thirty pounds sterling.

Union between the colonies of Massachusetts and Plymouth.

Two colonies, one at Plymouth, the other at Massachusetts, were now planted in New-England. Both were critically situated in respect to their neighbours. The Plymouth settlers had erected a trading house at Penobscot about the year 1627; of this the French from Arcadia had taken possession. This gave rise to complaints on both sides of incroachments on their respective rights, which led on finally to war between the parent countries.

The Massachusetts colony was threatened by the surrounding Indians. In these circumstances prudence dictated that union should be established between the two infant colonies. To bring about a measure so necessary to their safety, the Governor, with the Rev. Mr Wilson and others proceeded to Plymouth, 40 miles through the wilderness on foot. They were kindly and respectfully received by governor Bradford, and the principal gentlemen at Plymouth; and the result of this embassy was a lasting friendship between the colonies.

Complaint against the colonists.

The colonists, in their zeal to preserve the unity and purity of the faith, had expelled from among them some, whose principles and conduct they disapproved. These persons complained to the king of the wrongs they had suffered. Their complaint was referred to the privy council for colonies, Jan. 1632; but most of the charges being denied, and "to avoid discouragement to the adventurers, and in hopes that the colony which then had a promising appearance would prove beneficial to the kingdom," the complaint was dismissed.

Chalmers.

New embarkations for New-England, and the order of the king thereupon.

The spirit of persecution still raged in England. Many of the persecuted, less enterprising than their brethren who had already migrated to America, had been waiting with solicitude to know their situation and prospects. Satisfied on these points from the accounts they had received, great numbers embarked this year (1633) for New England. So numerous, and of such character were these emigrants, that the king in council thought fit to issue the following order, Feb. 21. 1633. "Whereas the board is given to understand of the frequent transportation of great numbers of his majesty's subjects out of this kingdom to the plantation of New-England, among whom divers persons known to be ill affected, discontented, not only with civil but ecclesiastical government here, are observed to resort thither, whereby such confusion and distraction is already grown there, especially in point of religion, as besides the ruin of the said plantation, cannot but highly tend both to the scandal of church and state here: And whereas it was informed in particular, that there are at the present, divers ships in the river of Thames, ready to set sail thither, freighted with passengers and provisions: It is thought fit, and ordered that stay should be forthwith made of the said ships until further order from the board. And the several masters and freighters of the same should attend the board, on Wednesday next in the afternoon, with a list of the passengers, and provisions in each ship. And that Mr Cradock a chief adventurer in that plantation, now present before the board, should be required to cause the letters patent for the said plantation to be brought to this board."

Hutchinson.

This order, however, in consequence of an able vindication of the conduct of the governor, and colonists of New-England by such of the company as were present, did not put a stop to emigrations. In some of the summer months of this year there arrived 12 or 14 ships filled with passengers. Among the distinguished characters who came over about this time were Mr Haynes, Sir Henry Vane, and the Rev. Messrs Cotton, Hooker and Stone.—The first was afterwards many years governor of Connecticut. The second was the next year elected governor of Massachusetts. The three last named were among the most eminent divines of that day, and their migration to New-England, drew after them multitudes of the persecuted puritans. Mr Cotton is said to have been more useful and influential in settling the civil as well as ecclesiastical polity of New-England than any other person.

Representative government established, and the rights of the people asserted.

Until this period the legislative powers had been exercised by the governor, deputy governor, and assistants, and the whole body of freemen in person, though the latter had been permitted to have but little share in the government; but the colony had now become so numerous that it was inconvenient and indeed impracticable to legislate in one assembly; nor was it safe, surrounded as they were with hostile Indians, for the freemen to leave their families for so long a time unprotected: Necessity therefore obliged them to establish a *representative form of government*, which they did by general consent, though no express provision was made for it in the charter. Accordingly the freemen elected twenty-four deputies, who appeared in general court, May, 1634, as their representatives. Their first business was to assert the rights of the people by passing the following resolutions; viz. "That none but the general court had power to make and establish laws, or to elect and appoint officers as governor, deputy governor, assistants, treasurer, secretary, captains, lieutenants, ensigns, or any of like moment, or to remove such upon misdemeanor, or to set out the duties or powers of these officers.—That none but the general court hath power to raise monies, and taxes, and to dispose of lands, viz. to give and confirm proprieties." After these resolutions, they proceeded to the election of magistrates. Then they further determined, "That there shall be four general courts held yearly, to be summoned by the governor for the time being, and not to be dissolved, but by consent of the major part of the court. That it shall be lawful for the freemen of each plantation to choose two or three, before every general court, to confer of, and prepare, such business as by them shall be thought fit to consider of at the next court; and that such persons as shall be hereafter so deputed by the freemen of the several plantations, to deal in their behalf in the affairs of the commonwealth, shall have the full power and voices of all the said freemen, derived to them for the making and establishing of laws, granting of lands, &c. and to deal in all other affairs of the commonwealth, wherein the freemen have to do, the matter of election of magistrates and other officers only excepted, wherein every freeman is to give his own voice."—And to show their resentment, they imposed a fine upon the court of assistants for going contrary to an order of the general court. "The legislative body thus organized, continued without alteration, (except that the number of general courts annually was reduced, in 1644, from four to two,) till the loss of the charter in 1684. This is supposed to have been the second house

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house of representatives that ever assembled in America. A house of burgesses met for the first time in Virginia, May 1620, fourteen years before.

Code of laws enacted.

Having thus established their form of government, the enaction of a code of laws was the next business in course. The leading characters among the colonists, were of opinion that the subjects of any prince or state had a natural right to emigrate to any other state or country, when deprived of liberty of conscience, and that upon such a removal their allegiance ceased. They considered their subjection to the crown of England as voluntary, and founded on mutual compact, and this compact was their charter. They maintained their right to make their own laws, and to elect their own magistrates, but acknowledged that their laws must not be repugnant to those of England; and that by their compact they had no right to be subject to, nor seek protection from, any foreign prince. With these sentiments, and without any partiality for the laws of their mother country, under which they had suffered so many hardships, it is not surprising that they did not adopt the laws of England as the foundation of their code. The peculiarity of their situation, indeed, rendered necessary corresponding laws and regulations. And as their leading object in migrating to this country, was to enjoy liberty of conscience, and to support and transmit pure to their posterity, the religion of the Bible; and finding in this book the leading principles of good government, and a system of laws for the general regulation of human conduct, they adopted it as their "principal code of law, and declared, as an article in their bill of rights, that no man should suffer but by an express law, sufficiently published, yet in case of a defect of law in any particular instance, *by the word of God*."

"It is obvious to all in the present age, that the peculiarities of the Jewish nation must render their jurisprudence inapplicable, in a variety of instances, to a people so differently circumstanced; and the rights of individuals could gain nothing by neglecting the experience of mankind, in former judicial proceedings, where they were in any degree similar to cases which might arise. The code of laws became marked with many additional capital crimes, unknown as such to those of England; and smaller offences were multiplied with rigorous exactness. As this severity had for its object, an exemplary purity of morals and religion, which should extend to every person in society, it of course reached the more private actions of its members, and included all the relationships subsisting between them.

"Their capital offences were idolatry, witchcraft, blasphemy, murder, bestiality, sodomy, adultery, man-stealing, bearing false witness, conspiracy and rebellion, cursing, or smiting a parent, unless when neglected in education, or provoked by extreme and cruel correction, rebellious and stubborn conduct in a son disobeying the voice and chastisement of his parents, and living in notorious crimes, rape, and arson; other offences were also made capital upon a second or third conviction, and the degree of the offence was in some instances increased by the circumstance of its being committed on the Sabbath.

"In the inferior classes of crimes were many peculiar to the situation of the colony, especially with regard to sumptuary regulations, and the enforcing of industry. In these there are strong proofs of the disposition which prevailed, of shewing respect to particular descriptions of families by distinctions in their favour.

Their punishments bore a resemblance to the general rigour of their penal code, and were sometimes, even in capital cases left to the discretion of their judges. There is a law on the subject of torture, which is a stain rather upon the volume in which it is recorded, than upon the practice of the country; to the honour of which it may be said, that the use of this statute has been so little contemplated, that it became wholly obsolete. This law prohibits torture generally, but excepts any case in which the criminal is first fully convicted, by clear and sufficient evidence; after which, if it be apparent from the nature of the case, that there be confederates with him, he may be tortured, yet not with such tortures as are barbarous and inhuman. The very terms of this statute seem to disarm it of the power of injuring, and would render it, if it were in force, a less dreadful engine of inhumanity than the *peine forte et dure* of the English law. The rigour of justice extended itself as well to the protection of the rights of property, as to the moral habits of the people; and a remarkable instance of this is shown in the power given to creditors, over the persons of their debtors. The law admitted of a freeman's being sold for service to discharge his debts, though it would not allow of the sacrifice of his time, by his being kept in prison unless some estate was concealed.

"The governor and assistants were the first judicial court; to this, inferior jurisdictions were added; and upon the house of representatives coming into existence, the judicial authority was shared by them, as in the words of their law, the second branch of the civil power of this commonwealth. The subordinate jurisdictions, were the individual magistrates, the commissioners of towns and the county courts. These seem in some sense to have acted as the deputies of the general court, since, in difficult points, they were allowed to state the case without the names of the parties, to that court, and receive its declaration of the law.

"The perpetual controversy incident to dividing power among several orders, disproportionate in their numbers, took place between the assistants and representatives. Whether they should vote in separate bodies or collectively, became a serious dispute. As by a defect in the constitution they held both legislative and judicial authority; it was at last compromised, that in making the laws, the two houses should vote separately, with a negative upon each other; but in trying causes, in case they should differ in this mode, they should proceed to determine the question by voting together.

"As in their government, hereditary claims were rejected, their public officers being all periodically chosen from the body of the freemen, and without regard to distinct orders, so in the descent and distribution of real or personal estates of intestates, the exclusive claim of any one heir was not admitted, but equal division was made among all, reserving only to the eldest son a double portion. This, especially in case of a numerous family, which is not an uncommon instance in a young country, effectually prevented the undue accumulation of property. These two regulations may be said to be the great pillars on which republican liberty in Massachusetts is supported. There was an inestimable advantage

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gained to the cauſe of freedom by a law in 1641, which declares the lands of the inhabitants free from all fines and licences upon alienation, heriots, wardſhips, and the whole train of feudal exactions, which have ſo grievouſly oppreſſed mankind in other parts of the world. They tendered hoſpitality and ſuccour to all chriſtian ſtrangers flying from the tyranny of their perſecutors, or from famine, wars, or the like compulſory cauſe, and intitled them to the ſame law and juſtice as was adminiſtered among themſelves.

But while they have thus ſcrupulouſly regulated the morals of the inhabitants within the colony, and offered it as an aſylum to the oppreſſed among mankind, they neglected not to prevent the contagion of diſſimilar habits, and heretical principles from without. A law was made in the year 1637, that none ſhould be received to inhabit within the juriſdiction, but ſuch as ſhould be allowed by ſome of the magiſtrates; and it was fully underſtood, that differing from the religious tenets generally received in the country, was as great a diſqualification, as any political opinions whatever. In a defence of this order, it is advanced, that the apoſtolic rule of rejecting ſuch as brought not the true doctrine with them, was as applicable to the commonwealth as the church, and that even the prophane were leſs to be dreaded than the able advocates of erroneous opinions."

Minot's continuation p. 24 &c.

Character of the firſt ſettlers of New-England.

The firſt ſettlers of New England were certainly a remarkable people; of a character peculiarly adapted to thoſe important deſigns in providence which they were to fulfil. They were deſtined to plant and ſubdue a wilderneſs, filled with ſavage and ferocious enemies; to lay the foundation of a great empire: and this too under the jealous and unpropitious eye of their parent country. Accordingly they were enterpriſing, brave, patient of labour and ſufferings, and poſſeſſed a firmneſs of ſpirit, and a zeal for religion bordering on enthuſiaſm. They had alſo among them their full proportion of the learned and beſt informed men of that age. A body of men more remarkable for their piety, more exemplary in their morals, more reſpectable for their wiſdom, never before, nor ſince, commenced the ſettlement of any country. What have been conſidered as blemiſhes in their character ſeemed neceſſary in their ſituation. "Leſs rigour would have diſqualified them for diſcharging the heavy duties which they had to perform, and perhaps more liberality would have introduced ſectaries which would have weakened the community by diviſions, and profligates who would have corrupted it by their vices."

Minot.

One of the firſt ſtateſmen in America,* has thus characteriſed the fathers of New England. "Religious, to ſome degree of enthuſiaſm, it may be admitted they were, but this can be no peculiar derogation from their character, becauſe it was at that time almoſt the univerſal character, not only of England, but of Chriſtendom: had this however been otherwiſe, their enthuſiaſm, conſidering the principles on which it was founded, and the ends to which it was directed, far from being a reproach, was greatly to their honour. For I believe it will be found univerſally true, that no great enterprize for the honour, or happineſs of mankind, was ever atchieved, without a large mixture of that noble infirmity. Whatever imperfections may be juſtly aſcribed to them, which however are as few as any mortals have diſcovered, their judgment in forming their policy was founded on wiſe and benevolent principles; it was founded on revelation and reaſon too; it was conſiſtent with the beſt, greateſt, and wiſeſt, legiſlators of antiquity."

* John Adams, late Preſident of the U. States.

New-Hampſhire and Maine ſettled.

In the years 1621 and 1622, captain John Maſon, and Sir Ferdinando Gorges, obtained grants of the Plymouth Council, (of which they were the moſt active members) of all the country between Naumkeag, (now Salem) and Sagadahock river; and back to the Lakes of Canada. The tract between Naumkeag and Merrimack, which was granted to Maſon, he called *Mariana*. The reſt, granted jointly to both they named *Laconia*.

The next year (1623), they planted a colony, and eſtabliſhed a fiſhery on Piſcataqua river. About the ſame time a variety of other little ſettlements were formed, on the coaſt between the Merrimack and Sagadahock rivers. But none of them flouriſhed, being "rather temporary eſtabliſhments for traffick than ſeed plots of future plantations." So ſlow was the progreſs of the ſettlements in this part of New England, that fifteen years after their commencement, (in July 1638,) when Joſſelyn ſailed along this coaſt, he ſaw, he obſerves, "no other than a mere wilderneſs, here and there by the ſea ſide, ſcattered plantations with a few houſes."

In 1629 the ſoutheaſtern part of the preſent ſtate of New Hampſhire was purchaſed of the Indians, and a deed obtained of them by John Wheelwright and others from Maſſachuſetts. The ſame year captain Maſon procured a new patent from the council of Plymouth, for a ſtill larger tract, including this Indian purchaſe. This tract was now named New Hampshire.

For ſeveral years after this, the adventurers paid very little attention to agriculture. They imported their bread corn from England and Virginia. Their views were chiefly turned to the diſcovery of the lakes, and of mines, to the cultivation of grapes, to the peltry trade, and the fiſheries. The peltry trade was of ſome value, and the fiſheries ſupported the inhabitants, but neither lakes nor mines were found, and the vines which they planted periſhed. Diſcouraged by ill ſucceſs, the adventurers in England ſold their ſhares to Maſon and Gorges, who, in conſequence, became the ſole proprietors. They in 1634 renewed their exertions to increaſe the colony, and appointed Francis Williams, a wiſe and popular man, its Governor.

An attempt was made by Maſon and Gorges about this time, to divide New England into twelve Lordſhips, under the direction of a general governor. This ſcheme was countenanced at Court, but was never adopted, and produced no material injury to the rights of the ſettlers.

The religious views and ſentiments of Maſon and Gorges, did not accord with thoſe of the planters of Maſſachuſetts;—the object of the latter was to eſtabliſh a chriſtian community, for the preſervation and ſpread of pure religion, and liberty of conſcience; while that of the former was to plant colonies, which ſhould yield them wealth and power. The enterprize of Maſon and Gorges was, however, at this period, exemplary and uſeful, as it ſerved to excite a ſpirit of emulation in other adventurers, and their memory deſerves reſpect. Captain Maſon died in the winter of 1635-6. Governor Winthrop in his Journal makes the following remark on his death, evincive of the temper of thoſe times. "He was the chief mover in all attempts againſt us, (the Maſſachuſetts colony) and was to have ſent the general governor; and for this end was providing ſhips. But the Lord, *in mercy*, took him away, and all the buſineſs fell on ſleep."

In

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In April 1639, Gorges obtained from Charles I. a confirmation of his patent, and "his limits were now extended to one hundred miles from the rivers ſouthweſtward into the deſert." This tract was called Maine. By this patent Gorges was inveſted with all the royal rights of a Count palatinate—with greater powers than had ever been granted by a ſovereign to a ſubject. Encouraged by theſe attentions, and inveſted with authority, the following year he eſtabliſhed civil government within the province, appointed Joſſelyn and others his counſellors, and tranſmitted to them (March 1640) ordinances to regulate them in the adminiſtration of juſtice. But he poſſeſſed not the talents requiſite to the government of a colony; the Conſtitution he had formed for Maine, was merely executive, without any legiſlative powers, nor did it provide any aſſembly in which the people might be repreſented. Encouragement was not given to emigrants to purchaſe and cultivate his lands. Agriculture was neglected. Lands were granted, not as freeholds, but by leaſes, ſubject to quit-rents, and no proviſion was made for the regular ſupport of the clergy. With ſuch a government and ſuch regulations, it could not be expected that the colony would flouriſh; on the contrary "the province languiſhed for years in hopeleſs imbecility; and its languors ceaſed, and a principle of life was infuſed, only when he ceaſed to be its proprietary and lawgiver." The town of York, however, was incorporated by him, with city privileges, in 1641, though this circumſtance ſeems to have added neither to its wealth nor importance.

Exeter ſettled.

Religious diſſentions were excited about this time in Maſſachuſetts by the introduction of Antinomian principles. At the head of thoſe who embraced theſe ſentiments was the Rev. John Wheelwright, brother of the famous Ann Hutchinſon, who, finding oppoſition too powerful, quitted Maſſachuſetts, and with a number of his followers, planted the town of Exeter. Senſible of the neceſſity of government and laws, of which they were deſtitute, thirty-five perſons, in October 1639, "combined themſelves in the name of Chriſt, to erect ſuch a government as ſhould be agreeable to the will of God." They conſidered themſelves as ſubjects of England, acknowledged the laws of the realm, and promiſed obedience to ſuch laws as ſhould be made by their own repreſentatives, and choſe a Mr Underhill for their governor. Their ſituation, however, was neither happy nor proſperous.

Not long after a ſmall, but more reſpectable number of perſons from England, ſettled at Dover, and in October 1640, theſe people, and thoſe who had planted themſelves at Portſmouth under Williams, formed themſelves, each, into a body politic, after the example of their neighbours at Portſmouth.

Four diſtinct governments, (including one at Kittery on the north ſide of the river) were now formed on the ſeveral branches of the Piſcataqua. Theſe combinations being only voluntary agreements, liable to be broken or ſubdivided on the firſt popular diſcontent, there could be no ſafety in the continuance of them. The diſtractions in England, at this time, had cut off all hope of the royal attention, and the people of the ſeveral ſettlements were too much divided in their opinions to form any general plan of government, which could afford a proſpect of permanent utility. The more conſiderate perſons among them, therefore, thought it beſt to treat with Maſſachuſetts, about taking them under their protection. That government was glad of an opportunity, to realize the conſtruction which they had put upon the clauſe, of their charter, wherein their northern limits are defined: for a line drawn from eaſt to weſt at the diſtance of "three miles to the northward of Merrimack river, and of any and every part thereof," will take in the whole Province of New-Hampſhire, and the greater part of the Province of Maine, ſo that both Maſon's and Gorges' patents muſt have been vacated. They had already intimated their intention to run this eaſt and weſt line, and preſuming on the juſtice of their claim, they readily entered into a negociation with the principal ſettlers of Piſcataqua reſpecting their incorporation with them. The affair was more than a year in agitation, and was at length concluded by an inſtrument ſubſcribed in the preſence of the general court, by George Wyllys, Robert Saltonſtall, William Whiting, Edward Holiock, and Thomas Makepeace, in behalf of themſelves and the other, partners of the two patents; by which inſtrument they reſigned the juriſdiction of the whole to Maſſachuſetts, on condition that the inhabitants ſhould enjoy the ſame liberties with their own people, and have a court of juſtice erected among them. The property of the whole patent of Portſmouth, and of one third part of that of Dover, and of all the improved lands therein, was reſerved to the lords and gentlemen proprietors, and to their heirs forever. *Belknap.*

Thus New-Hampſhire ceaſed to be a ſeparate province. Each of the aſſociations before mentioned diſſolved their reſpective compacts, which had been productive of much contention and anarchy, and peaceably ſubmitted to Maſſachuſetts.

Settlement of Connecticut.

In the year 1631, Wahquimacut, a ſachem of one of the tribes upon the Connecticut river, viſited the governors of Maſſachuſetts and Plymouth, and earneſtly beſought them to make a ſettlement upon that river. Wahquimacut was induced to make this requeſt from a hope that the Engliſh might protect him and his nation againſt the Pequods, who, from their number, and power, threatened to exterminate the river tribes. To perſuade the Engliſh to comply with his requeſt, he repreſented to them the fertility of the country, and its advantages for trade, and promiſed to give them eighty beaver ſkins, and an annual ſupply of corn. Mr Winthrop, the governor of Maſſachuſetts, was not inclined to accept the offer.—Mr Winſlow, the governor of Plymouth, thought it worthy of conſideration, and, that he might judge of the truth of the ſachem's repreſentations, viſited the river in the latter part of this year.

In 1632, a more particular examination of the river and adjoining territories was made by the people of New Plymouth, with a deſign to fix upon a proper ſite for a trading houſe. Having found a ſuitable ſituation, they endeavoured to engage governor Winthrop and his council to unite with them in this new ſettlement; but not having ſucceeded in this attempt, they reſolved by themſelves to undertake it. Accordingly in October 1633, William Holmes of Plymouth, with a ſmall company of men, ſailed up the Connecticut; and notwithſtanding the threats of the Pequods, and of the Dutch, who had lately built a ſmall fort at Hartford, New-England. erected a trading house a short distance below the mouth of the little river in Windsor. This was the first house that was erected in Connecticut. The English, thus established, treated the Indians with justice and kindness; and the Indians in return testified to them, in every possible manner, affection and good will. The fierce and high spirited Pequods were the only people who refused this interchange of good offices, and who thus early manifested a deep animosity towards the English. In 1634, the inhabitants of Dorchester, Watertown, and Newtown, applied to the general court of Massachusetts for permission to remove to Connecticut. After warm and long debates, this permission was refused. Nevertheless the body of the people of Dorchester, and of the towns of Newtown, Cambridge and Watertown, concluded to remove.

Hist. Col. for 1798, p. 167. In the summer of 1635, they performed the dangerous and laborious journey across the wilderness to Connecticut river. At the time of their removal, the Dutch had extended their claim, to the river, and made a settlement a few miles below Windsor. The fortitude of those pious adventurers was truly wonderful. About one hundred men, women, and children, took their departure from the three towns beforementioned, to travel through an unexplored wilderness. They were fourteen days performing the tedious journey. The wilderness, through which they passed, for the first time resounded, with the praises of God. They prayed, and sang psalms and hymns as they marched along; the Indians following and looking on them in silent admiration.

They arrived at this river, the object of their ardent expectation, near the mouth of Scantic river in East Windsor. The Dorchester people, with Mr Wareham for their minister, began the settlement of Windsor on the west side of the river; they suffered great hardships the first winter, and their cattle perished for want of food; for to carry much provision or furniture through a pathless wilderness was impracticable. Their principal provisions and household furniture had been put on board several small vessels, which, by reason of delays, and the tempestuousness of the season, were either cast away, or did not arrive. Several vessels were wrecked on the shore of New-England, by the violence of the storms. Every resource appeared to fail, and the people were under the dreadful apprehensions, of perishing by famine. They supported themselves in this distressing period with that heroic firmness and magnanimity, for which the first settlers of New-England had been so eminently distinguished. Trumbull's Hist. Com.

The Indians on, and near, the river were numerous. Three Sachemdoms were in the vicinity. The seat of one was near the mouth of Podunck river, lying in the southwest corner of East Windsor. A second at Middletown, twenty miles below; and the third at Farmington, about twelve miles west of Windsor.

Some of the first settlers of Windsor were gentlemen of opulence and education, as were also those of Hartford and Wethersfield, which settlements were begun at the same time. The right of settling here they purchased of the old Plymouth company in England, and they paid the Indians for the soil. They had sent some men the year preceding their removal, to make the purchase of the natives, whom they looked upon as the only rightful proprietors. (For the remainder of the history of Connecticut, see article CONNECTICUT, Vol. I. of this Work.)

Settlement of Rhode-Island. Motives of the same kind with those which are well known to have occasioned the settlement of most of the other United States, gave birth to the settlement of Rhode-Island. The emigrants from England, who came to Massachusetts, though they did not perfectly agree in religious sentiments, had been tolerably united by their common zeal against the ceremonies of the Church of England. But as soon as they were removed from ecclesiastical courts, and possessed a charter allowing liberty of conscience, they fell into disputes and contentions among themselves; and, notwithstanding all their sufferings and complaints in England, excited by the principle of uniformity, (such is human nature) the majority here were as fond of this principle as those from whose persecution they had fled.

The true grounds of religious liberty were not embraced at this time, nor understood by any sect. While all disclaimed persecution for the sake of conscience, a regard for the public peace, and the preservation of the Church of Christ from infection, together with the obstinacy of the heretics, was urged in justification of that, which, stripped of all its disguises, the light of nature, and the laws of Christ, in the most solemn manner condemn.

Mr Roger Williams, a Puritan minister, came over to New-England in 1631, and settled at Salem, assistant to the Rev. Mr Skelton. His settlement was opposed by the magistrates because he refused to join with the church, at Boston, unless they would make a public declaration, of their repentance for maintaining communion with the church of England, while in their native country. In consequence Mr Williams removed to Plymouth where he remained assistant to Mr Smith, three years; when he disagreed with some influential characters in that town, and by invitation returned to Salem and succeeded Mr Skelton who had lately deceased. His settlement was still opposed by the magistrates, who charged him with maintaining, "That it is not lawful for a godly man to have communion in family prayer, or in an oath, with such as they judge unregenerate;" therefore he refused the oath of fidelity, and taught others to follow his example; "that it is not lawful for an unregenerate man to pray; that the magistrate has nothing to do in matters of the first table; that there should be a general and unlimited toleration of all religions; that to punish a man for following the dictates of his conscience was persecution; that the patent which was granted by king Charles was invalid, and an instrument of injustice which they ought to renounce, being injurious to the nations, the king of England having no power to dispose of their lands to his own subjects." On account of these sentiments, and for refusing to join with the Massachusetts churches, he was at length banished the colony, as a disturber of the peace of the church and commonwealth. Miss Adams' Hist. New-England.

He left his house, wife and children at Salem in the dead of winter, and sought a residence within the limits of Massachusetts.—Fortunately for Mr Williams, he had cultivated an acquaintance with the Indians, and learned their language, and before he left the colony, he had privately treated with Canonicus and Osamaquio, two Narragansett sachems, for a tract of land within their territories, provided he should be under the necessity of settling among them. These circum-

stances,

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ſtances, together with the advice of governor Winthrop induced him, with four of his friends, after his baniſhment, to direct his courſe towards Narraganſett Bay. He with his companions eſtabliſhed themſelves firſt at Secunk, or Seckhonck, now Rehoboth. But that place being within the bounds of Plymouth colony, governor Winſlow, in a friendly manner, adviſed them to remove to the other ſide of the river, where the lands were not covered by any patent. Accordingly in 1636, they croſſed Seekhonk river, and landed among the Indians, by whom they were hoſpitably received, and thus laid the foundation of a town which, "from a ſenſe of God's merciful providence to him in his diſtreſs," Mr Williams called PROVIDENCE. Here the little colony were ſoon after joined by a number of others, and though they were ſecured againſt the Indians by the terror of the Engliſh, yet, for a conſiderable time, they ſuffered much from fatigue and want; but they enjoyed liberty of conſcience, and the conſolation of having "provided a refuge for perſons perſecuted for conſcience ſake."

Unhappy religious diſſentions ſtill prevailed in Maſſachuſetts; and from a miſtaken zeal for the purity of the faith, governor Winthrop ſtrove to exterminate the opinions which he diſapproved. For this purpoſe, on the 30th of Auguſt 1636, a ſynod was convened at Newtown (now Cambridge) to whom eighty erroneous opinions were preſented; theſe were debated and condemned. At a court holden at the ſame place, the following October, a few of the leading characters who had embraced theſe errors were baniſhed, and ſeveral others were cenſured for ſeditious conduct. Theſe tranſactions threw the Maſſachuſetts colony into a ferment. The ſubſequent election of civil officers was carried by a party ſpirit excited by religious controverſy. Thoſe who were baniſhed by the court, joined by a number of their friends, left the colony, and went in queſt of a new place for ſettlement. They firſt proceeded to Providence, where they were kindly received by Mr Williams, and with whom they remained for ſome time. In March 1638, two Sachems, by virtue of their authority, and in conſideration of fifty fathoms of white beads, ſold to Mr Coddington (one of the moſt reſpectable of theſe exiles) and his aſſociates, the great iſland of Aquidneck, and the other iſles in Narraganſet bay, except two which had been previouſly ſold. The natives ſoon after agreed upon receiving ten coats and twenty hoes, to remove before the next winter. The largeſt iſland was ſoon after called Rhode-Iſland. Having thus acquired a title and poſſeſſion on conſiderations which gave ſatisfaction to the original owners, they here eſtabliſhed themſelves; and copying the conduct of their neighbours, they formed a ſimilar aſſociation for the purpoſes of civil government. Though the numbers aſſociated were few, yet the ſoil being fruitful, and the climate agreeable, many perſons ſoon reſorted where they found protection, and the iſland, in a few years, became ſo populous as to ſend out colonists to the adjacent ſhores.—The little colony elected Mr Coddington their judge and chief magiſtrate. This gentleman came to America in 1630, and ſettled at Boſton as a merchant. After his removal to Rhode-Iſland, he embraced the ſentiments of the Friends, and became the father of that denomination of Chriſtians in that colony. Their Yearly-meeting was held in his houſe till his death in 1688. Mr John Clarke was another principal character among the exiles; for the ſake of enjoying liberty of conſcience, he voluntarily abandoned the colony of Maſſachuſetts and ſettled in Rhode-Iſland, where, in 1644, he founded a Baptiſt Church.

Rhode-Iſland purchaſed and planted.

The firſt ſettlement on Rhode-Iſland was made at the north end, and called Portſmouth. In 1639, another ſettlement was begun at the ſouth-weſt part of the iſland on a fine harbour, which they called Newport. From the convenience of this harbour, the fertility and pleaſantneſs of the iſland, and the wealth of the firſt ſettlers, this place had a rapid growth, and in a few years became the capital of the colony. The government which they eſtabliſhed was of the democratic kind. The chief magiſtrate and four aſſiſtants were inveſted with part of the executive powers; the remainder with the legiſlative authority was exerciſed by the body of the people in town meetings.

The colonies at Providence and Rhode-Iſland at different periods received large acceſſions from the denominations of Baptiſts and Friends who were perſecuted in other colonies. What diſtinguiſhes theſe colonies from all others is, that they were ſettled on a "plan of entire religious liberty; men of every denomination being equally protected and countenanced, and enjoying the honours and offices of government." Belknap.

The inefficacy of a voluntary government and the want of a patent to legalize their proceedings, was ſoon experienced by the coloniſts at Providence and Rhode-Iſland. Accordingly, in the year 1643, they ſent Mr Roger Williams to England, as their agent, to procure for them a charter from the Crown. On his arrival at London, he found that King Charles I. had been driven from his capital; he of courſe applied to thoſe who had aſſumed the power. Sir Henry Vane, his former aſſociate and friend in America, received him kindly, and aided his views. In March 1644, through the Earl of Warwick, then governor and admiral of all the plantations, he obtained from Parliament, "a free and abſolute charter of civil incorporation of Providence plantations in Narraganſet bay," inveſting the inhabitants with the requiſite authority to govern themſelves, but according to the laws of England.

Mr Williams was well received by ſome of the leading members of Parliament, and when he was about to embark for America they gave him a letter of recommendation to the governor and aſſiſtants of Maſſachuſetts, in which they repreſented the merits of Mr Williams, and adviſed to the performance of all friendly offices towards him. This letter had the effect to ameliorate the differences which had ſubſiſted between Mr Williams and the Maſſachuſetts colony; and there was afterwards a profeſſion of chriſtian love and mutual correſpondence between them. Yet, while Williams retained what were deemed dangerous principles, the governor and aſſiſtants of Maſſachuſetts thought it inexpedient to grant him liberty of ingreſs and egreſs, leſt the people ſhould be drawn away with his erroneous opinions.

Rhode-Iſland refuſed admiſſion into the colonial confederacy of 1643.

When in 1643, the dangers and neceſſities of the New-England colonies induced them to think of forming a confederacy for their mutual ſupport and defence, Providence and Rhode-Iſland plantations were deſirous of uniting in the plan; but Maſſachuſetts, diſliking their

New-England.

their religious sentiments, opposed their motion, and refused them a seat in the convention for forming the confederacy. Thus forsaken of their neighbours, they found it necessary to devise other means of safety. They accordingly cultivated the friendship of the neighbouring Sachems, with assiduity and success, and in a short time acquired such an influence with them as to procure from the Narragansett chiefs, in 1644, a formal surrender of their country to King Charles I. in right of his crown, in consideration of his protection of them against their enemies. This territory was afterwards called *the King's Province*.

The Narraganset Indians surrender their country to the king of England.

The people of these plantations, thus empowered to manage their own affairs, in the true spirit of democracy, convened an assembly in May 1647, composed of the body of freemen, in the several plantations. Several salutary regulations were adopted. The executive power, by this assembly, was vested in a president. This form of government, so agreeable to their inclinations and views, they did not long enjoy in tranquillity. It was suspended in October, 1652, by an order of the council of state for the Commonwealth. The Parliament wished to acquire a participation, at least, in the administration of affairs, by establishing here those plans of reformation which they attempted in Massachusetts, and which they actually effected in Virginia and Maryland. But Providence and Rhode-Island, deriving the same advantages from the distractions which soon after ensued in England, that the colonies have always taken of the disorders of the sovereign state, resumed its form of government: And this it continued to enjoy without farther interruption, till the Restoration.

That event gave great satisfaction to these plantations. They immediately proclaimed Charles II. and not long after sent Mr Clarke, as their agent, to the court of that monarch, to solicit for a patent, which was deemed in New-England so essential to real jurisdiction: and in Sept. 1662, he obtained the object of his wishes. Yet, owing to the opposition of Connecticut, the present charter was not finally passed till July 1663. The immigrations, before mentioned, from Massachusetts, and the subsequent settlements at Providence and Rhode-Island, were recapitulated; "which being convenient for commerce," says the patent, "may much advance the trade of this realm, and greatly enlarge the territories thereof:" and being willing to encourage the undertaking of his subjects, and to secure to them the free enjoyment of their civil and religious rights, which belonged to them as Englishmen, he conferred on them ample liberty in religion, and special privileges with regard to jurisdiction. The patentees, and such as should be admitted free of the society, were incorporated by the name of "The governor and company of the English colony of Rhode-Island and Providence." The supreme, or legislative power, was invested in an assembly; the constituent members were to consist of the governor, the assistants, and such of the freemen as should be chosen by the towns; but the governor or deputy governor, and six assistants were to be always present. Thus constituted, the assembly was empowered to make ordinances, and forms of government and magistracy, for the rule of the lands and inhabitants; so that they should not be repugnant, but agreeable to the laws of England, considering the nature of the place and people; to erect such courts of justice for determining all acts within the colony, as they should think fit; to regulate the manner of elections to places of trust, and of freemen to the assembly; to impose lawful punishments, pecuniary and corporal, according to the course of other corporations within the realm; and to pardon such criminals, as they should think fit. That the inhabitants might be religiously and civilly governed, a governor, deputy governor and ten assistants were appointed for the management of their affairs; and they were authorised to execute the ordinances before mentioned, which every one was commanded to obey. The governor and company were enabled to transport such merchandize and persons, as were not prohibited by any statute of the kingdom; and "paying such customs as are, and ought to be paid for the same:" They were empowered to exercise martial law, and upon just causes, to invade and destroy the native Indians and other enemies. There was granted to the governor and company, and their successors, "that part of the dominions of the Crown, in New-England, containing the islands in Narraganset bay, and the countries and parts adjacent: To be holden of the manor of East Greenwich, in common soceage." The inhabitants of those territories and their children, were declared fully intitled to the same immunities, as if they had resided or had been born within the realm; and to guard against the experienced oppressions of Massachusetts, they were enabled to pass and repass through any other English colonies, and to traffic with them. But with this proviso, that nothing should hinder any subjects whatsoever from fishing on the coasts of New-England.

Charles II. proclaimed, and a patent obtained.

Its contents.

Chalmers.

Such was the substance of the charter of Rhode-Island, and such were the privileges conferred by it. The government of this Province was administered to the satisfaction of Charles II. during the remainder of his reign. By the charter of this province "None were at any time thereafter to be molested, for any difference in matters of religion," yet the first assembly that convened under this charter, in March 1663, among a variety of other ordinances and laws, enacted one declarative of the privileges of his majesty's subjects; in which they say, "that all men of competent estates and of civil conversation, *Roman Catholics only excepted*, shall be admitted freemen, or may choose, or be chosen, colonial officers." By this act, persecution of the Roman Catholics immediately commenced, by depriving them of the rights of citizens, in violation of their charter privileges. This is a remarkable fact in the history of a people who have been singular for their attachment to, and zealous in defending, the doctrine of universal freedom of opinion in matters of religion.

Roman Catholics barred from the privileges of freemen.

Upon the accession of James II. to the throne, the colonists of Rhode-Island and Providence immediately transmitted to him an address, in which they acknowledged their subjection to him, pledged themselves to obey his authority, and asked in return for the protection of their chartered privileges.—This address did not, however, avail to protect them against the effects of the plans of reform in New-England, resolved on by the British court. Articles of "high misdemeanor were exhibited to the Lords of the Committee of Foreign Plantations, against the governor and company of

New-England.

of the colony of Rhode-Iſland and Providence," in which, among other things, they are charged with neglecting to keep an authentic record of their laws; with refuſing to permit the inhabitants to have copies of them, with razing or cancelling their laws as they pleaſe, without conſent of the aſſembly, and with adminiſtering the government, and juſtice, without taking the legal oaths. These charges were referred to the attorney general, July 1685, with orders immediately to iſſue a writ of *quo warranto* againſt their patent. The governor and company were ſerved with a regular notice of the proceſs, which had been iſſued againſt them, and they were put upon their defence; they declined ſtanding a ſuit with their king. In full aſſembly, they paſſed an act formally ſurrendering to his majeſty their charter, with all the powers it contained. This act, it is ſaid, "was afterwards made way with, agreeably to a common practice." The governor and company afterwards aſſembled, and on ſerious conſiderations of the ſuit inſtituted againſt them, agreed upon an addreſs to his majeſty, in which they pray that their charter privileges, civil and religious, might be continued; that "all things wherein they have been weak and ſhort, through ignorance, may be remitted and pardoned." They conclude by "proſtrating their *all* at his majeſty's feet, with entire reſolution to ſerve him with faithful hearts." Such ſervile language was improper for freemen to uſe, or for the ruler of a free people to receive. It failed of its intended effect. No ſooner was the addreſs received than the committee of the colonies, with the approbation of the king, ordered, that Sir Edward Andros, the governor of Maſſachuſetts, ſhould demand the ſurrender of their charter, and govern them in the manner the other colonies of New England were governed. At the ſame time they were aſſured of his majeſty's protection, and of his determination to exerciſe no other authority over them than what was common to the other plantations. Accordingly, in December 1686, Andros formally diſſolved the government of Rhode-Iſland, broke their ſeal, aſſumed the reins of government, and ſelected five of the citizens and formed them into a legiſlative council. This ſtate of things continued ſcarcely two years, when the revolution of 1688, put an end to the tyrannic authority of Andros, in this, and the other colonies. Their charter was reſumed, and has ever ſince continued to be the baſis, of the civil adminiſtration of their government.

Articles of charge exhibited againſt the governor and company, and a writ of *quo warranto* iſſued.

Chalmers.

Charter ſurrendered to Sir Edward Andros.

The year 1638 was remarkable for a great earthquake throughout New England. This earthquake, as did that alſo of 1627, which was equally violent and extenſive, conſtituted a remarkable era, which was long remembered and referred to by the pious inhabitants of theſe infant colonies.

Earthquake.

Great praiſe is due to the fathers of New England for their early attention to the education of children and youth. In 1636, the general court granted 400*l.* towards the eſtabliſhment of a public grammar ſchool at Newtown, (ſince called Cambridge.) Two years after, the Rev. JOHN HARVARD, a worthy miniſter of Charleſtown, died and bequeathed one half of his eſtate, amounting to a little upwards of 1800 dollars to this infant ſeminary; in conſequence of which, the general court gave it the name of HARVARD COLLEGE. Under the patronage of the legiſlature, and by frequent and liberal benefactions from the pious wealthy and generous friends of ſcience, this inſtitution ſoon roſe into reſpectability and has ſince been the ſource of incalculable benefit to New England.

Harvard College founded.

New-England.

In 1640, in conſequence of a change of affairs in the mother country, emigration to New England ceaſed. It was eſtimated at the time, that about 4000 families, conſiſting of 21,000 ſouls, had arrived in 298 ſhips, and ſettled in this new world. Since this period there can be no doubt, many more perſons have migrated *from*, than *to* New England. The expence of the removal of theſe 4000 families was eſtimated at 192,000*l.* ſterling, which, including what they paid to the council of Plymouth, and afterwards to the ſachems of the country, was a dear purchaſe of their lands.

Amount of original ſtock whence New-England was peopled.

Expoſed to foreign and domeſtic enemies, four of the New England colonies, *viz.* Maſſachuſetts, Plymouth, Connecticut, and New-Haven, confederated for mutual defence. Rhode-Iſland, as we have before noticed, was denied the privilege of joining this confederacy. The articles of union were agreed on and ratified, May 19th, 1643, and were in ſubſtance as follows:

Confederation of the colonies.

"The united colonies of New England, *viz.* Maſſachuſetts, Plymouth, Connecticut and New Haven, enter into a firm and perpetual league offenſive and defenſive.

Each colony to retain a diſtinct and ſeparate juriſdiction, no two colonies to join in one juriſdiction, without the conſent of the whole; and no other colony to be received into the confederacy without the like conſent.

The charge of all wars, offenſive and defenſive, to be borne in proportion to the male inhabitants between 16 and 60 years of age in each colony.

Upon notice from three magiſtrates, of any colony, of an invaſion, the reſt ſhall immediately ſend aid; Maſſachuſetts 100, and each of the other, 45 men; and if a greater number be neceſſary, the commiſſioners to meet and determine upon it.

Two commiſſioners from each government, being church members, to meet annually the firſt Monday in September; the firſt meeting to be held at Boſton, then at Hartford, New Haven, and Plymouth, and ſo yearly in that order, ſaving, that two meetings ſucceſſively be held at Boſton.

All matters wherein ſix ſhall agree, to be binding upon the whole; and if there be a majority, but under ſix, the matter in queſtion to be referred to the general court of each colony, and not to be obligatory unleſs the whole agree to it.

A preſident, for preſerving order, to be choſen by the commiſſioners each year out of their number.

The commiſſioners ſhall have power to eſtabliſh laws, or rules, of a civil nature, and of general concern for the conduct of the inhabitants, *viz.* relative to their behaviour towards the Indians, to fugitives from one colony to another, and the like.

No colony to engage in war, except upon a ſudden exigency, and in that caſe to be avoided as much as poſſible, without conſent of the whole.

If a meeting be ſummoned upon any extraordinary occaſion, and the whole number of commiſſioners do not aſſemble, any four who ſhall meet may determine upon a war when the caſe will not admit of delay, and ſend for the agreed proportion of men out of each juriſdiction; but not leſs than ſix ſhall determine the juſtice of the war, or have power to ſettle bills of charges, or make levies for the ſame.

New-England. Hutchinson. If any colony break any article of the agreement, or in any wise injure another colony, the matter shall be considered and determined by the commissioners of the other colonies."

Indians christianized. In 1650 a society in England, instituted for propagating the gospel, began a correspondence with the commissioners of the united colonies, who were employed as agents for the society. In consequence, exertions were made to christianize the Indians. The Rev. Mr Eliot, minister of Roxbury, distinguished himself in this pious work. He translated the bible into the Indian language, established a town in which he collected a number of Indian families; taught them husbandry, the mechanic arts, and a prudent management of their affairs, and instructed them with unwearied attention in the principles of the christian religion. His zeal and success have justly obtained for him the title of the *Apostle of New England*.

Quaker persecution. The persecution of the Quakers commenced in 1656, and continued till September 1661, when an order was received from the king, requiring that neither capital nor corporeal punishment should be inflicted on the Quakers, but that offenders should be sent to England. During this persecution several were executed. On the subject of the New England persecutions, the author of the European settlements in North America, judiciously remarks; "Such is the manner of proceeding of religious parties towards each other, and in this respect the people of New England were not worse than the rest of mankind; nor was their severity any just matter of reflection upon that mode of religion which they profess. No religion, however true or false, can excuse its own members, or accuse those of any other, on the score of persecution." Religious intolerance is now very generally reprobated, and it is hoped the time has already arrived, when no people can be found who think, "that by killing men for their religion, they do God good service."

Synod held in Boston. By order of the general court a synod of the New-England churches convened at Boston, September 1662. The people were at this time much divided in opinion on the two following questions, which were submitted to the synod for their decision, *viz.* 1*st* "Who are the subjects of baptism?" 2*d* "Whether, according to the word of God, there ought to be a consociation of churches, and what should be the manner of it?" The general court ordered the result of this synod, which was not unanimous, to be printed, and it may be seen at large in Dr Mather's Magnalia, or in Neal's history of the Puritans.

Comet. The people of New England were surprised by the appearance of a Comet, from the 17th of November, 1664, till the 4th of February following. They deemed it ominous, (as they afterwards did the Aurora Borealis,) of some calamity which was shortly to befal them.

Indian war. In the year 1675, a war with the Indians, by the name of *Phillip's war*, broke out, and endangered the existence of the colony. Some doubted whether the Indians would not succeed in the total extirpation of the English. This distressing war lasted more than a year, and was finally terminated by the death of Phillip, at whose instigation it was commenced.

Sufferings of the colonists. About this time the colonists were afflicted with various and great calamities. While they were contending in a bloody war with the natives, for their lives and their property, complaints were making in England, which struck at the powers of government. An inquiry now commenced which issued in the loss of the charter. At the same time Great Britain and Ireland were suffering under a prince, hostile to civil and religious liberty; and connected as New England was with the mother country, she could not but share, in a greater or less degree, in the evils of such a government. Add to these, the small pox spread through the country, and uncommon losses had been sustained by sea, during the wars which were about this time carrying on against the French and Dutch.

Another Synod convened. In this state of things, a Synod was convened by order of the general court, in May 1679, and two questions referred to their consideration. 1*st*, "What are the reasons that have provoked the Lord to bring his judgments on New England? 2*d*, What is to be done, that those evils may be removed?" The solicitude manifested on this occasion, and the measures adopted by the fathers of New England, evinced their piety and wisdom.

Loss of the charter. In June 1683, articles of high misdemeanor were exhibited by Edward Randolph, the public accuser of those days, against the Governor and Company of Massachusetts. In consequence a writ of *quo warranto* was ordered, and Randolph was appointed to carry it to New England; and to give importance to the messenger, and to his message, both of which were extremely obnoxious to the people of Massachusetts, a frigate was ordered to convey him to Boston. To prevent too great an alarm in the colony, a declaration accompanied the *quo warranto*, that it should affect no private rights. When these arrived, the general court deliberated on the critical state of their affairs. The governor, and a majority of the assistants resolved to submit to the royal pleasure, and transmitted an address to that effect. But the representatives, supported by the decisive influence of the clergy, refused their assent. All was ineffectual to preserve the charter. In Trinity term 1684, judgment was given for the king, by the high court of Chancery, against the Governor and Company of Massachusetts, "that their letters, patents, and the enrollment thereof be cancelled."

Thus ended the ancient government of Massachusetts by legal process. The validity of these proceedings was afterwards questioned by high authority. The house of commons at a subsequent period resolved, "that those *quo warranto's* against the charter of New England, were illegal and void."

State of New-England at this period. Amidst all her disputes with the mother country, New England greatly flourished. Agricultural pursuits were successful, manufactures and commerce were extended, and population and wealth were increased, because "the rough hand of oppression had not touched the labours of the inhabitants, or interrupted the freedom of their pursuits." If for a short time the splendour of New England independence was obscured by the clouds of royal authority, it soon blazed forth never to be extinguished.

Ten months passed after the dissolution of the charter, when it was thought necessary to establish a temporary government for the preservation of order. During this period, James II. ascended the throne of England, and was proclaimed in Boston, April 1685, with "sorrowful and affected pomp." In September following, a commission was issued, appointing a president and council,

New-England.

council, compoſed of the moſt loyal of the inhabitants of the government of Maſſachuſetts, New Hampſhire, Maine, and Narraganſet, till the chief governor ſhould arrive. Col. Dudley, a native of Maſſachuſetts, was appointed preſident.

Dudley appointed preſident.

The people reluctantly ſubmitted to a power which they could not oppoſe; declaring, that "though they could not give their aſſent to it, they ſhould demean themſelves as loyal ſubjects, and humbly make their addreſſes to God, and in due time to their gracious ſovereign, for relief." Counſellors were nominated by the king; no houſe of repreſentatives was mentioned in the commiſſion; ſtill, to reconcile the minds of the people to the intended introduction of a governor general, the courts of juſtice were allowed to remain on their original plan; juries were continued, former laws and cuſtoms were obſerved.

Hutchinſon.

Sir Edmond Andros arrives in Boſton, as Capt. General of New-England.

Before a year of Dudley's adminiſtration had expired, (Dec. 1686) Sir Edmond Andros arrived in Boſton from New-York, where he had been governor, being now appointed Capt. General, and Vice Admiral of Maſſachuſetts, New Hampſhire, Maine, Plymouth, Rhode Iſland and Connecticut, during pleaſure. In 1683, New-York and New-Jerſey were added to his juriſdiction. He with four of his council was empowered to grant lands with ſuch quit-rents as the king ſhould appoint. Like all tyrants, from Nero to the demagogues of the preſent day, Sir Edmond began his adminiſtration with profeſſions of high regard for the public welfare.

The tenor of his adminiſtration.

In the fall of 1689, he went to Hartford where the aſſembly were ſitting, and demanded the charter, declaring their government diſſolved. Remonſtrances were made, and the buſineſs delayed till evening; then, tradition ſays, the charter was brought into the aſſembly, and laid on the table; candles were extinguiſhed, but lighted again. The charter could not be found. All was quiet and peaceable. The charter had been taken by Capt. Wadſworth and concealed in a hollow tree. Still Sir Edmond ſeized the reins of government; turned out the old, and appointed new officers, civil and military.

Turnbull.

Numerous were the oppreſſions of this tyrant. The preſs was reſtrained, liberty of conſcience infringed, and exorbitant taxes levied. The charter being vacated, it was pretended all titles to land were deſtroyed; farmers therefore, who had cultivated their ſoil for half a century, were obliged to take new patents, giving large fees, or writs of intruſion were brought, and

1688.

their lands ſold to others. To prevent petitions or conſultations, town meetings were prohibited, excepting one in a year for the choice of town officers. Leſt the cries of oppreſſion ſhould reach the throne, he forbid any perſon to leave the country without permiſſion from the government. But the reſolute Dr Increaſe Mather, eſcaped the watchful governor, and his guards and emiſſaries; croſſed the Atlantic, and ſpread before the king the complaints of New-England. But relief came not till the revolution.

1689.

When the report reached Boſton, that the Prince of Orange had landed in England, joy beamed in every eye. Though the governor impriſoned the man who brought the Prince's declaration; though by a proclamation, he commanded all perſons to prepare for an invaſion from Holland; though magiſtrates, and the more conſiderate men were determined quietly to wait the iſſue; yet the indignant ſpirit of the people could not be reſtrained. On the morning of April 18th, the public fury burſt forth like a volcano. The inhabitants of Boſton were in arms; the country flocking to their

Inſurrection.

aſſiſtance. Andros and his aſſociates fled to a fort, reſiſtance was vain, he was made a priſoner, and conducted to England. The charges exhibited againſt him not being ſigned by the colonial agents, he was diſmiſſed, and this tyrant, thus indignantly ſpurned from New England, was appointed governor of Virginia.

Mr Bradſtreet, the late governor, with thoſe who had been magiſtrates under the charter, aſſumed the government, taking the name of a "Council of Safety," till new orders ſhould arrive from England. Theſe were ſhortly after received from King William, who, with his Queen Mary, were proclaimed in Boſton May 29th 1689, with more ceremony than had ever been known in that colony on the like occaſion. The revolution in Boſton was popular in New Hampſhire, but they found themſelves in a very unſettled ſtate. After waiting in vain for orders from England, they choſe deputies to agree on ſome mode of government, and finally determined to return to their ancient union with Maſſachuſetts.

William and Mary proclaimed in Boſton.

In 1692, Samuel Allen obtained a commiſſion for the government of New Hampſhire. Having purchaſed of Maſon's heirs the lands of the colony, they were embroiled with new controverſies for ſeveral years.

Previous to this, in 1688, an Indian war broke out in New England; various were the provocations plead by the natives in their juſtification. They charged the Engliſh with ſtopping the fiſh in Saco river; with not paying the tribute of corn ſtipulated in a former treaty; with turning cattle upon their corn; with granting away their lands, and cheating them in trade. The firſt blood was ſhed at North Yarmouth, in September. In the ſpring the Penicook Indians joining thoſe of Saco, they made a dreadful ſlaughter at Cocheco. Meſandouit being hoſpitably lodged at Major Waldron's, in the night opened the gate, and a hundred, ſome ſay five hundred, Indians ruſhed into the garriſon, murdered the Major, and 22 others, took 29 priſoners, burned 4 or 5 houſes, and fled loaded with plunder. The captives were ſold to the French in Canada. In Auguſt they took the fort at Pemaquid; and ſo frequent were their aſſaults, and ſo great the public alarm, that the country round retired to Falmouth for ſafety. The ſame month Major Swayn, with ſeven or eight companies from Maſſachuſetts, relieved the garriſon at Blue Point, which was beſet with Indians. Major Church, with another party of Engliſh, and chriſtian Indians, from Plymouth colony, marched to the eaſtward. Swayn making his head quarters at Berwick, ſent Capt. Wiſwel, and Lieut. Flag, on a ſcout. Near Winnipiſioke pond, Flag left a number of his friendly Indians, who continued there a number of days. It was afterwards diſcovered that they had an interview with the hoſtile natives, and gave them all the information in their power. So ſtrong is the attachment that binds us to our native country, that often the bonds of gratitude, oaths and religion, like Sampſon's cords, burſt aſunder, when they interfere with this paſſion. Feeble then is that government which depends on foreigners for defence or counſel.

Indian war.

New-England.

Garriſons were left in Wells, York, Berwick and Cocheco. October 23d, 1691, Mr Goodridge and his wife were murdered in Rowley, Byfield Pariſh, and the family carried into captivity. The good man was ſhot in his houſe, as he ſtood praying with his family.

As the French were the malignant inſtigators of the Indians in their bloody aſſaults, it was thought eſſential to the peace of New England, that theſe enemies ſhould be attacked in their own dominions. Hence vigorous

Expedition againſt Canada.

exertions were made for an expedition againſt Canada. The command was given to Sir William Phips, who failed from Hull Auguſt 19th, 1690, with a fleet of 32 ſail, and arrived before Quebec October 5th; but the ſeaſon being far ſpent; the army from Connecticut and New York which was to have entered the province, having returned after viſiting the lake; and the troops with Sir William being ſickly and diſcouraged, the expedition failed, and in November the troops arrived at Boſton. This expedition involved the government in a heavy debt; a thouſand men periſhed, and a general gloom ſpread through the country. In this ſituation, a flag of truce from the ſavages, deſiring a ſuſpenſion of hoſtilities, was doubly welcome. A conference was held at Sagadahoc; they reſtored ten captives, and agreed on a truce till the firſt of May 1691. The next January the ſavages deſtroyed York; killed 50 perſons, and carried 100 into captivity. In 1693, a peace was concluded at Pamaquid.

A new charter obtained.

In 1691 the general court employed two of their members, with Sir Henry Aſhhurſt and the Rev. Dr Mather, to ſolicit the reſtoration of their charter. In this they were diſappointed; but a new charter was given, including the colony of Plymouth, Province of Maine and Nova Scotia, with all the country between Nova Scotia and Maine to the River St Lawrence; alſo Elizabeth Iſlands, Nantucket and Martha's Vineyard, in the government of Maſſachuſetts. But the people were greatly diſappointed in their new charter. Many of their invaluable privileges were taken from them. They no longer choſe their governors, ſecretary, or officers of admiralty. The militia was under the controul of the governor. A houſe of repreſentatives was not mentioned. To levy taxes, grant adminiſtrations, prove wills, and try capital offenders, was the office of the governor and council. But in the true ſpirit of their native independence, the firſt act of the legiſlature in Maſſachuſetts, after receiving the charter, contained the following clauſe: "No aid, tax, tollage, aſſeſſment, cuſtom, loan, benevolence, or impoſition whatſoever ſhall be laid, aſſeſſed, impoſed, or levied on his majeſty's ſubjects, or their eſtates, on any pretence whatever; but by the act and conſent of the governor, council and repreſentatives of the people, aſſembled in general court."

It was now ſeventy-two years ſince the firſt ſettlement of Plymouth. During this period, making their own laws and chooſing their own rulers, New England had eſtabliſhed regulations for promoting learning and religion, not equalled perhaps in any nation. In 1643,

Dr Stiles' M. S.

there were 36 churches in New England; in 1650, there were 40, which contained 7750 communicants; and though the philoſophiſt points the finger of deriſion at the pious founders of theſe republics, the hiſtory of man does not preſent any people adopting wiſer meaſures, or producing more permanent bleſſings. No where is knowledge more generally diffuſed, no where are morals more correct, religion more pure, or the inhabitants more independent and happy.

1692. Sir William Phips governor.

But the faireſt day has its cloud. Sir William Phips the firſt governor under the new charter, found the province in a deplorable ſituation. An Indian war was waſting the frontiers. An agitation, a terror of the public mind in the greater part of Eſſex county, like a tornado, was driving the people to the moſt deſperate conduct. In the tempeſt of paſſion, a government of laws, trial by jury; all the guards againſt oppreſſion, were too feeble to protect the perſon, or property, of the moſt loyal ſubject. The pillars of civil government were ſhaken to their foundation, by the amazing power of ſuppoſed *witchcraft*. In the beginning of

The witchcraft infatuation.

1692, the Rev. Samuel Paris of Salem village, now Danvers, had a daughter aged 9, and a niece aged 11, "who were diſtreſſed with ſingular diſtempers." The means uſed by the phyſician being ineffectual, he gave it as his opinion, that "*they were under an evil hand.*" The neighbours immediately believed that they were bewitched. An Indian ſervant and his wife, privately made ſome experiments "to find out the witch." The children being informed of this, immediately complained of Tituba, the Indian woman, that ſhe pinched, pricked, and tormented them. They ſaid ſhe was viſible to them, here and there, where others could not ſee her. Sometimes they would be dumb, and choaked, and have pins thruſt into their fleſh. Mr Paris, being deeply affected with the diſtreſs of his family, invited a number of his brethren in the miniſtry to viſit him, and give their advice. They adviſed him "to wait on the providence of God, and to be much in prayer." Accordingly two or three private faſts were kept at his houſe, at one of which ſeveral miniſters came and joined with him. After this, there was a public faſt in the village, and afterwards in ſeveral congregations in the neighbourhood; and finally, the general court appointed a faſt through the colony, "to ſeek the Lord, that he would rebuke Satan." Still the diſtreſſes increaſed, more perſons complained of their ſufferings, and more were accuſed. At the ſight of theſe the ſufferers would ſwoon and fall into fits; at the touch of the ſame perſons, they would revive. The public mind was ſhocked and alarmed; the moſt deciſive proceedings followed. For a time, all, or moſt of the people were of one mind. March 2d, there was a public examination at the village, and ſeveral were committed to priſon. There was another examination at Salem, April 22d, and a number more impriſoned. June 2d, an old woman was tried and condemned at Salem, and executed on the 10th, making no confeſſion. Five more were tried June 30th, and executed July 19th; ſix more were tried Aug. 6th, and all executed the 19th, except one woman who pleaded pregnancy. One of theſe was Mr George Burroughs, ſometime miniſter at Wells; he had alſo preached at the village, but met with great oppoſition. A great number of witneſſes appeared at his trial; a ſpecimen of their teſtimonies may be ſeen by the following depoſition. "Elizur Keyſar, aged about forty-five years ſaith, that on Thurſday laſt paſt, being the 5th of this inſtant, month of May, I was at the houſe of Thomas Beadle in Salem, and Capt. Daniel King being there alſo at the ſame time; and in the

Calef.

ſame

New-England.

fame room, faid Capt. Daniel King afked me whether I would not go up and fee Mr Burroughs, and difcourfe with him, he being then in one of the chambers of faid houfe. I told him it did not belong to me, and I was unwilling to make or meddle with it; then faid King faid, are you not a chriftian? If you are a chriftian, go and fee him, and difcourfe with him. But I told him I did believe it did not belong to fuch as I was to difcourfe him, he being a learned man. The faid King faid, I believe he is a child of God, a choice child of God, and that God would clear up his innocency. So I told him my opinion or fear was, that he was the chief of all the perfons accufed for witchcraft, or the ringleader of them all; and told him alfo, that I believed if he was fuch a one, his mafter (meaning the devil) had told him before now, what I faid of him. And faid King feeming to me to be in a paffion, I did afterwards forbear. The fame afternoon, I having occafion to be at faid Beadle's houfe, in the chamber where Mr George Burroughs kept, I obferved that the faid Burroughs did fteadfaftly fix his eyes upon me. The fame evening, being in my own houfe, in a room without any light, I did fee very ftrange things appear in the chimney, I fuppofe a dozen of them, which feemed to me to be fomething like jelly that ufed to be in the water, and quivered with a ftrange motion, and then quickly difappeared. Soon after which I did fee a light up in the chimney, about the bignefs of my hand, fomething above the bar, which quivered and fhaked, and feemed to have a motion upward; upon which I called the maid, and fhe looking up the chimney, faw the fame; and my wife looking up, could not fee any thing. So I did, and do conclude it was fome diabolical operation"! ! !

Original depofitions.

On the margin of this depofition is written, Mr Elizur Keyfar declared to the jury of inqueft, that the evidence in the paper is the truth upon oath, Auguft 31, 1692.

Nine perfons received fentence of death, September 17th, eight of whom were executed September 22d, one woman being reprieved, pleading pregnancy.—Giles Cory had been preffed to death, September 16th, becaufe he would not (feeing all were convicted) put himfelf on trial by the jury. Previous to this, numbers had confeffed themfelves guilty of witchcraft, it being the only way of faving their lives, none who confeffed being executed. But the fuppofed fufferers becoming more daring, accufed fome of the beft people in the country. Sufpicion roufed from its lethargy; condemnation ceafed; the accufers were filent; thofe under fentence were reprieved, and afterwards pardoned.

If we can be convinced by the the uniform proteftations of thofe executed, or the confeffions of numbers who had been accufers, or the deliberate recantations of others who had confeffed themfelves witches, or the univerfal conviction of error in the minds of thofe who had been leading actors in thefe awful fcenes, or the entire change of public opinion, we fhall be fatisfied that the whole originated in folly and delufion. All thefe are facts. All thofe executed, the firft excepted, protefted their innocence with their dying breath, when a confeffion would have faved their lives. Several years after, perfons who had been accufers, when admitted to the church confeffed their delufion in fuch conduct, and afked "pardon for having brought the guilt of innocent blood on the land." The following is an extract from the confeffion of fix perfons belonging to Andover, who had owned themfelves witches;—"We were all feized as prifoners; knowing ourfelves altogether innocent, we were all exceedingly aftonifhed, and amazed, and affrighted out of our reafon; and our deareft relations feeing us in this dreadful condition, and knowing our great danger, apprehending there was no other way to fave our lives, perfuaded us to confefs: we faid any thing and every thing which they defired."

New-England.

Church records of Danvers.

On the day of a public faft, in the fouth meeting-houfe of Bofton, one of the judges, who was concerned in the condemnation of thefe unhappy victims at Salem, delivered in a paper, and while it was reading flood up: it was to defire prayers, &c. "being apprehenfive he might have fallen into fome errors at Salem."

The following is from the declaration of twelve men, who had been jurymen at fome of thefe trials:—"We do therefore fignify our deep fenfe of, and forrow for, our errors in acting on fuch evidence—we pray that we may be confidered candidly and aright, by the living fufferers, as being then under the power of a ftrong and general delufion." Mr Paris, who was active in the profecution, and evidently a ferious and confcientious man, in his public confeffion, November 26th, 1694, fays, "I do acknowledge, upon after confideration, that were the fame troubles again to happen, which the Lord of his mercy forever prevent, I fhould not agree with my former apprehenfions in all points; as for inftance," &c.

Mr Paris public confeffion

Martha Cory, a member of the church in Salem village, admitted April 27th, 1690, was, after examination upon fufpicion of witchcraft, March 21, 1692, committed to prifon, and condemned to the gallows yefterday. This day in public, by general confent, fhe was voted to be excommunicated out of the church. The following will fhow, in a moft affecting manner, the light in which the church viewed this vote, ten years after. "In December, 1702, the paftor fpoke to the church on the Sabbath as followeth.—Brethren, I find in your church book a record of Martha Cory's being excommunicated for witchcraft; and the generality of the land being fenfible of the errors that prevailed in that day, fome of her friends have moved me feveral times to propofe to this church, whether it be not our duty to recal that fentence, that fo it may not ftand againft her to all generations. And I myfelf being a ftranger to her, and being ignorant of what was alleged againft her, I fhall now only leave it to your confideration, and fhall determine the matter by a vote, the next convenient opportunity.—February 14th, The paftor moved the church to revoke Martha Cory's excommunication: a majority voted for revoking it." So deep was the people's fenfe of the errors of thofe tranfactions, that a great part of Mr Paris's congregation could not perfuade themfelves to fit under his miniftry. Accordingly, after great difficulty, after a refpectable council had laboured in vain for their reconciliation, after an arbitration refpecting the bufinefs, Mr Paris was difmiffed July 24, 1697, as the aggrieved ftate to the arbitrators, "for being an inftrument of their miferies."

Ibid.

If any reader point the finger of fcorn at the people of Effex, or the judiciary of Maffachufetts, for their

New-England. credulity and errors, he is informed they acted in conformity to the public opinion of the world at that time; that they were guided in their judicial proceedings by the writings of Keeble on the common law, Sir Matthew Hale, Glanvil, Bernard, Baxter, &c. He is informed that while the people of this once devoted neighbourhood soon saw and retracted their errors, and would now be the last people to fall into such a delusion, other parts of the world have been more slowly convinced. At Tring, in Hertfordshire, 20 miles from London, in 1751, two aged persons were drowned, supposed to be guilty of witchcraft. At Huntingdon, the anniversary of the execution of a family for witchcraft is celebrated to this day. A preacher from Cambridge delivers a discourse against witchcraft. At Embo, in Scotland, a person was executed for witchcraft in 1727. At Rome, the Rev. Father Altizza was lately seized for the crime of sorcery.

Walker's Geog. Magnalia, The Bee.

War kindled by the French. In 1694, the sword was drawn again, after being sheathed about a year. The Sieur Villion, commander of the French at Penobscot, with 250 Indians from the tribes of St John, Penobscot, and Norridgwag, assaulted the people on Oyster-river, in New-Hampshire; killed and captured about 100 persons, and burned 20 houses, 5 of which were garrisons.

Complaints against Governor Phips. During these distresses, the people became uneasy, ascribing their sufferings to the government, and a number made complaint to the king against governor Phips. He and his accusers were summoned to Whitehall. In November he embarked for England. A majority of the general court being in his favour, he carried a recommendation from the legislature, that they might not be deprived of so excellent a governor. But before his trial, he was seized with a malignant fever, of which he died, in the 54th year of his age. Sir William Phips was born of poor parents, on the bank of the Kenneber. He was first a shepherd, then a ship carpenter, then a seaman. By discovering a Spanish wreck, near Port De La Plata, he became rich, and was brought into notice. He was a man of enterprize, diligence, and perseverance, religious himself, and disposed to promote piety in others.

His death.

Mather.

Indian ravages. The Indians continuing to ravage the frontiers, in October, 1695, a party penetrated to Newbury, and made captives of John Brown and his family, excepting one girl who escaped, and ran 5 miles to the water side, near Newburyport, and alarmed the people.—Capt. Greenleaf instantly pursued, and, before it was light the next day, overtook and rescued the captives, nine in number. The Indians, when they found it impossible to carry them off, had determined and attempted to kill them; but such was their hurry, the wounds they gave them were not mortal: all recovered.

The French and Indians, in 1696, took and demolished the fort at Pemaquid.

Projected French invasion fails, and issues in peace with the Indians. In 1697, the French projected an invasion of the country. A fleet arrived at Newfoundland, expecting an army from Canada, to assault Boston, and ravage the coast to Piscataqua; but the season was advanced, provisions failed, and the design was relinquished. After the peace of Ryswick, 1698, the French could no longer assist the savages; they therefore buried the hatchet, restored their captives, ratified their former engagements, and, in 1699, submitted to the British crown.

Earl Bellamont governor. At the close of the war in Europe, the king appointed the earl of Bellamont governor of New-York, Massachusetts, and New-Hampshire. He resided at New-York; Mr Stoughton conducted the affairs of New-England. In May, lord Bellamont visited Boston. He was a nobleman of polite, conciliating manners, and professed great esteem for the congregational ministers, and with the general court, as was customary at that time, attended the stated Thursday lectures at Boston. In his time, the pirates, who had been connived at for 30 or 40 years, were arrested and punished. Numbers were executed at Boston; Bradish, Kidd, and others were carried to England, tried and executed.

Pirates executed.

Soon after the session of the general court, in May, 1700, lord Bellamont returned to New-York, where he died, the 5th of March following.

Dudley governor. Queen Ann appointed Joseph Dudley, Esq. to succeed him as governor of Massachusetts and New-Hampshire, in 1702. According to his instructions, he required a permanent salary, and maintained a long and obstinate struggle with the general court of Massachusetts, but was finally obliged to relinquish the object.

War with the French and Indians. In 1703, the Indians, aided as usual by the French, attacked all the settlements from Canso to Wells; killed and took about 130 people, and burned many houses. Women and children fled to garrisons; the men carried their arms into the field of labour, and posted centinels round them; small parties of the enemy were frequently making assaults; and the whole country, from Deerfield to Canso, for some time was in constant alarm. Towards the close of the year, 300 French and Indians fell upon Deerfield, murdered 40 of the inhabitants, took 100 captives, and left the village in flames. To repel such bloody foes, the famous Col. Church, so distinguished in the wars of Philip, in 1704, was ordered to the eastward. At Piscataqua, he was joined by major Hilton; they destroyed Minas and Chignecto, and did some damage to the French at Penobscot and Passamaquoddy.

The following year, a number of captives taken at Deerfield were redeemed. In April, 1706, the Indians killed 8 people at Oyster-river. The garrison was near, but not a man in it. The women put on hats, loosened their hair, and fired so briskly, that the enemy fled, without burning or plundering the house they had assaulted. The year following, the Indians came to Reading, within 10 miles of Boston, killed a woman and three children, and carried off 5 captives. Persons were also killed and prisoners taken this year at Chelmsford, Sudbury, Groton, and Exeter.

Belknap.

Death of governor Winthrop. On the 27th November, 1707, died John Winthrop, Esq. governor of Connecticut, and was buried in Boston. The bones of John Winthrop, the first governor of Massachusetts, his son and grandson, governors of Connecticut, rest in the same tomb, in the oldest burying ground in Boston. There was this year an unsuccessful expedition against Port Royal.

Hutchinson. On the 29th of August, 1708, Haverhill was assaulted by the Indians; 30 or 40 persons were killed, among whom was their minister, Mr Rolfe; 20 or 30 houses were burned, and the rest plundered. Such had been the loss of men in Massachusetts, by their dreadful wars with the French and Indians, that, in

1713,

New-England.

Effects of French and Indian wars. Hutchinson.

1713, the province had not doubled in half a century. The same observations may be made respecting the period from 1722 to 1762. Had the French in Canada been subdued a hundred years sooner, it is supposed there would have been more than three hundred thousand souls in New-England, more than there now is.

Acadia taken, and annexed to New-England.

In 1710, the territory of Acadia was subdued, by the surrender of Port Royal. The name of the place was changed to Annapolis, in honour of the queen. Samuel Vetch, a colonel in the victorious army, was appointed governor.

Unsuccessful expedition against Canada.

This success encouraged New-England to attempt, the next year, the conquest of Canada. General Nicholson was successful in soliciting aid from the British court. The combined army of Old and New-England troops, being 6,500 men, with a fleet of 5 ships of war, engaged in the enterprize; but in the way, eight transports were wrecked on Egg-Island, and a thousand people perished, among whom there was but one man from New-England. The expedition was relinquished: the consequence was new assaults from the savages. But news of the peace of Utrecht arriving, a suspension of arms was proclaimed at Portsmouth, October 29, 1712. The Indians came in, and agreed upon articles of peace. Never was an event more welcome to the provinces. They had been bleeding for almost 40 years; five or six thousand men had fallen in battle, or by disease, in the army. Massachusetts and New-Hampshire were the principal sufferers. The inhabitants of Connecticut had increased to about seventeen thousand. The people were religious; their righteousness exalted their character. In 1696, there were one hundred and thirty churches in these colonies, thirty-five of which were in Connecticut. At this period, Connecticut had forty-five towns. The number of ordained ministers was forty-three. There was an ordained minister to every four hundred persons, or to every eighty families. There was not one vacant church in the colony. There was also a number of candidates preaching in the new towns, where no churches were formed. About this time Boston was laid in ashes by an accidental fire, but was soon rebuilt in a more elegant style.

Trumbull.

State of New-England churches.

Shute governor;

The death of queen Ann, and the accession of George I. was announced in New-England, September 15, 1714. Col. Shute being appointed governor of Massachusetts and New-Hampshire, Mr Dudley retired to a private station. He was a man of ambition, possessing too high ideas of royal authority, to accord with the republican feelings of the people of New-England. Their controversies with him, and with other governors, proved, that they could never be enslaved, till their character was totally changed. Col. Shute arrived in Boston, October 5th, 1716, and was received with great parade. The summer following, he, with a number of the council from both provinces, met the Indians at Arrowsic Island, to confirm their friendship, to persuade them to relinquish popery, and embrace the protestant religion. He offered them an Indian bible, and a protestant missionary; they rejected both.

His controversy with the legislature.

Some time elapsed before the opposition usually displayed against royal governors showed itself; but, in 1720, the storm rose higher than it had for a number of years. The governor negatived the speaker, chosen by the house; they refused to choose another; he dissolved them. The flame of popular resentment blazed through the province. He revived the old controversy of a fixed salary, and met with the fate of his predecessors. But the people of New-Hampshire were satisfied with governor Shute's administration, and contributed more than their proportion towards his support. So strong was the tide of opposition at Boston, that the governor, in 1720, returned to England, and presented a variety of complaints against the house of representatives. Among other things, he complained, that they had usurped his right of appointing days of fasting and thanksgiving. The British ministry justified the governor, and the province was obliged to accept an explanatory charter, dated August 12th, 1724. This confirmed the right of the governor to negative the speaker, and forbid the house to adjourn for more than two days, without his consent.

Small pox first inoculation in America.

In 1721 the small pox was very mortal in Boston, and several adjacent towns. In Boston 5889 caught it, and 844 died. The Rev. Dr Cotton Mather had read of inoculation among the Turks. He recommended it to the physicians. Dr Boylston alone complied. He was first successful in his own family, and afterwards gave it to many others in the same way; but the business was, in general, very unpopular, and finally forbidden by the general court.

Indian war.

In the winter an unsuccessful attempt was made to seize Ralle, the French missionary at Norridgwag. This provoked the Indians to vengeance, and after various hostilities, they destroyed Brunswick. By these things the government was induced in 1722, to make another attempt upon Norridgwag. Captains Moulton and Harman of York, surprised the village, killed the Jesuit and about 80 Indians; rescued three prisoners, burned the wigwams, and chapel; and brought away the plate and furniture. The military spirit was roused, government offered £100 for every scalp; captain Lovewell of Dunstable became a daring adventurer. At one time he brought in ten scalps; but soon after fell in battle with more than a fourth part of his companions, near Winipisiokeepond.

Hutchinson.

After governor Shute's departure, lieutenant governor Dummer managed the affairs of Massachusetts, and Mr Wentworth those of New Hampshire. In 1724 fort Dummer was built in Hinsdale and the first settlement made in Vermont. (*See* Vermont.) At his decease, governor Dummer bequeathed a valuable estate in Byfield to that parish, towards supporting a grammar school. This is now Dummer Academy.

Burnet governor.

Upon the accession of George II. in 1727, Mr William Burnet, son to the good bishop of Sarum, was appointed governor of Massachusetts and New Hampshire. He had been popular as a governor of New York and New Jersey, and was received in Boston with great pomp, being met there by the lieutenant governor of New Hampshire, and a committee of the council and assembly. The government of New Hampshire gave him a fixed salary on certain conditions, but in Massachusetts there was soon a warm altercation between him and the general court on this subject. His nerves should have been "made of sterner stuff," to contend with Massachusetts. He was disappointed; he was depressed; he died in a few months. When the news of this reached England, the resentment there was so great,

His death.

that

New-England.

Belcher governor.

that a propofal was made of reducing the colony to abfolute dependence on the crown; but milder meafures prevailed, and Mr Jonathan Belcher, a native of the province, an only fon of a wealthy farmer, then a merchant in London, was appointed governor of Maffachufetts and New Hampfhire.

While thefe provinces were in a conftant ferment by their contentions with their governors, Connecticut and Rhode Ifland, under their ancient charter, enjoyed tranquillity, chofe their own rulers, and enacted their own laws. The altercations of Maffachufetts fanned the coals of independence, and finally produced the explofion which has forever feparated the two countries.

In Auguft 1730, Mr Belcher was received with great joy; like his predeceffors he propofed a fixed falary, like them he faw his propofal repelled with violence. He faw the caufe was defperate, and obtained leave from the Britifh court, to receive fuch fums as fhould be granted him. So terminated the long, the tedious conteft refpecting the governor's falary.

The divifional line in 1740, was finally determined by the lords of the council, between New Hampfhire and Maffachufetts. New Hampfhire obtained 14 miles in breadth, and about 50 in length, more than they had claimed. A party the following year oppofed Mr Belcher, and by their inceffant applications to the miniftry, by falfehood and forgery, they finally prevailed. He was fucceeded in New Hampfhire, by Benning Wentworth; in Maffachufetts by William Shirley. Mr Belcher repaired to court; demonftrated his own integrity and the bafenefs of his enemies, was appointed governor of New Jerfey, paffed a quiet life, and his memory has been treated with merited refpect.

Belknap.

Shirley governor.

Capture of Louifbourg.

In 1744, news of war with France and Spain being received, forces were raifed to attack Nova Scotia. Governor Shirley projected an invafion of Louifbourg, the *Dunkirk of America*. Its fortifications had employed French troops twenty-five years, and coft 30,000,000 livres. A majority of one, in the general court voted for the expedition. The land forces were commanded by colonel William Pepperell of Kittery; the Englifh fquadron by commodore Warren. The laft of April, the following year, the troops, 3800 in number, landed at Chapeaurogue Bay. The tranfports had been difcovered early in the morning from the town, which was the firft notice they had of the defign. In the night of May 2, 400 men burned the ware-houfes containing the naval ftores. The French were alarmed, fpiked their guns, flung their powder into a well, and abandoning the fort, fled to the city. The New England troops cheerfully fubmitted to extreme hardfhips; for 14 nights fucceffively, they were yoked together like oxen, dragging cannon and mortars, through a morafs of two miles. The commanding artillery of the enemy forbade this toil in the day. No people on earth perhaps, are more capable of fuch laborious and daring exploits, than the independent farmers of New England. On the 17th of June, the garrifon capitulated, but the flag of France was kept flying, which decoyed into the harbour, fhips of the enemy, to the value of £600,000 fterling. The weather, during the fiege, was fine, but the day following rains began, which continued 10 days, and muft have proved fatal to the provincial troops, had not the capitulation prevented. The good people of New England were deeply affected by this evident interpofition of divine providence.

New-England.

Threatened invafion of New-England by the French.

The next year, 1746, a French fleet failed to pour deftruction on New England. Twenty men of war, an hundred tranfports, eight thoufand veteran troops, made the country tremble. In their confternation they were difappointed of a fquadron of defence, from the mother country. God interpofed. A mortal ficknefs fpread through the fleet; a tempeft fcattered them; the commander, difappointed and mortified, poifoned himfelf, his fucceffor fell on his fword. Never was the hand of divine providence more vifible; never was a difappointment more fevere to the enemy; never a deliverance more complete without human aid, than this in favour of New England.

Belknap.

As the diftreffes of war ceafed, the people were alarmed in 1749, with the report of an American epifcopacy; but the defign was not executed. This year, Benning Wentworth made a grant of Bennington.

A congrefs convene at Albany.

In 1754 a congrefs met in Albany, confifting of delegates from New Hampfhire, Maffachufetts, Rhode Ifland, Connecticut, New York, Pennfylvania, and Maryland; but the plan of government they propofed was rejected, both in England and America. Had this inftrument been accepted the mind is loft in conjecturing what might have been the confequences. Perhaps the revolution of 1776, had been poftponed a long period; perhaps the millions and millions of the human race lately deftroyed in Europe, and Afia, by the demon of revolutionary madnefs, might have long furvived, to fwell the tide of human felicity.

Nova Scotia taken from the French.

Preparations were made, in 1755, to diflodge the French from Nova Scotia. Colonel Winflow raifed two thoufand men, but the command of the expedition was given to colonel Monkton. The French were fubdued. The inhabitants had taken the oath of allegiance to the Britifh crown, but were accufed of furnifhing fupport and intelligence to Indians and French in annoying the colonies, fome of them were in arms. It was determined to remove them; about two thoufand fouls were accordingly tranfported to New England. The cloud of their forrows was never difpelled; in a land of ftrangers they pined away and died. They were remarkable for the fimplicity of their manners, the ardor of their piety, and the purity of their morals.

Braddock's defeat.

General Braddock, with 2200 regular and provincial troops, marched this year for fort du Quefne, but fell into an ambufcade, and was fatally wounded, panic feized his regular troops, but colonel Wafhington, his aid-decamp, with his militia, covered their retreat, and faved the fhattered army.

Succefs of the Englifh arms.

In 1758, Louifbourgh, Frontenac, and Fort du Quefne, fubmitted to the Englifh, a fmall compenfation for more than 2000 men killed and wounded in the rafh and unfuccefsful attack upon Ticonderoga. Splendid were the victories of the year 1759. Niagara, Ticonderoga, Crown Point, and Quebec, fubmitted to the Englifh. At the taking of Quebec, Wolfe, the Britifh commander, after being wounded in the wrift, received a fatal ball in his breaft. Leaning on the fhoulder of a lieutenant; finking in the agonies of death, he heard a cry "they run." For a moment reviving, he afked who ran. It was anfwered "the French." He replied "I thank God I die happy," and expired. Montcalm, the French commander, alfo the fecond in command, was

Humphreys.

New-England.

was killed. Quebec surrendered, and the whole province was soon annexed to the British empire.

In 1762, Martinico, Grenada, St Vincents, and Havanna submitted: English valour was triumphant in every quarter of the globe; peace followed.

Commencement of the American Revolution.

It was now thought a proper time to tax America. The stamp act which passed in 1765, roused New England. Every mean was used to inform the mind, and kindle the passions. Massachusetts made the proposal, and a congress assembled. In Connecticut the people met; the stamp master resigned. The first of November, when the stamp act was to operate in Boston, the bells tolled, shops were shut, effigies of the royalists were carried about in derision, and torn to pieces. There was no violence to any person, no disorder. At Portsmouth the bells tolled; a coffin was prepared; on the lid was inscribed, "Liberty, aged 145;" a procession moved with unbraced drums; minute guns were fired; an oration was delivered at the grave. At the close, the coffin was taken up, signs of life appeared in the corpse; "Liberty revived," was substituted; the bells struck a cheerful key; joy sparkled in every countenance. All was decency and order. At Rhode Island the day passed in a similar manner. In March 1766, the obnoxious act was repealed; ships in the Thames displayed their colours; houses were illuminated through the city of London; the colonies rejoiced in their deliverance.

Stamp act.

The limits of this article, prevent a detail of the various events, which produced the revolutionary war, and the independence of the United States. We only observe that new duties on various articles, the sending of troops to Boston; the firing of the guard, after they had been highly provoked, which was called a massacre; the shutting up of the port of Boston, &c. again fired the indignation of the country. Votes of legislatures, committees of correspondence, liberty poles in towns and villages, displayed the resolute zeal of the people to defend their rights.

War commenced.

In the night of April 18th, 1775, Gen. Gage sent 800 troops to destroy the stores at Concord. At eleven o'clock they embarked at Boston common, and landed at Phip's farm with all possible stillness. But so watchful were the people; so alive to every motion of the British troops, that nothing could be obtained by stratagem. News was instantly carried to Concord, and the country was alarmed. By two in the morning, 130 of the Lexington militia had assembled to oppose them. Between 4 and 5 o'clock, the enemy appeared. Major Pitcairn, rode up, ordered the militia to disperse, fired his pistol and ordered his men to fire. Some were killed, several returned the fire; but the British proceeded to Concord, and executed their commission. There they fired upon major Butterick; he returned the fire, and the British soon began their retreat to Boston. The Americans closely followed, firing from fences and walls. At Lexington, Lord Percy met them with 900 men. These having two pieces of cannon, kept their pursuers a greater distance. Before dark they reached Bunker-Hill, having travelled that day between 30 and 40 miles. The next day they returned to Boston. Sixty-five of their number had been killed, 180 wounded, 28 taken prisoners. The Americans had 50 killed, 38 wounded, and missing. The provincial congress then sitting, voted an army of 30,000 men; 13,600 to be from their own province. They sent to the other New England colonies, an army of 20,000 men instantly invested Boston, under the command of general Ward. Soon were these joined by a large body from Connecticut, under General Putnam, whose name was then a host. The continental congress resolved then to organize an army, and recommend a general fast. The clergy, in their sermons and prayers consecrated the cause, and kept alive the ardour of the people. Colonel Arnold sent from Connecticut, being joined by colonel Allen, May 10th, took Ticonderoga, and Crown Point, with all their military stores.

Battle at Lexington.

An army raised.

Bunker hill battle.

On the night of June 16, 1775, general Putnam with a thousand men, took possession of Breed's Hill (erroneously called Bunker's.) They laboured with such diligence and ardour, that by the dawn of light, they had thrown up a redoubt, of 8 rods square. As soon as the British ships discovered them in the morning they began a heavy fire, which was supported by a fort on Cop's hill in Boston. An incessant storm of balls and bombs, was poured on this handful of farmers, the greater part of whom had probably never heard the roar of artillery before. Diligently they continued their work, and had almost completed a breastwork to the water eastward; when the firing became intolerable. They had been laborious through the night; they had not been relieved, nor supplied with refreshment. In this exhausted situation, they were destined to meet the fury of British valor. A little after noon boats and barges filled with 3,000 veterans, the flower of the royal army, landed in Charlestown. Generals Howe, and Pigot, commanded. Bourgoyne and Clinton stood watchful on Cop's hill. British troops and citizens of Boston, crowded their roofs and steeples to witness the dubious conflict. The American army and the country people, thronged the surrounding hills. The fleet, as well as the camps gazed at the opening scene. The king's troops deliberately advanced, that their artillery might demolish the new raised works. Charlestown was now set on fire, by order of the British commander, and immediately 400 houses were in a blaze. The lofty steeple of the meeting house, formed a pyramid of flame, magnificent and awful, in view of many thousand anxious spectators. The slow approach of the enemy, gave time to assume greater presence of mind. In this crisis Putnam made an harangue. He reminded them "that they were all marksmen; and could bring a squirrel from the highest tree." He charged them "to be cool and reserve their fire till the enemy were near; till they could see the white of their eyes." They obeyed. At the distance of ten rods, they began a furious discharge of small arms. The British, whose ranks were thinned, retreated with precipitation. Again Putnam addressed his men. He told them "they had done well, and would do much better, and directed them to aim at the officers." The British returned. The fire was terrible. Their officers exclaimed, "it is downright butchery to lead the men against the lines." In telling the story, "My God," said Putnam, "I never saw such carnage of the human race." At the next assault, the enemy receiving new strength by the arrival of general Clinton; the cannonade from the ships, the batteries of Boston, and the field artillery increasing its fury, and the powder of the Americans failing, a retreat was ordered. Fifteen hundred Americans were engaged; seventy-seven were killed, among whom was the brave general Warren,

See note in Rev. Mr Parish's sermon on the death of general Washington.

Warren, a volunteer in the action; 278 were wounded and miffing. The Britifh loft one thoufand and fifty-four killed; of whom 19 were commiffioned officers.—A greater number than they loft at the battle of Quebec, which gave them the province of Canada; a proof that Putnam's orders were not difregarded.

Falmouth burnt.

The people of Falmouth, now Portland, violently oppofing the loading of a maft fhip, captain Mowat received orders to burn the town. Privateers at this time were fuccefsful. Captain Manley brought in a veffel loaded with military ftores, valued at £50,000. This fummer a detachment was fent from Cambridge to Quebec, under the command of colonel Arnold; they afcended the Kennebec, and had a difmal march thence into Canada. Many of the men became fickly; one third were difcouraged and returned; thofe who bravely perfevered were compelled to eat their dogs, their fhoes, and even their cartouch boxes. In thirty one days they again found inhabitants. They joined general Montgomery, and with him fcaled the walls of Quebec. American valor was unfuccefsful. The brave Montgomery fell; Arnold was wounded; one hundred men were killed or wounded, three hundred taken prifoners. Thefe general Carlton treated with the moft delicate humanity, as he always did his prifoners.

Expedition to Canada.

Bofton evacuated.

On the night of March 4th, 1776, works were raifed on the hills of Dorchefter, twelve hundred men were employed, and two hundred teams. So prodigious were their labours that in the morning, the whole feemed to the Britifh "like enchantment and invifible agency." General Howe was feized with confternation. In vaft confufion and hurry Bofton was evacuated.

Of affairs in the north.

In 1777, aftonifhment and terror fpread through New England by the flight of St Clair from Ticonderoga. The rear of his army was attacked at Hubberton, a few miles from Lake George. The brave col. Francis of Beverly fell, with a number of his men. General St Clair was at Caftleton within hearing of the mufquetry, but though his officers entreated with tears, that they might return to fuccour their brethren, he forbade them. General Stark turned the alarming tide of affairs by his gallant action at Bennington. He routed colonel Baum, and killed or wounded a great part of his detachment. This kindled new courage through the Eaftern States. It was the firft ftep to the capture of Bourgoyne, which procured us fuccour in Europe, and infured the independence of the country. This year Vermont declared itfelf a fovereign ftate.

Sullivan's unfuccefsful expedition againft Rhode-Ifland.

Five hundred Britifh and Heffian troops burned the meeting houfe in Warren (Rhode-Ifland,) the church in Briftol, and a number of houfes in each town in 1778. Newport was foon threatened by land and fea. General Sullivan paffed to the ifland with ten thoufand troops in high fpirits, and nothing forbid the conqueft of the Britifh, who took poffeffion of this ifland in 1776, but a failure of aid from the French fleet. This brought on them many execrations in New England. General Pigot, the Britifh commander, had fo placed himfelf, that a fleet was neceffary to attack them with hope of fuccefs. After an action, fupported with fpirit, Sullivan left the ifland with the lofs of 2 or 300 men.

Tryon's expedition into Connecticut.

In the fummer of 1779, governor Tryon landed at New-Haven and plundered the town, proceeding by water burned Fairfield; continuing the work of deftruction he burned part of Greens Farms, and the pleafant town of Norwalk.

American Academy incorporated.

On the 4th of May 1780, the American Academy of Arts and Sciences, now one of the moft refpectable literary focieties in America, was incorporated by the general court of Maffachufetts.

New London burnt.

Early in the morning of September 6th, 1781, general Arnold landed a detachment of troops on Groton Point, and proceeded up to New London with his fleet. He fet fire to the town, and immediately 60 houfes and 84 ftores were deftroyed, without oppofition. But the party at Groton found more bloody work. The men in Fort Grifwold, who had haftened there in the morning, from the neighbourhood, defended themfelves to the laft extremity. The Britifh finally entered the fort, fword in hand, and killed every man they found. Col. Ledyard refigning his fword, the officer plunged it into his heart. One man efcaped by concealing himfelf in the magazine, another by climbing up a chimney in the barrack; one or two, who fell wounded among the flain; recovered. Awful was this day to Groton. The compact part of the town was in afhes; feventy of her valuable citizens, who in the morning rufhed to arms, lay dead in the fort; they were conveyed to their families for interment. Peace between the belligerent powers, put an end to thefe bloody fcenes in 1783.

In 1784, New Hampfhire eftablifhed a conftitution of civil government, as Maffachufetts had done in 1780. Connecticut, and Rhode Ifland, continued their ancient conftitutions, and experienced no fenfible change by the revolution.

Infurrection in Maffachufetts.

Owing to their embarraffed circumftances, from the decay of trade, the lofs of public credit, the weight of public and private debts, in the fall of 1786, the three eaftern counties of Maffachufetts obftructed the judicial courts; but were foon brought to fubmiffion, and are now very generally among the zealous friends of good government.

Federal conftitution.

The next year the federal conftitution was formed, and afterwards adopted by all the ftates of New England; who with the other parts of the union, have liberally fhared the bleffings of that event, in the revival of commerce, and public credit, the increafe of wealth, the promotion of the liberal arts, and all that exalts or adorns civil fociety; long may thefe enterprifing States remain folid pillars in the federal edifice; and long maintain the pure morals, the ferious religion and wife inftitutions of their pious forefathers.

New-England is a country which prefents to the traveller all the varieties of furface which can be found. There is a plain of great extent in the foutheaftern part of Maffachufetts. Extenfive plains are alfo fpread through a confiderable part of the counties of York and Cumberland, and along the Merrimack through the interior of New Hampfhire. Many others not inconfiderable exift in other places. Vallies of every fize, from the great Connecticut valley to the little bafon, conftitute of courfe no inconfiderable part of a country which is fo generally undulating, and whofe hills are a proverbial defcription of its furface. Connecticut valley extends from Saybrook to the Canada line, and is not far from three hundred miles in length. Its breadth varies from half a mile to twenty miles, and is charmingly diverfified by the intrufion of numerous

New-England.

rous spurs from the two great ranges of mountains which form its eastern and western boundaries.

The mountains in New-England are either long ranges or separate eminences. The westernmost range begins in the county of Fairfield, and, passing through the counties of Litchfield and Berkshire, may be said to unite with the Green Mountains at Williamstown, in the northwest corner of Massachusetts; being there separated only by the narrow valley of Hoosac river. The highest part of this range is Toghkonnuck mountain in Egremont, the southwestern corner of the same state. Over this mountain, which is probably elevated more than 3000 feet above the ocean, runs the boundary between Massachusetts, Connecticut, and New York. This range, hitherto known by no appropriate name, may with propriety be called *Toghkonnuck Range*.

The second range is that of the *Green Mountains*. The eastern front of this range begins at New Haven, in a noble bluff called West Rock, and extends thence, to the Canada line; sloping however with a very gradual declension, in the northern parts of Vermont; and in Canada becoming merely a collection of small hills. The two highest summits of this range are the Camel's Rump, (so called from its strong resemblance to the back of that animal) and the mountain of Mansfield, both in Vermont, in the county of Chittenden: These are very lofty, several thousand feet above the ocean. The third range begins also at New Haven in another very delightful eminence, called the East-Rock; and, passing through the counties of New Haven, Hartford, and Hampshire, extends into Canada, through the whole length of the state of New Hampshire. The Blue Hills in Southington, Mount Tom, Mount Holyoke, in the vicinity of Northampton and Hadley, and Mount Toby, in Sunderland, are the principal summits of this range south of New Hampshire. This range although less lofty than the highest parts of the two former, is yet more precipitous and romantic than either. It crosses Connecticut river just below Northampton and Hadley in Massachusetts. No mountains in New England present, from their summits, so delightful views as are furnished by various eminences of this range. This may be advantageously termed *The range of Mount Tom*, which is the principal eminence.

The south or eastern range is less distinctly marked; it begins at Lyme, in Connecticut, and forms the eastern boundary of the Connecticut valley, until it unites with the last mentioned range in the county of Hampshire. It has no very remarkable eminences.

Of single mountains, the highest, in Massachusetts, is Saddle mountain, in the towns of Adams and Williamstown, so called from its striking resemblance to that piece of furniture. This mountain is computed to be little less than 4000 feet above the surface of the ocean. Its southern point is the highest land in Massachusetts. Watchusett is a lofty hill in Princeton, in the county of Worcester. Aschutney is a noble single hill in Windsor, in the state of Vermont. Monadnock is a very lofty conical mountain in Jaffrey, New Hampshire. The White Mountains in New Hampshire are a round clump with numerous summits, of which *Mount Washington*, is far the highest; being probably between ten and eleven thousand feet above the surface of the ocean; and much the highest land in the United States. Nothing can be more majestic than the appearance of this mountain; it is covered a great part of the year, with snow, and in this state is seen ninety miles at sea, in fair weather, and one hundred and sixty from its base. The mountains called Moosehillock, or Moosheelock and Ossipee, are short ranges in New Hampshire, of very considerable height, and very respectable appearance; as are those called Pondicherry, (vulgarly Cherry) a lofty range of the White Mountains, on the northwest; though these last may be considered as a continuation of the range of Mount Tom.

New England abounds in cataracts and cascades, alternately of great beauty and grandeur; of the first of these, the Connecticut, Housatonic, or Hooestonnuc, Onion, Saco, Kennebec, and Penobscot furnish a great number, as do also several smaller rivers. The cascades of the White Mountains are perhaps unrivalled in their romantic beauty.

Precipices of great wildness and grandeur, are presented by very many of these mountains. The southwestern side of the summit of Mount Washington, particularly, which is a perpendicular descent of vast extent, and is superlatively majestic and awful. Of softer or more elegant scenery, few countries furnish so many or so exquisite varieties as New England. The fine intervals which border its numerous streams, particularly the noble ones on the Connecticut, are among the most finished beauties of the landscape. To complete the picture, the native and universal verdure which clothes the lean and dry, as well as the rich and moist part, gives an unrivalled cheerfulness to the whole country.

New England has a very healthful climate, as is evinced by the longevity of the inhabitants. It is estimated that about one in seven of the inhabitants live to the age of 70 years; and about one in thirteen or fourteen to 80 years and upwards.

North-west, west, and south-west winds are the most prevalent. East and north-east winds, which are unelastic and disagreeable, are frequent at certain seasons of the year particularly in April and May, on the sea-coasts. The weather is less variable than in the middle and especially the southern states, and more so than in Canada. The extremes of heat and cold, according to Farenheit's thermometer are from 20° below to 100° above 0. The medium is from 48° to 50°. The inhabitants of New England, on account of the dryness of their atmosphere, can endure without inconvenience, a greater degree of heat than the inhabitants of a moister climate. It is supposed by some philosophers, that the difference of moisture in the atmosphere in Pennsylvania and New England is such as that a person might bear at least ten degrees of heat more in the latter than in the former.

The quantity of water which annually falls in England is computed at 24 inches; in New-England, from 42 to 48; and yet in the latter they suffer more from drought than in the former. These facts evince the remarkable dryness of the atmosphere, in this eastern division of the United States, and in part account for its singular healthfulness. Winter commonly commence, in its severity, about the middle of December; sometimes earlier, and sometimes not till Christmas. Cattle are fed or housed, in the northern parts of New-England, from about the 20th of November to the 20th of May; in the southern part not quite so long. There

New-England. have been frosts in every month in the year, though not in the same year; but not very injurious.

The diseases most prevalent in New-England are the following, viz.

Alvine fluxes	Inflammatory	Fevers.
St. Anthony's Fire	Slow nervous, and	
Asthma	Mixed	
Atrophy	Pulmonary Consumption	
Catarrh	Quinsy	
Colic	Rheumatism.	

Of these disorders, the pulmonary consumption is much the most destructive, and is commonly the effect of imprudent exposures to cold and rainy weather, and the night air with the same quantity of clothing, and the wearing of damp linen; and among the lowest order of people, from the intemperate use of strong liquors, especially of fresh distilled rum, which, in too many instances, proves the bane of morals, and the ruin of families.

The small pox, which is a specific, infectious disease, is not allowed at present to be communicated by inoculation, except in hospitals erected for the purpose, in bye places, and in cases where there is a probability of a general spread of the infection in a town. Nor is this disease permitted to be communicated generally by inoculation, in any of the United States, except New-York, New-Jersey, Pennsylvania, Delaware and South Carolina.

In populous towns, the prevalent diseases are more numerous and complicated, owing to want of fresh air and exercise, and to luxurious and fashionable living.

In these northern latitudes, the prevalent disorders among the males of the winter months are *inflammatory*. Both men and women suffer from not adopting a warmer method of clothing.

On Lake Champlain, and some other waters, and where running streams have been converted into nearly stagnant ponds, intermittents frequently prevail. But this disease is seldom known within 30 or 40 miles of the sea coast. In some of the elevated parts of Vermont, and in a few places in the western parts of New-Hampshire, children, women, and some men of delicate constitutions, are affected with swellings on the throat. This effect is ascribed to their drinking brook and river water. Boston, Providence, Newburyport, and a few other places on the sea coast, and in the interior country, have been visited with the yellow fever.

A late writer (A) has observed, that "in other countries, men are divided according to their wealth or indigence, into three classes; the opulent, the middling, and the poor; the idleness, luxuries and debaucheries of the first, and the misery and too frequent intemperance of the last, destroy the greater proportion of these two. The intermediate class is below those indulgencies which prove fatal to the rich, and above those sufferings to which the unfortunate poor fall victims: this is therefore the happiest division of the three. Of the rich and poor, the American Republic furnishes a much smaller proportion than any other district of the known world. In Connecticut particularly, the distribution of wealth and its concomitants is more equal than elsewhere, and therefore, as far as excess or want of wealth may prove destructive or salutary to life, the inhabitants of this state may plead exemption from diseases."— What this writer says of Connecticut in particular, will, with very few exceptions, apply to New-England at large.

Soil. The soil of New-England is diversified by every variety, from a lean and barren sand, to the richest clays and loams. The first great division of soil is a brown loam every where mixed with gravel. With this the hills, which constitute a great proportion of the whole surface, are universally covered. This soil is always favourable to the production of grass, and in the western parts of the country (when not too moist) of wheat and all other kinds of grain, and of every kind of fruit suited to the climate. Maize, or Indian corn, grows well, even on the wet grounds, where this soil exists.

Clayey soils are more rarely found, and are also very productive, especially when manured. A rich loam, varying towards clay, begins at Guilford and Branford in Connecticut, and spreads through the whole breadth of that state, terminating in West Springfield. The same soil prevails also in Salisbury and Sharon, and covers about one quarter of the western half of Connecticut. This soil, wherever it exists, is favourable to every kind of cultivation, and is surpassed in goodness by no land in this country.

Sand prevails very commonly on the plains, and abounds in the south eastern part of Massachusetts, in the old colony of Plymouth. The yellow pine plains are commonly a mixture of sand and gravel; are light and warm, and friendly to every production which does not demand a richer soil. The white pine plains are usually covered with loam, as are some of the yellow pine plains, and are not unfrequently fertile. The vallies, almost without exception, are a rich mould, and friendly to every growth of the climate.

The intervals, which border the various streams, are usually lands formed by earth deposited by the floods (or, as they are called, freshets) in the spring, and are of the richest quality. Marshes, except of trifling extent, are rare. The most considerable are around New-Haven, and along the eastern coast of Massachusetts and New-Hampshire.

Rivers. The principal rivers of New-England are the Schoduc, Penobscot, Kennebec, Amariscoggin, Saco, Piscataqua, Merrimack, Parkers, Charles, Taunton, Providence, Thames, Connecticut, Hooestonnuc, or Stratford, Onion, La Moille, and Missiscoui. Penobscot, Kennebec, Merrimac and Connecticut are the largest.

Innumerable smaller rivers divide the country in every direction, enrich the soil, adorn the landscape, and furnish mill seats to almost every village. Windmills are erected in very few places. The principal rivers will be described under their proper heads.

Lakes, Ponds and Harbours. The principal lakes are Champlaine and Memphremagog, lying partly in Vermont and partly in New-York; Winnipiseogee and Umbagog, in New-Hampshire; Sebago, Moosehead, Willeguenguagun, and Chilmacook or Grand Lake, in Maine. Small lakes, commonly

(A) Dr Foolke, in a discourse read before the American Philosophical Society.

commonly called ponds, of every fize, are fcattered throughout the country. Springs and fmall brooks water almoft every farm.

Harbours abound in Maine and Maffachufetts. The moft ufeful ones at prefent, are thofe of Machias, Frenchman's Bay, Wifcaffet, Portland, and Wells, in Maine; Pifcataqua, in New-Hampfhire; Newburyport, Salem, Marblehead, Bofton, Province Town, and New Bedford, in Maffachufetts proper; Newport, Briftol, and Providence, in Rhode-Ifland; and New London, New-Haven, and Black Rock in Fairfield, in Connecticut. Burlington Bay is the moft confiderable harbour in Lake Champlaine, on the Vermont fhore.

Productions.

The produce of the fields in New-England is of every kind fuited to the climate. In the weftern half, and in various parts of the eaftern, wheat, before the ravages of the Heffian fly, grew abundantly; but that infect has not a little difcouraged the culture of this grain. Indian corn is a moft abundant and ufeful grain, furnifhing a very healthful and pleafing food to the inhabitants, and yielding alfo the beft means of fattening their numerous herds of cattle and fwine. The kind, frequently called fweet-corn, is perhaps the moft delicious of all culinary vegetables, if eaten young, and one of the moft falubrious. The juice of the corn-ftalk yields a rich molaffes, and a fpirit not inferior to that of the fugar cane. No cultivated vegetable makes fo noble an appearance in the field.—Fruits of every kind, which fuit a temperate climate, abound, or may be eafily made to abound here. The heat of the fummer brings to high perfection the peach, apricot, and nectarine. The orchards of apple-trees cover a confiderable part of the whole country, except the new fettlements. Cider is the common drink of the inhabitants of every clafs, and may often be obtained, in the interior country, by paying for the labour of gathering the apples and making the cider. Pears, plums, cherries, currants, goofeberries, whortleberries, blackberries, bilberries, &c. abound. Perry is made in fome parts of the country, but not in great quantities. Butternuts, fhagbarks, and various other fruits of the different fpecies of the hickory and hazle-nuts, are plentifully furnifhed by the fouthern half of New-England. Madeira nuts and black walnuts are rarely cultivated, although the laft grow very eafily and rapidly. Hortuline productions are alfo abundant, of every kind found in this climate, and grow with very little care or culture. Gardening is much improved, and ftill advancing; many good gardens are feen in almoft every quarter of New-England. But the moft important production of New England is grafs. This not only adorns the face of the country, with a beauty unrivalled in the new world, but alfo furnifhes more wealth and property to its inhabitants than any other kind of vegetation. A farm of two hundred acres of the beft grazing land, is worth, to the occupier, as much as a farm of three hundred acres of the beft tillage land. The reafon is obvious. Far lefs labour is neceffary to gather the produce, and convey it to market.

The beef and pork of New England are abundant and excellent, and feed the inhabitants of many other countries. The mutton is alfo exquifite, when well fed, and of the proper age; but it muft be confeffed, that, except in a part of the eaftern half of this country, it is very often brought to market too young and indifferently fed, to the injury of both the farmer and the confumer. The lamb is univerfally fine, but is moft excellent in the ftates of New-Hampfhire and Vermont; and particularly in the parts of thefe ftates which border on Connecticut river. A great difcouragement to the raifing of fheep, exifts in a kind of enclofure which is extenfive, the ftone wall: over this wall fheep pafs with great eafe, and cannot, without much difficulty and labour, be prevented from intruding into all the parts of a farm, wherever this kind of fence is in ufe. This evil, which is not a fmall one, will, however, be probably removed by increafing the new breed of fheep, called the *Otter breed*. Thefe fheep, which, it is faid, began in an extraordinary manner, at Mendon, in Maffachufetts (of which a fufficiently correct account to be inferted here has not been received), have legs fomewhat refembling thofe of a hare; and while they are not inferior to the common breed, in flefh or wool, are unable to climb any fence; a circumftance which, in New-England, confers on them a peculiar value.—The wool of the New-England fheep is of a good ftaple, and may be improved (as it often has been by attentive farmers) to a high, but indefinite degree. The beft wool, and the beft mutton alfo are furnifhed by fhort and fweet paftures, and in dry feafons.

The veal of New-England is extremely rich and fine when well fed, as it is to a great extent.

Butter and cheefe, in this country, are made in vaft quantities, and of various goodnefs. The butter is very generally excellent, but is ftill very commonly rendered fenfibly worfe in the firkin, by the imperfect manner in which it is prepared. A great quantity of ordinary cheefe is fhipped yearly, to the difadvantage of both the maker and the merchant. There is alfo a great quantity of cheefe of a fuperior quality made throughout the country. The dairies in Pomfret and Brooklyn, and a few of the neighbouring towns in the eaftern part of Connecticut, are probably more generally of the firft clafs, than in any other quarter.

Forefts.

Of the forefts of New-England, and not improbably of the world, the white pine is the firft ornament: The greateft diameter of this extraordinary tree does not exceed fix feet, but its height, in fome inftances, exceeds two hundred and fixty. This vaft ftem is often exactly ftraight, and tapering, and without a limb, to the height of more than one hundred and fifty feet. The colour and form of the foliage are exquifite; and the whole crown is noble beyond any thing of this kind, and perfectly fuited to the ftem which it adorns. The murmurs of the wind in a grove of white pines, is one of the firft poetical objects in the field of nature. This tree is of vaft importance for building. The white oak of New-England is a noble and moft ufeful tree. It is lefs enduring than the live, or the Englifh oak; but the early decay of fhips, built of the white oak, fo generally complained of, is lefs owing to the nature of the tree, than to the hafte and careleffnefs of the builders.—When the timber has been well felected and feafoned, fhips formed of this material, have come near to the age of thofe built of the Englifh oak. The chefnut is alfo of incalculable importance as a mater[illegible] the conftruction of buildings, and for fencing. [illegible] e com-p[illegible]fed of good rails of this tree, will [illegible] y or eighty years. The chefnut is very [illegible] ugh-out the fouthern half of New Eng[illegible] no-

 [illegible]alls

New-England.

small value, on account of the nourishment it affords to swine during their growth.

The country likewise abounds in a very great variety of flowering shrubs and plants, many of which are not only beautiful but highly useful.

Population and character.

New-England is the most populous part of the United States. It contained, in 1790, 1,009,522 souls, and in 1800, 1,233,011. The great body of these are landholders and cultivators of the soil. As they possess, in fee simple, the farms which they cultivate, they are naturally all attached to their country; the cultivation of the soil makes them robust and healthy, and enables them to defend it.

New-England may, with propriety, be called a nursery of men, whence are annually transplanted, into other parts of the United States, thousands of its natives. Vast numbers of them, since the war, have emigrated into the northern parts of New-York, into Canada, Kentucky, the Western Territory, and Georgia; and indeed into every state, and every town of note in the Union.

The inhabitants of New-England are almost universally of English descent; and it is owing to this circumstance, and to the great and general attention that has been paid to education, that the English language has been preserved among them so free from corruption.

The New-Englanders are generally tall, stout, and well built. Their education, laws and situation, serve to inspire them with high notions of liberty. Their jealousy is awakened at the first motion towards an invasion of their rights. They are indeed often jealous to excess; a circumstance which is a fruitful source of imaginary grievances, and of groundless suspicions and complaints against government. But these ebullitions of jealousy, though censurable, and productive of some political evils, shew that the essence of true liberty exists in New-England; for watchfulness is a guardian of liberty, and a characteristic of free republicans. A chief foundation of freedom in the New-England states, is a law by which intestate estates descend to all the children, or other heirs, in equal proportions. In consequence of these laws, the people of New-England enjoy an equality of condition unknown in any other part of the world: And it is in this way that the people have preserved that happy mediocrity among themselves, which, by inducing economy and industry, removes from them temptations to luxury, and forms them to habits of sobriety and temperance. At the same time, their industry and frugality exempt them from want, and from the necessity of submitting to any encroachments on their liberties.

In New-England, learning is more generally diffused among all ranks of people than in any other part of the United States; a fact arising from the excellent establishment of schools in every town.

In these schools, which are generally supported by a public tax, and under the direction of a school committee, are taught the elements of reading, writing and arithmetic; and in the more wealthy towns, they are beginning to introduce the higher branches of grammar, geography, &c.

New-England.

A very valuable source of information to the people is the newspapers, of which not less than 30,000 are printed every week in New-England, and circulated in almost every town and village in the country. (A)

A person of mature age, who cannot both read and write, is rarely to be found. By means of this general establishment of schools, the extensive circulation of newspapers, and the consequent diffusion of learning, every township throughout the country is furnished with men capable of conducting the affairs of their town with judgment and discretion: These men are the channels of political information to the lower class of people, if such a class may be said to exist in New-England, where every man thinks himself at least as good as his neighbour. The people, from their childhood, form habits of canvassing public affairs, and commence politicians. This naturally leads them to be very inquisitive. It is with knowledge as with riches, the more a man has, the more he wishes to obtain; his desire has no bound. This desire after knowledge, in a greater or less degree, prevails throughout all classes of people in New-England; and, from their various modes of expressing it, some of which are blunt and familiar, bordering on impertinence, strangers have been induced to mention *impertinent inquisitiveness* as a distinguishing characteristic of New-England people. But this inquisitiveness is rarely troublesome, and generally pleasing. The common people in New-England are outdone by no common people in the world, in civility to strangers.

Before the late war, which introduced into New-England a flood of corruptions, together with many improvements, the Sabbath was observed with great strictness; no unnecessary travelling, no secular business, no visiting, no diversions were permitted on that sacred day. The people considered it as consecrated to divine worship, and were generally punctual and serious in their attendance upon it. Their laws were strict in guarding the Sabbath against every innovation. The supposed severity with which these laws were composed and executed, together with some other traits in their religious character, have acquired for the New-Englanders the name of a superstitious, bigotted people. But all persons are called superstitious by those less conscientious, and less disposed to regard religion with reverence, than themselves. Since the war, a catholic, tolerant spirit, occasioned by a more enlarged intercourse with mankind, has greatly increased, and is becoming universal: And if they do not go beyond the proper bound, and liberalize away all true religion, of which there is very great danger, they will counteract that strong propensity in human nature, which leads men to vibrate from one extreme to its opposite.

There is one distinguishing characteristic in the religious character of this people, which we must not omit to mention; and that is, the custom of annually celebrating fasts and thanksgivings. In the spring, the

(A) In 1798, there were one hundred and twenty different newspapers printed in the United States, many of them daily papers, and more printed twice a week. In 1788, it was estimated, that no less than *four millions* of newspapers were circulated through the country every year. They have probably nearly doubled since.

the governors of the ſeveral New-England ſtates, except Rhode Iſland, iſſue their proclamations, appointing a day to be religiouſly obſerved in faſting, humiliation and prayer, throughout their reſpective ſtates; in which the predominating vices, that particularly call for humiliation, are enumerated. In autumn, after harveſt, that gladſome era in the huſbandman's life, the governors again iſſue their proclamations, appointing a day of public thankſgiving, enumerating the public bleſſings received in the courſe of the foregoing year.

This pious cuſtom originated with their venerable anceſtors, the firſt ſettlers of New-England; and has been handed down as ſacred, through the ſucceſſive generations of their poſterity. A cuſtom ſo rational, and ſo happily calculated to cheriſh in the minds of the people, a ſenſe of their dependence on the GREAT BENEFACTOR of the world for all their bleſſings, it is hoped will ever be ſacredly preſerved.

The people of New England generally obtain their eſtates by hard and perſevering labour: they of conſequence know their value, and are frugal. Yet in no country do the indigent and unfortunate fare better. Their laws oblige every town to provide a competent maintenance for their poor, and the neceſſitous ſtranger is protected and relieved by their humane inſtitutions. It may in truth be ſaid, that in no part of the world are the people happier, better furniſhed with the neceſſaries and conveniences of life, or more independent than the farmers in New England. As the great body of the people are hardy, independent freeholders, their manners are, as they ought to be, congenial to their employment, plain, ſimple, and manly. Strangers are received and entertained among them with a great deal of artleſs ſincerity, and friendly, plain hoſpitality. Their children, thoſe imitative creatures, to whoſe education particular attention is paid, early imbibe the manners and habits of thoſe around them; and the ſtranger, with pleaſure, notices the honeſt and decent reſpect that is paid him by the children as he paſſes through the country.

As the people, by repreſentation, make their own laws and appoint their own officers, they cannot be oppreſſed; and, living under governments which have few lucrative places, they have few motives to bribery, corrupt canvaſſings, or intrigue. Real abilities and a moral character unblemiſhed, are the qualifications requiſite in the view of moſt people, for officers of public truſt. The expreſſion of a wiſh to be promoted, was, and is ſtill, in ſome parts of New England, the direct way to be diſappointed.

The inhabitants are generally fond of the arts and ſciences, and have cultivated them with great ſucceſs. Their colleges have flouriſhed. The illuſtrious characters they have produced, who have diſtinguiſhed themſelves in politics, law, divinity, the mathematics and philoſophy, natural and civil hiſtory, and in the fine arts, particularly in poetry and painting, evince the truth of theſe obſervations.

Many of the women in New England are handſome. They generally have fair, freſh and healthful countenances, mingled with much female ſoftneſs and delicacy. Thoſe who have had the advantages of a good education, and they are numerous, are genteel, eaſy, and agreeable in their manners, and are ſprightly and ſenſible in converſation. They are early taught to manage domeſtic concerns with neatneſs and economy. Ladies of the firſt diſtinction and fortune, make it a part of their daily buſineſs to ſuperintend the affairs of the family. Employment at the needle, in cookery, and at the ſpinning wheel, with them is honourable. Idleneſs, even in thoſe of independent fortunes, is univerſally diſreputable. The women in country towns, manufacture the greater part of the clothing of their families. Their linen and woollen cloths are ſtrong and decent. Their butter and cheeſe is not inferior to any in the world.

Among the amuſements of the people of New England is dancing, of which the young people of both ſexes are extremely fond. Gaming is practiſed by none but thoſe who cannot, or rather will not, find a *reputable* employment. The gameſter, the horſe-jockey, and the knave, are equally deſpiſed, and their company is avoided by all who would ſuſtain fair and irreproachable characters.

The athletic and healthy diverſions of cricket, foot-ball, quoits, wreſtling, jumping, hopping, foot races, and priſon baſs are univerſally practiſed in the country, and ſome of them in the moſt populous places, and by people of almoſt all ranks.

In New England there are eight colleges, 1 in Connecticut, 1 in Rhode-Iſland, 2 in Maſſachuſetts, 1 in Maine, 1 in New Hampſhire, 2 in Vermont, containing, in the whole about a thouſand ſtudents, and the number is annually increaſing. There are about three times the number of reſpectable academies, ſcattered at convenient diſtances, through the country, containing not leſs than two thouſand ſcholars, and a great number of grammar ſchools, in which the dead languages are taught; beſides common *free ſchools* already mentioned, in every village and neighbourhood in New England.

For promoting general ſcience, there have been inſtituted the American academy of arts and ſciences, and the Maſſachuſetts hiſtorical ſociety at Boſton, and the Connecticut academy of arts and ſciences, at New Haven. For the advancement of agricultural knowledge, ſeveral ſocieties have been eſtabliſhed, and many others have been formed for various charitable and humane purpoſes.

The people of New England are Proteſtant chriſtians, excepting a few Jews, who have a ſynagogue in Newport, and a ſmall ſociety of Roman Catholics, in Boſton. The Proteſtants are divided into congregationaliſts, which is the prevailing denomination, Epiſcopalians, Baptiſts, Friends or Quakers, Methodiſts, and a few Univerſaliſts. As in other parts of the United States, ſo in the part we are deſcribing, there are numbers who have their religion yet to chooſe.—They have *liberty*, but no *religion*.

The clergy of New England are a numerous body of men, and, generally ſpeaking, are reſpectable for their piety, pure morals, learning and uſeful induſtry, and live in great harmony and affection with their people. The cauſe of general literature is much indebted to their labours. Probably eight tenths of the publications, in New England from its firſt ſettlement, have been from the pens of the Clergy.

The number and pious exertions, of miſſionary ſocieties of which ſeven or eight are inſtituted in the differ-

New-England, ‖ New Gottingen

ent States, some of them patronized by the government, do honour to the religious character of New England. At the expense, and under the direction of these societies, a large number of missionaries are annually sent among the frontier settlers, who are destitute of the means of religious instruction. The business of missionaries, is to instruct from house to house, to preach publicly, to administer ordinances, and distribute bibles and various other religious books. The good effects which have followed these exertions, in preserving and cherishing the early religious habits of these people, and guarding them against the poison of infidelity and vice, have been great beyond calculation.

Boston is the largest town in New England, and may be considered its capital. Besides this are Salem, and Newburyport in Massachusetts; Portland in Maine, Portsmouth in New Hampshire, Bennington, Windsor, Rutland, in Vermont, Hartford, New Haven, and New London in Connecticut, and Providence and Newport in Rhode Island. See these described under their respective heads. Exclusive of those above named, there are in New England upwards of 100 towns which have each more than 2000 inhabitants—many of which have three, four, or five thousand.

New England is the most commercial part of the United States. Of ninety-three millions of dollars, the amount of exports from the United States in the year ending 30th Sept. 1801, New England exported 18,761,867 dollars, or about a fifth part of the whole. Her tonnage in 1798, amounted to 360,911 more than half the whole belonging to the United States. About 30,000 tons are usually employed by Massachusetts alone in carrying on the fisheries; 50,000 in the coasting business, and the remainder, to the amount of 281,436 tons (owned in Massachusetts in 1798) in foreign trade to all parts of the world.—*Morse.*

NEWENHAM, *Cape*, is the north point of Bristol Bay, on the north-west coast of North-America. All along the coast the flood tide sets strongly to the north-west, and it is high water about noon on full and change days. N. lat. 58 42, W. long. 162 24.—*ib.*

NEW FAIRFIELD, the north-westernmost township in Fairfield county Connecticut.—*ib.*

NEW FANE, the chief town of Windham county, Vermont, is situated on West river, a little to the north-west of Brattleborough. In has 660 inhabitants.—*ib.*

NEW GARDEN, a township in Chester county, Pennsylvania.—*ib.*

New Garden, a settlement of the Friends in Guildford county, N. Carolina.—*ib.*

NEW GENEVA, a settlement in Fayette county, Pennsylvania.—*ib.*

NEW GERMANTOWN, a post-town of New-Jersey, situated in Hunterdon county. It is 28 miles north-west of Brunswick, 47 north by east of Trenton, and 77 north-east by north of Philadelphia.—*ib.*

NEW GLOUCESTER, a small post-town in Cumberland county, District of Maine, 27 miles northerly of Portland, and 146 north of Boston. It was incorporated in 1774, and contains 1355 inhabitants.—*ib.*

NEW GOTTINGEN, a town of Georgia, situated in Burke county, on the west bank of Savannah river, about 18 miles east of Waynesborough, and 35 north-west of Ebenezer.—*ib.*

New Granada, ‖ New Hampshire.

NEW GRANADA, a province in the southern division of Terra Firma, S. America, whose chief town is Santa Fe de Bagota.—*ib.*

NEW GRANTHAM, a township in Cheshire county, New Hampshire, was incorporated in 1761, and contains 333 inhabitants, and is about 15 miles south-east of Dartmouth college.—*ib.*

NEW HAMPSHIRE, one of the United States of America, is situated between lat. 42 41 and 45 11 north, and between 70 40 and 72 28 west long. from Greenwich; bounded north by Lower Canada; east by the District of Maine; south by Massachusetts, and west by Connecticut river, which separates it from Vermont. Its shape is nearly that of a right angled triangle. The District of Maine and the sea its leg, the line of Massachusetts its perpendicular, and Connecticut river its hypothenuse. It contains 9,491 square miles, or 6,074,240 acres; of which at least 100,000 acres are water. Its length is 168 miles; its greatest breadth 90; and its least breadth 19 miles.

This State is divided into 5 counties, viz. Rockingham, Strafford, Cheshire, Hillsborough, and Grafton. The chief towns are Portsmouth, Exeter, Concord, Dover, Amherst, Keen, Charlestown, Plymouth, and Haverhill. Most of the townships are 6 miles square, and the whole number of townships and locations is 214; containing 141,885 persons, including 158 slaves. In 1767, the number of inhabitants were estimated at 52,700. This State has but about 18 miles of sea-coast, at its south-east corner. In this distance there are several coves for fishing vessels, but the only harbour for ships is the entrance of Piscataqua river, the shores of which are rocky. The shore is mostly a sandy beach, adjoining to which are salt marshes, intersected by creeks, which produce good pasture for cattle and sheep. The intervale lands on the margin of the great rivers are the most valuable, because they are overflowed and enriched by the water from the uplands which brings a fat slime or sediment. On Connecticut river these lands are from a quarter of a mile to a mile and an half on each side, and produce corn, grain, and grass, especially wheat, in greater abundance and perfection than the same kind of soil does in the higher lands. The wide spreading hills are esteemed as warm and rich; rocky moist land is accounted good for pasture; drained swamps have a deep mellow soil; and the vallies between the hills are generally very productive. Agriculture is the chief occupation of the inhabitants; beef, pork, mutton, poultry, wheat, rye, Indian corn, barley, pulse, butter, cheese, hops, esculent roots and plants, flax, hemp, &c. are articles which will always find a market, and are raised in immense quantities in New Hampshire, both for home consumption and exportation. Apples and pears are the most common fruits cultivated in this State, and no husbandman thinks his farm complete without an orchard. Tree fruit of the first quality, cannot be raised in such a northern climate as this, without particular attention. New York, New Jersey and Pennsylvania have it in perfection. As you depart from that tract, either southward or northward, it degenerates. The uncultivated lands are covered with extensive forests of pine, fir, cedar, oak, walnut, &c. New Hampshire is intersected by several ranges of mountains. The first ridge, by the name of the Blue Hills, passes through Rochester,

Barrington

Barrington and Nottingham, and the ſeveral ſummits are diſtinguiſhed by different names. Behind theſe are ſeveral higher detached mountains. Farther back the mountains riſe ſtill higher, and among the third range, Chocorua, Oſſapy, and Kyarſarge, are the principal. Beyond theſe is the lofty ridge which divides the branches of Connecticut and Merrimack rivers, denominated the *Height of Land*. In this ridge is the celebrated Monadnock mountain. Thirty miles N. of which is Sunapee, and 48 miles further is Mooſehillock, called alſo Mooſhelock mountain. The ridge is then continued northerly, dividing the waters of the river Connecticut from thoſe of Saco, and Amariſcoggin. Here the mountains riſe much higher, and the moſt elevated ſummits in this range, are the White Mountains. The lands W. of this laſt mentioned range of mountains, bordering on Connecticut river, are interſperſed with extenſive meadows, rich and well watered. Oſſapy Mountain lies adjoining the town of Moultonborough on the N. E. In this town it is obſerved, that in a N. E. ſtorm the wind falls over the mountain, like water over a dam; and with ſuch force, as frequently to unroof houſes. People who live near theſe mountains, by noticing the various movements of attracted vapours, can form a pretty accurate judgment of the weather; and they hence ſtyle theſe mountains their Almanack. If a cloud is attracted by a mountain, and hovers on its top, they predict rain; and if, after rain, the mountain continues capped, they expect a repetition of ſhowers. A ſtorm is preceded for ſeveral hours by a roaring of the mountain, which may be heard 10 or 12 miles. But the White Mountains are undoubtedly the higheſt land in New England, and, in clear weather, are diſcovered before any other land, by veſſels coming in to the eaſtern coaſt; but by reaſon of their white appearance, are frequently miſtaken for clouds. They are viſible on the land at the diſtance of 80 miles, on the S. and S. E. ſides; they appear higher when viewed from the N. E. and it is ſaid, they are ſeen from the neighbourhood of Chamblee and Quebec. The Indians gave them the name of Agiocochook. The number of ſummits in this cluſter of mountains cannot at preſent be aſcertained, the country around them being a thick wilderneſs. The greateſt number which can be ſeen at once, is at Dartmouth, on the N. W. ſide, where ſeven ſummits appear at one view, of which four are bald. Of theſe the three higheſt are the moſt diſtant, being on the eaſtern ſide of the cluſter; one of theſe is the mountain which makes ſo majeſtic an appearance all along the ſhore of the eaſtern counties of Maſſachuſetts: it has lately been diſtinguiſhed by the name of MOUNT WASHINGTON. During the period of 9 or 10 months, theſe mountains exhibit more or leſs of that bright appearance, from which they are denominated white. In the ſpring, when the ſnow is partly diſſolved, they appear of a pale blue, ſtreaked with white; and after it is wholly gone, at the diſtance of 60 miles, they are altogether of the ſame pale blue, nearly approaching a ſky colour; while at the ſame time, viewed at the diſtance of 8 miles or leſs, they appear of the proper colour of the rock. Theſe changes are obſerved by people who live within conſtant view of them; and from theſe facts and obſervations, it may with certainty be concluded, that the whiteneſs of them is wholly cauſed by the ſnow, and not by any other white ſubſtance, for in fact there is none.

The moſt conſiderable rivers of this State are Connecticut, Merrimack, Piſcataqua, Saco, Androſcoggin, Upper and Lower Amonooſuck, beſides many other ſmaller ſtreams. The chief lakes are Winnipiſeogee, Umbagog, Sunapee, Squam, and Great Oſſipee. Before the war, ſhip-building was a ſource of conſiderable wealth to this State; about 200 veſſels were then annually built, and ſold in Europe and in the Weſt-Indies, but that trade is much declined. Although this is not to be ranked among the great commercial States, yet its trade is conſiderable. Its exports conſiſt of lumber, ſhip-timber, whale oil, flax-ſeed, live ſtock, beef, pork, Indian corn, pot and pearl aſhes, &c. &c. In 1790, there belonged to Piſcataqua 33 veſſels above 100 tons, and 50 under that burden. The tonnage of foreign and American veſſels cleared out from the 1ſt of October, 1789, to 1ſt of October, 1791, was 31,097 tons, of which 26,560 tons were American veſſels. The fiſheries at Piſcataqua, including the Iſle of Shoals, employ annually 27 ſchooners and 20 boats. In 1791, the produce was 25,850 quintals of cod and ſcale fiſh. The exports from the port of Piſcataqua in two years, viz. from 1ſt of October, 1789, to 1ſt of October, 1791, amounted to the value of 296,839 dollars, 51 cents; in the year ending September 30th, 1792, 181,407 dollars; in 1793, 198,197 dollars; and in the year 1794, 153,856 dollars. The bank of New Hampſhire was eſtabliſhed in 1792, with a capital of 60,000 dollars; by an act of aſſembly the ſtockholders can increaſe it to 200,000 dollars ſpecie, and 100,000 dollars, in any other eſtate. The only college in the State is at Hanover, called Dartmouth college, which is amply endowed with lands, and is in a flouriſhing ſituation. The principal academies are thoſe of Exeter, New Ipſwich, Atkinſon, and Amherſt. —*Morſe.*

NEW HAMPTON, a poſt-town of New Hampſhire, ſituated in Strafford county, on the W. ſide of Lake Winnipiſeogee, 9 miles S. E. of Plymouth, and 9 N. W. of Meredith. The townſhip was incorporated in 1777, and contains 652 inhabitants.—*ib.*

NEW HANOVER, a maritime county of Wilmington diſtrict, N. Carolina, extending from Cape Fear river north-eaſt along the Atlantic ocean. It contains 6831 inhabitants, including 3738 ſlaves. Chief town, Wilmington.—*ib.*

NEW HANOVER, a townſhip in Burlington county, New Jerſey, containing about 20,000 acres of improved land, and a large quantity that is barren and uncultivated. The compact part of the townſhip is called *New-Mills*, where are about 50 houſes, 27 miles from Philadelphia, and 13 from Burlington.—*ib.*

NEW HANOVER, a townſhip in Morgan county, Pennſylvania.—*ib.*

NEW HARTFORD, a ſmall poſt-town in Litchfield county, Connecticut, 14 miles N. E. of Litchfield, 20 W. by N. of Hartford.—*ib.*

NEW HAVEN *County*, Connecticut, extends along the Sound between Middleſex county, on the eaſt, and Fairfield county on the weſt; about 30 miles long from north to ſouth, and 28 from eaſt to weſt. It is divided into 14 townſhips. It contained in 1756, 17,955 free perſons, and 226 ſlaves; in 1774, 25,896 free perſons, fons, and 925 flaves; and in 1790, 30,397 free perfons, and 433 flaves.—*ib.*

NEW HAVEN, *(City)* the feat of juftice in the above county, and the femi-metropolis of the State. This city lies round the head of a bay which makes up about 4 miles north from Long Ifland Sound. It covers part of a large plain which is circumfcribed on three fides by high hills or mountains. Two fmall rivers bound the city eaft and weft. It was originally laid out in fquares of 60 rods; many of thefe fquares have been divided by crofs ftreets. Four ftreets run north-weft and fouth-eaft, and are croffed by others at right angles. Near the centre of the city is the public fquare, on and around which are the public buildings, which are a ftate-houfe, two college edifices, and a chapel, three churches for Congregationalifts, and one for Epifcopalians; all which are handfome and commodious buildings. The college edifices, chapel, ftate-houfe, and one of the churches are of brick. The public fquare is encircled with rows of trees, which render it both convenient and delightful. Its beauty, however, is greatly diminifhed by the burial-ground, and feveral of the public buildings which occupy a confiderable part of it. Many of the ftreets are ornamented with rows of trees on each fide, which give the city a rural appearance. The profpect from the fteeples is greatly variegated and extremely beautiful. There are between 3 and 400 neat dwelling-houfes in the city, principally of wood. The ftreets are fandy but clean. Within the limits of the city, are 4000 fouls. About one in 70 die annually. Indeed as to pleafantnefs of fituation and falubrity of air, New Haven is hardly exceeded by any city in America. It carries on a confiderable trade with New York and the Weft India iflands. The exports for one year, ending Sept. 30, 1794, amounted to the value of 171,868 dollars. Manufactures of card teeth, linen, buttons, cotton, and paper are carried on here. Yale college, which is eftablifhed in this city, was founded in 1700, and remained at Killingworth until 1707, then at Saybrook until 1716, when it was removed and fixed at New Haven. It has its name from its principal benefactor Governor Yale. There are at prefent fix college *domiciles*, two of which, each 100 feet long and 40 wide, are inhabited by the ftudents, containing 32 chambers each, fufficient for lodging 120 ftudents; a chapel 40 by 50 feet, with a fteeple 130 feet high; a dining-hall 60 by 40 feet; a houfe for the prefident, and another for the profeffor of divinity. In the chapel is lodged the public library, confifting of about 3000 volumes, and the philofophical apparatus, as complete as moft others in the United States, and contains the machines neceffary for exhibiting experiments in the whole courfe of experimental philofophy and aftronomy. The mufeum, to which additions are conftantly making, contains many natural curiofities. From the year 1700 to 1793, there have been educated and graduated at this univerfity about 2,303. The number of ftudents is generally 150. The harbour, though inferior to New London, has good anchorage, with 3 fathom and 4 feet water at common tides, and 2½ fathom at low water. This place and Hartford are the feats of the legiflature alternately. It is 40 miles S. W. by S. of Hartford, 54 from New London, 88 from New-York, 152 from Bofton, and 183 north-eaft of Philadelphia. N. lat. 41 18, W. long. 72 56.—*ib.*

NEW HAVEN, a townfhip in Addifon county, Vermont, on Otter Creek or River, containing 723 inhabitants.—*ib.*

NEW HEBRIDES, a clufter of iflands in the Pacific Ocean, fo called by Capt. Cook in 1794—the fame as the *Archipelago of the Great Cyclades* of Bougainville, or the *Terra Auftral* of Quiros.—*ib.*

NEW HAMPSTEAD, a townfhip in Orange county, New York, bounded eafterly by Clarkftown, and foutherly by the ftate of New Jerfey. It was taken from Haverftraw, and incorporated in 1791. By the ftate cenfus of 1796, there were 245 of its inhabitants qualified electors.—*ib.*

NEW HOLDERNESS, a townfhip in Grafton county, New Hampfhire, fituated on the E. fide of Pemigewaffet river, about 3 miles E. by S. of Plymouth. It was incorporated in 1761, and contains 329 inhabitants.—*ib.*

NEW HOLLAND, a town of Pennfylvania, Lancafter county, in the midft of a fertile country. It contains a German church and about 70 houfes. It is 12 miles E. N. E. of Lancafter, and 54 W. N. W. of Philadelphia.—*ib.*

NEW HUNTINGTON, a mountainous townfhip in Chittenden county, Vermont, on the S. W. fide of Onion river, containing 136 inhabitants.—*ib.*

NEWINGTON, a townfhip; formerly part of Portfmouth and Dover, in Rockingham county, New Hampfhire. It contains 542 inhabitants.—*ib.*

NEW INVERNESS, in Georgia, is fituated near Darien on Alatamaha river. It was built by the Scotch Highlanders, 160 of whom landed here in 1735.—*ib.*

NEW IPSWICH, a townfhip in Hillfborough county, New Hampfhire, on the W. fide of Souhegan river, upon the fouthern line of the State. It was incorporated in 1762, and contains 1241 inhabitants. There is an academy, founded in 1789, having a fund of about £1,000, and has generally about 40 or 50 ftudents. It is about 24 miles S. E. of Keene, and 75 W. S. W. of Portfmouth.—*ib.*

NEW JERSEY, one of the United States of America, is fituated between 39 and 41 24 N. latitude, and between 74 44 and 75 33 W. longitude from London; bounded E. by Hudfon's river and the Ocean; W. by Delaware Bay and river, which divide it from the States of Delaware and Pennfylvania; N. by the line drawn from the mouth of Mahakkamak river, in lat. 41 24 to a point on Hudfon's river, in lat. 41. It is about 160 miles long and 52 broad, containing about 8,320 fquare miles, equal to 5,324,800 acres. It is divided into 13 counties, *viz.* Cape May, Cumberland, Salem, Gloucefter, Burlington, Hunterdon, and Suffex; thefe 7 lie from S. to N. on Delaware river; Cape May and Gloucefter extend acrofs to the fea; Bergen, Effex, Middlefex, and Monmouth, lie from N. to S. on the eaftern fide of the ftate; Somerfet and Morris are inland counties. The number of inhabitants is 184,139, of whom 11,423 are flaves. The moft remarkable bay is Arthur Kull, or Newark Bay, formed by the union of Paffaick and Hackinfac rivers. The rivers in this State though not large, are numerous. A traveller in paffing the common road from New York to Philadelphia, croffes 3 confiderable rivers, *viz.* the Hackinfac and Paffaick, between Bergen and Newark, and the Rariton by Brunfwick.

Brunſwick. Paſſaick is a very crooked river. It is navigable about 10 miles, and is 230 yards wide at the ferry. The cataract, or Great Falls, in this river, is one of the greateſt natural curioſities in the State. The river is about 40 yards wide, and moves in a ſlow, gentle current, until coming within a ſhort diſtance of a deep cleft in a rock, which croſſes the channel, it deſcends and falls above 70 feet perpendicularly, in one entire ſheet. One end of the cleft, which was evidently made by ſome violent convulſion in nature, is cloſed; at the other, the water ruſhes out with incredible ſwiftneſs, forming an acute angle with its former direction, and is received into a large baſon, whence it takes a winding courſe through the rocks, and ſpreads into a broad ſmooth ſtream. The cleft is from 4 to 12 feet broad. The falling of the water occaſions a cloud of vapour to ariſe, which, by floating amidſt the ſun-beams, preſents rainbows to the view, which adds beauty to the tremendous ſcene. The new manufacturing town of Patterſon is erected upon the Great Falls in this river. Rariton river is formed by two conſiderable ſtreams, called the north and ſouth branches; one of which has its ſource in Morris, the other in Hunterdon county. It paſſes by Brunſwick and Amboy, and mingling with the waters of the Arthur Kull Sound, helps to form the fine harbour of Amboy. Bridges have lately been erected over the Paſſaick, Hackinſac and Rariton rivers, on the poſt-road between New-York and Philadelphia. Theſe bridges will greatly facilitate the intercourſe between theſe two great cities. The counties of Suſſex, Morris, and the northern part of Bergen, are mountainous. As much as five-eighths of moſt of the ſouthern counties, or one-fourth of the whole State, is almoſt entirely a ſandy barren, unfit in many parts for cultivation. All the varieties of ſoil, from the worſt to the beſt kind, may be found here. The good land in the ſouthern counties lies principally on the banks of rivers and creeks. The barrens produce little elſe but ſhrub-oaks and yellow pines. Theſe ſandy lands yield an immenſe quantity of bog iron ore, which is worked up to great advantage in the iron-works in theſe counties. In the hilly and mountainous parts which are not too rocky for cultivation, the ſoil is of a ſtronger kind, and covered in its natural ſtate with ſtately oaks, hickories, cheſnuts, &c. and when cultivated, produces wheat, rye, Indian corn, buckwheat, oats, barley, flax, and fruits of all kinds, common to the climate. The land in this hilly country is good for grazing, and farmers feed great numbers of cattle for New-York and Philadelphia markets. The orchards in many parts of the State equal any in the United States, and their cyder is ſaid, and not without reaſon, to be the beſt in the world. The markets of New York and Philadelphia, receive a very conſiderable proportion of their ſupplies from the contiguous parts of New-Jerſey. Theſe ſupplies conſiſt of vegetables of many kinds, apples, pears, peaches, plums, ſtrawberries, cherries and other fruits—cyder in large quantities, butter, cheeſe, beef, pork, mutton, and the leſſer meats. The trade is carried on almoſt ſolely with and from thoſe two great commercial cities, New York on one ſide, and Philadelphia on the other; though it wants not good ports of its own. Manufactures here have hitherto been inconſiderable, not ſufficient to ſupply its own conſumption, if we except the articles of iron, nails, and leather. A ſpirit of induſtry and improvement, particularly in manufactures, has however, of late, greatly increaſed. The iron manufacture is, of all others, the greateſt ſource of wealth to the State. Iron-works are erected in Glouceſter, Burlington, Suſſex, Morris, and other counties. The mountains in the county of Morris give riſe to a number of ſtreams, neceſſary and convenient for theſe works, and at the ſame time furniſh a copious ſupply of wood and ore of a ſuperior quality. In this county alone, are no leſs than 7 rich iron mines, from which might be taken ore ſufficient to ſupply the United States; and to work it into iron, there are 2 furnaces, 2 rolling and ſlitting mills, and about 30 forges, containing from 2 to 4 fires each. Theſe works produce annually, about 540 tons of bar iron, 800 tons of pigs, beſides large quantities of hollow ware, ſheet iron, and nail rods. In the whole State it is ſuppoſed there is yearly made about 1200 tons of bar iron, 1200 do. of pigs, 80 do. of nail-rods, excluſive of hollow ware, and various other caſtings, of which vaſt quantities are made. The inhabitants are a collection of Low Dutch, Germans, Engliſh, Scotch, Iriſh, and New-Englanders, and their deſcendants. National attachment, and mutual convenience, have generally induced theſe ſeveral kinds of people to ſettle together in a body, and in this way their peculiar national manners, cuſtoms and character, are ſtill preſerved, eſpecially among the poorer claſs of people, who have little intercourſe with any but thoſe of their own nation. The people of New-Jerſey are generally induſtrious, frugal, and hoſpitable. There are in this ſtate, about 50 Preſbyterian congregations, ſubject to the care of 3 Preſbyteries; beſides upwards of 40 congregations of Friends, 30 of Baptiſts, 25 of Epiſcopalians, 28 of Dutch Reformed, beſides Methodiſts, and a ſettlement of Moravians. All theſe religious denominations live together in peace and harmony; and are allowed, by the conſtitution of the State, to worſhip Almighty God agreeably to the dictates of their own conſciences. The college at Princeton, called Naſſau Hall, has been under the care of a ſucceſſion of Preſidents, eminent for piety and learning; and has furniſhed a number of Civilians, Divines, and Phyſicians, of the firſt rank in America. It has conſiderable funds, is under excellent regulations, and has generally from 80 to 100 ſtudents, principally from the ſouthern ſtates. There are academies at Freehold, Trenton, Hackinſack, Orangedale, Elizabeth-Town, Burlington, and Newark; and grammar ſchools at Springfield, Morriſtown, Bordentown, and Amboy. There are a number of towns in this State, nearly of equal ſize and importance, and none that has more than 300 houſes compactly built. Trenton is one of the largeſt, and the capital of the ſtate. The other principal towns are Brunſwick, Burlington, Amboy, Bordentown, Princeton, Elizabeth-Town, Newark, and Morriſtown. This ſtate was the ſeat of war for ſeveral years, during the bloody conteſt between Great-Britain and America. Her loſſes both of men and property, in proportion to the population and wealth of the State, was greater than of any other of the Thirteen States. When General Waſhington was retreating through the Jerſies, almoſt forſaken by all others, her militia were at all times obedient to his orders; and, for a conſiderable length of time, compoſed the ſtrength of his army. There is hardly a town in the ſtate that lay in the progreſs of the Britiſh army, that was not rendered ſignal, by ſome enterpriſe or exploit.—*ib.*

NEW KENT, a county of Virginia, bounded on the S. side of Pamunky and York rivers. It is about 33 miles long, and 12 broad, and contains 6,239 inhabitants, including 3,700 slaves. New Kent court house is 30 miles from Richmond, and as far from Williamsburg.—*ib.*

NEW LEBANON, a post town in Dutchess county, New York, celebrated for its medicinal springs. The compact part of this town is pleasantly situated partly in an extensive valley, and partly on the declivity of the surrounding hills. The spring is on the south side, and near the bottom of a gentle hill, but a few rods west of the Massachusetts west line; and is surrounded with several good houses, which afford convenient accommodations for the valetudinarians who visit these waters. Concerning the medicinal virtues of this spring, Dr Waterhouse, Professor of the theory and practice of physic, at Harvard University, and who visited it in the summer of 1794, observes, "I confess myself at a loss to determine the contents of these waters by chymical analysis, or any of the ordinary tests. I suspect their impregnation is from some cause weakened. Excepting from their warmth, which is about that of new milk, I never should have suspected them to come under the head of medicinal waters. They are used for the various purposes of cookery, and for common drink by the neighbours, and I never could discover any other effects from drinking them, than what we might expect from rain or river water of that temperature. There was no visible change produced in this water by the addition of an alkali, nor by a solution of alum; nor was any effervescence raised by the oil of vitriol; neither did it change the colours of gold, silver, or copper; nor did it redden beef or mutton boiled in it; nor did it extract a black tincture from galls; neither did it curdle milk, the whites of eggs, or soap. The quality of the waters of the pool at Lebanon is, therefore, very different from those of Saratoga. These are warm and warmish, those very cold, smart, and exhilarating. Frogs are found in the pool of Lebanon, and plants grow and flourish in and around it; but plants will not grow within the vapour of those of Saratoga, and as for small animals, they soon expire in it. Hence we conclude that that *spiritus mineralis* which some call aerial acid, or fixed air, abounds in the one but not in the other. Yet the Lebanon pool is famous for having wrought many cures, especially in rheumatisms, stiff joints, scabby eruptions, and even in visceral obstructions and indigestions; all of which is very probable. If a person who has brought on a train of chronic complaints, by intemperance in eating and drinking, should swallow four or five quarts of rain or river water in a day, he would not feel so keen an appetite for animal food, or thirst for spirituous liquors. Hence such a course of water drinking will open obstructions, rinse out impurities, render perspiration free, and thus remove that unnatural load from the animal machine, which causes and keeps up its disorders. Possibly, however, there may be *something* so subtle in these waters as to elude the scrutinizing hand of the chymists, since they all allow that the analysis of mineral waters is one among the most difficult things in the chymical art." A society of *Shakers* inhabit the south part of the town in view of the main stage-road, which passes through this town. Their manufactures of various kinds are considerable, and very neat and excellent. It is about 32 miles E. by S. of Albany, 103 north of New-York, and 6 W. of Pittsfield.—*ib.*

NEWLIN, a township in Chester county, Pennsylvania.—*ib.*

NEW LONDON, a maritime county of Connecticut, comprehending the S. E. corner of it, bordering E. on Rhode-Island, and S. on Long-Island Sound, about 30 miles from E. to W. and 24 from north to south. It was settled soon after the first settlements were formed on Connecticut river; and is divided into 11 townships, of which New-London and Norwich are the chief. It contained in 1756, 22,844 inhabitants, of whom 829 were slaves; in 1790, 33,200, of whom 586 were slaves.—*ib.*

New London, a city, port of entry, and post-town in the above county, and one of the most considerable commercial towns in the State. It stands on the W. side of the river Thames, about 3 miles from its entrance into the Sound, and is defended by Fort Trumbull and Fort Griswold, the one on the New London, the other on the Groton side of the Thames. A considerable part of the town was burnt by Benedict Arnold in 1781. It has since been rebuilt. Here are two places of public worship, one for Episcopalians, and one for Congregationalists, about 300 dwelling houses, and 4,600 inhabitants. The harbour is large, safe and commodious, and has 5 fathoms water; high water at full and change, 54 minutes after 8. On the W. side of the entrance is a light house, on a point of land which projects considerably into the Sound. The exports for a year ending September 30th, 1794, amounted to 557,453 dollars. In that year 1000 mules were shipped for the West Indies. It is 14 miles south of Norwich, 54 S. E. by S. of Hartford, 54 E. of New Haven, and 237 N. E. by E. of Philadelphia. N. lat. 41 25, W. long. 72 15. The township of New London was laid out in lots in 1648, but had a few English inhabitants two years before. It was called by the Indians *Nameag* or *Towawog*, and from being the seat of the Pequot tribe, was called *Pequot*. It was the seat of *Sassacus*, the grand monarch of Long-Island, and part of Connecticut and Narraganset.—*ib.*

New London, a small township in Hillsborough county, New Hampshire, incorporated in 1779, and contains 311 inhabitants. It lies at the head of Black-water river, and about 3 miles from the N. E. side of Sunapee Lake.—*ib.*

New London, a post town of Virginia, and the chief town of Bedford county. It stands upon rising ground, and contains about 130 houses, a court house and goal. There were here in the late war several work shops for repairing fire arms. It is 133 miles W. by S. of Richmond, 152 west of Petersburg, and 393 S. W. by W. of Philadelphia.—*ib.*

NEW MADRID, in the northern part of Louisiana, is a settlement on the W. bank of the Mississippi, commenced some years ago, and conducted by Col. Morgan of New Jersey, under the patronage of the Spanish king. The spot on which the city was proposed to be built is situated in lat. 36 30 N. and 45 miles below the mouth of Ohio river. The limits of the new city of Madrid were to extend 4 miles S. and 2 W. from the river; so as to cross a beautiful, living deep lake, of the purest spring water, 100 yards wide, and several miles in length, emptying itself, by a constant and rapid narrow stream, through the centre of the city. The banks of this lake, called St. Annis, are high, beautiful and pleasant; the water deep, clear and sweet, and well stored with fish; the bottom a clear sand, free from woods, shrubs, or other vegetables. On each side of this delightful lake, streets were to be laid out, 100 feet wide, and a road to be continued round it, of the same breadth; and the streets were directed to be preserved forever, for the health and pleasure of the citizens. A street 120 feet wide, on the bank of the Mississippi, was laid out; and the trees were directed to be preserved for the same purpose. Twelve acres, in a central part of the city were to be preserved in like manner, to be ornamented, regulated, and improved by the magistracy of the city for public walks; and 40 half-acre lots for other public uses; and one lot of 12 acres for the king's use. We do not hear that this scheme is prosecuting, and conclude it is given up. The country in the vicinity of this intended city is represented as excellent, and, in many parts, beyond description. The natural growth consists of mulberry, locust, sassafras, walnut, hickory, oak, ash, dog-wood, &c. with one or more grape-vines running up almost every tree; and the grapes yield, from experiments, good red wine in plenty, and with little labour. In some of the low grounds grow large cypress trees. The climate is said to be favourable to health, and to the culture of fruits of various kinds, particularly for garden vegetables. The praires or meadows are fertile in grass, flowering-plants, strawberries, and when cultivated produce good crops of wheat, barley, Indian corn, flax, hemp, and tobacco, and are easily tilled. Iron and lead mines and salt-springs, it is asserted, are found in such plenty as to afford an abundant supply of these necessary articles. The banks of the Mississippi, for many leagues in extent, commencing about 20 miles above the mouth of the Ohio, are a continued chain of lime-stone. A fine tract of high, rich, level land, S. W. W. and N. W. of New-Madrid, about 25 miles wide, extends quite to the river St Francis.—*ib.*

NEWMANSTOWN, Pennsylvania, situated in Dauphin county, on the east side of Mill Creek. It contains about 30 houses, and is 14 miles E. by N. of Harrisburg, and 72 N. W. by W. of Philadelphia.—*ib.*

NEWMARKET, a township in Rockingham county, New Hampshire, north of Exeter, of which it was formerly a part, and 13 miles west of Portsmouth. It was incorporated in 1727, and contains 1137 inhabitants. Fossil shells have been found near Lamprey river in this town, at the depth of 17 feet; and in such a situation as that the bed of the river could never have been there. The shells were of oysters, muscles, and clams intermixed.—*ib.*

NEWMARKET, a village in Frederick county, Maryland, on the high road to Frederickstown, from which it lies nearly 13 miles W. S. W. and about 36 north-west of the Federal City.—*ib.*

NEWMARKET, a village in Dorchester county, Maryland, 3 miles north-east of Indian-Town, on Choptank river, 9 north-east of Cambridge, and as far north-west of Vienna.—*ib.*

NEWMARKET, a town in Virginia, Amherst county, on the north side of James river, at the mouth of Tye river. It is a small place, contains a tobacco warehouse; is 100 miles above Richmond, and 378 from Philadelphia.—*ib.*

NEW MARLBOROUGH, a township in Ulster county, New-York.—*ib.*

NEW MARLBOROUGH, Berkshire county, Massachusetts. It is 23 miles southward of Lenox, and 144 S. W. by W. of Boston.—*ib.*

NEW MARLBOROUGH, a town in King George's county, Virginia, on the west side of Patowmac river, 10 miles east of Falmouth.—*ib.*

NEW MEADOWS *River*, in the District of Maine, a water of Casco Bay, navigable for vessels of a considerable burden a small distance.—*ib.*

NEW MILFORD, a post town of Connecticut, Litchfield county, on the eastern side of Housatonick river, about 16 miles north of Danbury, 20 south-west of Litchfield, and 52 W. by S. W. of Hartford.—*ib.*

NEW ORLEANS, the metropolis of Louisiana, was regularly laid out by the French in the year 1720, on the east side of the river Mississippi, in lat. 30 2 north, and long. 89 53 west; 18 miles from Detour des Anglois, or English Turn, and 105 miles from the Balize at the mouth of the river. All the streets are perfectly straight but too narrow, and cross each other at right angles. There were, in 1788, 1,100 houses in this town, generally built with timber frames, raised about 8 feet from the ground, with large galleries round them, and the cellars under the floors level with the ground; any subterraneous buildings would be constantly full of water. Most of the houses have gardens. In March, 1788, this town, by a fire, was reduced in five hours to 200 houses. It has since been rebuilt. The side next the river is open, and is secured from the inundations of the river, by a raised bank, generally called the levee, which extends from the English Turn, to the upper settlements of the Germans, a distance of more than 50 miles, with a good road all the way. There is reason to believe that in a short time New-Orleans may become a great and opulent city, if we consider the advantages of its situation, but a few leagues from the sea, on a noble river, in a most fertile country, under a most delightful and wholesome climate, within 2 weeks sail of Mexico, and still nearer the French, Spanish, and British West-India islands, with a moral certainty of its becoming a general receptacle for the produce of that extensive and valuable country on the Mississippi, Ohio, and its other branches; all which are much more than sufficient to ensure the future wealth, power, and prosperity of this city. The vessels which sail up the Mississippi haul close along side the bank next to New Orleans, to which they make fast, and take in or discharge their cargoes with the same ease as at a wharf.—*ib.*

NEW PALTZ, a township in Ulster county, New York, bounded easterly by Hudson river, southerly by Marlborough and Shawangunk. It contains 2,309 inhabitants, including 302 slaves. The compact part of it is situated on the eastern side of Wall Kill, and contains about 250 houses and a Dutch church. It is 10 miles from Shawangunk, 14 southerly of Kingston, 20 south-west of Rhinebeck, and 80 north-north-west of New York.—*ib.*

NEWPORT, a township of Nova Scotia, in Hants county, on the river Avon. The road from Halifax runs part of the way between this township and Windsor; and has settlements on it at certain distances.—*ib.*

NEWPORT, a township in Cheshire county, New

 Hampshire,

Newport. Hampshire, east of Claremont. It was incorporated in 1761, and contains 780 inhabitants.—*ib.*

Newport, a maritime county of the state of Rhode-Island, comprehending Rhode-Island, Cannonicut, Block, Prudence, and several other small islands. It is divided into 7 townships, and contains 14,300 inhabitants, including 366 slaves.—*ib.*

Newport, the chief town of this county, and the semi-metropolis of the state of Rhode Island; stands on the south-west end of Rhode Island, about 5 miles from the sea. Its harbour, (which is one of the finest in the world) spreads westward before the town. The entrance is easy and safe, and a large fleet may anchor in it and ride in perfect security. It is probable this may, in some future period, become one of the man-of-war ports of the American empire. The town lies north and south upon a gradual ascent as you proceed eastward from the water, and exhibits a beautiful view from the harbour, and from the neighbouring hills which lie westward upon the main. West of the town is Goat-Island, on which is Fort Washington. It has been lately repaired and a citadel erected in it. The fort has been ceded to the United States. Between Goat-Island and Rhode Island is the harbour. Newport contains about 1,000 houses, built chiefly of wood. It has 10 houses for public worship, 4 for Baptists, 2 for Congregationalists, one for Episcopalians, one for Quakers, one for Moravians, and one for Jews. The other public buildings are a state house, and an edifice for the public library. The situation, form and architecture of the state house, give it a pleasing appearance. It stands sufficiently elevated, and a long wharf and paved parade lead up to it from the harbour. Front or Water street is a mile in length. Here is a flourishing academy, under the direction of a rector, and tutors, who teach the learned languages, English grammar, geography, &c. A marine society was established here in 1752, for the relief of distressed widows and orphans, and such of their society as may need relief. This city, far famed for the beauty of its situation and the salubrity of its climate, is no less remarkable for the great variety and excellent quality of fresh fish which the market furnishes at all seasons of the year. No less than fifty different kinds have been produced in this market. The excellent accommodations and regulations of the numerous packets, which belong to this port, and which ply thence to Providence and New-York, are worthy of notice. They are said, by European travellers, to be superior to any thing of the kind in Europe. This town, although greatly injured by the late war, and its consequences, has a considerable trade. A cotton and duck manufactory have been lately established. The exports for a year, ending Sept. 30, 1794, amounted to 311,200 dollars. It was first settled by Mr William Coddington, afterwards governor, and the father of Rhode Island, with 17 others, in 1639. It is 30 miles S. by E. of Providence, 14 south east of Bristol, 75 S. W. by S. of Boston, 113 E. N. E. of New Haven, and 292 N. E. by E. of Philadelphia. N. lat. 41 29, W. long. from Greenwich 71 17.—*ib.*

Newport, a small post town in Newcastle county, Delaware; situated on the north side of Christiana Creek, three miles W. of Wilmington. It contains about 200 inhabitants, and carries on a considerable trade with Philadelphia, in flour. It is 6 miles N. E. by N. of Christiana Bridge, and 31 S. W. of Philadelphia.—*ib.*

Newport, a township in Luzerne county, Pennsylvania.—*ib.* Newport, ‖ Newton.

Newport, a small post-town in Charles county, Maryland, 11 miles S. E. of Port Tobacco, 94 S. by W. of Baltimore, and 195 south-west of Philadelphia. —*ib.*

Newport, a very thriving settlement in Liberty county, Georgia, situated on a navigable creek, 34 miles south of Savannah, and 7 or 8 south of west from Sunbury. This place, commonly known by the name of *Newport Bridge*, is the rival of Sunbury, and commands the principal part of the trade of the whole county. A post-office is kept here.—*ib.*

NEW RIVER, a river of Tennessee, which rises on the north side of the Alleghany mountains, and running a north-east course enters Virginia, and is called Kanhaway.—*ib.*

NEW ROCHELLE, a township in West-Chester county, New-York, on Long-Island Sound. It contained 692 inhabitants, of whom 89 were slaves, in 1790. In 1796, there were 100 of the inhabitants qualified electors. It is 6 miles S. W. of Rye, and 20 north-easterly of New York city.—*ib.*

NEW SALEM, or *Pequottink*, a Moravian settlement, formed in 1786, on the E. side of Huron river, which runs northward into Lake Erie.—*ib.*

New Salem, a township in Hampshire county, Massachusetts, bounded E. by the west line of Worcester county. It was incorporated in 1753, and contains 1543 inhabitants. It is 85 miles W. by N. of Boston. —*ib.*

New Salem, a township in Rockingham county, New Hampshire, adjoining Pelham and Haverhill.—*ib.*

NEW-SAVANNAH, a village in Burke county, Georgia, on the S. W. bank of the Savannah, 12 miles S. E. of Augusta.—*ib.*

NEW-SMYRNA *Entrance*, or *Moskito Inlet*, on the coast of Florida, is about 11 leagues north-north-west ¼ west from Cape Canaveral.—*ib.*

NEW-SWEDELAND was the name of the territory between Virginia and New-York, when in possession of the Swedes, and was afterwards possessed, or rather claimed by the Dutch. The chief town was called *Gottenburg*.—*ib.*

NEWTON (John), an eminent English mathematician was born at Oundle in Northamptonshire, 1622. After a proper foundation at school, he was sent to Oxford, where he was entered a commoner of St Edmund's Hall in 1637. He took the degree of bachelor of arts in 1641; and the year following was created master, among several gentlemen that belonged to the king and court, then residing in the university. At which time, his genius being inclined to astronomy and the mathematics, he applied himself diligently to those sciences, and made a great proficiency in them, which he found of service during the times of the usurpation. After the restoration of Charles II. he reaped the fruits of his loyalty; being created doctor of divinity at Oxford Sept. 1661, he was made one of the king's chaplains, and rector of Ross in Herefordshire, in the place of Mr John Toombes, ejected for nonconformity. He held this living till his death, which happened at Ross on Christmas-day 1678. Mr Wood gives him the character of a capricious and humoursome person: however that may be, his writings are sufficient monuments of his genius and skill in the mathematics. These are,

1. *Astro-*

1. *Astronomia Britannica*, &c. in three parts, 1656, in 4to. 2. Help to Calculation; with Tables of Declination, Afcenfion, &c. 1657, 4to. 3. *Trigonometria Britannica*, in two books, 1658, folio; one compofed by our author, and the other tranflated from the Latin of Henry Gellibrand. 4. *Chiliades centum Logarithmorum*, printed with, 5. Geometrical Trigonometry, 1659. 6. Mathematical Elements, three parts, 1660, 4to. 7. A perpetual Diary or Almanac, 1662. 8. Defcription of the Ufe of the Carpenter's Rule, 1667. 9. Ephemerides, fhewing the Intereft and rate of Money at 6 *per cent*, &c. 1667. 10. *Chiliades centum Logarithmorum, et Tabula Partium proportionalium*, 1667. 11. The Rule of Intereft, or the Cafe of Decimal Fractions, &c. Part II. 1668, 8vo. 12. School-Paftime for young Children, &c. 1669, 8vo. 13. Art of practical Gauging, &c. 1669. 14. Introduction to the Art of Rhetoric, 1671. 15. The Art of Natural Arithmetic, in whole Numbers, and Fractions Vulgar and Decimal, 1671, 8vo. 16. The Englifh Academy, 1677, 8vo. 17. Cofmography. 18. Introduction to Aftronomy. 19. Introduction to Geography, 1678, 8vo.*

* *Biog. Dict.* new edit.

NEWTON, a pleafant townfhip in Middlefex county, Maffachufetts, fituated on Charles river, and is 9 miles weft of Bofton. It was incorporated in 1691, and contains 1360 inhabitants.—*Morse.*

NEWTON, a fmall town in Chefter county, Pennfylvania, 22 miles fouth of Philadelphia.—*ib.*

NEWTON, a townfhip in Rockingham county, New Hampfhire, on Powow river, adjoining Amefbury, in Maffachufetts, 10 or 12 miles foutherly of Exeter. It was incorporated in 1749, and contains 530 inhabitants.—*ib.*

NEWTOWN, a poft-town in Fairfield county, Connecticut, 9 miles eaft-north-eaft of Danbury, 26 weft-north-weft of New-Haven, 61 fouth-weft of Hartford, and 80 north-eaft of New-York. The town ftands pleafantly on an elevated fpot, and was fettled in 1708. —*ib.*

NEWTOWN, on Staten-Ifland, New-York, is 3 miles N. E. of Old-Town, as far eaft of Richmond, and 9 fouth-wefterly of New-York.—*ib.*

NEWTOWN, a townfhip in Queen's county, New-York, includes all the iflands in the Sound oppofite the fame. It is about 8 miles eaft of New York, and contains 2,111 inhabitants, including 533 flaves.—*ib.*

NEWTOWN, a townfhip in Weft Chefter county, New-York; of whofe inhabitants 276 are electors.—*ib.*

NEWTOWN, a townfhip in Tioga county, New-York, lies between the fouth end of Seneca lake and Tioga river; having Chemung townfhip eaft, from which it was taken and incorporated in 1792. In 1796, 169 of its inhabitants were electors.—*ib.*

NEWTOWN, a townfhip in Gloucefter county, New Jerfey.—*ib.*

NEWTOWN, the feat of juftice in Suffex county, New Jerfey, is about 10 miles S. E. of Sandyfton.—*ib.*

NEWTOWN, the capital of Bucks county, Pennfylvania. It contains a prefbyterian church, a ftone jail, a court-houfe, an academy, and about 50 houfes. It was fettled in 1725, and is 10 miles W. of Trenton, in New Jerfey, and 30 N. E. by N. of Philadelphia.—There are two other townfhips of this name, the one in Delaware county, the other in that of Cumberland.—*ib.*

NEWTOWN, a fmall town of Virginia, fituated in Frederick county, between the north and fouth branches of Shenandoah river; 7 miles fouth of Winchefter, and 173 north-north-weft of Richmond.—*ib.*

NEW-UTRECHT, a fmall maritime town of New-York, fituated in King's county, Long-Ifland, oppofite the Narrows, and 7 miles fouth of New-York city. The whole townfhip contains 562 inhabitants; of whom 76 are qualified electors, and 206 flaves.—*ib.*

NEW-WINDSOR, a townfhip of Ulfter county, New-York, pleafantly fituated on the W. bank of Hudfon river, juft above the high lands, 3 miles fouth of Newburgh, and 6 north of Weft Point. It contains 1819 inhabitants; of whom 261 are qualified electors, and 117 flaves. A valuable fet of works in this town for manufacturing fcythes were deftroyed by fire. In 1795, the legiflature granted the unfortunate proprietor, Mr. Boyd, £1500 to enable him to re-eftablifh them. The compact part of the town contains about 40 houfes and a prefbyterian church, 64 miles north of New-York. The fummer refidence of governor Clinton was formerly at a rural feat, on the margin of the river, at this place.—*ib.*

NEW-WRENTHAM, diftrict of Maine, a townfhip 6 miles E. of Penobfcot river, adjoining Orrington, and 15 miles from Buckfton.—*ib.*

NEW-YEAR'S *Harbour*, on the north coaft of Staten Land Ifland, at the fouth extremity of South America, affords wood and good water; was difcovered Jan. 1, 1775; hence its name. S. lat. 54 49, weft long. 64 11.—*ib.*

NEW-YEAR'S *Iflands*, near the above harbour, within which is anchorage at north half weft from the harbour, at the diftance of two leagues from it.—*ib.*

NEW-YORK, one of the United States of America, is fituated between lat. 40 40 and 45 north, and between long. 73 10 and 80 weft; is about 350 miles in length, and 300 in breadth; bounded fouth-eafterly by the Atlantic ocean; eaft by Connecticut, Maffachufetts, and Vermont; north by Upper Canada; fouth-weft and weft by Pennfylvania, New Jerfey, and Lake Erie. It is fubdivided into 21 counties as follows, viz. New-York, Richmond, Suffolk, Weft Chefter, Queen's, King's, Orange, Ulfter, Dutchefs, Columbia, Renffelaer, Wafhington, Clinton, Saratoga, Albany, Montgomery, Herkemer, Onondago, Otfego, Ontario, and Tioga. In 1790, this ftate contained 340,120 inhabitants; of whom 21,324 were flaves. Since that period the counties of Renffelaer, Saratoga, Herkemer, Onondago, Otfego, and Tioga have been taken from the other counties. In 1796, according to the ftate cenfus, there were 195 townfhips, and 64,017 qualified electors. Electors in this ftate are divided into the following claffes:

Freeholders to the value of £1000	36,338
Do. to the value of £20 and under £100	4,838
Do. who rent tenements of 40*s*. per annum	22,598
Other freeholders	243
	64,017

It is difficult to afcertain accurately the proportion the number of electors bears to the whole number of inhabitants in the ftate. In the county of Herkemer, the electors to the whole number of inhabitants was, in 1795, nearly as 1 to 6, but this proportion will not hold through the ftate. In 1790, the number of inhabitants in the ftate was, as already mentioned, 340,120, of whom 41,785 were electors. In 1795, the number

number of electors was 64,017, which, if the proportion between the electors and the whole number of inhabitants be the same, gives, as the whole number of inhabitants in 1795, 530,177, an increase, in 5 years, of 190,057.

The chief rivers are Hudson, Mohawk, and their branches. The rivers Delaware and Susquehannah rise in this state. The principal lakes are Otsego, Oneida, George, Seneca, Cayuga, Salt, and Chautaughque. The principal bay is that of York, which spreads to the southward before the city of New-York.

The legislature of New-York, stimulated by the enterprizing and active Pennsylvanians, who are competitors for the trade of the western country, have lately granted very liberal sums, towards improving those roads that traverse the most settled parts of the country, and opening such as lead into the western and northern parts of the state, uniting, as far as possible, the establishments on Hudson's river, and the most populous parts of the interior country, by the nearest practicable distances. By late establishments of post-roads, a safe and direct conveyance is opened between the most interior western parts of this state, and the several states in the Union: and when the obstructions between Hudson's river and lake Ontario are removed, there will not be a great deal to do to continue the water communication by the lakes, and through Illinois river to the Mississipi. New-York, to speak generally, is intersected by ridges of mountains, extending in a N. E. and S. W. direction. Beyond the Alleghany mountains, however, the country is level, of a fine rich soil, covered in its natural state with maple, beech, birch, cherry, black walnut, locust, hickory, and some mulberry trees. On the banks of Lake Erie are a few chesnut and oak ridges. Hemlock swamps are interspersed thinly through the country. All the creeks that empty into Lake Erie have falls, which afford many excellent mill-seats. The lands between the Seneca and Cayuga lakes, are represented as uncommonly excellent, being most agreeably diversified with gentle risings, and timbered with lofty trees, with little underwood. The legislature have granted a million and a half acres of land, as a gratuity to the officers and soldiers of the line of this state. This tract forms the military townships of the county of Onondago. East of the Alleghany mountains, which commence with the Kaat's Kill, on the west side of Hudson's river, the country is broken into hills with rich intervening vallies. The hills are cloathed thick with timber, and when cleared afford fine pasture, the vallies, when cultivated, produce wheat, hemp, flax, peas, grass, oats, Indian corn, &c. Of the commodities produced from culture, wheat is the principal. Indian corn and peas are likewise raised for exportation; and rye, oats, barley, &c. for home consumption. The best lands in the state, along the Mohawk river and north of it, and west of the Alleghany mountains, but a few years ago was mostly in a state of nature, but has been of late rapidly settling. In the northern and unsettled parts of the state, are plenty of moose, deer, bears, some beavers, martins, and most other inhabitants of the forest, except wolves. The Ballstown, Saratoga, and New-Lebanon medicinal springs are much celebrated. The salt made from the Salt Springs here is equal in goodness to that imported from Turk's Island. The weight of a bushel of the salt is 136 lb. A spring is reported to have been discovered in the Susquehannah country, impregnated with nitre, from which salt-petre is made in the same manner that common salt is made from the Onondago springs. Large quantities of iron ore are found here. A silver mine has been worked at Phillipsburg, which produced virgin silver. Lead is found in Herkemer county, and sulphur in Montgomery. Spar, zink or spelter, a semi-metal, magnes, used in glazings, pyrites of a golden hue, various kinds of copper ore, and lead and coal mines are found in this state, also petrified wood, plaster of Paris, isinglass in sheets, talcs, and crystals of various kinds and colours, flint, asbestos, and several other fossils. A small black stone has also been found, which vitrifies with a small heat, and it is said makes excellent glass. The chief manufactures are iron, glass, paper, pot and pearl ashes, earthen ware, maple sugar and molasses, and the citizens in general manufacture their own clothing. This state, having a short and easy access to the ocean, commands the trade of a great proportion of the best settled and best cultivated parts of the United States. Their exports to the West-Indies are biscuit, peas, Indian corn, apples, onions, boards, staves, horses, sheep, butter, cheese, pickled oysters, beef and pork. But wheat is the staple commodity of the state, of which no less than 677,700 bushels were exported so long ago as the year 1775, besides 2,555 tons of bread, and 2,828 tons of flour. The increase since has been in proportion to the increase of the population. In wheat and flour about a million bushels are now annually exported. West-India goods are received in return for the above articles. Besides the articles already enumerated, are exported flax-seed, cotton wool, sarsaparilla, coffee, indigo, rice, pig-iron, bar iron, pot-ash, pearl-ash, furs, deer skins, logwood, fustic, mahogany, bees-wax, oil, Madeira wine, rum, tar, pitch, turpentine, whale-fins, fish, sugars, molasses, salt, tobacco, lard, &c. but most of these articles are imported for re-exportation. The exports to foreign parts, for the year ending September 30, 1791, 1792, &c. consisting principally of the articles above enumerated, amounted as follows; in 1791, to 2,505,465 dolls. 10 cents; 1792—2,535,790 dolls. 25 cents; 1793—2,932,370 dolls.; 1794—5,442,183 dolls. 10 cents; 1795—10,304,580 dolls. 78 cents. This state owned in 1792, 46,626 tons of shipping, besides which she finds employment for about 40,000 tons of foreign vessels. There are in this state, two handsomely endowed and flourishing colleges, viz. Columbia, formerly King's College, in the city of New-York, and Union College, at Schenectady. Besides these, there are dispersed in different parts of the state, 14 incorporated academies, containing in the whole as many as 6 or 700 students. These, with the establishment of schools, one at least in every district of 4 square miles, for the common branches of education, must have the most beneficial effects on the state of society. The sums granted by the legislature of this state for the encouragement of literature since the year 1790, have been very liberal, and is evincive of the wisest policy. In March, 1790, the legislature granted to the regents of the university, who have by law the superintendance and management of the literature of the state, several large and valuable tracts of land, on the waters of Lakes George and Champlain, and also Governor's Island in the harbour of New-York, with intent that the rents and income thereof should be by them applied to the advancement of literature. At the ſame time they granted them £1000 currency, for the ſame general purpoſe. In April, 1792, they ordered to be paid to the regents £1500 for enlarging the library, £200 for a chemical apparatus, £1200 for erecting a wall to ſupport the college grounds, and £5000 for erecting a hall and an additional wing to the college: Alſo £1500 annually for 5 years, to be diſcretionally diſtributed among the academies of the ſtate. Alſo £750, for 5 years, to be applied to the payment of the ſalaries of additional profeſſors. In their ſeſſions ſince 1795, the ſums they have granted for the ſupport of the colleges, academies, and of common ſchools throughout the ſtate, have been very liberal. The religious ſects or denominations in this ſtate are, Engliſh Preſbyterians, Dutch reformed, Baptiſts, Epiſcopalians, Friends or Quakers, German Lutherans, Moravians, Methodiſts, Roman Catholics, Shakers, a few followers of Jemima Wilkinſon at Geneva, and ſome Jews in the city of New-York. The treaſury of this ſtate is one of the richeſt in the Union. The treaſurer of the ſtate reported to the legiſlature in Jan. 1796, that the funds amounted to 2,119,068 dollars, 33 cents, which yields an annuity of 234,218 dollars. Beſides the above immenſe ſum, there was at that period in the treaſury £134 207 : 19 : 10½ currency. The ability of the ſtate, therefore, is abundantly competent to aid public inſtitutions of every kind, to make roads, erect bridges, open canals, and puſh every kind of improvement to the moſt deſirable length. The body of the Six Nations of Indians inhabit the weſtern part of this ſtate.

The Engliſh language is generally ſpoken throughout the ſtate, but is not a little corrupted by the Dutch dialect, which is ſtill ſpoken in ſome counties, particularly in King's, Ulſter, Albany, and that part of Orange which lies S. of the mountains. But as Dutch ſchools are almoſt, if not wholly diſcontinued, that language, in a few generations, will probably ceaſe to be uſed at all. And the increaſe of Engliſh ſchools has already had a perceptible effect in the improvement of the Engliſh language. Beſides the Dutch and Engliſh, there are in this ſtate many emigrants from Scotland, Ireland, Germany, and ſome few from France. Many Germans are ſettled on the Mohawk, and ſome Scots people on the Hudſon, in the county of Waſhington. The principal part of the two former ſettled in the city of New-York, and retain the manners, the religion, and ſome of them the language of their reſpective countries. The French emigrants ſettled principally at New-Rochelle, and on Staten-Iſland, and their deſcendants, ſeveral of them, now fill ſome of the higheſt offices in the United States. The weſtern parts of the ſtate are ſettled and ſettling principally from New-England. There are three incorporated cities in this ſtate, New-York, Albany, and Hudſon.—*ib.*

New-York *County*, in the above ſtate, comprehending the iſland of New-York, or Manhattan, on which the metropolis ſtands, and the following ſmall iſlands: Great Barn, Little Barn, Manning's, Nutten, Bedlow's, Bucking, and Oyſter Iſlands. It contained, in 1790, 33,131 inhabitants, including 2369 ſlaves. Now, in 1796, the number of inhabitants amounts to about 70,000, of whom 7,272 are qualified electors.—*ib.*

New-York *City* is ſituated on the S. W. point of York iſland, at the confluence of Hudſon and Eaſt rivers, and is the metropolis of the ſtate of its name, and the ſecond in rank in the Union. The length of the city on Eaſt river is upwards of two miles, and rapidly increaſing, but falls ſhort of that diſtance on the banks of the Hudſon. Its breadth, on an average, is about a mile; and its circumference, 4 or 5 miles. The plan of the city is not perfectly regular, but is laid out with reference to the ſituation of the ground. The ground which was unoccupied before the peace of 1783, was laid out in parallel ſtreets of convenient width, which has had a good effect upon the parts of the city lately built. The principal ſtreets run nearly parallel with the rivers. Theſe are interſected, though not at right angles, by ſtreets running from river to river. In the width of the ſtreets there is a great diverſity. Water-ſtreet and Pearl-ſtreet, which occupy the banks of Eaſt river, are very conveniently ſituated for buſineſs, but they are low and too narrow; not admitting in ſome places of walks on the ſides for foot paſſengers. Broad-ſtreet, extending from the Exchange to City Hall, is ſufficiently wide. This was originally built on each ſide of the creek, which penetrated almoſt to the City Hall. This ſtreet is low, but pleaſant. But the moſt convenient and agreeable part of the city is the Broadway. It begins at a point which is formed by the junction of the Hudſon and Eaſt rivers —occupies the height of land between them, upon a true meridional line—riſes gently to the northward—is nearly 70 feet wide—adorned, where the fort formerly ſtood, (which has lately been levelled) with an elegant brick edifice, for the accommodation of the governor of the ſtate, and a public walk from the extremity of the point, occupying the ground of the lower battery which is now demoliſhed; alſo with two Epiſcopal churches, and a number of elegant private buildings. It terminates, to the northward, in a triangular area, fronting the bridewell and alms-houſe, and commands from any point, a view of the Bay and Narrows. Since the year 1788, that part of the city, which was buried in ruins during the war, has been rapidly rebuilding, the ſtreets widened, ſtraitened, raiſed in the middle under an angle ſufficient to carry off the water to the ſide gutters, and foot-ways of brick made on each ſide. At this time, the part that was deſtroyed by fire is all covered with elegant brick houſes. Wall-ſtreet is generally 50 feet wide and elevated, and the buildings elegant. Hanover-ſquare and Dock-ſtreet are conveniently ſituated for buſineſs, and the houſes well built. William-ſtreet is alſo elevated and convenient, and is the principal market for retailing dry goods. Many of the other ſtreets are pleaſant, but moſt of them are irregular and narrow. The houſes are generally built of brick, and the roofs tiled. There are remaining a few houſes built after the old Dutch manner; but the Engliſh taſte has prevailed almoſt a century. The moſt magnificent edifice in this city is *Federal Hall*, ſituated at the head of Broad-ſtreet, where its front appears to great advantage, in which is a gallery 12 feet deep, guarded by an elegant iron railing. In this gallery our beloved Washington, attended by the ſenate and houſe of repreſentatives, took his oath of office in the face of Heaven, and in preſence of a large concourſe of people aſſembled in front, at the commencement of the operation of the Federal conſtitution, April 30th, 1789. The other public buildings in the city are, three houſes for public

New York. worship for the Dutch Reformed church, four Presbyterian churches, three Episcopal churches, two for German Lutherans and Calvinists, two Friends' meeting-houses, two for Baptists, two for Methodists, one for Moravians, one Roman Catholic church, one French Protestant church, and a Jew's synagogue. Besides these there is the governor's house, already mentioned, a handsome building, the college, jail, and several other buildings of less note. The city is accommodated with four markets in different parts, which are furnished with a great plenty and variety of provisions, in neat and excellent order.

King's college, in the city of New-York, was principally founded by the voluntary contributions of the inhabitants of the province, assisted by the general assembly, and the corporation of Trinity Church; in the year 1754, a royal charter (and grant of money) being then obtained, incorporating a number of gentlemen therein mentioned, by the name of "The Governors of the College of the province of New-York, in the city of New-York, in America;" and granting to them and their successors forever, amongst various other rights and priveleges, the power of conferring all such degrees as are usually conferred by either of the English universities. By the charter it was provided that the president shall always be a member of the church of England, and that a form of prayer collected from the liturgy of that church, with a particular prayer for the college, shall be daily used, morning and evening, in the college chapel; at the same time, no test of their religious persuasion was required from any of the fellows, professors or tutors; and the advantages of education were equally extended to students of all denominations. The building (which is only one third of the intended structure) consists of an elegant stone edifice, three complete stories high, with four staircases, 12 apartments in each, a chapel, hall, library, museum, anatomical theatre, and a school for experimental philosophy. The college is situated on a dry gravelly soil, about 150 yards from the bank of Hudson's river, which it overlooks, commanding a most extensive and beautiful prospect. Since the revolution, the legislature passed an act constituting 21 gentlemen (of whom the governor and lieutenant-governor, for the time being, are members *ex officiis)* a body corporate and politic, by the name and style of "The Regents of the University of the State of New-York." They are entrusted with the care of literature in general in the state, and have power to grant charters of incorporation for erecting colleges and academies throughout the state, are to visit these institutions as often as they shall think proper, and report their state to the legislature once a year. King's College, which we have already described, is now called *Columbia College*. This college, by an act of the legislature passed in the spring of 1787, was put under the care of 24 gentlemen, who are a body corporate by the name and style of "The Trustees of Columbia College in the city of New-York." This body possess all the powers vested in the governors of King's College, before the revolution, or in the regents of the university, since the revolution, so far as their power respected this institution. No regent can be a trustee of any particular college or academy in the state. The regents of the university have power to confer the higher degrees, and them only. The college edifice has received no New York. addition since the peace, though the erection of a hall and a wing have been contemplated, and funds for the purpose granted by the legislature. The annual revenue arising from the estate belonging to the college, exclusive of some bonds, which are not at present productive, amounts to £1,535 currency. Columbia college consists of two faculties; a faculty of arts and a faculty of physic. The first has a president and 7 professors, and the second a dean and 7 professors. The students attending both the faculties at the beginning of the year 1795 amounted to 140. The officers of instruction and immediate government in the faculty of arts, are a president, professor of mathematics and natural philosophy, a professor of logic and geography, and a professor of languages. To these have lately been added a professor of chymistry and agriculture, a professor of oriental languages, a professor of law, and a professor of the French language. In the faculty of physic, the dean is lecturer on clinical medicine in the New-York hospital; and there are the professorships of botany, of anatomy, of the obstetric art, of materia medica, of the institutes of medicine, of surgery, and the practice of physic. These professors afford the necessary instruction in the healing art. The library and museum were destroyed during the war. Upwards of £800 (of monies granted by the legislature) have been lately expended in books to increase the library. The philosophical apparatus is new and complete. The government of the city (which was incorporated in 1696) is now in the hands of a mayor, aldermen and common council. The city is divided into seven wards, in each of which there is chosen annually by the people an alderman and an assistant, who, together with the recorder, are appointed annually by the council of appointment. The mayor's court, which is held from time to time by adjournment, is in high reputation as a court of law. A court of sessions is likewise held for the trial of criminal causes. The situation of the city is both healthy and pleasant. Surrounded on all sides by water, it is refreshed with cool breezes in summer, and the air in winter is more temperate than in other places under the same parallel. This city is esteemed the most eligible situation for commerce in the United States. It almost necessarily commands the trade of one half New Jersey, most of that of Connecticut, part of that of Massachusetts, and almost the whole of Vermont, besides the whole fertile interior country, which is penetrated by one of the largest rivers in America. This city imports most of the goods consumed between a line of 30 miles E. of Connecticut river, and 20 miles west of the Hudson, which is 130 miles; and between the ocean and the confines of Canada, about 400 miles; a considerable portion of which is the best peopled of any part of the United States; and the whole territory contains nearly a million people, or one one-fifth of the inhabitants of the Union. Besides, some of the other states are partially supplied with goods from New-York. But in the staple commodity, flour, Pennsylvania and Maryland have exceeded it, the superfine flour of those states commanding a higher price than that of New-York; not that the quality of the grain is worse, but because greater attention is paid in those states to the inspection and manufacture of that article. In the manufacture likewise of iron, paper, cabinet works, &c.

New York, || Neybe. Pennsylvania exceeds not only New York, but all her sister States. In times of peace, however, New York will command more commercial business than any town in the United States. In time of war it will be insecure, without a marine force; but a small number of ships will be able to defend it from the most formidable attacks by sea. A want of good water is a great inconvenience to the citizens, there being few wells in the city. Most of the people are supplied every day with fresh water, conveyed to their doors in casks, from a pump near the head of Queen street, which receives it from a spring almost a mile from the centre of the city. This well is about 20 feet deep and four feet diameter. The average quantity drawn daily from this remarkable well, is 110 hogsheads of 130 gallons each. In some hot summer days 216 hogsheads have been drawn from it; and what is very singular, there is never more or less than about 3 feet water in the well. The water is sold commonly at three pence a hogshead at the pump. This inconvenience, however, has of late been removed in a great degree by the introduction of the Manhattan water in pipes to various parts of the city, this, so far as it has been carried, is of very great advantage. On a general view of this city, as described 40 years ago, and in its present state, the comparison is flattering to the present age; particularly the improvements in taste, elegance of manners, and that easy unaffected civility and politeness which form the happiness of social intercourse. The number of inhabitants in the city and county of New-York in 1756, was 10,881; 1771, 21,863; 1786, 23,614; 1790, 33,131; 1796, 7.272 electors; probably about 70,000 inhabitants. There is no bason for the reception of vessels, but the road where they lie in East river, which is protected from the violence of the sea by the circumjacent islands. The great rapidity of the tides in the narrow channels between Long Island and York Island, and between Long Island and Staten Island, increased by the water of Hudson and East rivers, preserves the channel from being obstructed by ice; so that navigation is always open, except a few days when the weather is uncommonly severe. The entries from foreign ports only into this port in 1795 were 941, *viz.* ships, 178—brigs, 309—barques, 9—snows, 7—schooners, 268—sloops, 170. Works of defence have been erected here to a considerable extent, and when completed on the original plan, will afford great security to the city, from enemies' ships. New York city is 95 miles N. E. of Philadelphia, 127 S. W. of Hartford, 197 N. E. of Baltimore, 252 S. W. of Boston, 375 from Portland, in Maine, 373 from Richmond, 620 from Fayetteville, 913 from Charleston, and 1.020 from Savannah. N. lat. 40 42 8, W. long. 74 9 45.—*ib.*

New York *Island*, on which the city of that name stands, is about 15 miles long, and does not exceed two in any part in breadth. It is joined to the main land by a bridge, called King's Bridge, 15 miles N. of New York city.—*ib.*

NEYBE, or *Neiva*, a fertile plain on the south side of the island of St Domingo; bounded E. by the bay and river of its name, on the W. by the river of Dames, and the Pond of Heniquelle. It contains about 80 square leagues, abounds with game, and is a chosen spot for flamingoes, pheasants, and royal or crowned peacocks. These last have a more delicate flavour and more brilliant plumage than the peacocks of Europe. Nine leagues from the W. bank of the Neybe is the town, containing about 200 houses, and can turn out 300 men fit to bear arms. This town is 15 leagues W. by N. of Azua, and 16 from the point where the line of demarcation cuts Brackish Pond. This territory produces a sort of plaister, talc, and fossil salt. The natural reproduction of the salt is so rapid, that a pretty large hollow, is absolutely filled up again in the course of a year. The river might be rendered navigable for small craft, and the plain is able to afford eligible situations for 150 sugar plantations.—*ib.*

Niagara. NIAGARA *River* and *Falls*. Niagara *river*, connects the N. E. end of Lake Erie with Lake Ontario, and is about 30 miles in length, from Fort Erie to Niagara Fort, and forms a part of the boundary between the United States and Upper Canada. It receives Chippeway or Welland river from the W. and Tonewanto Creek from the E. and embosoms Great and Navy Islands. Fort Slusher stands on the E. side of this river near Navy Island. The *Falls*, in this river, are opposite Fort Slusher, about 7 or 8 miles south of Lake Ontario, and form the greatest curiosity which this, or indeed any other country, affords. In order to have a tolerable idea of this stupendous fall of water, it will be necessary to conceive that part of the country in which Lake Erie is situated, to be elevated above that which contains Lake Ontario, about 300 feet; the slope which separates the upper and lower country is generally very steep, and in many places almost perpendicular; it is formed by horizontal strata of stone, great part of which is lime stone. The slope may be traced by the north side of Lake Ontario, near the bay of Torento, round the west end of the Lake; thence the direction is generally east. Between Lake Ontario and Lake Erie it crosses the strait of Niagara and the Genessee river; after which it becomes lost in the country towards Seneca Lake. It is to this slope the country is indebted both for the Cataract of Niagara and the great Falls of Genessee. The Cataract of Niagara, some have supposed, was formerly at the northern side of the slope near the landing; and that from the great length of time, and the quantity of water, and distance which it falls, the solid stone is worn away for about seven miles up towards Lake Erie, (B) and a chasm is formed which no person can approach without terror. Down this chasm the water rushes with a most astonishing noise and velocity, after it makes the great pitch. Here the fancy is constantly engaged in the contemplation of the most romantic and awful prospect imaginable; when the eye catches the falls, the contemplation is instantly arrested, and the beholder admires in silence. The river is about 742 yards wide at the falls. The perpendicular pitch of this vast body of water produces a sound that is frequently heard at the distance of 20 miles, and in

(B) Gen. Lincoln, who visited and examined these falls, in 1794, says, "On a careful examination of the banks of the river, there appears to be no good foundation for this opinion."

in a clear day, and fair wind, 40 and even 50 miles. A perceptible tremulous motion in the earth is felt for several rods round. A heavy cloud or fog is constantly ascending from the falls, in which rainbows may always be seen when the sun shines. This fog or spray, in the winter season, falls upon the neighbouring trees, where it congeals, and produces a most beautiful crystalline appearance: this remark is applicable also to the Falls of Genessee. It is conjectured that the water must fall at least 65 feet in the chasm; the perpendicular pitch at the cataract is 150 feet; other accounts say only 137 feet: to these add 58 feet, which the water falls the last half mile immediately above the falls, and we have 273, which the water falls in the distance of 7½ miles. Animals swimming near the Rapids above the great Cataract are instantly hurried to destruction. Just below the Great Pitch, the water and foam may be seen puffed up in large spherical figures; they burst at the top, and project a column of the spray to a prodigious height, and then subside, and are succeeded by others which burst in like manner. This appearance is most remarkable about half way between the island that divides the falls and the west side of the strait, where the largest column of water descends. The descent into the chasm of this stupendous cataract is very difficult, on account of the great height of the banks; but when once a person has descended, he may go up to the foot of the Falls, and take shelter behind the descending column of water, between that and the precipice, where there is a space sufficient to contain a number of people in perfect safety, and where conversation may be held without interruption from the noise, which is less here than at a considerable distance. On Christmas night, 1795, a severe shock of an earthquake was felt here, and by which a large piece of the rock that forms the famous cataract was broken off.—*ib.*

Niagara, a fort and post town in the State of New York, situated on the E. side of Niagara river, at its entrance into Lake Ontario, and opposite to Newark, in Canada. Niagara Fort is a most important post, and secures a greater number of communications, through a large country, than probably any other pass in interior America. It is about 9 miles below the cataract, 80 N. W. of Williamsburg on Genessee river, 370 N. W. of Philadelphia, and 560 W. by N. of Boston. N. lat. 43 20 W. long. 79. The fort was built by the French about the year 1725, and was delivered up to the United States, according to the treaty of 1794, by the British, in 1796. Although it is a degree N. of Boston, yet the season is quite as mild here as at that town, and vegetation quite as early and forward. It is thought that the climate meliorates in the same latitude as one proceeds from the Atlantic westward.—*ib.*

NICARAGUA, a lake in the province of New Spain, 117 leagues in circumference. Its western part is not more than 20 miles from the S. W. coast of Mexico. It sends its waters east to the ocean, by a spacious river of its name, which divides the province of Nicaragua from Costa Rico. This renders the towns on the banks of the lake of considerable importance, particularly the cities of Granada, Leon, and Nicaragua. The first is on the south side in lat. 11 8 N. and long. 85 12 W. and is 45 miles westward of the city of Nicaragua, that stands at some distance south from the lake. Leon is at the west end of the lake, and in lat. 12 N. and long. 87 W. The lake is interspersed with several islands, and full of fish, but infested with alligators. Nicaragua river empties into the sea, opposite to the island of Monglares. N. lat. 11 40, W. long. 82 47.—*ib.*

Nicaragua, a maritime province of Mexico, having Honduras on the north, the North Sea on the east, Costa Rico on the S. E. and the South Sea on the S. W. It is about 400 miles long, and 120 broad. The air is wholesome and temperate, and the soil fertile, producing quantities of sugar, cochineal, and fine chocolate. This is considered as the garden of America; being so pleasant and fruitful, that when the Spaniards first visited it, they called it Mahomet's paradise.—*ib.*

NICHOLAS, *Cape St*, the north-west extremity of the island of St Domingo, in the West Indies. It is 2 leagues W. of the town of its name, but more commonly called *The Mole*, 9 or 10 leagues east of Cape Mayzi, at the east end of Cuba, and 46 leagues north-east by north of Cape Dame Marie, and, with this last cape, forms the entrance into the large bay called the Bite or Bight of Leogane.—*ib.*

Nicholas, *Port St*, on the coast of Peru, in S. America, lies north of Port St John, about a league to leeward of the river Masca, and 6 leagues S. S. E. of Port Cavallo. It is safer than St John's harbour, but affords neither wood nor water.—*ib.*

NICKAJACK, an Indian town on the S. E. side of Tennessee river, at the point of a large bend, about 36 miles north-east of the Creek's Crossing Place. Half way between these lies the Crow Town, on the same side of the river.—*ib.*

NICKER, one of the small Virgin Islands, situated between Anegada and Virgin Gorda, on the latter of which it is dependent. N. lat. 18 30, W. long. 65 5.—*ib.*

NICOLE (Francis), a very celebrated French mathematician, was born at Paris December 23. 1683. His early attachment to the mathematics induced M. Montmort to take the charge of his education; and he opened out to him the way to the higher geometry. He first became publicly remarkable by detecting the fallacy of a pretended quadrature of the circle. This quadrature a M. Mathulon so assuredly thought he had discovered, that he deposited, in the hands of a public notary at Lyons, the sum of 3000 livres, to be paid to any person who, in the judgment of the Academy of Sciences, should demonstrate the falsity of his solution. M. Nicole, piqued at this challenge, undertook the task, and exposing the paralogism, the Academy's judgment was, that Nicole had plainly proved that the rectilineal figure which Mathulon had given as equal to the circle, was not only unequal to it, but that it was even greater than the polygon of 32 sides circumscribed about the circle. The prize of 3000 livres Nicole presented to the public hospital of Lyons.

The Academy named Nicole, Eleve-Mechanician, March 12. 1707; Adjunct in 1716, Associate in 1718, and Pensioner in 1724; which he continued till his death, which happened the 18th of January 1758, at 75 years of age.

His works were all inserted in the different volumes of the Memoirs of the Academy of Sciences; and are as follow: 1. A General Method for determining the Nature of Curves formed by the Rolling of other Curves upon any Given Curve; in the volume for the year 1707.

1707. 2. A General Method for Rectifying all Roulets upon Right and Circular Baſes, 1708. 3. General Method of determining the Nature of thoſe Curves, which cut an Infinity of other Curves given in Poſition, cutting them always in a Conſtant Angle, 1715. 4. Solution of a Problem propoſed by M. de Lagny, 1716. 5. Treatiſe of the Calculus of Finite Differences, 1717. 6. Second Part of the Calculus of Finite Differences, 1723. 7. Second Section of ditto, 1723. 8. Addition to the two foregoing papers, 1724. 9. New Propoſition in Elementary Geometry, 1725. 10. New Solution of a Problem propoſed to the Engliſh Mathematicians, by the late M. Leibnitz, 1725. 11. Method of Summing an Infinity of New Series, which are not ſummable by any other known method, 1727. 12. Treatiſe of the Lines of the Third Order, or the Curves of the Second Kind, 1729. 13. Examination and Reſolution of ſome Queſtions relating to Play, 1730. 14. Method of determining the Chances at Play. 15. Obſervations upon the Conic Sections, 1731. 16. Manner of generating in a Solid Body all the Lines of the Third Order, 1731. 17. Manner of determining the Nature of Roulets formed upon the Convex Surface of a Sphere; and of determining which are Geometric and which are Rectifiable, 1732. 18. Solution of a Problem in Geometry, 1732. 19. The Uſe of Series in reſolving many Problems in the Inverſe Method of Tangents, 1737. 20 Obſervations on the Irreducible Caſe in Cubic Equations, 1738. 21. Obſervations upon Cubic Equations, 1738. 22. On the Triſection of an Angle, 1740. 23. On the Irreducible Caſe in Cubic Equations, 1741. 24. Addition to ditto, 1743. 25. His Laſt Paper upon the ſame, 1744. 26. Determination, by Incommenſurables and Decimals, the Values of the Sides and Areas of the Series in a Double Progreſſion of Regular Polygons, inſcribed in and circumſcribed about a Circle, 1747.*

* Hutton's Dictionary.

NICOLA, or *Nichola Town Gut*, on the north eaſt coaſt of the iſland of St Chriſtopher's.—*Morſe.*

NICOYA, or *St Lucar*, a town of Coſta Rico, in the kingdom of Mexico, North America, having a harbour on a bay of the North Pacific Ocean, in lat. 10 20 N. and long. 88 10 W. About 10 leagues is the bay of Salinas, from whence the inhabitants of this place procure and ſend to Panama the purple juice of a ſhell-fiſh found in it, beſides ſalt, honey, maize, fowls and wheat; and here is alſo a pearl fiſhery. The town is up within the land, but ſhips ride in the river Cipanſo, 2 leagues to the N. W. from the iſland of Chira, to take in goods from it; which river is navigable for large periaguas that bring down the goods to the ſhips. The iſland of Chira affords plenty of freſh water and proviſions.—*ib.*

NICTAU, a river of Nova Scotia, which waters the townſhip of Annapolis; on its banks are quantities of bog and mountain ore. A bloomery has been erected in the town.—*ib.*

NICUESA, *Gulf of*, is on the eaſt coaſt of the country of Honduras, on the Spaniſh Main, having Cape Gracias a Dios for its north limit, and Cape Blanco, on the ſouth; Catherine, or Providence, is due eaſt from it.—*ib.*

NIEBE, or *Neybe*, a bay and river on the ſouth coaſt of the iſland of St Domingo. The bay is ſituated at north-north-eaſt from Cape Beata. N. lat. 18 3, W. long. 73 46 —*ib.*

NIEUWLAND (Peter), profeſſor of mathematics and natural philoſophy in the univerſity of Leyden, was born at Diemermeer, a village near Amſterdam, on the 5th of November, 1764. His father, by trade a carpenter, having a great fondneſs for books, and being tolerably well verſed in the mathematics, inſtructed his ſon himſelf till he attained to his eleventh year. Young Nieuwland appears to have diſplayed ſtrong marks of genius at a very early period. When about the age of three, his mother put into his hand ſome prints, which had fifty verſes at the bottom of them by way of explanation. Theſe verſes ſhe read aloud, without any intention that her ſon ſhould learn them; and ſhe was much ſurpriſed ſome time after to hear him repeat the whole from memory, with the utmoſt correctneſs, on being only ſhewn the prints.

Before he was ſeven years of age he had read more than fifty different books, and in ſuch a manner that he could frequently repeat paſſages from them both in proſe and in verſe. When about the age of eight, Mr Aenæ at Amſterdam, one of the greateſt calculators of the age, aſked him if he could tell the ſolid contents of a wooden ſtatue of Mercury which ſtood upon a piece of clock-work. "Yes (replied young Nieuwland), provided you give me a bit of the ſame wood of which the ſtatue was made; for I will cut a cubic inch out of it, and then compare it with the ſtatue." Poems which (ſays his eulogiſt) diſplay the utmoſt livelineſs of imagination, and which he compoſed in his tenth year, while walking or amuſing himſelf near his father's houſe, were received with admiration, and inſerted in different poetical collections.

Such an uncommon genius muſt ſoon burſt through thoſe obſtacles which confine it. Bernardus and Jeronimo de Boſch, two of the firſt and wealthieſt men at Amſterdam, became young Nieuwland's benefactors, and contributed very much to call forth his latent talents. He was taken into the houſe of the former in his eleventh year, and he received daily inſtruction from the latter for the ſpace of four years. While in this ſituation he made conſiderable progreſs in the Latin and Greek languages, and he ſtudied philoſophy and the mathematics under Wyttenbach. In the year 1783 he tranſlated the two diſſertations of his celebrated inſtructors, Wyttenbach and de Boſch, on the opinions which the ancients entertained of the ſtate of the ſoul after death, which had gained the prize of the Teylerian theological ſociety.

From the month of September 1784 to 1785, Nieuwland reſided at Leyden as a ſtudent in the univerſity, and afterwards applied with great diligence, at Amſterdam, to natural philoſophy and every branch of the mathematics, under the direction of Profeſſor van Swinden. He had ſcarcely begun to turn his attention to chemiſtry, when he made himſelf maſter of the theory of the much-lamented Lavoiſier, and could apply it to every phenomenon. He could read a work through with uncommon quickneſs, and yet retain in his mind the principal part of its contents.

Nieuwland's attention was directed to three principal purſuits, which are ſeldom united; poetry, the pure mathematics, and natural philoſophy. In the latter part of his life he added to theſe alſo aſtronomy. Among the poems which he publiſhed, his Orion alone has rendered his name immortal in Holland. Of the ſmall eſſays which he published in his youth, the two following are particularly deserving of notice: 1. A Comparative View of the Value of the different Branches of Science; and, 2. The best Means to render general, not Learning, but Soundness of Judgment and Good Taste.

One of his great objects was to bring the pure mathematics nearer to perfection, to clear up and connect their different parts, and in particular to apply them to natural philosophy and astronomy. Cornelius Douwes discovered an easy method of determining the latitude of a place at sea, not by the meridian altitude of the sun, but by two observations made at any other period of the day. This method, however, being still imperfect, Nieuwland turned his thoughts towards the improvement of it, and in the beginning of the year 1789, wrote a paper on the subject, which he transmitted to M. de Lalande at Paris, from whom it met with great approbation. In the year 1792, when Nieuwland resided two months at Gotha with Major von Zach these two learned men often conversed on this method of finding the latitude, and calculated the result of observations which they had made with a sextant and an artificial horizon. The above paper, enlarged by these observations, was inserted by Major von Zach with Nieuwland's name in the first Supplement to Bode's Astronomical Almanack, Berlin, 1793.

This, however, was not the only service which Nieuwland endeavoured to render to astronomy. It had been observed by Newton, Euler, De la Place, and others, that the axes of the planets do not stand perpendicular, but inclined, to the plane of their orbits; and Du Sejour, in his analytical treatise on the apparent motion of the heavenly bodies, considers it as highly probable that this phenomenon depends on some *physical* cause; which, however, he does not venture to assign. Nieuwland proceeded farther, and laid down principles, from which he drew this conclusion, that the above phenomenon is intimately connected with the whole system of attraction. On these principles he made calculations, the result of which was exactly equal to the angle of the inclination of the earth's axis to the plane of its orbit. Nieuwland communicated his discovery with much modesty to the celebrated Professor Damen at Leyden, who proposed some objections to it which discouraged Nieuwland, and induced him to revise his calculations with more accuracy. Major von Zach transmitted the paper which contained them to M. De la Place at Paris, and caused it to be printed also, for the opinion of the learned, in the Supplement to Professor Bode's Astronomical Almanack for the year 1793.

The writer of this article is not acquainted either with the principles which this young astronomer assumed, or with the calculations which he made from them; but if he holds gravitation to be essential to matter, and the inclination of the axes of the planets to be the necessary result of the law of gravitation, he is undoubtedly in an error. The axes of the planets are not all equally inclined, nor does the inclination vary in exact proportion to the squares of the distances.

Nieuwland's talents and diligence soon recommended him to the notice of his country. In his twenty-second year, he was appointed a member of the commission chosen by the College of Admiralty at Amsterdam for determining the longitude and improving marine charts. On this labour he was employed eight years, and undertook also to prepare a nautical almanack, and to calculate the necessary tables. The mathematical part was in general entrusted to Nieuwland; but he assisted also his two colleagues van Swinden and van Keulen, in the departments assigned to them, with such assiduity, that most of the work published on the longitude, together with the three additional parts, were the fruits of his labour. In the second edition of the explanation of the nautical almanack, he had also the principal share; and he was the author, in particular, of the explanation of the equation of time, the method of determining the going of a time piece, and of calculating the declination of the moon.

Soon after Nieuwland engaged in this employment, it appeared as if his destination was about to be changed. In the year 1787, he was chosen by the States of Utrecht to succeed Professor Hennert; but on account of certain circumstances this appointment did not take place. He was, however, invited to Amsterdam by the magistrates of that city, to give lectures on mathematics, astronomy, and navigation. While in this situation, he wrote his useful and excellent treatise on navigation, the first part of which was published at Amsterdam in 1793, by George Hulst van Keulen; and it is much to be wished that M. van Swinden would complete this work from the papers bequeathed to him by his deceased friend the author.

In astronomical pursuits, Nieuwland applied not only to the theoretical, but also to the practical part; and in this study he was encouraged and assisted by Major von Zach, with whom he resided some time in the course of the year 1792, and who instructed him in the proper use of the sextant. This affectionate friend published also all his observations and calculations in the before-mentioned Supplement to Bode's Astronomical Almanack.

In the year 1789, Nieuwland was chosen member of a learned society whose object was chemical experiments; and so apt was his genius for acquiring knowledge, that in a little time he made himself completely master of the theory of chemistry. A proof of this is the treatise which he read on the 24th of May 1791, in the society, distinguished by the motto of *Felix Meritis*, and which has been printed in the first part of the New General Magazine (*Niew Algemeen Magazyn*). At the same time he was able to examine the important discoveries made by the society, to assist in preparing an account of them for the press, and to publish them with sufficient accuracy in the French language. Three parts of this work appeared under the title of *Recherches Physico chymiques*. The first part appeared in 1792, and was afterwards reprinted in the *Journal de Physique*. The second was published in 1793, and the fourth in 1794. Some letters of his on chemistry may be found also in a periodical work called *The Messenger* (*Letterbode*).

This ingenious and diligent man was of great service also in the philosophical department to the above society, *Felix Meritis*, of which he had been chosen a titular member on the 25th of January 1788, and an honorary member on the 15th of March 1791. The papers for which it was indebted to him are as follows:—1. On the Newest Discoveries in Astronomy, and the Progress lately made in that Science, 1788. This is an extract from a Latin oration which he intended to deliver

deliver at Utrecht when he expected to succeed Professor Hennert.—2. On the Figure of the Earth, 1789. —3. On the Course of Comets, and the Uncertainty of the Return of the Comet now Expected, 1790.—4. On the Nature of the Mathematics. The principal object of this paper was to illustrate the idea, that the mathematics may be considered as a beautiful and perfect language.—5. On the Periodical Decrease or Increase in the Light of Certain Fixed Stars, and Particularly of the Star Algol, 1790.—6. On the Solution of Spherical Trigonometry by Means of a New Instrument Invented by Le Guin, 1791. M. le Guin having transmitted to the College of Admiralty at Amsterdam an instrument which might be used with great advantage in trigonometrical operations, and by which, in calculating the longitude, one could deduce the real from the apparent distance, the admiralty charged Nieuwland to examine this instrument; and he found that it might be of excellent service for the above purpose.—7. On the Relative Value or Importance of the Sciences, 1791.—8. On the System of Lavoisier, 1792. —9. On the Selenotopographia of Schröder, 1793.—10. On what is Commonly Called Cultivation, Instruction, or Enlightening, 1793.

Nieuwland had applied closely to the mathematics, astronomy, and navigation, for six years; during which time he made considerable improvements in nautical charts, and filled up his vacant hours with the study of philosophy and chemistry. In the month of July 1793 he was invited to the university of Leyden, to be professor of philosophy, astronomy, and the higher mathematics, in the room of the celebrated Damen; and the admiralty of Amsterdam requested him to continue his nautical researches, which he did with great assiduity till the period of his death. The only variation which he now made in his studies related to natural philosophy, for with the mathematics he was already sufficiently acquainted. He applied therefore to the experimental part, and spared no pains nor labour to become perfect in it; which would certainly have been the case, had he not been snatched from science and his friends at the early age of thirty. He died of an inflammation in his throat, accompanied with a fever, on the 15th of November 1794.

In his external appearance, Nieuwland was not what might be called handsome, nor had he ever been at pains to acquire that ease of deportment which distinguishes those who have frequented polite company. His behaviour and conversation were however agreeable, because he could discourse with facility on many subjects, and never wished to appear but under his real character. On the first view one might have discerned that he was a man of great modesty and the strictest morality. His father was a Lutheran, and his mother a baptist; but he himself was a member of what is called the reformed church, *i. e.* a Calvinist, and always showed the utmost respect for the Supreme Being both by his words and his actions.

NIEVA *Island*, lies south-west of Mistake Bay, and on the north-east side of Hudson's Straits.—*ib.*

NIEVA TERRA, near the east end of Hudson's Straits, in North America, in lat. 62 4 N. and long. 67 7 W. and has high water on the spring-tide days at 50 min. past 9 o'clock.—*ib.*

NIGANICHE, an island on the coast of Cape Breton Island, and in the south part of the Gulf of St Lawrence, is to the southward of a cape about 4 leagues south-south-west of Achepe harbour, and 8 leagues from North Cape.—*ib.*

NIGER, a large river in Africa, of which many erroneous accounts have been published, and among them that which we have given in the *Encyclopædia*. By Herodotus, Pliny, Ptolemy, and other ancient authors, it is uniformly said to flow from *west* to *east*, dividing Africa as the Danube divides Europe; and from the report of the Africans, the first of these authors calls it a large river abounding with crocodiles. In the twelfth century, however, Edrisi describes the Niger, which he calls the Nile of the negroes, as running from *east* to *west*, and falling into the Atlantic Ocean; and his account was universally adopted by subsequent writers, till its falsehood was discovered by the African Association. From a number of concurring reports, Major Houghton was led to believe that the course of the Niger is from *west* to *east*, according to the most ancient account; and the truth of these reports has been established beyond all controversy by Mr Park, who saw the Niger himself, and actually accompanied it for many miles in its majestic course as laid down by Herodotus.

This river rises in or near the country of Manding (which see in this *Supplement*), between the parallels of 10 and 11 degrees of north latitude, and between the 5th and 9th degree of west longitude, which comprehends a space the most elevated of all this portion of Africa. This is evident from the opposite courses of the three great rivers which rise in it. These are the Gambia, which runs to the west-north-west; the Senegal, which runs to the north-west; and the Joliba (A), or Niger, running to the east-north-east. The head of the principal branch of the Senegal river is about 80 geographical miles to the west of that of the Niger; and the head of the Gambia is again about 100 miles west of the Senegal.

Mr Park traced the Niger to Silla, a considerable town about 420 miles from its source; and it was there larger than the Thames at Westminster. But 420 miles are but a very small part of the course of the Niger, which doubtless receives many tributary streams before it reach Kassina, 700 miles farther eastward, where there is every reason to believe that it was viewed by the ancient Romans. Our traveller collected at Silla what information he could from the Moorish and Negro traders concerning the further course of this majestic stream, as well as of the kingdoms through which it runs; and the following notices he believes to be authentic:

Two short days journey to the eastward of Silla, is the town of Jenne, which is situated on a small island in the river; and is said to contain a greater number of inhabitants than Sego itself, or any other town in Bambarra. (See Sego, *Suppl.*). At the distance of two days more, the river spreads into a considerable lake, called *Dibbie* (or the dark lake); concerning the extent of

(A) This is the negro name of the river, and signifies the *great water*.

of which, all the information which our author could obtain was, that in crossing it, from west to east, the canoes lose sight of land one whole day. From this lake, the water issues in many different streams, which terminate in two large branches, one whereof flows towards the north-east, and the other to the east; but these branches join at Kabra, which is one day's journey to the southward of Tumbuctoo, and is the port or shipping-place of that city. The tract of land which the two streams encircle, is called Jinbala, and is inhabited by negroes; and the whole distance by land, from Jenne to Tumbuctoo, is twelve days journey.

From Kabra, at the distance of eleven days journey, down the stream, the river passes to the southward of Houssa, which is two days journey distant from the river. Of the further progress of this great river, and its final exit, all the natives with whom Mr Park conversed seemed to be entirely ignorant. Their commercial pursuits seldom induce them to travel further than the cities of Tumbuctoo and Houssa; and as the sole object of those journeys is the acquirement of wealth, they pay but little attention to the course of rivers, or the geography of countries. It is, however, highly probable that the Niger affords a safe and easy communication between very remote nations. All our author's informants agreed, that many of the negro merchants who arrive at Tumbuctoo and Houssa, from the eastward, speak a different language from that of Bambarra, or any other kingdom with which they are acquainted. But even these merchants, it would seem, are ignorant of the termination of the river; for such of them as can speak Arabic, describe the amazing length of its course in very general terms, saying only, that they believe *it runs to the world's end.*

Major Rennel, by comparing a great many accounts of the progress of this river beyond Houssa, with the idea which prevails in that city of its termination, has shewn it to be in a very high degree probable, that the waters of the Niger have no direct communication with the sea, but that they are spread out into a great lake in Wangara and Ghana, and evaporated by the heat of the sun. See Wangara in this *Supplement*.

NIGUA, a river on the south side of the island of St Domingo. Its mouth is 7 leagues east of the Nisao. The rivers Nigua and Jayna are not very far apart. But as they advance from their springs, they recede from each other, the former running westward from the latter. Between them lies an extensive and fertile plain. The quantity of pure gold that was dug from its cavities, its sugar, cocoa, indigo, and other plantations, paid duties of a greater amount than those now paid by all the Spanish part of the island put together. All these rivers might be easily rendered navigable. The parish and small town of Nigua contain about 2,500 persons, partly free people of colour.—*Morse.*

NILE, the name of a celebrated river, which, as it has been described in the *Encyclopædia*, should not have been introduced into this place, did we not think ourselves bound candidly to confess that, in our opinion, its sources, at least those sources which were the objects of ancient curiosity, have never yet been seen by any European. This seems to be proved, beyond the possibility of controversy, by Major Rennel in the Appendix to Mr Park's Travels, and by Mr Browne in his account of the *Bahr-el-abiad*, and *Dar-Fur* or *Soudan*. See Soudan in this *Supplement*.

Mr Bruce himself acknowledges that the Nile, which waters Egypt, is the confluence of two streams, and that the western stream, which he, with others, calls *Bahr-el-abiad*, or the *white river*, is the largest of the two. Were a man therefore to travel from Cairo up the banks of the Nile in quest of its source, he would, doubtless, when he should arrive at the division of the river into two channels, continue his journey up the greater of these; for what could induce him to turn aside with the less? Not the *name*; for neither the less nor the greater has by itself the name which, in Egypt, is given to both when united. The former, which undoubtedly has its source in Abyssinia, is there called the Abay or Abavi; and, in other countries through which it runs, the Bahr el Afrek; the latter is, from its source to its junction with the Abay, called the Bahr el abiad. Pliny believed that the Nile came from the west; and Ptolemy says expresly that its remote source is in the *mountains of the moon*. But this Nile must be the White River, which certainly rises to the westward of Abyssinia, and, according to Abulfeda, in the mountains of Komri or Kummeri; which, in Arabic, signifies *lunar*, being the adjective of Kummer, the moon.

In perfect conformity with this ancient account of the source of the Nile, Mr Ledyard was told at Cairo by certain persons from Dar-Fur, that this celebrated river has its coy fountains in their country, at the distance of 55 days journey to the westward of Senaar, which brings them to the Komri mountains of Abulfeda, who, as well as Ptolemy and Edrisi, places the head of the Nile in a quarter far removed from Abyssinia. Ptolemy has indeed mentioned both branches; and while he describes the eastern in such a way as that it cannot be taken for any other than the Abyssinian branch, or the Nile of Bruce and the Portuguese Jesuits, speaks of a larger branch flowing from a more distant source, situated to the south-west. But this can be no other than Bruce's white river, the *Bahr-el-abiad* of Ledyard and Browne. It is true, there is an apparent difference in the account given by these two last mentioned travellers of the country in which the Bahr-el-abiad rises; but it is a difference only apparent. Ledyard was told at Cairo that it rises in Dar Fur; Mr Browne, who resided long in Dar-Fur, was there told, that the sources of the river are near to a place called *Donga*, the residence of the chief or king of an idolatrous nation to the southward of Dar-Fur. It is to be observed, however, that the slave-merchants who trade between Donga and Cairo are always attached to the Soudan or Dar-Fur caravan; and that therefore the persons who told Ledyard that the Nile rises in their country were probably from Donga, though he took them for Furians from the name of their caravan. Mr Browne informs us, that the country about Donga is very mountainous, and that in the spot where the river rises there are said to be forty distinct hills, which are called *Kumri*. From them issues a great number of springs, that, uniting into one great channel, form the Bahr-el-abiad, which suffers the same periodical increase and diminution as the Nile in Egypt. The people of Donga are quite naked, black, and, as we have already observed, idolaters.

ters. Major Rennel places the mountains of the moon between 5° 40′ and 8° 10′ N. Lat. and between 24° 30′ and 30° 25′ E. Long. Their latitude and longitude, as laid down by Mr Browne, are somewhat, tho' very little, different; whilst Geesh, the source of Bruce's Nile, lies between the 10th and 11th degree of N. Lat. and in about the 37th degree of E. Long.

NIMIQUAS, a nation, or, more properly, two tribes in South Africa, called by Vaillant the *Less* and *Greater* Nimiquas.

The country of the Less Nimiquas extends in longitude from the mountains of Camis to the sea on the west, *i. e.* from 15° 25′ to 18° 25′ east from London, and in latitude from 28° 12′ to 29° 36′ south. From the information which our author could collect, he thinks that the number of inhabitants throughout the whole of this tract does not exceed 6000 souls. Even this number is annually diminished by the frequent attacks of Boshmen, and the aridity of the soil. Of the Boshmen we have already given such an account as can leave no doubt of the destructive nature of their incursions; and the soil must be arid indeed, if it be true, as Vaillant assures us, that in the country of the Less Nimiquas rain never falls except when it thunders, and that thunder is so rare as frequently not to be heard for the space of a whole year.

For this want of rain our author accounts in a satisfactory manner: "The country (he says) having neither forests nor lofty mountains to arrest the clouds, those which come from the north pass freely over it, and proceed on to Camis, where they burst and fall, either in rain in the valleys, or in snow on the summits of these mountains, which are the loftiest throughout the south of Africa." The country is of course not fruitful, and its sterility obliges the inhabitants frequently to change their residence, so that they are the most wandering of all the Hottentot tribes. In this barren region the Dutch colonists suppose that gold mines may be found; but our author discovered among the hordes no traces of this metal, though he found many indications of rich copper mines.

The Less Nimiquas, though of a tolerable stature, are not so tall as their neighbours to the eastward; and indeed Vaillant affirms, that the people to the east in the southern part of Africa are much superior to those of the west both in moral and physical qualities, while the animals are far inferior. The Less Nimiquas are great believers in witchcraft; and our author gives a ridiculous account of an interview that he had with an old witch named *Kakoes*, who had a complete ascendency, not only over the whole horde, but also over the savage Boshmen. These robbers, he says, never attempted to plunder the territory where she took up her residence; and she has been known, when their thefts came to her knowledge, to proceed alone, and unguarded, to their retreats in the midst of the woods, to threaten them with her vengeance, and thus compel them to a restitution of the stolen property. All her influence, however, over her own tribe, could procure for our author and his attendants only six sheep.

The women of the horde received his Hottentots with great kindness; and permitted them to discover very singular charms, of which it is needless here to insert a description. Among this people he saw abundance of bracelets, necklaces, and ear-rings of copper; and some of these ornaments were so well made and finely polished, that they must have been manufactured in Europe, and the fruits of an intercourse with the whites. But he saw several others, which, from their grotesque shape and rude workmanship, evidently shewed that they were fabricated by the savages themselves.

"These ornaments (says he) are worn by the Nimiquas in the same manner as by the other savages; yet I observed among them some whimsical peculiarities. I have seen persons with six ear rings of the same shape in one ear, and none in the other: I have seen some with bracelets from the wrist to the elbow on one arm, while the other arm was bare: I have seen others with one side of the face painted in compartments of various colours, while on the other side both the colours and figures were different. In general, I observed great propensity to ornaments among the Less Nimiquas; for their krosses and all their garments were plentifully covered with glass and copper beads, strung on threads, and fastened on every part of their dress. They even wore them in their hair, which was plastered with grease in the most disgusting manner. Many had their heads covered with a reddish incrustation, composed of grease and a powder resembling brick dust, with which their hair was so pasted together, that you would have sworn it to be a cap of red morter. Those who had it in their power to display this luxury of dress, were as proud as are our *petits-maitres*, when they can shake a head loaded with powder, perfume, and pomatum. The *naup-kros*, or short apron, of the women, was adorned with rows of glass beads hanging down to their feet; in other respects they were dressed like the other Hottentots."

The country of the *Greater Nimiquas* is placed by the author in nearly the same longitude with that of the Less, and between 25° and 28° south latitude. It is barren like the other; but the people are much taller, being generally about five feet ten inches high. The men are dull and stupid, but the women are lively and extremely amorous; and both men and women are comparatively handsome and of a slender make. Extravagantly addicted to smoking tobacco, the young girls bartered their favours for a single pipe; and as Vaillant was chief of the caravan, a white, and possessor of tobacco of much better quality, many advances were made to him. "I have no doubt (says he) but I might have formed, for a few pipesfuls only, an alliance with every family in the horde. I was even pressed so closely, as to be obliged to employ some resistance: but, at the same time, I must confess, that my refusals were given in such a way as not to offend; and they who, in consequence of their advances, had been exposed to them, having soon found other arrangements to make, did not shew me the less friendship. I must here add, that the girls alone appeared to me thus free; while the married women on the contrary were modest and reserved. This is a characteristic difference, which distinguishes the Greater Nimiquas from the Hottentot people in general; as likewise does the low cringing air they assume when they have any thing to ask."

It has been said by Kolben, that the Nimiqua women, when they bear twins, destroy one of the infants, but Vaillant assures us that this is a falsehood, as is likewise another tale which is current in the colony. It has been said that the fathers, to shew what affection

Nimiquas. they bear their children, feed their eldest in a particular manner, as being of right the first object of paternal care. For this purpose they put him in a coop as it were; that is, they shut him up in a trench made under their hut, where, being deprived of motion, he loses little by perspiration, while they feed and cram him in a manner with milk and grease. By degrees the child fattens, and gets as round as a barrel; and when he is come to such a state as not to be able to walk, but to bend under his own weight, the parents exhibit him to the admiration of the horde; who from that period conceive more or less esteem and consideration for the family, according as the monster has acquired more or less rotundity.

Such was the account given to our author by a man who affirmed that he had been an eye witness of this mode of cramming the heir-apparent; but whenever any questions were asked on the subject of the Nimiquas themselves, the persons addressed were ready to laugh in our author's face. "Still (says he), as it appeared strange to me, that a man should talk of what he had seen, when he had in reality seen nothing; as it was possible that the fable might have some foundation, without being true in all particulars—I was willing to convince myself what could have given rise to it; and every time I visited a horde, I took care, under different pretences, to examine, one after another, all the huts of the kraal, and to ask which was the eldest child of the family: but I nowhere saw any thing that indicated either this pretended coop, or this pretended cramming."

The Nimiquas are great cowards; yet, like the surrounding nations, they have their assagays and poisoned arrows; and, like them, can handle these arms with dexterity. They possess also those war oxen, so formidable in battle, and so favourable to the cowardice or inactivity of the combatants. They have even a peculiar implement of war, which their neighbours have not. This is a large buckler, of the height of the person who bears it, behind which the Nimiqua can completely conceal himself. But, beside that his natural apathy prevents him from giving or taking offence, he is in reality pusillanimous and cowardly from the coldness of his disposition. To utter only the name of *Houzouana* before him is sufficient to make him tremble. See Houzouanas in this *Suppl.*

Notwithstanding his frigidity, the Nimiqua is not insensible to pleasure. He even seeks with avidity those which, requiring but little exertion, are capable of agitating him and procuring agreeable sensations. Their musical instruments are the same as those of the other Hottentots; but their dancing is very different, and resembles the temper of the nation. If the countenance have received from nature features that can express our passions, the body also has its attitudes and movements that paint our temper and feelings. The dance of the Nimiqua is frigid like himself, and so devoid of grace and hilarity, that, were it not for the extreme gaiety of the women, it might be called the dance of the dead.

These tortoises, to whom dancing is a fatigue, shew little eagerness for any thing but wagers, games of calculation and chance, and all the sedentary amusements which require patience and reflection, of which they are more capable than they are of motion. When our author, with great propriety, prohibited gaming in his camp, the Nimiquas, who had staid long with him, took their departure.

Ninety-Six ‖ Nizolius.

NINETY SIX, a district of the upper country of South Carolina, west of Orangeburg district, and comprehends the counties of Edgefield, Abbeville, Laurens, and Newbury. It contains 33,674 white inhabitants, sends 12 representatives and 4 senators to the State legislature, 3 of the former and one of the latter for each county, and one member to Congress. It produces considerable quantities of tobacco for exportation. Chief town, *Cambridge*, or, as it was formerly called, *Ninety Six*, which is 60 miles west by north of Columbia, 147 north west of Charleston, 49 north of Augusta in Georgia, and 762 from Philadelphia. In May, 1781, this town was closely besieged by Gen. Greene, and bravely defended by the British, commanded by Col. Cruger.—*Morse.*

NIPECON, a large river which empties into Lake Superior, from the northward. It leads to a tribe of the Chippewas, who inhabit near a lake of the same name. Not far from the Nipegon is a small river, that, just before it enters the lake, has a perpendicular fall, from the top of a mountain of 600 feet. It is very narrow, appears like a white garter suspended in the air. —*ib.*

NIPISSING *Lake* is north-east of Lake Huron, and connected with it by French river.—*ib.*

NIPISSINS. Indians inhabiting near the head waters of the Ottowas river. Warriors 300.—*ib.*

NISAO, a river which rises in the centre of the island of St Domingo, and falls into the sea on the south side, and on the western side of the point of its name; 7 leagues W. of Nigua river.—*ib.*

NISQUEUNIA, a settlement in the State of New York, above the city of Albany. This is the principal seat of the society called Shakers. A few of this sect came from England in 1774; and a few others are scattered in different parts of the country.—*ib.*

NITTA, a species of the Mimosa, which flourishes on the banks of the Senegal in Africa. It is valuable to the inhabitants for its fruit, the pods of which are long and narrow, containing a few black seeds enveloped in a fine mealy powder, of a bright yellow colour, which resembles the flour of sulphur, and has a sweet mucilaginous taste. When eaten by itself it is clammy; but when mixed with milk or water, it constitutes a very pleasant and nourishing food, supplying the place of corn to the negroes.—*Park's Travels.*

NITTANY *Mountain*, in Pennsylvania, is between the Juniatta and the W. branch of Susquehannah river. —*Morse.*

NIVERNOIS, a large bay at the east end of Lake Ontario.—*ib.*

NIXONTON, a post town of N. Carolina, and capital of Pasquotank county; lies on a northern water of Albemarle Sound, and contains a court-house, gaol, and a few dwelling houses. It is 28 miles N. E. of Edenton, and 468 S. W. of Philadelphia.—*ib.*

NIZOLIUS (Marius), a grammarian of Italy, who by his wit and erudition contributed much to the promotion of letters in the 16th century. He published, in 1553, *Lib. 4. De veris Principiis et vera Ratione philosophandi, contra Pseudo philosophos.* In this work he attacks, with much vivacity, the schoolmen, not only

Noblebo-rough, ‖ Nombre de Dios.

ly for the barbarifm of their terms, but for many ridiculous opinions which they held. Leibnitz was fo ftruck with its folidity and elegance, that, to expofe the obftinacy of thofe who were zealoufly attached to Ariftotle, he gave a new edition of it, with critical notes of his own, 1670, in 4to. Nizolius publifhed alfo, *Thefaurus Ciceronianus, five Apparatus Linguæ Latinæ e Scriptis Tullii Ciceronis collectus*, in folio. This is a good Latin dictionary, compofed of the words and expreffions of Cicero; to which, it feems, Nizolius fhewed as much bigotry as the fchoolmen to their notions; and fell under the character of thefe pedants whom Erafmus has ridiculed in his *Ciceronianus*. We do not find the year either of his birth or death.

Biog. Dictionary.

NOBLEBOROUGH, a townfhip in Lincoln county, Diftrict of Maine, incorporated in 1788, and contains 516 inhabitants. It is 10 miles S. E. of New-Caftle, and 192 N. E. of Bofton.—*Morse.*

Nobleborough, a townfhip in the north-eaftern part of Herkemer county, New York, fituated on the north-weftern fide of Canada Creek.—*ib.*

NOCKAMIXON, a townfhip in Buck's county, Pennfylvania.—*ib.*

NOCTURNAL arch, is the arch of a circle defcribed by the fun, or a ftar, in the night.

NODDLE's *Ifland*, a fmall pleafant and fertile ifland in Bofton harbour, Maffachufetts. It is about 2 miles eaft north-eaft of the town, on the Chelfea fhore. It is occupied as a farm, and yields large quantities of excellent hay.—*Morse.*

NODWAY, a river or rather a long bay which communicates with James' Bay, at the S. E. extremity of Rupert's river.—*ib.*

NOIR, or *Black River*, in Louifiana, runs fouthward, and joins Rouge or Red River.—*ib.*

Noir, *Cape*, on the S. W. coaft of the ifland of Terra del Fuego, at the entrance of the Straits of Magellan. S. lat. 54 30, W. long. 73 13.—*ib.*

NOIX, *Ifle au*, or *Nut Ifle*, a fmall ifle of 50 acres, near the north end of Lake Champlain, and within the province of Lower Canada. Here the Britifh have a garrifon containing 100 men. It is about 5 miles N. N. E. of the mouth of La Cole river, 20 north of Ifle La Motte, and 12 or 15 fouthward of St John's.—*ib.*

NOLACHUCKY, a river in the eaftern part of the State of Tenneffee, which runs W. S. W. into French Broad river, about 26 miles from Holfton river. Near the banks of this river Grenville college is eftablifhed.—*ib.*

NOLIN *Creek*, a branch of Green river in Kentucky. The land here is of an inferior quality.—*ib.*

NOMAN's *Land Ifland*, lies a little S. W. of Martha's Vineyard, and is about 3 miles long and two broad. It belongs to Duke's county, Maffachufetts. N. lat. 41 15, W. long. 71 5.—*ib.*

NOMBRE de DIOS, a port to the S. S. E. of the cape to the eaftward of Porto Bello, on the Spanifh Main, or N. coaft of S. America, at the diftance of about 7 leagues. It is at the bottom of a large deep bay, being wide to the eaft fide in lat. 9 43 N. and long. 78 35 W. The iflands called Baftimentos are in this bay. Large veffels feldom frequent this part now, although there is from 5 to 8 fathoms and clean ground. Experience pointed out that they were in danger of foundering at anchor, fuch is the fury with which the fea pours into the bay. Thofe veffels that now vifit it, if their bufinefs require any ftay, prefer riding at the Baftimentos, or at Porto Bello.—*ib.*

Nombre de Dios, ‖ Norfolk.

Nombre de Dios, on the W. coaft of Mexico, fituated on the North Pacific Ocean, is a large and populous town, a little to the northward of the tropic of Cancer, and 20 leagues to the north of Guadalaxara. N. lat. 23 38, W. long. 104.—*ib.*

NONAGESIMAL, or Nonagesimal *Degree*, called alfo the *Mid heaven*, is the higheft point, or 90th degree of the ecliptic, reckoned from its interfection with the horizon at any time; and its altitude is equal to the angle that the ecliptic makes with the horizon at their interfection, or equal to the diftance of the zenith from the pole of the ecliptic. It is much ufed in the calculation of folar eclipfes.

NONAGON, a figure having nine fides and angles. In a regular nonagon, or that whofe angles and fides are all equal, if each fide be 1, its area will be 6·1818242 $= \frac{9}{4}$ of the tangent of 70°, to the radius 1.

NONESUCH, a river of Cumberland county, Diftrict of Maine. It paffes to the fea through the town of Scarborough; and receives its name from its extraordinary frefhets.—*Morse.*

Nonesuch, a harbour at the E. end of the ifland of Antigua. The road is foul and full of rocks; and it has not more than 6 or 8 feet water, except in one place, which is very difficult.—*ib.*

NOOHEEVA, one of the Ingraham Iflands, faid to be the parent of them all, fituated about 10 leagues S. W. of Ooahoona. Capt. Roberts named it *Adams*; it is the fame which Ingraham called *Federal Ifland*. The lat. of the body of the ifland is 8 58 S. and nearly in the fame meridian with Wooapo, between 140 and 140 10 W. long. from Greenwich. All accounts of the natives concurred, fays Capt. Roberts, in reprefenting it as populous and fruitful, and to have a large bay with good anchorage.—*ib.*

NOORT *Point*, on the coaft of Chili, is the north point of the bay or port of Coquimbo, the other is called Point Tortugas.—*ib.*

NORFOLK, a populous maritime county of Maffachufetts, lately taken from the fouthern part of Suffolk county, and lies to the fouthward around the town and harbour of Bofton. And contains 20 townfhips, of which Dedham is the feat of juftice. Number of inhabitants 24,280.—*ib.*

Norfolk, a populous county of Virginia, bounded north by James's river, which divides it from Warwick. It contains 14,524 inhabitants, including 5,345 flaves.—*ib.*

Norfolk, a port of entry and poft town and feat of juftice in the above county, on the eaft fide of Elizabeth river, immediately below the confluence of the eaftern branch. It is the moft confiderable commercial town in Virginia. The channel of the river is from 350 to 400 yards wide, and at common flood tides has 18 feet water up to the town. The harbour is fafe and commodious, and large enough to contain 300 fhips. It was burnt on the 1ft of January, 1776, by the Liverpool man of war, by order of the Britifh governor Lord Dunmore; and the lofs amounted to £300,000 fterling. It now contains about 500 dwelling houfes, a court houfe, gaol, an epifcopal and methodift church, a theatre, and and an academy. In 1790, it contained 2,959 inhabitants, including 1294 slaves. The town is governed by a mayor and several aldermen. It carries on a brisk trade to the West-Indies, Europe and the different states, and constitutes, with Portsmouth, which stands on the opposite side of the river, a port of entry. The exports for one year, ending September 30th, 1794, amounted to 1,660,752 dollars. A canal, of 16 miles in length, is now cutting from the north branch of Albemarle Sound in N. Carolina, to the waters of the S. branch of Elizabeth river. It will communicate with Elizabeth river 9 miles from Norfolk. Merchant vessels of the largest size may go within a mile from the mouth of the canal; and here, the water being fresh, the worm, which does such damage to vessels in Norfolk and Portsmouth, will not affect them. It is 114 miles E. S. E. of Richmond, 54 from Williamsburg, 30 N. E. of Suffolk, and 389 S. by W. of Philadelphia. N. lat. 36 55, W. long. 76 28.—*ib.*

Norfolk, a township in Litchfield county, Connecticut, 15 miles north of Litchfield, on the Massachusetts line.—*ib.*

NORMAL, is used sometimes for a perpendicular.

NORMAN, *Cape*, on the west coast of Newfoundland island, is on the gulf of St Lawrence, and the western entrance of the narrow bay of Mauco, 20 leagues from Cape Ferrol. N. lat. 51 39, W. long. 55 58. High water at full and change days at 9 o'clock.—*Morse.*

NORONHA *Island, Ferdinando*, in the S. Pacific Ocean, laid down in lat. 3 56 south, and long. 132 38 west. Captain Cook, in his second voyage, looked for it in long. 132 5, but did not find it.—*ib.*

NORRIDGEWALK, or *Norridgewock*, a post-town in Lincoln county, on Kennebeck river, Maine, incorporated in 1788, and contains 376 inhabitants. It is 10 miles west of Canaan, 239 N. by E. of Boston, and 587 north-east of Philadelphia. The Indian town of this name stood about 40 miles above Fort Halifax, where Kennebeck river, as you ascend it, after taking a south-westward course, turns to the northward, and forms a point where the town stood. It was destroyed by a party under Col. Harman, in 1724.—*ib.*

NORRISTON, the principal town in Montgomery county, Pennsylvania, is about 20 miles N. W. of Philadelphia, on the N. bank of the Schuylkill, having about 20 houses, a court house and jail, and a handsome edifice of stone for the preservation of records, and an observatory. This town was the residence of that celebrated philosopher and philanthropist, Dr. *David Rittenhouse*. In his *observatory*, near his mansion house, he was interred, agreeably to his request, June, 1796. His tomb-stone contains nothing but his name and the simple record of the days and years of his birth and death. "Here, (says the elegant writer of his eulogy, Dr. *Rush*) shall the philosophers of future ages resort to do homage to his tomb, and children yet unborn shall point to the dome which covers it, and exultingly say, "There lies our *Rittenhouse*."—*ib.*

NORTHAMPTON, a large uneven county of Pennsylvania; situated in the N. E. corner of the state on Delaware river, which separates it from the state of New Jersey and New York. It is divided into 27 townships, and contains 24,250 inhabitants.—*ib.*

Northampton, a township in Buck's county, Pennsylvania.—*ib.*

Northampton, a town in Northampton county, Pennsylvania, on the S. W. bank of Lehigh river, 5 or 6 miles S. W. of Bethlehem.—*ib.*

Northampton, a county of Halifax district, North Carolina, bounded north by the state of Virginia, containing 9,981 inhabitants, including 4,409 slaves.—*ib.*

Northampton, a maritime county of Virginia, situated on the point of the peninsula, which forms the E. side of the entrance into Chesapeak Bay. It has the ocean E. and Accomack county on the north. Its southern extremity is Cape Charles, in lat. 37 11 N. and long. 75 57 W. off which is the small island called Smith's Island. This county contains 6,889 inhabitants, including 3,244 slaves. The lands are low and sandy.—*ib.*

Northampton *Court House*, in the above county, where a post-office is kept, is 40 miles S. by W. of Accomack court house, 43 north-east of Norfolk, and 239 south of Philadelphia.—*ib.*

Northampton, a respectable post town and capital of Hampshire county, Massachusetts, situated within a bend of Connecticut river, on its W. side, 40 miles north of Hartford, in Connecticut, and 100 west of Boston. It contains a spacious congregational church, a court house, jail, and about 250 dwelling houses, many of which are genteel buildings. Its meadows are extensive and fertile; and it carries on a considerable inland trade. This township was incorporated in 1685, and contains 1,628 inhabitants.—*ib.*

Northampton, a township in Burlington county, New Jersey, which contains about 56,000 acres, half of which is under improvement, the other half is mostly pine barren. The chief place of the township is called Mount Holly. It contains about 150 houses, an Episcopal church, a Friend's meeting-house, and a market-house. It is 22 miles from Trenton, and 20 from Philadelphia.—*ib.*

NORTHBOROUGH, a township in Worcester county, Massachusetts, formerly the northern part of Westborough. It was incorporated in 1760, and contains 619 inhabitants. It is 10 miles E. of Worcester, and 36 W. of Boston.—*ib.*

NORTHBRIDGE, a township in Worcester county, Massachusetts, taken from Uxbridge, which bounds it on the S. It was incorporated in 1772, and contains 569 inhabitants. Blackstone river runs through this town. It is 12 miles S. by E. of Worcester, and 45 S. W. of Boston.—*ib.*

NORTH CAROLINA, one of the United States, is bounded N. by Virginia; E. by the Atlantic Ocean; S. by S. Carolina, and W. by the state of Tennessee. It lies between 33 50, and 36 30 N. lat. and between 76 8 and 83 8 W. long. being about 450 miles in length, and 180 in breadth, containing about 34,000 square miles. The districts of this state are classed in three divisions, viz. The *Eastern* districts, *Edenton*, *Newbern* and *Wilmington*—the *Middle* districts, *Fayetteville*, *Hillsborough* and *Halifax*—and the *Western* districts, *Morgan* and *Salisbury*. The eastern districts are on the sea-coast, extending from the Virginia line southward to S. Carolina. The five others cover the whole state, W. of the maritime districts; and the greater part of them extend across the state from N. to S. These districts are subdivided into 58 counties, which contained, in 1790, 393,751 inhabitants, of whom 100,571

North Carolina.

were slaves. The chief *rivers* of N. Carolina are Chowan and its branches, Roanoke, Tar, Neus, and Cape Fear or Clarendon. Most of these and the smaller rivers have bars at their mouths; and the coast furnishes no good harbours except Cape Fear. There are two remarkable *swamps* in this state, the one in Currituck county, the other on the line between this state and Virginia. The most remarkable *sounds* are Albemarle, Pamlico and Core Sounds—the *capes*, Lookout, Hatteras and Fear. Newbern is the largest town in the state; the other towns of note are Edenton, Wilmington, Halifax, Hillsborough, Salisbury, and Fayetteville; each of which have been, in their turns, the seat of the general assembly. Raleigh, situated near the centre of the state, has lately been established as the metropolis. N. Carolina, in its whole width, for 60 miles from the sea, is a dead level. A great proportion of this tract lies in forest, and is barren. On the banks of some of the rivers, particularly of the Roanoke, the land is fertile and good. Interspersed through the other parts, are glades of rich swamp, and ridges of oak land, of a black, fertile soil. Sixty or eighty miles from the sea, the country rises into hills and mountains, as in S. Carolina and Georgia. Wheat, rye, barley, oats and flax, grow well in the back hilly country. Indian corn and pulse of all kinds, in all parts. Cotton and hemp are also considerably cultivated here, and might be raised in much greater plenty. The cotton is planted yearly: the stalk dies with the frost. The labour of one man will produce 1000 pounds in the seeds, or 250 fit for manufacturing. A great proportion of the produce of the back country, consisting of tobacco, wheat, Indian corn, &c. is carried to market in S. Carolina and Virginia. The southern interior counties carry their produce to Charleston, and the northern to Petersburg, in Virginia. The exports from the lower parts of the state, are tar, pitch, turpentine, rosin, Indian corn, boards, scantling, staves, shingles, furs, tobacco, pork, lard, tallow, bees-wax, myrtle-wax, and a few other articles, amounting in the year, ending September 30th, 1791, to 524,548 dollars. Their trade is chiefly with the West Indies and the northern states. In the flat country near the sea-coast, the inhabitants, during the summer and autumn, are subject to intermitting fevers, which often prove fatal, as bilious or nervous symptoms prevail. The western hilly parts of the state are as healthy as any part of America. That country is fertile, full of springs and rivulets of pure water. Autumn is very pleasant, both in regard to the temperature and serenity of the weather, and the richness and variety of the vegetable productions, which the season affords. The winters are so mild in some years, that autumn may be said to continue till spring. Wheat harvest is in the beginning of June, and that of Indian corn early in September.

The large natural growth of the plains, in the low country, is almost universally pitch pine, which is a tall handsome tree, far superior to the pitch pine of the northern states. This tree may be called the staple commodity of N. Carolina. It affords pitch, tar, turpentine, and various kinds of lumber, which, together, constitute at least one half of the exports of this state. No country produces finer white and red oak for staves. The swamps abound with cypress and bay trees. The latter is an evergreen, and is food for the cattle in winter. The misletoe is common in the back country. This is a shrub, which differs in kind, perhaps, from all others. It never grows out of the earth, but on the tops of trees. The roots (if they may be so called) run under the bark of the tree, and incorporate with the wood. It is an evergreen resembling the garden box-wood. The late war, by which N. Carolina was greatly injured, put a stop to several iron works. There are four or five furnaces in the state, that are in blast, and a proportionable number of forges. The western parts of this state, which have been settled within the last 40 years, are chiefly inhabited by Presbyterians from Pennsylvania, the descendants of people from the north of Ireland, and are exceedingly attached to the doctrines, discipline and usages of the church of Scotland. They are a regular industrious people. The Moravians have several flourishing settlements in the upper part of this state. The Friends or Quakers have a settlement in New-Garden in Guilford county, and several congregations at Perquimins and Pasquotank. The Methodists and Baptists are numerous and increasing. The general assembly of N. Carolina, in December 1789, passed a law incorporating 40 gentlemen, 5 from each district, as trustees of the University of N. Carolina. The state has given handsome donations for the endowment of this seminary. The general assembly, in December, 1791, loaned £5,000 to the trustees, to enable them to proceed immediately with their buildings. There is a very good academy at Warrenton, another at Williamsborough, in Granville, and three or four others in the state, of considerable note. North Carolina has had a rapid growth. In the year 1710, it contained but about 1200 fencible men. In 1794, the number was estimated at about 50,000. It is now, in point of numbers, the fourth state in the Union. By the constitution of this state, which was ratified in December, 1796, all legislative authority is vested in two distinct branches, both dependent on the people, viz. a senate and house of commons, which, when convened for business, are styled the general assembly. The senate is composed of representatives, one from each county, chosen annually by ballot. The house of commons consists of representatives chosen in the same way, 2 for each county, and one for each of the towns of Edenton, Newbern, Wilmington, Salisbury, Hillsborough, Halifax, and Fayetteville. The history of North Carolina is less known than that of any other of the states. From the best accounts that history affords, the first permanent settlement in North Carolina was made about the year 1710, by a number of Palatines from Germany, who had been reduced to circumstances of great indigence, by a calamitous war. The infant colony remained under the general government of South Carolina, till about the year 1729, when seven of the proprietors, for a valuable consideration, vested their property and jurisdiction in the crown; and the colony was erected into a separate province, by the name of North Carolina, and its present limits established by an order of George II.—*ib.*

North Carolina, North Castle.

NORTH CASTLE, a township of New York, in West Chester county, north of Mount Pleasant, and the White Plains on the borders of Connecticut. In 1790, it contained 2,478 inhabitants. In 1796, there were

173 of the inhabitants qualified electors. It is 10 miles from White Plains, and 20 from Ridgefield in Connecticut.—*ib.*

NORTH-EAST, a small river which empties in at the head of Chesapeak Bay, about five miles below Charlestown; only noticeable for the quantity of herrings caught in it.—*ib.*

NORTH-EAST-TOWN, a township in Dutchess county, New-York, about 90 miles N. of New-York city; between Rhynbeck and Connecticut west line. In 1790, it contained 3,401 inhabitants. In 1796, there were in it 391 qualified electors.—*ib.*

NORTH-EDISTO *Inlet*, on the coast of S. Carolina, is 11 miles from Stono Inlet, and 3 E. N. E. from South Edisto.—*ib.*

NORTHFIELD, a township in Orange county, Vermont, between 20 and 30 miles W. of Newbury, in the W. part of the county.—*ib.*

NORTHFIELD, a thriving township, in the N. part of Hampshire county, Massachusetts; situated on the E. side of Connecticut river, 30 miles N. of Northampton, 100 N. W. by W. of Boston. It contains 868 inhabitants. The town was incorporated in 1673, and some years after desolated by the Indians. The inhabitants returned again in 1685, but it was soon after destroyed a second time. In 1713 it was again rebuilt, and one third of the township was taken off, and incorporated by the name of Hinsdale. Fort Dummer was in the vicinity of this town.—*ib.*

NORTHFIELD, a small town in Rockingham county, New Hampshire, taken from Canterbury, on the E. side of Merrimack river, and incorporated in 1780. It contains 606 inhabitants.—*ib.*

NORTHFIELD, a township in Richmond county, Staten Island, New York, containing 1021 inhabitants, including 133 qualified electors, and 133 slaves.—*ib.*

NORTH HAMPTON, a township of New Hampshire, in Rockingham county, which contains 657 inhabitants, taken from Hampton and incorporated in 1742.—*ib.*

NORTH-HAVEN, a township of Connecticut, situated in New-Haven county, on the E. side of East river, 8 miles N. by E. of New-Haven, and 32 S. by W. of Hartford. It was settled in 1660 by 35 men, principally from Saybrook. This town is the birth-place of that learned, pious and excellent man, Dr Ezra Stiles, late president of Yale college.—*ib.*

NORTH-HEMPSTEAD, a township in Queen's county, Long-Island, New York, bounded easterly by Oyster Bay, northerly by the sound, and south by South Hempstead. In 1790, it contained 2696 inhabitants, of whom 507 were slaves. In 1796, 232 of the inhabitants were qualified electors. The soil is but indifferent.—*ib.*

NORTH-HUNTINGTON a township in Westmoreland county, Pennsylvania.—*ib.*

NORTH *Island*, on the coast of S. Carolina, lies on the north side of Winyah harbour.—*ib.*

NORTHLINED *Lake*, in N. America, is about 160 miles S. of the head of Chesterfield Inlet; is full of islands, and about 80 miles long, and 25 broad.—*ib.*

NORTH KINGSTOWN, a town in Washington county, Rhode Island, which carries on a considerable trade in the fisheries, besides some to the West Indies. Its harbour is called Wickford, on the west side of Narraganset bay, opposite the north end of Canonnicut Island. It is about 8 miles north-west of Newport, and 20 southerly of Providence. The township contains 2,907 inhabitants.—*ib.*

NORTH MOUNTAIN, one of the ridges of the Allegany Mountains, which extends through Virginia and Pennsylvania. There is a curious syphon fountain in Virginia, near the intersection of lord Fairfax's boundary with the North Mountain, not far from Brock's Gap, on the stream of which is a grist mill, which grinds two bushels of grain at every flood of the spring.—*ib.*

NORTHPORT, a township in Hancock county, District of Maine, taken from the northerly part of Duck Trap Plantation, and incorporated in 1796.—*ib.*

NORTH REEF, off the island of St Domingo, in the West-Indies, lies in lat. 20 33 N. and long. 69 12 W.—*ib.*

NORTH RIVER, in Massachusetts, for its size, is remarkable for its depth of water, being in some places not more than 40 or 50 feet wide, yet vessels of 300 tons are built at Pembroke, and descend to Massachusetts Bay, 18 miles distant, as the river runs. It rises in Indian Head Pond, in Pembroke, and runs a serpentine course between Scituate and Marshfield. The river is navigable for boats to the first fall, 5 miles from its source. Thence to the nearest waters which run into Taunton river, is only three miles. A canal to connect the waters of these two rivers, which communicate with Narraganset and Massachusetts bays, would be of great utility, as it would save a long and dangerous navigation round Cape Cod.—*ib.*

NORTH RIVER, a very considerable river of New Mexico, in North America, which rises in the north part of it, and directs its course to the S. E. and empties into the Gulf of Mexico, at the W. end, in about lat. 26 12 north.—*ib.*

NORTH RIVER, a branch of Fluvanna river, in Virginia.—*ib.*

NORTH SALEM, a township in West Chester county, New York, bounded southerly by Salem, easterly by Connecticut, northerly by Dutchess county, and westerly by the middle of Croton river. In 1790, it contained 1058 inhabitants, including 58 slaves. In 1796, 162 of the inhabitants were qualified electors.—*ib.*

NORTH SOUND POINT is the projecting point of land on the N. E. side of the island of Antigua, in the West-Indies, and is about S. S. E. from Long Island.—*ib.*

NORTHUMBERLAND, a town in Grafton county, New Hampshire, situated on the E. side of Connecticut river, at the mouth of the Upper Amonoosuck. It was incorporated in 1779, and contains 117 inhabitants.—*ib.*

NORTHUMBERLAND, a county of Pennsylvania, bounded N. by Lycoming, S. and W. by Dauphin and Mifflin counties. It is divided into 16 townships, and in 1790 contained 17,161 inhabitants. The county of Lycoming has since the census been lately taken from it, but the county is supposed to contain nearly as many inhabitants as before; a great number of people having emigrated to this part of the state. Chief town, Sunbury.—*ib.*

NORTHUMBERLAND, a flourishing post town in the above county, situated on the point of land formed by the

the junction of the E. and W. branches of the Susquehannah. It is laid out regularly, and contains about 120 houses, a Presbyterian church, and an academy. It is 2 miles N. by W. of Sunbury, and 124 N. W. by W. of Philadelphia.—*ib.*

NORTHUMBERLAND, a county of Virginia, bounded E. by Chesapeak Bay, and W. by Richmond. It contains 9,163 inhabitants, including 4,460 slaves. The court-house, where a post office is kept, is 12 miles from Kinsale, 18 from Lancaster court-house, 86 from Fredericksburg, and 317 from Philadelphia.—*ib.*

NORTH-WALES, a town of Caroline county, Virginia, on Pamunky river, about 2 miles below the junction of N. and S. Anna branches.—*ib.*

NORTH-WEST *River*, a branch of Cape Fear, or Clarendon river, in N. Carolina. It is formed by the junction of Haw and Deep rivers; and it is 300 yards wide at Ashwood, 80 or 90 miles above the Capes; even when the stream is low, and within its banks. On the west side of this river, about 40 miles above Ashwood, in the banks of a creek, 5 or 6 feet below the sandy surface, are to be seen, projecting out many feet in length, trunks of trees entirely petrified. —*ib.*

NORTHWOOD, an interior and elevated township in Rockingham county, New-Hampshire, in which, and on its borders, are a number of small ponds, whose waters feed Piscataqua and Suncook rivers. It was incorporated in 1773; contains 744 inhabitants, and is about 39 miles north-west of Portsmouth. Crystals and crystalline spars are found here.—*ib.*

NORTH-YARMOUTH, a post-town of the District of Maine, in Cumberland county, on a small river which falls into Casco Bay. It is 17 miles W. by S. of Brunswick, 14 north of Portland, and 140 E. of Boston. The township is extensive, was incorporated in 1713, and contains 1,978 inhabitants. Cussen's river divides it from Freeport on the N. E.—*ib.*

NORTON, a township in Essex county, Vermont, situated on the Canada line, having Canaan east, and Holland on the west —*ib.*

NORTON, a township of Massachusetts, situated in Bristol county, and 33 miles southward of Boston. It was incorporated in 1711, and contains 1428 inhabitants. The annual amount of the nail manufacture here is not less than 300 tons. There is also a manufacture of ochre which is found here, similar to that at Taunton.—*ib.*

NORTON, a settlement on the north-east coast of Cape Breton Island.—*ib.*

NORTON'S *Sound*, on the N. W. coast of N. America, extends from Cape Darby on the N. N. W. to Cape Denbigh, or Cape Stephen's on the S. or S. E. N. lat. 64 50.—*ib.*

NORWALK, a pleasant post-town in Fairfield county, Connecticut, situated on the north side of Long-Island Sound. It contains a Congregational and an Episcopal church which are neat edifices, and between 40 and 50 compact houses. It is 13 miles W. by S. of Fairfield, 34 S. W. by W. of New-Haven, 54 N. E. of New York, and 149 from Philadelphia. N. lat. 41 9, W. long. 73 47. The township is situated in a fertile wheat country, and was settled in 1651. Here are iron-works and a number of mills. It has a small trade to New York and the West-Indies.—*ib.*

NORWAY, a township of New York, in Herkemer county, incorporated in 1792. By the State census of 1796, it contained 2,164 inhabitants, of whom 353 were electors.—*ib.*

NORWAY, a new township in Cumberland county, District of Maine, incorporated 1797.—*ib.*

NORWICH, a considerable township in Windsor county, Vermont, on the west side of Connecticut river, opposite to Dartmouth college. It contains 1158 inhabitants.—*ib.*

NORWICH, a township in Hampshire county, Massachusetts, 24 miles S. W. of Northampton, and 114 west of Boston. It was incorporated in 1773, and contains 742 inhabitants.—*ib.*

NORWICH, a city and post town of Connecticut, and of the second rank in New London county, situated at the head of navigation on Thames river, 14 miles north of New London, and 40 S. E. of Hartford. This commercial city has a rich and extensive back country; and avails itself of its happy situation on a navigable river, which affords a great number of convenient seats for mills, and water machines of all kinds. The inhabitants manufacture paper of all kinds, stockings, clocks and watches, chaises, buttons, stone and earthen ware, oil, chocolate, wire, bells, anchors, and all kinds of forge-work. The city contains about 450 dwelling-houses, a court house, and two churches for Congregationalists, and one for Episcopalians, and about 3000 inhabitants. The city is in three detached, compact divisions, viz. Chelsea, at the landing, the Town, and Bean Hill; in the latter division is an academy, and in the town is an endowed school. The courts of law are held alternately at New London and Norwich. This town was settled in 1660, by 35 men, principally from Saybrook. It is 251 miles N. E. of Philadelphia. N. lat. 41 34, W. long. 72 29.—*ib.*

NORWICH, a township in Tioga county, New York, taken from the towns of Jericho and Union, and incorporated in 1793. It is settled principally by people from Connecticut; is bounded southerly by Oxford, and lies 55 miles west of Cherry Valley. By the State census of 1796, 129 of its inhabitants were electors.—*ib.*

NOTCH, *The*, a pass in the western part of the White Mountains, in New-Hampshire; the narrowest part of which is but 22 feet wide, between two perpendicular rocks. It is 25 miles from the Upper Coos. From the height above it a brook descends, and meanders through a meadow, formerly a beaver pond. It is surrounded by rocks, which, on one side, are perpendicular, and on the others, rise in an angle of 45 degrees, a strikingly picturesque scene. This defile was known to the Indians, who formerly led their captives through it to Canada; but it had been forgotten or neglected, till the year 1771, when two hunters passed through it. There is a road this way now to the Upper Coos.—*ib.*

NOTCH, CAPE, is the W. point of Goodluck Bay, in the Straits of Magellan. S. lat. 53 33, W. long. 74 34.—*ib.*

NOTTAWAY, a small river of Virginia, which runs E. by S. and receives Black Water on the line of N. Carolina; thence pursuing a S. by W. course of about 10 miles, it joins the Meherrin; the confluent stream then assumes the name of Chowan river, and empties into Albemarle Sound.—*ib.*

Nottaway, a county of Virginia, bounded N. and N. W. by Amelia, from which it was taken in the year 1788.—*ib.*

NOTTINGHAM, a township in Rockingham county, New-Hampshire, 14 miles N. of Exeter, and 25 N. W. of Portsmouth. It was incorporated in 1722, and contains 1068 inhabitants.—*ib.*

Nottingham, *West*, a township in Hillsborough county, New-Hampshire, situated on the E. side of Merrimack river; was incorporated in 1746, and contains 1064 inhabitants. It has Massachusetts line for its southern boundary, which divides it from Dracut, and is about 45 miles N. N. W. of Boston.—*ib.*

Nottingham, a township in Chester county, Pennsylvania.—*ib.*

Nottingham, the most northern town of Burlington county, New Jersey, situated on the eastern bank of Delaware river, between Bordentown and Trenton. —*ib.*

Nottingham, a town in Prince George's county, Maryland, situated on Patuxent river, nearly 16 miles north-easterly of Piscataway and 20 S. E. of the Federal City.—*ib.*

NOXAN, or *Noxonton*, or *Nox-Town*, a town of New-Castle county, Delaware, 21 miles north of Dover, and 9 S. by S. W. of St George's town.—*ib.*

NUBLADA, an island in the Pacific Ocean, with 3 small ones north of it and near to it, W. by S. of Cape Corientes, on the coast of Mexico, and east of Roco Portida. N. lat. 16 40, W. long. 122 30.—*ib.*

NUCHVUNK, a place in New-Britain, the resort of Walrusses, in winter; with the teeth of these animals the Indians head their darts. Lat. 60 north.—*ib.*

NUEL, or Newel, the upright post about which stairs turn, being that part of the staircase which sustains one end of the steps.

NUESTRA *Senora de la Paz*, an episcopal see and town of Peru, in S. America. S. lat. 17 10, W. long. 64.—*Morse.*

Nuestra *Senora de la Vittoria*, a town of Mexico. N. lat 18, W. long. 92 35.—*ib.*

NUEVO *Baxo*, a bank called by the British the New Bear, being about 32 leagues south of the west end of the island of Jamaica, in lat. 15 57 north. It has a key, 2 cables length long and 1¼ broad; stretching E. by N. and W. by S. The British find this a good station in a Spanish war, as most ships come this way from the Spanish Main, going to the Havannah.—*ib.*

O.

OACHATE *Harbour*, near the south point of Ulietea, one of the Society Islands, in the S. Pacific Ocean, N. W. of Otaheite. S. lat. 16 55, west long. 151 24.—*Morse.*

OAHAHA, a river of Louisiana, which empties into the Mississippi from the N. W. in lat. 39 10 north, and 7 miles north of Riviere au Beuf.—*ib.*

OAHOONA, one of the Ingraham Isles, which is said to be the northernmost of all this cluster. It lies about 10 leagues north-east of Nooheeva. To this island Capt. Roberts gave the name of *Massachusetts*. Capt. Ingraham had before called it *Washington*.—*ib.*

OAITIPIHA or *Aitepeha Bay*, situated near the north-east end of the lesser peninsula of the island of Otaheite, has good anchorage in 12 fathoms. S. lat. 17 46, west long. 149 14.—*ib.*

OAK *Bay*, or the *Devil's Head*, in the Bay of Fundy, is 9 leagues S. S. E. of Moose Island. It is very high land, and may be seen at 10 or 12 leagues distance.—*ib.*

Oak *Island*, a long narrow island on the coast of N. Carolina, which with Smith's Island forms the S. W. channel of Cape Fear river.—*ib.*

OAKHAM, a township in Worcester county, Massachusetts; 15 miles north-west of Worcester, and 62 west of Boston. It was incorporated in 1762, and contains 772 inhabitants.—*ib.*

OAKMULGEE *River* is the southern great branch of the beautiful Alatamaha, in Georgia. At the Oakmulgee Fields it is about 300 or 400 yards wide. These rich and fertile fields are on the east side of the river, above the confluence of the Oconee with this river; these two branches are here about 40 miles apart. Here are wonderful remains of the power and grandeur of the ancients of this part of America, consisting of the ruins of a capital town and settlement, vast artificial hills, terraces, &c.—*ib.*

OASIS, (plur. Oases), a fertile spot in the midst of a sandy desart. In the Sahara, or Great Desart of Africa, there are many *Oases* of extreme fertility.

OATARA, a small woody island on the south-east of Ulietea Island, in the S. Pacific Ocean; between 3 and 4 miles from which to the north-west are two other small islands in the same direction as the reef, of which they are a part.—*Morse.*

OBED's *River*, in Tennessee, runs south-westerly into Cumberland river 290 miles from its mouth, by the course of the stream. Thus far Cumberland river is navigable for large vessels.—*ib.*

OBION, a navigable river of Tennessee, which runs south-westerly into the Mississippi, 24 miles southerly of Reelfoot rivers. It is 70 yards broad, 17 miles from its mouth.—*ib.*

OBITEREA, an island 100 leagues S. of the Society Islands. S. lat. 22 40, W. long. 150 50. It contains no good anchorage, and the inhabitants are averse to the intrusion of strangers.—*ib.*

OBLATE, flatted or shortened; as an oblate spheroid, having its axis shorter than its middle diameter; being formed by the rotation of an ellipse about the shorter axis.

OBLIQUE ascension, is that point of the equinoctial

noctial which rises with the centre of the sun, or star, or any other point of the heavens, in an oblique sphere.

Oblique Circle, in the stereographic projection, is any circle that is oblique to the plane of projection.

Oblique Descension, that point of the equinoctial which sets with the centre of the sun, or star, or other point of the heavens, in an oblique sphere.

Oblique Force, or *Percussion*, or *Power*, or *Stroke*, is that made in a direction oblique to a body or plane. It is demonstrated, that the effect of such oblique force, &c. upon the body, is to an equal perpendicular one, as the sine of the angle of incidence is to radius.

OBLONG spheroid, is that which is formed by an ellipse revolved about its longer or transverse axis; in contradistinction from the *oblate spheroid*, or that which is flatted at its poles, being generated by the revolution of the ellipse about its conjugate or shorter axis.

OBSERVATORY, portable. See Astronomy, n° 504, *Encycl.*

OCCIDENT equinoctial, that point of the horizon where the sun sets, when he crosses the equinoctial, or enters the sign Aries or Libra.

Occident Estival, that point of the horizon where the sun sets at his entrance into the sign Cancer, or in our summer when the days are longest.

Occident Hybernal, that point of the horizon where the sun sets at midwinter, when entering the sign Capricorn.

OCCOA, or *Ocoa*, a bay on the south side of the island of St Domingo, into which fall the small rivers Sipicepy and Ocoa. It lies east of Neybe or Julienne bay, and is bounded south-eastward by Point Salinas, and westward by the east point at the mouth of Bya river. Spanish ships of war anchor in this bay. Point Salinas is 22 leagues west of the city of St Domingo. —*Morse.*

Occoa, a bay near the east end of the island of Cuba, in the windward passage, about 20 miles east of Guantanamo Bay.—*ib.*

OCCOCHAPPO, or *Bear-Creek*, in the Georgia Western Territory, empties through the S. W. bank of Tennessee river, just below the muscle shoals. There is a portage of only about 50 miles from this creek to the navigable waters of Mobile river. The mouth of this creek is in the centre of a piece of ground, the diameter of which is 5 miles, ceded by the southern Indians to the United States for the establishment of trading posts.—*ib.*

OCCONEACHEY *Islands*, two long narrow islands at the head of Roanoke river, in Virginia, just below where the Staunton and Dan unite and form that river. —*ib.*

OCONA *Port*, on the coast of Peru, on the South Pacific Ocean, is 11 leagues N. W. of Quilca, and a bold coast, and 14 leagues S. E. of Attico.—*ib.*

OCONEE, the north main branch of Alatamaha river, Georgia. It is, in many places, 250 yards wide. Its banks abound with oak, ash, mulberry, hickory, black-walnut, elm, sassafras, &c.—*ib.*

Oconee *Town* lies on the east bank of the river of its name in Georgia; about 26 miles west-north-west of Golphington, and 62 west by north of Augusta.—*ib.*

OCCOQUAN, a river in Virginia which, after a short course, empties into Patowmac river, at High Point, 5 miles below Colchester.—*ib.*

OCRECOCK *Inlet*, on the coast of N. Carolina, leads into Pamlico Sound, and out of it into Albemarle Sound, through which all vessels must pass that are bound to Edenton, Washington, Bath, or Newbern. It lies in lat. 35 10 N. A bar of hard sand crosses the inlet, on which is 14 feet water at low tide. The land on the north is called Ocrecock, that on the south Portsmouth. Six miles within the bar, there is a hard sand shoal which crosses the channel called the Swash. On each side of the channel are dangerous shoals, sometimes dry. Few mariners, however well acquainted with the inlet, choose to go in without a pilot; as the bar often shifts during their absence on a voyage. It is about $7\frac{1}{4}$ leagues south-west $\frac{1}{2}$ west of Cape Hatteras.—*ib.*

OCTANT, the eighth part of a circle.

ODD, in arithmetic, is said of a number that is not even. The series of odd numbers is 1, 3, 5, 7, &c.

ODDLY-odd. A number is said to be oddly-odd, when an odd number measures it by an odd number. So 15 is a number oddly-odd, because the odd number 3 measures it by the odd number 5.

ODOUR, that quality of certain bodies which excites the sensation of smell. In the *Annales de Chimie*, Vol. XXI. p. 254, we have a detailed account of certain experiments made by M. Benedict Prevost of Geneva, with a view to render the *emanations of odorant bodies perceptible to sight*. The account is by much too long for a work like ours; especially as we feel not ourselves inclined to attribute to the experiments all the importance which seems to have been allowed to them by the first class of the French National Institute. We shall therefore state only a few of them, which seem most to favour the author's hypothesis.

1. A concrete odorant substance, laid upon a wet glass or broad saucer, covered with a thin stratum of water, immediately causes the water to recede, so as to form a space of several inches around it.

2. Fragments of concrete odorant matter, or small morsels of paper or cork, impregnated with an odorant liquor, and wiped, being placed on the surface of water, are immediately moved by a very swift rotation. Romieu had made this observation on camphor, and erroneously attributed the effect to electricity. The motion was perceptible even in pieces of camphor of seven or eight gros.

3. An odorant liquor being poured on the water, stops the motion till it is dissipated by evaporation. Fixed oil arrests the motion for a much longer time, and until the pellicle it forms on the water is taken off.

4. When the surface of the water is cleaned by a leaf of metal, of paper, or of glass, plunged in and withdrawn successively until the pellicle is removed, the gyratory motion is renewed. If a piece of red wax or of taper be dipped in water, and the drops shaken off into a glass of water containing odorant bodies in motion, the movement will be stopped. The same effect is not produced by metal.

5. A morsel of camphor, plunged to the depth of three or four lines in water, without floating, excites a movement of trepidation in the surrounding water, which repels small bodies in its vicinity, and carries them

them again to the camphor by ſtarts. The author concludes, that an elaſtic fluid eſcapes from the odorant body in the manner of the fire of a fuſee or the diſcharge of fire-arms.

6. When there is a certain proportion between the height of the water, and that of the ſmall fragment of camphor, the water is briſkly driven off, returns again to the camphor, and again retires, as if by an exploſion, the recoil of which often cauſes the camphor to make part of a revolution on its axis.

7. Camphor evaporates thirty or forty times more ſpeedily when placed upon water, than when entirely ſurrounded with air.

8. Camphor, during the act of diſſipation in the air, preſerves its form and its opaque whiteneſs; upon water it is rounded, and becomes tranſparent as if it had undergone a kind of fuſion. It may be inferred, that this ariſes from the acquired motion, which cauſes it to preſent a greater ſurface to the air.

9. When ſmall pieces of camphor are plunged in water, the camphor becomes rounded and tranſparent, does not acquire any motion, and its diſſipation is leſs perceptible than in the air. The concurrence of air and water is therefore neceſſary to diſengage the fluid which is the cauſe of the motion and total diſſipation of odorant bodies.

10. The motion of odorant bodies upon water decays and ceaſes ſpontaneouſly at the end of a certain time; becauſe the water having then contracted a ſtrong ſmell, the volatilization takes place in all the points of its ſurface; and the ſmall maſs being thus ſurrounded by the odorant fluid, which is no longer air, diſſolves, as in the ordinary odorant fluids, without forming the gaſeous jet which is the cauſe of the motion. The author compares the volatilization of the aromatic ſubſtance to a combuſtion excited by water.

M. Prevoſt hopes, that theſe and other experiments which he explains, will contribute to the theory of odours, which ſo nearly reſembles that of the gaſs. He does not flatter himſelf with having exhauſted this ſubject, but conſiders his diſcoveries as the means of rendering odour perceptible by water, not only to the ſight but even to the touch, as are likewiſe the vibrations of ſonorous bodies. Men deprived of the ſenſe of ſmell, and even the blind, according to him, may in this manner diſtinguiſh odorant bodies from thoſe which have no ſmell. "Perhaps (ſays he) this kind of odoroſcope may, by improvement, become an odorimeter. The exceptions, ſuch for example as that of the cerumen of the ears, which produces much effect on water without being perceptibly odorant, and that of the fingers when hot or moiſt, are merely apparent; for if our ſenſes do not in thoſe caſes diſcover odour, thoſe of animals more powerfully energetic, ſuch as the dog, perceive and diſtinguiſh individuals by its peculiar character. The odoroſcope may afford the information which is wanting reſpecting theſe effluvia. Thus it is that the fat of game, the ſmell of which is nearly to us imperceptible, is very much ſo to dogs, and exhibits ſenſible marks by the odoroſcope."

Profeſſor Venturi of Modena, who heard Prevoſt's memoir read in the National Inſtitute, had himſelf made ſome experiments with camphor kept ſeparately in the air, in the water, and at the ſurface of the water; whence he deduces, that the moſt active virtue for diſſolving camphor reſides at that part where both the air and the water touch the camphor at the ſame time. Hence he explains why, in like circumſtances, camphor evaporates more quickly in a moiſt than in a dry air; and why the Hollanders uſe water in their proceſs for ſubliming this ſubſtance.

It might be thought that the camphor was decompoſed at the ſurface of the water; that the water might ſeize the acidifying part, which renders the camphor concrete; and that the volatile part is diſſipated in the atmoſphere. The author rejects this notion. He thinks that water with camphor floating on its ſurface becomes charged with no more than a very ſmall portion: 1. Becauſe in theſe circumſtances the water acquires the ſame taſte and ſmell of camphor as it obtains when a ſmall quantity of this ſubſtance is kept plunged in the ſame fluid. This water, by expoſure to the air, loſes the qualities with which it had been charged, and becomes inſipid, and without ſmell. 2. Becauſe when the water is ſaturated with all it can take up, the diſſipation of the camphor continues at its ſurface as before. 3. Becauſe the aerial emanations of camphor made at the ſurface of water do themſelves cryſtallize into camphor.

Camphor at the ſurface of the water does nothing, therefore, but diſſolve; and when diſſolved at the ordinary temperature of the atmoſphere, it is not at firſt in the ſtate of vapour, as has been thought. It is ſimply a liquid which extends itſelf over the ſurface of water itſelf; and by this means coming into contact with a great ſurface of air, it is afterwards abſorbed and evaporated. This is proved by the following facts: 1. The ſolution of camphor at the ſurface of water is more rapid in proportion to the extent of the ſurface. In narrow veſſels, the ſection of the column would not be completed in ten days, even though the water might be extremely pure. 2 When the column of camphor has projecting parts, the liquid may be ſeen iſſuing by preference from certain points of the column, covering the ſurface of the water, and driving ſmall floating bodies before it, in the ſame manner as floating bodies go and return in a baſon into which the water of a canal enters with rapidity. 3. If a ſmall piece of camphor, already wetted at one end, be brought near the edge of water contained in a broad ſaucer, and be made to touch the ſaucer itſelf, it depoſits a viſible liquor, which is oily; and by attaching itſelf to the ſaucer, deſtroys the adheſion between the veſſel and the border of the water, ſo that the water retires on account of the affinity of aggregation, which not being oppoſed by the attraction of the ſaucer, cauſes the water to terminate in a round edge. If you remove the piece of camphor, the water will not return to its place until the oily fluid is evaporated. 4. In the ſame manner, when the column of camphor is half immerſed in the water, the oily liquor which iſſues forth deſtroys the adheſion of the water to the column, and produces a ſmall ſurrounding cavity. The ſolution ſtops, or is retarded for a moment, until the fluid, extending itſelf over the water, becomes evaporated: the water then returns to its place, and touches the ſame part of the camphor; the ſolution begins again, and in this manner the proceſs is effected by alternations of contact and apparent repulſion.

Of theſe memoirs by Prevoſt and Venturi, the Engliſh reader will find accurate and full tranſlations in the

firſt

first volume of *Nicholson's Philosophical Journal*, together with some judicious observations on them by the editor, which we shall take the liberty to adopt. "The philosophical consideration of odorant bodies is somewhat obscured by the old method of generalising, or referring the properties of bodies to some distinct principle or thing supposed capable of being separated from the body itself. Thus the odours of bodies have been supposed to depend on a substance imagined in a loose way to be common to them all and separable from them. Hence the terms, principle of smell, spiritus rector, and even in the modern nomenclature we find *aroma*. There does not in effect seem to be any more reason to infer the existence of a common principle of smell than of taste. The smell of ammoniac is the action of that gas upon the organ of sense; and this odorant invisible matter is exhibited to the sight when combined with an acid gas. But in the same manner as ammoniac emanates from water, and leaves most part of that fluid behind, so will the volatile parts of bodies be most eminently productive of this action; and very few, if any, natural bodies will be found which rise totally. The most striking circumstance in the effect is, that an act of such power should be attended with a loss by exhalation which is scarcely to be appreciated by weight, or in any other method during a short interval of time. But we know so little of nervous action, and of other phenomena of electricity, of galvanism (see GALVANISM in this *Suppl.*) or even of heat, which strongly affect the senses, but elude admeasurement by gravitation, that the difficulty of weighing the effluvia of odorant bodies becomes less astonishing."

ŒCONOMISTS, a sect of philosophers in France, who have made a great noise in Europe, and are generally believed to have been unfriendly to religion. The founder of this sect was a *Dr Duquesnai*, who had so well insinuated himself into the favour of Louis XV. that the king used to call him his *thinker*. The sect was called *œconomists*, because the œconomy and order to be introduced into the finances, and other means of alleviating the distresses of the people, were perpetually in their mouths. The Abbé Barruel admits, that there may have been some few of them who directed their speculations to no other object; but he brings very sufficient proof that the great aim of the majority of the sect was to eradicate from the minds of the people all reverence for divine revelation.

"Duquesnai (says he) and his adepts had more especially undertaken to persuade their readers, that the country people, and mechanics in towns, were entirely destitute of that kind of instruction necessary for their professions; that men of this class, unable to acquire knowledge by reading, pined away in an ignorance equally fatal to themselves and to the state; that it was necessary to establish free school, and particularly throughout the country, where children might be brought up to different trades, and instructed in the principles of agriculture. D'Alembert, and the Voltairean adepts, soon perceived the advantages they could reap from these establishments. In union with the œconomists, they presented various memorials to Louis XV. in which not only the temporal but even the spiritual advantages of such establishments for the people, are strongly urged. The king, who really loved the people, embraced the project with warmth. He opened his mind on the subject to Mr Bertin, whom he honoured with his confidence, and had entrusted with his privy purse;" and it was with great difficulty that this minister could convince him of the dangerous designs of the sect.

"Determined (says he) to give the king positive proof that the œconomists imposed upon him, I sought to gain the confidence of those pedlars who travel through the country, and expose their goods to sale in the villages, and at the gates of country seats. I suspected those in particular who dealt in books to be nothing less than the agents of philosophism with the good country folks. In my excursions into the country I fixed my attention above all on the latter. When they offered me a book to buy, I questioned them what might be the books they had? Probably catechisms or prayer-books? Few others are read in the villages? At these words I have seen many smile. No they answered, those are not our works; we make much more money of Voltaire, Diderot and other philosophic writings. What? said I; the country people buy Voltaire and Diderot? Where do they find the money for such dear works? Their constant answer was, we have them at a much cheaper rate than prayer-books; we can sell them at ten sols (5d.) a volume, and have a pretty profit into the bargain. Questioning some of them still farther, many of them owned that those books cost them nothing; that they received whole bales of them without knowing whence they came, but being simply desired to sell them in their journeys at the lowest price."

"Louis XV. warned by the discovery made by his minister, was at length satisfied that the establishment of these schools, so much urged by the conspirators, would only be a new instrument of seduction in their hands. He abandoned the plan; but, perpetually harassed by the protecting sophisters, he did not strike at the root of the evil, and but feebly impeded its progress. The pedlars continued to promote the measures of the conspirators; yet this was but one of the inferior means employed to supply the want of their free schools, as a new discovery brought to light one far more fatal.

"About the middle of the month of September 1789, little more than a fortnight antecedent to the atrocious 5th and 6th of October, at a time when the conduct of the National Assembly, having thrown the people into all the horrors of a revolution, indicated that they would set no bounds to their pretensions, Mr Le Roy, lieutenant of the King's Hunt, and an academician, being at dinner at the house of Mr D'Angevilliers, intendant of the buildings of his majesty, the conversation turned on the disasters of the revolution, and on those that were too clearly to be foreseen. Dinner over, the nobleman above mentioned, a friend of Le Roy, hurt at having seen him so great an admirer of the sophisters, reproached him with it in the following expressive words: *Well! this then, is the work of Philosophy!* Thunderstruck at these words—Alas! cried the academician, *to whom do you say so? I know it but too well, and I shall die of grief and remorse!* At the word *remorse*, the same nobleman questioned him whether he had so greatly contributed towards the revolution as to upbraid himself with it in that violent manner? 'Yes (answered he), I have contributed to it, and far more than I was aware of. I was secretary to the committee to which you are indebted for it; but I call heaven to witneſs, that I never thought it would go to ſuch lengths. You have ſeen me in the king's ſervice, and you know that I love his perſon. I little thought of bringing his ſubjects to this pitch, *and I ſhall die of grief and remorſe!*'

"Preſſed to explain what he meant by this committee, this ſecret ſociety, entirely new to the whole company, the academician reſumed: 'This ſociety was a ſort of club that we philoſophers had formed among us, and only admitted into it perſons on whom we could perfectly rely. Our ſittings were regularly held at the Baron D'Holbach's. Leſt our object ſhould be ſurmiſed, we called ourſelves œconomiſts. We created Voltaire, though abſent, our honorary and perpetual preſident. Our principal members were D'Alembert, Turgot, Condorcet, Diderot, La Harpe, and that Lamoignon, keeper of the ſeals, who on his diſmiſſion ſhot himſelf in his park.'

"The whole of this declaration was accompanied with tears and ſighs; when the adept, deeply penitent, continued: 'The following were our occupations; the moſt of thoſe works which have appeared for this long time paſt againſt religion, morals, and government, were ours, or thoſe of authors devoted to us. They were all compoſed by the members or by the orders of the ſociety. Before they were ſent to the preſs, they were delivered in at our office. There we reviſed and corrected them; added to, or curtailed them, according as circumſtances required. When our philoſophy was too glaring for the times, or for the object of the work we brought it to a lower tint; and when we thought that we might be more daring than the author, we ſpoke more openly. In a word, we made our writers ſay exactly what we pleaſed. Then the work was publiſhed under the title or name we had choſen, the better to hide the hand whence it came. Many ſuppoſed to have been poſthumous works, ſuch as *Chriſtianity Unmaſked*, and divers others *attributed to Freret and Boulanger* after their deaths, were iſſued from our ſociety.

'When we had approved of thoſe works, we began by printing them on fine or ordinary paper, in ſufficient number to pay our expences, and then an immenſe number on the commoneſt paper. Theſe latter we ſent to hawkers and bookſellers free of coſt, or nearly ſo, who were to circulate them among the people at the loweſt rate. Theſe were the means uſed to pervert the people, and bring them to the ſtate you now ſee them in. I ſhall not ſee them long, *for I ſhall die of grief and remorſe!*'

This recital is too well authenticated to be called in queſtion, and too plain to need a commentary. Let it be a warning againſt all ſecret ſocieties, by whatever title of benevolence they may be deſigned by thoſe who form them.

OENEMACK, the ſouth point of Briſtol Bay, on the N. W. coaſt of N. America. N. lat. 54 30, W. long. 160 30.—*Morſe.*

OGEECHEE, a river of Georgia, 18 miles ſouth of Savannah river, and whoſe courſes are nearly parallel with each other. It empties into the ſea oppoſite the north end of Oſſabaw Iſland, 18 miles ſouth of Savannah. Louiſville, Lexington and Georgetown are on the upper part of this river.—*ib.*

OGLETHORPE, a new county on the north ſide of Alatamaha river, weſt of Liberty county. Fort Telfair is in the S. E. corner of this county on the Alatamaha.—*ib.*

OHAMANENO, a ſmall but good harbour, on the W. ſide of Ulietea, one of the Society Iſlands, in the S. Pacific Ocean. S. lat. 16 45, W. long. 151 38. The variation of the compaſs in 1777, was 6 19 E.—*ib.*

OHAMENE *Harbour*, a fine bay on the E. ſide of Otaha, one of the Society Iſlands. It paſſes in by a channel between the two ſmall iſlands Toahoutu, and Whennuaia. Within the reef it forms a good harbour, from 25 to 16 fathoms water, and clear ground.—*ib.*

OHERURUA, a large bay on the S. W. part of the iſland of Otaha, one of the Society Iſlands, and the next harbour to the northward from Apotopoto Bay. There is anchorage from 20 to 25 fathoms, and has the advantage of freſh water. The breach in the reef which opens a paſſage into this harbour, is $\frac{1}{2}$ of a mile broad, in lat. 16 38 S. and long. 151 30 W.—*ib.*

OHETEROA, one of the Society Iſlands, which is about 12 miles long and 6 broad, inhabited by a people of very large ſtature, who are rather browner than thoſe of the neighbouring iſlands. It has no good harbour nor anchorage. Lat. 22 27 S. long. 150 47.—*ib.*

OHETUNA, a harbour on the S. E. ſide of Ulietea, one of the Society Iſlands.—*ib.*

OHEVAHOA, an iſland in the South Pacific Ocean. S. lat. 9 41, W. long. 139 2.—*ib.*

OHIO, a moſt beautiful river, ſeparates the North Weſtern Territory from Kentucky on the S. and Virginia on the S. E. Its current gentle, waters clear, and boſom ſmooth and unbroken by rocks and rapids, a ſingle inſtance only excepted. It is one quarter of a mile wide at Fort Pitt; 500 yards at the mouth of the Great Kanhaway; 1200 yards at Louiſville, and at the Rapids half a mile, but its general breadth does not exceed 600 yards. In ſome places its width is not 400, and in one place particularly, far below the Rapids, it is leſs than 300. Its breadth, in no one place, exceeds 1200 yards; and at its junction with the Miſſiſſippi, neither river is more than 900 yards wide. Its length, as meaſured according to its meanders by Capt. Hutchins, is as follows:—From Fort Pitt to

Log's Town	$18\frac{1}{2}$	Little Miami	$126\frac{1}{4}$
Big Beaver Creek	$10\frac{3}{4}$	Licking Creek	8
Little Beaver Creek	$13\frac{1}{2}$	Great Miami	$26\frac{3}{4}$
Yellow Creek	$11\frac{3}{4}$	Big Bones	$32\frac{1}{2}$
Two Creeks	$21\frac{3}{4}$	Kentucky	$44\frac{1}{4}$
Long Reach	$53\frac{3}{4}$	Rapids	$77\frac{1}{4}$
End Long Reach	$16\frac{1}{2}$	Low Country	$155\frac{3}{4}$
Muſkingum	$26\frac{1}{2}$	Buffalo river	$64\frac{1}{2}$
Little Kanhaway	$12\frac{1}{4}$	Wabaſh	$97\frac{1}{4}$
Hockhocking	16	Big Cave	$42\frac{3}{4}$
Great Kanhaway	$82\frac{1}{2}$	Shawanee river	$52\frac{1}{2}$
Guiandot	$43\frac{3}{4}$	Cherokee river	13
Sandy Creek	$14\frac{1}{2}$	Maſſac	11
Sioto, or Scioto	$48\frac{3}{4}$	Miſſiſſippi	46
			1188

In common winter and ſpring floods, it affords 30 or 40 feet water to Louiſville; 25 or 30 feet to La Tarte's Rapids; 40 above the mouth of the Great Kanhaway; and a ſufficiency at all times for light batteaux and canoes to Fort Pitt. The Rapids are in lat. 38 8. The inundations of this river begin about the laſt of March, and ſubſide in July, although they frequently happen in other months; ſo that boats which carry 300 barrels of flour from the Monongahela, or Youhiogeny, above Pittsburgh, have seldom long to wait for water. During these floods, a first rate man-of-war may be carried from Louisville to New Orleans, if the sudden turns of the river and the strength of its current will admit a safe steerage. It is the opinion of some well informed gentlemen, that a vessel properly built for the sea, to draw 12 feet water, when loaded, and carrying from 12 to 1600 barrels of flour, may be more easily, cheaply and safely navigated from Pittsburg to the sea, than those now in use; and that this matter only requires one man of capacity and enterprize to ascertain it. A vessel intended to be rigged as a brigantine, snow, or ship, should be double-decked, take her masts on deck, and be rowed to the Ibberville, below which are no islands, or to New Orleans, with 20 men, so as to afford reliefs of 10 and 10 in the night. Such a vessel, without the use of oars, it is supposed, would float to New Orleans from Pittsburgh in 20 days. If this be so, what agreeable prospects are presented to our brethren and fellow-citizens in the western country! The Rapids at Louisville descend about 10 feet in the distance of a mile and a half. The bed of the river is a solid rock, and is divided by an island into two branches, the southern of which is about 200 yards wide, but impassable in dry seasons. The bed of the northern branch is worn into channels by the constant course of the water, and attrition of the pebble stones carried on with that, so as to be passable for batteaux through the greater part of the year. Yet it is thought that the southern arm may be most easily opened for constant navigation. The rise of the waters in these Rapids does not exceed 20 or 25 feet. There is a fort situated at the head of the Falls. The ground on the south side rises very gradually. At Fort Pitt the river Ohio loses its name, branching into the Monongahela and Alleghany.—*ib.*

Ohio, the north-westernmost county of the State of Virginia, bounded east by Washington county, in Pennsylvania, and N.-W. by the river Ohio, which divides it from the N. W. Territory. It contains 5,212 inhabitants, including 281 slaves. Chief town, Liberty.—*ib.*

Ohio *Company's Purchase*, in the N. W. Territory, is a tract of excellent land situated on the north bank of the Ohio, east of Col. Symes's purchase. In this tract there were about 2,500 inhabitants in 1792.—*ib.*

OHIOPE, a small northern tributary stream of Alatamaha river, in Oglethorpe county, Georgia.—*ib.*

OHIOPIOMINGO, a tract of land so called in the State of Kentucky, situated in Nelson county, on Ohio river, and south westward of Salt river.—*ib.*

OHIOPYLE *Falls*, in Youghiogany river, are about 20 feet perpendicular height, where the river is 80 yards wide. They are 30 or 40 miles from the mouth of this river, where it mingles its waters with the Monongahela.—*ib.*

OHITAHOO, an island in the S. Pacific Ocean. S. lat. 9 55, W. long. 139 6.—*ib.*

OIL *Creek*, in Alleghany county, Pennsylvania, issues from a spring, on the top of which floats an oil, similar to that called Barbadoes tar, and empties into Alleghany river. It is found in such quantities, that a man may gather several gallons in a day. The troops sent to guard the Western Posts, halted at this spring, collected some of the oil, and bathed their joints with it. This gave them great relief from the rheumatic complaints, with which they were afflicted. The waters, of which the troops drank freely, operated as a gentle cathartic.—*ib.*

Oil-mill, a mill for expressing the oils from fruits, or grains, &c. As these States do not produce the olive, it would be needless to describe the mills which are employed in the southern parts of Europe. We shall content ourselves, therefore, with a description of a Dutch oil mill, employed for grinding and pressing lint-seed, rape-seed, and other oleaginous grains. Farther, to accommodate our description still more to our local circumstances, we shall employ water as the first mover; thus avoiding the enormous expence and complication of a windmill.

In Plate XXXVIII. fig. A,

1. Is the elevation of a wheel, over or undershot, as the situation may require.

2. The bell-metal socket, supported by masonry, for receiving the outer gudgeon of the water wheel.

3. The water course.

Fig. B.

1. A spur wheel upon the same axis, having 52 teeth.

2. The trundle that is driven by N° 1. and has 78 staves.

3. The *wallower*, or axis for raising the pestles. It is furnished round its circumference with *wipers* for lifting the *pestles*, so that each may fall twice during one turn of the water wheel, that is, three *wipers* for each pestle.

4. A frame of timber, carrying a concave half cylinder of bell-metal, in which the wallower (cased in that part with iron plates) rests and turns round. It will be seen in profile, fig. G.

5. Masonry supporting the inner gudgeon of the water wheel and the above mentioned frame.

6 Gudgeon of the wallower, which bears against a bell-metal step fixed in the wall. This double support of the wallower is found to be necessary in all mills which drive a number of heavy stampers.

Fig. C, Is the elevation of the pestle and press frame, their furniture, the mortars, and the press-pestles.

1. The six pestles.

2. Cross pieces between the two rails of the frame, forming, with these rails, guides for the perpendicular motion of the pestles.

3. The two rails. The back one is not seen. They are checked and bolted into the standards N° 12.

4. The tails of the *lifts*, corresponding to the wipers upon the wallower.

5. Another rail in front, for carrying the *detents* which hold up the pestles when not acting. It is marked 14 in fig. M.

6. A beam a little way behind the pestles. To this are fixed the pulleys for the ropes which lift and stop the pestles. It is represented by 16 in fig. M.

7. The said pulleys with their ropes.

8. The *driver*, which strikes the wedge that presses the oil.

9. The *discharger*, a stamper which strikes upon the inverted wedge, and loosens the press.

10. The lower rail with its cross pieces, forming the lower guides of the pestles.

Oil-Mill.

11. A small cog wheel upon the wallower, for turning the *spatula*, which stirs about the oilseed in the *chauffer-pan*. It has 28 teeth, and is marked N° 6 in fig. M.

12. The four standards, mortised below into the *block*, and above into the joists and beams of the building.

13. The six *mortars* hollowed out of the block itself, and in shape pretty much like a kitchen pot.

14. The feet of the pestles, rounded into cylinders, and shod with a great lump of iron.

15. A board behind the pestles, standing on its edge, but inclining a little backwards. There is such another in front, but not represented here. These form a sort of trough, which prevents the seed from being scattered about by the fall of the pestles, and lost.

16. The first *press-box* (also hollowed out of the block), in which the grain is squeezed, after it has come for the first time from below the milstones.

17. The second *press box*, at the other end of the block, for squeezing the grain after it has passed a second time under the pestles.

18. Frame of timber for supporting the other end of the wallower, in the same manner as at N° 4 fig. B.

19. Small cog wheel on the end of the wallower for giving motion to the mil-stones. It has 28 teeth.

20. Gudgeon of the wallower, bearing on a bell metal socket fixed in the wall.

21. Vessels for receiving the oil from the press-boxes.

22. Joists supporting the block.

Fig. D. Elevation and mechanism of the milstones.

1. *Upright shaft*, carrying the great cog wheel above, and the *runner milstones* below in their frame.

2. Cog-wheel of 76 cogs, driven by N° 19. of fig. C.

3. The frame of the *runners*. This will be more distinctly understood in N° 4. fig H.

4. The innermost runner, or the one nearest the shaft.

5. Outermost ditto, being farther from the shaft.

6. The *inner rake*, which collects the grain under the outer runner.

7. The *outer rake*, which collects the grain under the inner runner. In this manner the grain is always turned over and over, and crushed in every direction. The inner rake lays the grain in a slope, of which fig. O. is a section; the runner flattens it and the second rake lifts it again, as is marked in fig. P; so that every side of a grain is presented to the milstone, and the rest of the *legger* or *nether milstone* is so swept by them, that not a single grain is left on any part of it. The outer rake is also furnished with a rag of cloth, which rubs against the border or hoop that surrounds the nether milstone, so as to drag out the few grains which might otherwise remain in the corner.

8. The ends of the iron axle which passes through the upright shaft, and through the two runners. Thus they have two motions: *1mo*, A rotation round their own axis. *2do*. That by which they are carried round upon the nether milstone on which they roll. The holes in these milstones are made a little widish; and the holes in the ears of the frame, which carry the ends of the iron axis, are made oval up and down. This great freedom of motion is necessary for the runner milstones, because frequently more or less of the grain is below them at a time, and they must therefore be at liberty to get over it without straining, and perhaps breaking, the shaft

9. The ears of the frame which lead the two extremities of the iron axis. They are mortised into the under side of the bars of the square frame, that is carried round with the shaft.

10. The border or hoop which surrounds the nether milstone.

11. and 12. The nether milstone and masonry which supports it.

Fig E. Form of the wallower, shewing the disposition of the wipers along its surface.

1. Two parts of this shaft, which are nicely rounded, and fortified with iron plates, and which rest upon the bell-metal concaves, which are represented in n° 4. of fig. C.

2. The little wheels at each end, for giving motion to the two spatulæ, marked n° 11. fig. C.

3. The wipers for the second press.

4. The wipers for the first press.

5. The wipers for the six pestles.

Fig. F. Represents the surface of the wallower unfolded into a rectangular parallelogram, in order to shew the distribution of the wipers, and consequently the succession of the strokes given by the different pestles. This distribution has something peculiar. Each pestle has three wipers; and there are also three for the driver and discharger of the second press. The driver and wiper of the first press have but one and a half; one for the driver, and the half for the discharger; so that it strikes twice, and the driver only once, in a turn of the shaft. This is the Dutch practice, which differs from that of Flanders. The succession of the strokes may be conceived as follows: Reckon the stampers, including those of the presses, from the water wheel toward the other end of the wallower, and calling them *a*, *b*, *c*, *d*, *e*, *f*, *g*, *h*, *i*, *k*, and supposing that *a* makes the first stroke, they proceed in the following order for one turn of the wallower.

ab, *d*, *f*, *h*, *c*, *e*, *g*, *ab*, *d*, *f*, *h*, *c*, *e*, *g*, *ab*, *d*, *f*, *h*, *c*, *e*, *g*.

Here it may be observed that *a* and *b* strike together. They would do so if allowed; but one of them is held up by its detent till the workman sees proper to disengage it. Each pestle, and the driver and discharger of the second press, make three strokes for one turn of the wallower. But the driver *k* of the first press makes only one stroke in that time, namely, in the interval between the last strokes of *e* and *g*. The discharger *i* of this press makes two strokes; one of them in this same interval, and the other along with the first stroke of *e*. The second pressing requires a much more violent pressure than the first, because the cake must be left perfectly dry and hard.

Fig. G. Profile of the frame of timber which carries the wallower, and greatly contributes to render its motion steady.

Fig. H. Is a view of one of the milstones.

1. The nether milstones and the masonry supporting the whole.

2. The runner.

3. A sort of case which encloses the two wings of the milstone at a very small distance from it, in order

to

to prevent the grain which ſticks to it from being ſcattered. There is another method practiſed at ſome mills.

Fig. I. Repreſents that of Sardamm. AA are two iron rods, about half an inch ſquare, hanging on the axle, on each ſide of the milſtone. Theſe rods are joined by a croſs piece C. which almoſt touches the milſtone. A piece of leather is put between, which rubs upon the milſtone, and clears it of the grain which chances to ſtick to it. N° 4. and 6. repreſent the ears of this frame, by which the end of the iron axle is ſupported, and carried round by the upright ſhaft n° 5.

Fig. K. Plan of the runner milſtones, and the frame which carries them round.

1, 1. Are the two milſtones.

3, 3, 3, 3. The outſide pieces of the frame.

4, 4, 4, 4. The croſs bars of the frame which embrace the upright ſhaft 5, and give motion to the whole.

6, 6. The iron axis upon which the runners turn.

7. The outer rake.

8. The inner ditto.

Fig. L. Repreſents the nether milſtone ſeen from above.

1. The wooden gutter, which ſurrounds the nether milſtone.

2. The border or hoop, about ſix inches high, all round to prevent any ſeed from being ſcattered.

3. An opening or trap door in the gutter, which can be opened or ſhut at pleaſure. When open, it allows the bruiſed grain, collected in and ſhoved along the gutter by the rakes, to paſs through into troughs placed below to receive it.

4. Portion of the circle deſcribed by the outer runner.

5. Portion of the circle deſcribed by the inner one. By theſe we ſee that the two ſtones have different routes round the axis, and bruiſe more ſeed.

6. The outer rake.

7. The inner ditto.

8. The ſweep, making part of the inner rake, occaſionally let down for ſweeping off all the ſeed when it has been ſufficiently bruiſed. The preſſure and action of theſe rakes is adjuſted by means of wooden ſprings, which cannot be eaſily and diſtinctly repreſented by any figure. The oblique poſition of the rakes (the outer point going foremoſt) cauſes them to ſhove the grain inwards or toward the centre, and at the ſame time to turn it over, ſomewhat in the ſame manner as the mould-board of a plough ſhoves the earth to the right hand, and partly turns it over. Some mills have but one ſweeper; and, indeed, there is great variety in the form and conſtruction of this part of the machinery.

Fig. M. Profile of the peſtle frame.

1. Section of the horizontal ſhaft.

2. Three wipers for lifting the peſtles.

3. Little wheel of 28 teeth for giving motion to the ſpatula.

4. Another wheel, which is driven by it, having 20 teeth.

5. Horizontal axle of ditto.

6. Another wheel on the ſame axle having 13 teeth.

7. A wheel upon the upper end of the ſpindle, having 12 teeth.

8. Two guides, in which the ſpindle, turns freely, and ſo that it cannot be ſhifted higher and lower.

9. A lever, moveable round the piece n° 14. and having a hole in it at 9, through which the ſpindle paſſes, turning freely. The ſpindle has in this place a ſhoulder which reſts on the border of the hole 9; ſo that by the motion of this lever the ſpindle may be diſengaged from the wheel work at pleaſure. This motion is given to it by means of the lever 10, 10, moveable round its middle. The workman employed at the chauffer pulls at the rope 10, 11, and thus diſengages the ſpindle and ſpatula.

11. A peſtle ſeen ſidewiſe.

12. The *lift* of ditto.

13. The upper rails, marked n° 3. in fig. C.

14. The rail, marked n° 5. in fig. C. To this are fixed the detents which ſerve to ſtop and hold up the peſtles.

15. A detent, which is moved by the rope at its outer end.

16. A bracket behind the peſtles, having a pulley, through which paſſes the rope going to the detent 15.

17. The ſaid pulley.

18. The rope at the workman's hand, paſſing through the pulley 17, and fixed to the end of the detent 15.

This detent naturally hangs perpendicular by its own weight. When the workman wants to ſtop a peſtle, he pulls at the rope 18, during the riſe of the peſtle. When this is at its greateſt height, the detent is horizontal, and prevents the peſtle from falling by means of a pin projecting from the ſide of the peſtle, which reſts upon the detent, the detent itſelf being held in that poſition by hitching the loop of the rope upon a pin at the workman's hand.

19. The two lower rails, marked n° 10. fig. C.

20. *Great* wooden, and ſometimes ſtone, *block*, in which the mortars are formed, marked n° 21 in fig. C.

21. Veſſel placed below the preſs boxes for receiving the oil.

22. Chauffer, or little furnace, for warming the bruiſed grain.

23. Backet in the front of the chauffer, tapering downwards, and opening below in a narrow ſlit. The hair bags in which the grain is to be preſſed after it has been warmed in the chauffer, are filled by placing them in this backet. The grain is lifted out of the chauffer with a ladle, and put into theſe bags; and a good quantity of oil runs from it through the ſlit at the bottom into a veſſel ſet to receive it.

14. The ſpatula attached to the lower end of the ſpindle, and turning round among the grain in the chauffer-pan, and thus preventing it from ſticking to the bottom or ſides, and getting too much heat.

Fig. N. Plan of part of the works.

1, 1. Furnaces for warming the grain.

2, 2. The backets for holding the ſacks while they are a filling.

3, 3. The pan in which the bruiſed grain is heated by the chauffer.

4, 4. A trough for receiving the chips, into which the preſſed oil-cakes are cut, to be afterwards put into the pan and warmed.

5. The preſs-box for the ſecond preſſing.

6. The preſs box for the firſt preſſing.

7. The ſix mortars.

8. The ſloping boards, to hinder the ſcattering of the oil ſeed.

9. The nether milſtone, but out of its place.

10. Its centre a little higher than the reſt.

11. A rib of wood going round the edge of the nether milſtone, and even with its ſurface, but riſing a-

very;

very little outwards, and surrounded with a border or hoop about an inch high, to prevent the seed from being scattered on the ground.

Fig. Q. A section, lengthwise, of the great block, with the mortars and press-boxes.

1. The six pestles.

2. The six mortars, each of which has an iron plate at its bottom.

3. The *driving* stamper, which falls on the wedge of the first pressing.

4. Ditto, for the second ditto.

5. The *discharger*, which strikes on the inverted wedge in order to free the press.

6. Ditto, for the second pressing.

7. Wedge for freeing the press.

8. Wedge for pressing.

9. Wooden *cheeks*, two inches thick, which are placed between the middle wedge and the *sliding wedges* on each side.

10. Press-irons, between which are placed the hair-bags containing the bruised grain.

11. Iron plate, called the *fountain*, at the bottom, pierced with holes, corresponding with a hole in the block, for allowing the oil to run off from the pressed grain.

12. Vessel for receiving ditto.

13. A long iron plate at the bottom of the press-box, under the drawing and discharging wedges.

Fig. R. Another view of the press-irons.

1. The side-irons laid flat.

2. The same seen edgewise.

3. The pierced iron plate, upon which the two irons, n° 1. stand upright, with the hair-bag between them.

4. One of the hair-bags. It may be observed that the seams of these bags are made on the flat sides, and not on the edges, where they would be in danger of bursting.

5. A long hair-cloth, in which the bag is wrapped before it is set into the press. The bag, being filled with bruised grain, is placed with its bottom at *a*, and the top at *b*; the part *c a* is lapped over it, reaching to *b*, and then the other end *d* is lapped over that, and reaches to *a*, and the loop at its end serves as a handle by which to lift it, and place it properly between the press-irons.

Fig. S. The principal pieces of the press.

1. The wooden cheeks.

2. The discharging wedge.

3. The driving wedge.

4 and 5. The sliding blocks, which transmit the pressure produced by the driving wedge.

The foregoing enumeration and views of the different parts of a Dutch oil-mill, are sufficient, we imagine, to enable an intelligent mill-wright, to whom the machine is altogether new, to understand its manner of working, and its adaptation to the various parts of the process for extracting the oil from seeds or kernels. It would require a very minute description indeed to explain it to a person altogether unacquainted wi h mill-work.

The first part of the process is bruising the seed under the runner stones (A). That this may be more expeditiously done, one of the runners is set about ⅔ds of its own thickness nearer the shaft than the other. Thus they have different treads; and the grain, which is a little heaped towards the centre, is thus bruised by both. The inner rake gathers it up under the outer stone into a ridge, of which the section is represented in Plate XL. fig. O. The stone passes over it and flattens it. It is gathered up again into a ridge, of the form of fig. P. under the inner stone, by the outer rake, which consists of two parts. The outer part presses close on the wooden border which surrounds the nether stone, and shoves the seed obliquely inwards, while the inner part of this rake gathers up what had spread toward the centre. The other rake has a joint near the middle of its length, by which the outer half of it can be raised from the nether stone, while the inner half continues pressing on it, and thus scrapes off the moist paste. When the seed is sufficiently bruised, the miller lets down the outer end of the rake. This immediately gathers the whole paste, and shoves it obliquely outwards to the wooden rim, where it is at last brought to a part that is left unboarded, and it falls through into troughs placed to receive it. These troughs have holes in the bottom, through which the oil drips all the time of the operation. This part of the oil is directed into a particular cistern, being considered as the purest of the whole, having been obtained, without pressure, by the mere breaking of the hull of the seed.

In some mills this operation is expedited, and a much greater quantity of this best oil is obtained, by having the bed of masonry which supports the legger formed into a little furnace, and gently heated. But the utmost care is necessary to prevent the heat from becoming considerable. This, enabling the oil to dissolve more of the fermentable substance of the seed, exposes the oil to the risk of growing soon very rancid; and, in general, it is thought a hazardous practice, and the oil does not bring so high a price.

When the paste comes from under the stones, it is put into the hair bags, and subjected to the first pressing. The oil thus obtained is also esteemed as of the first quality, scarcely inferior to the former, and is kept apart (The great oil cistern being divided into several portions by partitions).

The oil cakes of this pressing are taken out of the bags, broken to pieces, and put into the mortars for the first *stamping*. Here the paste is again broken down, and the parenchyma of the seed reduced to a fine meal. Thus free egress is allowed to the oil from every vesicle in which it was contained. But it is now rendered much more clammy, by the forcible mixture of the mucilage, and even of the finer parts of the meal. When sufficiently pounded, the workman stops the pestle of a mortar, when at the top of its lift, and carries the contents of the mortar to the first chauffer pan, where it is heated to about the temperature of melting bees wax (this, we are told, is the test), and all the while stirred

(A) We are told, that in a mill at Reichenhoffen in Alsace, a considerable improvement has been made by passing the seed between two small iron rollers, before it is put under the millstones. A great deal of work is said to be saved by this preliminary operation, and finer oil produced, which we think very probable. The stamping and pressing go on as in other mills.

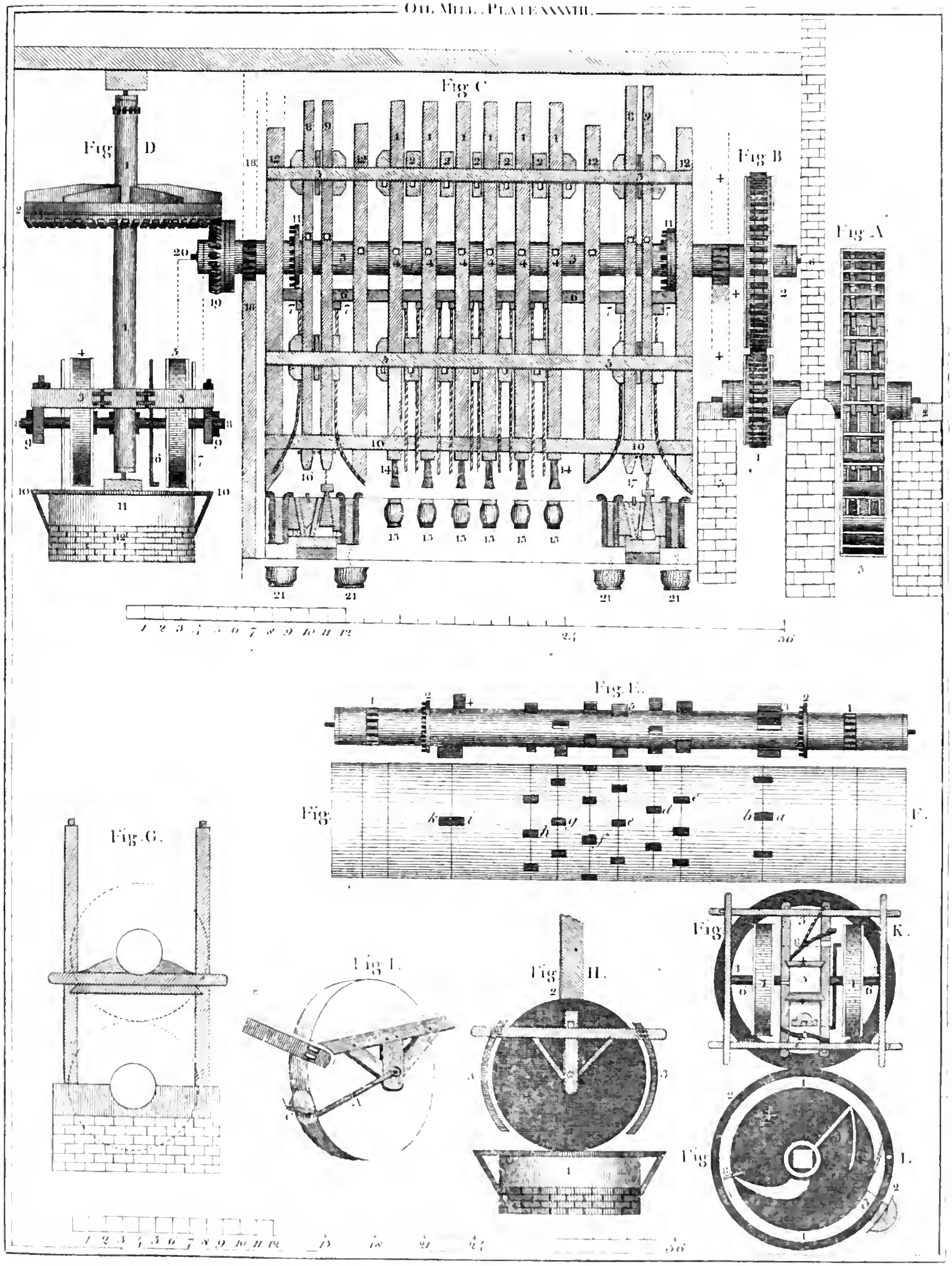
Fig C
Fig D
Fig B
Fig A
Fig E.
Fig. F.
Fig. G.
Fig. I.
Fig H.
Fig K.
Fig L.

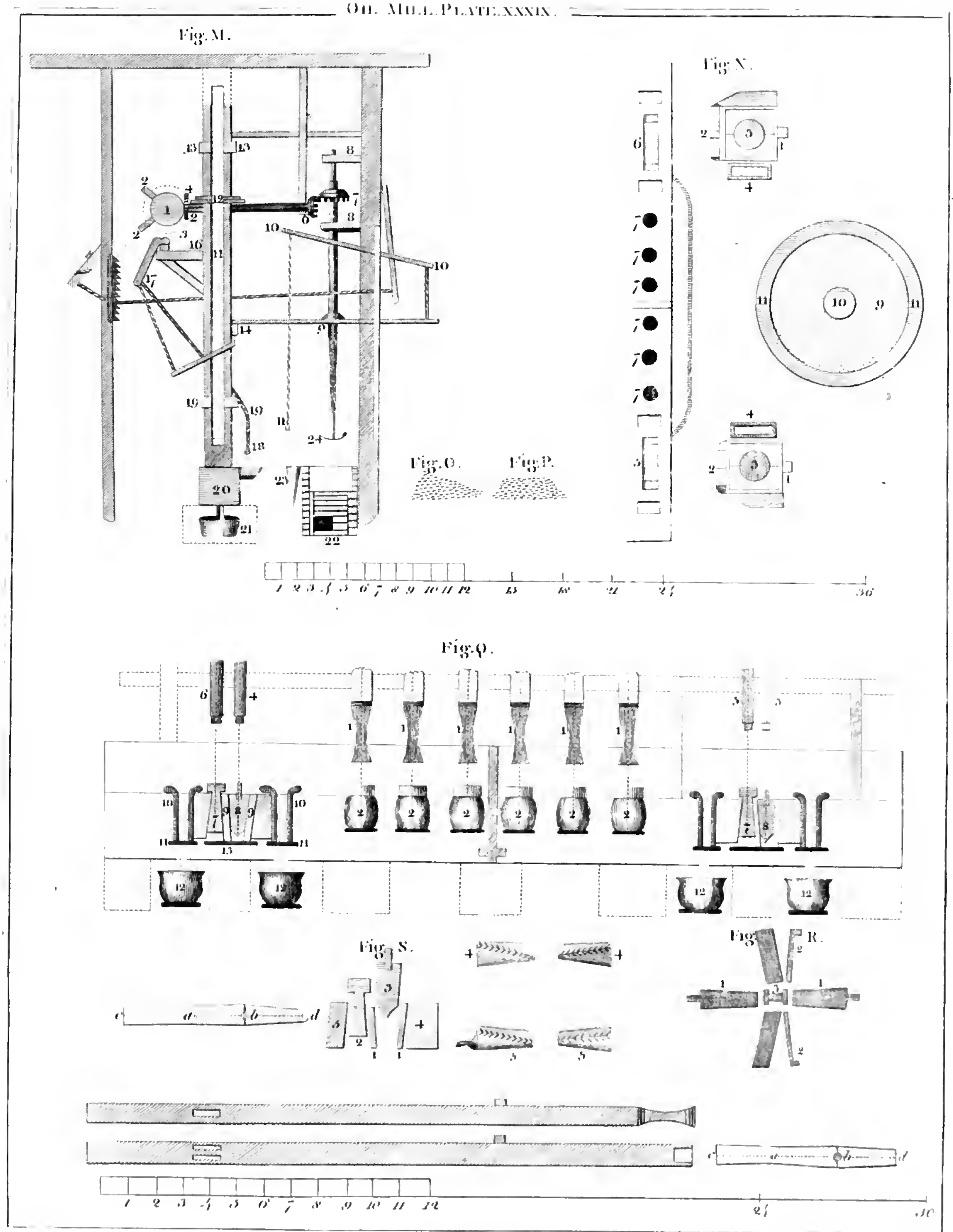
Fig. M.
Fig. N.
Fig. O.
Fig. P.
Fig. Q.
Fig. S.
Fig. R.

ſtirred about by the ſpatula. From thence it is again put into hair bags, in the manner already deſcribed; and the oil which drips from it during this operation is conſidered as the beſt of the ſecond quality, and in ſome mills is kept apart. The paſte is now ſubjected to the ſecond preſſing, and the oil is that of the ſecond quality.

All this operation of pounding and heating is performed by one workman, who has conſtant employment by taking the four-mortars in ſucceſſion. The putting into the bags and conducting of the preſſing gives equal employment to another workman.

In the mills of Piccardy, Alſace, and moſt of Flanders, the operation ends here; and the produce from the chauffer is increaſed, by putting a ſpoonful or two of water into the pan among the paſte.

But the Dutch take more pains. They add no water to the paſte of this their *firſt ſtamping*. They ſay that this greatly lowers the quality of the oil. The cakes which reſult from this preſſing, and are there ſold as food for cattle, are ſtill fat and ſoftiſh. The Dutch break them down, and ſubject them to the peſtles for the *ſecond ſtamping*. Theſe reduce them to an impalpable paſte, ſtiff like clay. It is lifted out, and put into the *ſecond* chauffer pan; a few ſpoonfuls of water are added, and the whole kept for ſome time as hot as boiling water, and carefully ſtirred all the while. From thence it is lifted into the hair bags of the laſt preſs, ſubjected to the preſs; and a quantity of oil, of the loweſt quality, is obtained, ſufficient for giving a ſatisfactory profit to the miller. The cake is now perfectly dry, and hard, like a piece of board, and is ſold to the farmers. Nay, there are ſmall mills in Holland, which have no other employment than extracting the oil from the cakes which they purchaſe from the French and Brabanters; a clear indication of the ſuperiority of the Dutch practice.

The nicety with which that induſtrious people conduct all their buſineſs is remarkable in this manufacture.

In their oil ciſtern, the parenchymous part, which unavoidably gets through, in ſome degree, in every operation, gradually ſubſides, and the liquor, in any diviſion of the ciſtern, comes to conſiſt of ſtrata of different degrees of purity. The pumps which lift it out of each diviſion are in pairs; one takes it up from the very bottom, and the other only from half depth. The laſt only is barrelled up for the market, and the other goes into a deep and narrow ciſtern, where the dreg again ſubſides, and more pure oil of that quality is obtained. By ſuch careful and judicious practices, the Dutch not only ſupply themſelves with this important article, but annually ſend conſiderable quantities into the very provinces of France and Flanders where they bought the ſeed from which it was extracted. When we reflect on the high price of labour in Holland, on the want of timber for machinery, on the expenſe of building in that country, and on the enormous expenſe of wind mill machinery, both in the firſt erection and the ſubſequent wear and tear, it muſt be evident, that oil mills erected in this country on water falls, and after the Dutch manner, cannot fail of being a great national advantage. The chatellanic or ſeigneurie of Lille alone makes annually between 30,000 and 40,000 barrels, each containing about 26 gallons.

What is here delivered is only a ſketch. Every perſon acquainted with machinery will underſtand the general movements and operations. But the intelligent mechanic well knows, that operations of this kind have many minute circumſtances which cannot be deſcribed, and which, nevertheleſs, may have a great influence on the whole. The rakes in the bruiſing-mill have an office to perform which reſembles that of the hand, directed by a careful eye and unceaſing attention. Words cannot communicate a clear notion of this; and a mill, conſtructed from the beſt drawings, by the moſt ſkilful workman, may gather the ſeed ſo ill, that the half of it ſhall not be bruiſed after many rounds of the machinery. This produces a ſcanty return of the fineſt oil; and the mill gets a bad character. The proprietor loſes his money, is diſcouraged, and gives up the work.—There is no ſecurity but by procuring a Dutch millwright, and giving him a liberal compenſation. Such unhoped-for taſks have been performed of late years by machinery; and mechanical knowledge and *invention* is now ſo generally diffuſed, that it is highly probable that we ſhould ſoon excel our teachers in this branch. But this very diffuſion of knowledge, by encouraging ſpeculation among the artiſts, makes it a ſtill greater riſk to erect a Dutch oil-mill without having a Dutchman, acquainted with its moſt improved preſent form, to conduct the work. We do our duty in giving this counſel.

OISTINS *Bay*, is near the ſouthern extremity of the iſland of Barbadoes, in the Weſt-Indies. It is formed to the S. E. by Kendal's Point. The bay is well defended by forts. The town of Oiſtins ſtands on this bay.—*Morſe.*

OKU JESSO. See SEGALIEN in this *Suppl.*

OLD CAPE FRANCOIS forms the N. point of Ecoſſoiſe or Coſbeck Bay, on the N. E. part of the iſland of St Domingo. All the French ſhips coming from Europe or the Windward iſlands, and bound to the north or weſt part of St Domingo Iſland, are obliged to come in ſight of the Cape Samana, (near 27 leagues ſouth-eaſt by eaſt of this cape) or at leaſt of Old Cape Francois, on account of the dangers of ſhoals to the eaſt. It is about 5 leagues eaſt of Cape de la Roche. N. lat. 19 40 30, W. long. from Paris 72 22.—*Morſe.*

OLD FORT *Bay* is ſituated at the ſouth end of the iſland of St Lucia, in the Weſt-Indies, having St Mary's Iſland and Bay to the eaſt.—*ib.*

OLD FORT *Iſlands*, in Eſquimaux Bay, on the coaſt of Labrador, in N. America. N. lat. 51 24, W. long. 57 48.—*ib.*

OLD *Harbour*, on the ſouth coaſt of the iſland of Jamaica in the Weſt-Indies, is to the weſtward of Port Royal. There are a number of ſhoals and iſlands in the entrance to it. Under ſome of them there is ſafe riding, in from 6 to 8 fathoms.—*ib.*

OLD MAN's *Creek*, in New Jerſey, empties into Delaware river, about 4 miles below Penn's Neck, and ſeparates the counties of Salem and Glouceſter.—*ib.*

OLD MEN's *Port* lies northward of Lima river in Peru, 8 or 9 miles N. of Cadavayllo river.—*ib.*

OLD ROAD, a town and harbour in the iſland of Antigua in the Weſt-Indies.—*ib.*

OLD ROAD *Bay*, on the S. W. coaſt of the iſland of St Chriſtopher's in the Weſt-Indies, between Church Gut W. and Bloody Point E. There is from 5 to 15 fathoms near the ſhore, and the leaſt towards the fort.—*ib.*

OLD ROAD *Town*, on this bay, lies between East and Black rivers, and is a port of entry.—*ib.*

OLD TOWN, in the State of New York, is situated on Staten Island, 3 miles S. W. of Newtown, and 12 south-westerly of New York city.—*ib.*

OLD TOWN, a small post town of Maryland, situated in Alleghany county, in lat. 39 30, on the N. bank of Patowmac river, and W. side of Saw Mill Run; 14 miles S. E. of Cumberland, 142 W. by N. of Baltimore, and 213 from Philadelphia.—*ib.*

OLD TOWN, in N. Carolina, near Brunswick.—*ib.*

OLD TOWN, a small town of Georgia, lying on the Ogeechee river, 85 miles N. W. by W. of Savannah.—*ib.*

OLEOUT, a small creek which empties into the east branch of Susquehannah, 5 miles N. E. of the mouth of Unadilla river.—*ib.*

OLINDA, the chief town of the captainship of Pernambuco, in Brazil, S. America. It is sometimes called *Pernambuco*, and has a good harbour situated north of Cape St Augustine, and south of Paraibo. It was taken by the Dutch in 1630, but was retaken by the Portuguese. S. lat. 8 13, W. long. 35 5.—*ib.*

OLLEROS, *Point*, on the coast of Peru, is 6 leagues S. E. of Quemada Morro, or Headland, and as far N. N. W. of Porto Cavallo. It is little frequented on account of want of trade, although it is a good harbour in case of squalls from the mountains, or of strong currents setting down from the sea.—*ib.*

OMAGUAS, a tribe of Indians inhabiting the banks of the river Amazon, and converted to Christianity in the year 1686, by father Fritz, a Spanish missionary. They flat the hind and fore part of the heads of their children, which gives them a monstrous appearance. They make a jest of other nations, calling them calabash heads.—*ib.*

OMARA, a river on the coast of Brazil, whose mouth is in lat. 5 0 S. and long. 36 0 W.—*ib.*

OMASUOS, a jurisdiction in the diocese of La Paz, in Peru, It begins almost at the gates of the city of La Paz, and extends 20 leagues, being bounded on the west by the famous lake of Titi Caca. The air of this jurisdiction is somewhat cold, so that it produces little grain; but has numerous flocks of cattle fed in its pastures; there is besides, a very advantageous trade carried on in another jurisdiction by the Indians living on the borders of the lake, who are remarkably industrious in improving that advantage.—*ib.*

OMEE, a corrupt name for *The Miami of the Lake*. The Miami towns on its banks are called the Omee towns, or Au Mi, by the French Americans, as a contraction of Au Miami.—*ib.*

OMEE-TOWN, one of the Miami towns, situated on a pleasant point formed by the junction of the rivers Miami and St Joseph. This town stood on the E. bank of the latter, opposite the mouth of St Mary's river, and was destroyed in Gen. Harmar's expedition, in 1790.—*ib.*

OMOAH, a small fortified town in the Spanish Main, at the bottom of the bay of Honduras, on the S. side, and is within a gulf to the eastward of Dolce Gulf, into which the river of its name comes in from the southward. It has a good harbour, which is open to the N. W. in which ships of any burden may ride in perfect safety. The British admiral, Parker, in conjunction with the people of Honduras, reduced the strong fort, which is situated on the E. side of the river, in 1779. The spoil was immense, being valued at 3 millions of dollars. The Spaniards in vain offered 300,000 dollars as a ransom for 250 quintals of quicksilver; a commodity indispensably necessary in working their gold and silver mines.—*ib.*

OMPHALOPTER, or OMPHALOPTIC, in optics, a glass that is convex on both sides, popularly called a *convex lens*.

OMPOMPANOOSUCK, a short, rapid river of Vermont, which empties into the Connecticut at Norwich, opposite to Dartmouth College. Its course is S. E. its breadth not more than 40 or 50 yards.—*ib.*

ONATIAYO, or *Oneatoyo*, an island in the S. Pacific Ocean. S. lat. 9 58, W. long. 138 51.—*ib.*

ONEEHOW, one of the Sandwich Islands, in the N. Pacific Ocean, called also *Neeheeheow*, about 5 or 6 leagues to the westward of Atooi. There is anchorage all along the coast of the island. It produces plenty of yams, and a sweet root called tee. N. lat. 21 50, W. long. 160 15.—*ib.*

ONEIDA, one of the Six Nations of Indians, containing 628 souls, who inhabit the country S. of Oneida Lake, called the Oneida Reservation. Their principal village, Kahnonwolohale, is about 20 miles S. W. of Whitestown. These Indians, for a number of years past, have been under the pastoral care of the Reverend Mr Kirkland, who with the Reverend Mr Sarjeant, have been chiefly supported in their mission, by the society established in Scotland for promoting Christian knowledge. This nation receive an annuity from the State of New York of 3552 dollars, for lands purchased of them in 1795, and an annuity of about 628 dollars from the United States. These annuities, (which operate as a discouragement to industry) together with the corn, beans and potatoes raised by the squaws, and the fish and game, caught by the men, afford them a barely tolerable subsistence. They are a proud nation, and affect to despise their neighbours, the Stockbridge and Brotherton Indians, for their attention to agriculture; but they already begin to feel their dependence on them, and are under a necessity of purchasing provisions of them. The nation is divided into three tribes, or clans, by the names of the *Wolf*, the *Bear*, and the *Turtle*. They have their name from their Pagan Deity, which some few of the nation still worship, and which is nothing more than a misshapen, rude, cylindrical *stone*, of about 120 pounds weight, in their language called *Oneida*, which signifies the *Upright Stone*. Formerly this stone was placed in the crotch of a tree, and then the nation supposed themselves invincible. These Indians are all of mixed blood; there has not been a *pure* Oneida for several years past.—*ib.*

ONEIDA *Lake* is about 20 miles W. of Old Fort Stanwix, now called Rome, State of New York, and is between 20 and 30 miles long, and narrow. It is connected with Lake Ontario on the W. by Oswego river, and with Fort Stanwix by Wood Creek.—*ib.*

ONEMACK *Point* is the south-west point of the continent of N. America, on the N. W. coast, and the south limit of Bristol Bay. It is 82 leagues S. S. W. of Cape Newenham, or the north point of that extensive bay; and in lat. 54 30 north, and long. 163 30 west.—*ib.*

O NIMAMOU, a harbour on the S. E. coast of Ulietea,

Ulietea, one of the Society Islands, in the S. Pacific Ocean. It is north-east of Ohetuna Harbour, on the same coast.—*ib.*

ONION, *Cape*, on the south-west side of Newfoundland Island, is about four leagues west of Quirpon Island, or the northern point of that extensive island.—*ib.*

ONION *River*, in the State of Vermont, formerly called *French River*, and by the Indians *Winooski*, rises in Cabot, about 14 miles to the west of Connecticut river, and is navigable for small vessels 5 miles from its mouth, in Lake Champlain, between the towns of Burlington and Colchester; and for boats between its several falls. It is one of the finest streams in Vermont, and runs through a most fertile country, the produce of which for several miles on each side of the river, is brought down to the lake at Burlington. It is from 20 to 30 rods wide, 40 miles from its mouth, and its descent in that distance is 172 feet, which is about 4 feet to the mile. Between Burlington and Colchester this river has worn through a solid rock of lime-stone, which in some time of remote antiquity must have formed at this place a prodigious cataract. The chasm is between 70 and 80 feet in depth at low water, and in one place 70 feet from rock to rock, where a wooden bridge is thrown across. At Bolton there is a chasm of the same kind, but somewhat wider, and the rock is at least 130 feet in height. From one side several rocks have fallen across the river, in such a manner as to form a natural bridge at low water, but in a situation to be an object of curiosity only. It was along this river that the Indians formerly travelled from Canada, when they made their attacks on the frontier settlements on Connecticut river.—*ib.*

ONONDAGO *Castle*, on the Onondago Reservation Lands in the State of New York, is 25 miles south-west of Oneida Castle.—*ib.*

ONONDAGO, or *Salt Lake*, in the State of New York, is about 5 miles long and a mile broad, and sends its waters to Seneca river. The waters of the Salt springs here are capable of producing immense quantities of salt. One person near the lake boiled down at the rate of 50 bushels a week, in the year 1792, which he sold for five shillings a bushel; but any quantity may be made, and at a less price. These springs are in the State reservation, and are a great benefit to the country, every part of which is so united by lakes and rivers as to render the supply of this bulky and necessary article very easy.—*ib.*

ONONDAGO, a river of New York, which rises in the Oneida Lake, and runs westwardly into Lake Ontario at Oswego. It is boatable from its mouth to the head of the lake, 74 miles, except a fall which occasions a portage of 20 yards, thence batteaux go up Wood-Creek almost to Fort Stanwix, 40 miles, whence there is a portage of a mile to Mohawk river. Toward the head of this river, salmon are caught in great numbers.—*ib.*

ONONDAGO, a county of New York State, consisting of military lands divided into 11 townships, viz. Homer, Pompey, Manlius, Lysander, Marcellus, Ulysses, Milton, Scipio, Aurelius, Ovid, and Romulus. The county is bounded westerly by Ontario county, and northerly by Lake Ontario, the Onondago river, and Oneida Lake. The county courts are held in the village of Aurora, in the township of Scipio. This county is admirably situated for inland navigation, being intersected by the two navigable rivers Seneca and Oswego, having besides 5 lakes and a number of creeks. There were 1323 of the inhabitants qualified to be electors in 1796, as appears by the State census.—*ib.*

ONONDAGO, formerly the chief town of the Six Nations, situated in a very pleasant and fruitful country, and consisted of five small towns or villages, about 30 miles S. W. of Whitestown.—*ib.*

ONONDAGOES, a tribe of Indians who live near Onondago Lake. About 20 years since they could furnish 260 warriors. In 1779 a regiment of men was sent from Albany, by Gen. J. Clinton, who surprized the town of this tribe, took 33 prisoners, killed 12 or 14, and returned without the loss of a man. A part of the Indians were then ravaging the American frontiers. This nation, which now consists of 450 souls, receives annually from the state of New York, 2,000 dollars; and from the United States about 450 dollars.—*ib.*

ONISCUS (See *Encycl.*). Two new species of this genus of insects were discovered by *La Martiniere*, the naturalist who accompanied Perouse on his last voyage of discovery. For the information of such of our readers as are entomologists, we shall give the author's description of these species. Of the first, which he says only *nearly* answers to the *generic* character of oniscus, E (fig. 1.) is a view of the upper part of its body, and at F of the lower. Its body is crustaceous, and of an opaque white, with two round rust-coloured spots on the anterior part of its corslet; two others, much larger, in the form of a crescent, are on the *elytræ*; its shield is also of the same colour. The under part of the thorax is furnished with four pair of legs: the first and third of which are terminated with sharp claws; the second, from its form, serves it to swim with; the fourth is very small, consisting of two membranaceous threads. Some scales, also membranaceous and very channelled, may also perform the office of legs: of these the two lower are the largest. Its belly is filled with vermicular intestines of the size of a hair; its mouth is placed between the first and second pair of legs, and is of the form of a small trunk placed between two lips, joined only at the upper extremity. Plate XXXII.

Fig. 2. represents an insect of the genus *oniscus Linn.* Its body is nearly of the form, consistence, and colour, of the *oniscus asellus*, except that it is not divided by segments as this last is. It has a double tail, three times as long as the body; from the insertion of which, at the hinder part of the body, spring two legs, used chiefly by the animal in swimming upon its back. The insect, viewed on the lower part H, presents six pair of legs; the two first of which terminate in very sharp and thick points; it makes use of the third to swim with, and to balance its body, together with that pair which is inserted at the base of the tail; the fourth pair, and the largest of all, is armed with two very sharp points, which the animal forces into the body of any fish on which it seizes; the two last pair are nothing more than very finely divided membranes. Between the two first is situated a trunk, smooth, and about half a line long; at the base of the third pair are two points, of a horney consistence, very hard, and firmly fixed. The two horns also below the large pair of legs are, in like manner, very firmly united to its body.

Martiniere imagines it to be by means of these darts that it pierces the body of the fish on which it is found, and that then, changing its situation, it finds means to introduce its trunk into the holes thus formed. When put into a glass it sinks to the bottom, and rises again to the surface with the greatest ease, advancing with the edge of its body, and describing curves. Its two long tails are very easily pulled off, without the animal appearing to suffer any pain.

ONSLOW, a maritime county of Wilmington district, N. Carolina, W. of Cape Lookout. It contains 5,387 inhabitants, including 1748 slaves. Chief town, Swansborough.—*Morse.*

Onslow, a township of Nova Scotia, Halifax county, at the head of the Basin of Minas, 35 miles N. E. of Windsor, and 46 N. by W. of Halifax. It was settled by emigrants from New England.—*ib.*

ONTARIO, one of that grand chain of lakes which divide the United States from Upper Canada. It is situated between lat. 43 15 and 44 N. and long. 76 30 and 80 W. Its form is nearly elliptical; its greatest length is from S. W. to N. E. and its circumference about 600 miles. The division line between the State of New York and Canada, on the N. passes through this lake, and leaves within the United States 2,390,000 acres of the water of Lake Ontario, according to the calculation of Mr Hutchins. It abounds with fish of an excellent flavour, among which are the Oswego bass, weighing 3 or 4 lbs. Its banks in many places are steep, and the southern shore is covered principally with beech trees, and the lands appear good. It communicates with Lake Erie by the river Niagara. It receives the waters of Geneffee river from the S. and of Onondago, at Fort Oswego, from the S. E. by which it communicates through Oneida Lake, and Wood Creek, with the Mohawk river. On the N. E. this lake discharges itself into the river Cataraqui, (which at Montreal takes the name of St Lawrence) into the Atlantic Ocean. It is asserted that these lakes fill once in 7 years; but the fact is doubted. The islands are all at the eastern end, the chief of which are Wolf, Amherst, Gage, and Howe Islands.—*ib.*

Ontario, a large, fertile county of New York, comprehending the Geneffee country, and bounded N. by the lake of its name. It is well watered by Genneffee river, its tributaries, and a number of small lakes. Here are 8 townships, viz. Geneffee, Erwine, Jerusalem, Williamsburg, Toulon, Seneca, Bloomfield, and Canadaqua, or Kanandaigua, which last is the chief town, situated at the N. W. corner of Canandarqua Lake, 15 miles W. of Geneva, and 30 N. E. of Williamsburg. This county was taken from Montgomery in 1789, and in 1790, contained 1,075 inhabitants, including 11 slaves. Such has been the emigration to this county, that there were, in 1796, 1258 of the inhabitants who were qualified to be electors.—*ib.*

ONZAN, a cape or point on the north coast of Brazil, opposite to cape St Lawrence, forming together the points of Laguariba river; the latter cape being on the west side of the river. The river is 10 leagues S. E. by E. of Bohia Baxa.—*ib.*

OONALASHKA, one of the islands of the northern Archipelago, on the N. W. coast of America, the natives of which have the appearance of being a very peaceable people, being much polished by the Russians, who also keep them in subjection. There is a channel between this and the land to the north, about a mile broad, in which are soundings from 40 to 27 fathoms. N. lat. 53 55, W. long. 166 31.—*ib.*

OPAQUE, not translucent, nor transparent, or not admitting a free passage to the rays of light.

OPARO or Oparro, the name given by Captain Vancouver to a small island which he discovered in latitude 27° 36′ south, and in longitude 215° 49′ east from Greenwich. It was estimated at about 6½ miles in length, and no other land was in sight. Its principal character is a cluster of high craggy mountains, forming, in several places, most romantic pinnacles, with perpendicular cliffs nearly from their summits to the sea: the vacancies between the mountains would more properly be termed chasms than valleys. The tops of six of the highest hills bore the appearance of fortified places, resembling redoubts; having a fort of blockhouse, in the shape of an English glass-house, in the centre of each, with rows of palisadoes a considerable way down the sides of the hills, nearly at equal distances. These overhanging, seemed intended for advanced works, and apparently capable of defending the citadel by a few against a numerous host of assailants. On all of them people were noticed as if on duty, constantly moving about. What we considered (says the author) as block-houses, from their great similiarity in appearance to that sort of building, were sufficiently large to lodge a considerable number of persons, and were the only habitations we saw. Yet, from the number of canoes that in so short a time assembled round the English ship, it is natural to conclude, that the inhabitants are very frequently afloat; and to infer, that the shores, and not those fortified hills which appeared to be in the centre of the island, would be preferred for their general residence.

Whether the fortified places here described were intended for defences of the islanders against each other, or against attacks from some more powerful neighbours, could only be conjectured; but the latter idea seems the most probable. From the language of the people, and their resemblance to the Friendly islanders, Captain Vancouver considers them all as having sprung from the same original stock. The people of Oparo, however, are distinguished by two circumstances, certainly in their favour. Not one of them was tattowed; and though they appeared not to have ever seen a European before, they all seemed perfectly well acquainted with the uses to which they could apply iron, and preferred articles of it to looking-glasses, beads, and other trinkets, with which savages are usually delighted. Though there appeared to be anchoring ground near the north west end of the island, circumstances rendered it inconvenient for Captain Vancouver to land on it; so that we are yet in a great measure strangers to the dispositions of the people, though they appeared to be hospitable.

OPECKON *Creek*, in Virginia, a south-west water of Potowmac river.—*Morse.*

OPEN Flank, in fortification, is that part of the flank which is covered by the orillon or shoulder.

OPENING *of the Trenches*, is the first breaking of ground by the besiegers, in order to carry on their approaches towards a place.

OPERA Glass, is a diagonal perspective, of which the following concise and perspicuous description is taken

Ophrys. ken from Dr Hutton's Mathematical Dictionary.—ABCD (Plate XLI.) represents a tube about four inches long; in each side of which there is a hole EF and GH, exactly against the middle of a plane mirror IK, which reflects the rays falling upon it to the convex glass LM; through which they are refracted to the concave eye-glass NO, whence they emerge parallel to the eye at the hole *r s*, in the end of the tube. Let P *a* Q be an object to be viewed, from which proceed the rays P *c*, *a b*, and Q *d*: these rays, being reflected by the plane mirror IK, will shew the object in the direction *c p*, *ba*, *d q*, in the image *p q*, equal to the object PQ, and as far behind the mirror as the object is before it: the mirror being placed so as to make an angle of 45 degrees with the sides of the tube. And as, in viewing near objects, it is not necessary to magnify them, the focal distances of both the glasses may be nearly equal; or, if that of LM be three inches, and that of NO one inch, the distance between them will be but two inches, and the object will be magnified three times, being sufficient for the purposes to which this glass is applied.

When the object is very near, as XY, it is viewed through a hole *x y*, at the other end of the tube AB, without an eye glass; the upper part of the mirror being polished for that purpose as well as the under. The tube unscrews near the object-glass L M, for taking out and cleansing the glasses and mirror. The position of the object will be erect through the concave eye-glass.

The peculiar artifice of this glass is to view a person at a small distance, so that no one shall know who is observed; for the instrument points to a different object from that which is viewed; and as there is a hole on each side, it is impossible to know on which hand the object is situated which you are viewing. It is chiefly used in play-houses; and hence its name: but we have seen it most indecently employed by those who should have set a better example, even in a cathedral church!

OPHRYS (See *Encycl.*) A new species of this plant has been lately described in the *Annual Hampshire Repository*, by a Fellow of the Linnean Society, in the following words:

"*Stem*—about 12 inches high, erect, stipulate, geniculate, pubescent at the upper genicles. *Spike*—strictly spiral, flowers spirally ascending, about 24, brightly white. Upper petal ovato-acuminate, pubescent, lightly ciliate, straight. Two middle *petals* oblong-recurved. Two lower *petals* oblong-acuminate, lightly ciliate only on the lower side near the base, projecting like elephant's tusks. *Nectary*, broad, recurved, ragged, bicipitate. *Leaves floral*—carinate acuminate, ciliate reaching and pointing to the middle of the flowers. *Leaves radical*—five or six, about six inches long, narrow, attenuate both ways, acuminate, the lower more hastate. *Leaves cauline*—lanceolate, alternate.

"Observation.—This plant has much the habit, as well as autumnal florescence, of Oriental spirals, and is so perfectly spiral also, that the specific name of the other should be altered, as being no longer exclusively spiral; at the same time that a specific name should be given to this: neither of which (says the author) I shall presume to do, but shall suggest it to the Linnean Society, of which I have the honour to be a Fellow."—This ophrys flowered, for the first time, it is believed, in England, in Hampshire, October 1796.

Ophiucus, ‖ Optic.

OPHIUCUS, a constellation of the northern hemisphere; called also *Serpentarius*.

OPIUM (See *Encycl.*), is a medicine of such intrinsic value, and of so high a price, that every method which promises to increase the quantity in the market must be of importance. It was therefore, with much propriety, that *the Society for the Encouragement of Arts, &c.* some time ago, voted 50 guineas to Mr John Ball of Williton, Somersetshire, for the discovery of his method of preparing opium from poppies of the growth of England. The poppies, which he recommends as the most productive, are the *double* or *semi-double*, of a dark colour; the seeds of which he advises to be sown the latter end of February, and again about the second week in March, in beds three feet and a half wide (well prepared with good rotten dung, and often turned or ploughed, in order to mix it well, and have it finely), either in small drills, three in each bed, in the manner sallads are sown, and when about two inches high, to thin them one foot apart; or otherwise, to sow them in beds, in the broad-cast way, and thin them to the same distance. If they be kept free from weeds, they will grow well, and will produce from four to ten heads, shewing large and different coloured flowers; and when their leaves die away, and drop off, the pods then being in a green state, is the proper time for extracting the opium, by making such longitudinal incisions as are, for this purpose, made in the east (See OPIUM and PAPAVER, *Encycl.*) Immediately on the incision being made, a milky fluid will issue out; which is the opium, and which, being of a glutinous nature, will adhere to the bottom of the incision; but some poppies are so productive, that it will drop from the pod on the leaves underneath. The next day, if the weather should be fine, and a good deal of sunshine, the opium will be found a greyish substance, and some almost turning black: it is then to be scraped from the pods, and (if any there) from the leaves, with the edge of a knife, or other instrument for that purpose, into pans or pots; and in a day or two, it will be of a proper consistence to make into a mass, and to be potted.

According to Mr Ball, fields cannot be sown with any thing more lucrative to the farmer than poppies, especially if those fields have a south exposure. "By a calculation (says he) which I have made, supposing one poppy to grow in one square foot of earth, and to produce only one grain of opium, more than £50 will be collected from one statute acre of land; but if we consider, that one poppy produces from three or four to ten heads, that in each head from six to ten incisions may be made, and that from many of them, (I mean from one incision) I have taken away two or three grains of opium—What must then be the produce?"

Mr Ball produced to the Society letters from Dr Latham of Bedford-row, Dr Pearson of Leicester-square, and Mr Wilson of Bedford-street, declaring, that, in their opinion, his English opium is equal in effect, and superior in purity, to the best foreign opium.

OPPS, a village in Northampton county, Pennsylvania, 6 miles south-east of Bethlehem, and about 7 north by east of Quaker's Town.—*Morse.*

OPTIC INEQUALITY, in astronomy, is an apparent irregularity in the motions of far distant bodies; so called, because it is not really in the moving bodies, but arising from the situation of the observer's eye. For if the

the eye were in the centre, it would always see the motions as they really are.

Optic *Pyramid*, in perspective, is a pyramid formed by the visible object which is the *base*, and the rays drawn from the perimeter of that object, which meet at the eye in a point, which is the *apex* of the pyramid. Hence, also, we may know what is meant by an *optic triangle*.

Optic *Rays*, particularly means those by which an optic pyramid, or optic triangle, is terminated.

OPTICS. Under this head in the Encyclopædia n° 259 to 264 have been described various kinds of microscopes, which see. The Rev. Dr John Prince of Salem, Massachusetts, has politely favoured the editor with the following description of the Lucernal Microscope, the improvements of which are his invention. This account was published by Mr Hill from Dr Prince's letter in the Gentleman's Magazine for Nov. 1796, and afterwards in Mr Jones's new edition of Adams's Microscopical Essays.

The Lucernal being generally allowed to be the most perfect microscope, and of the most extensive use of any yet made, and a very material improvement in the construction of that described in the Microscopical Essays of that indefatigable artist and worthy man the late Mr George Adams, having been suggested to him by the Rev. Dr Prince of Salem, Massachusetts, at a time when I had given orders for one, I was the first person for whom he made one on the new principle.

"In the former construction there was no contrivance for bringing the object into the field of view; so that, upon the least variation in situation or size, you were obliged to find out the place for the object by moving it backwards and forwards. This is now remedied by mounting the microscope on a firm double joint like a telescope (as at B). The adjusting apparatus is fixed at the broad end. The joint is nearly in the centre of gravity, so that a very small motion will bring any object, less than an inch in diameter, into the field of view. This motion is effected by two screws at right angles to each other; one screw raising or covering the body; the other moving it sideways: the screw at the same time forming a double joint to accommodate the parts to the movement (as at C). The handle of the rackwork is shewn at D.

Plate I. fig. 7. Appendix.

"To screen the image from the light (which will be often found to be advantageous), there is a pyramidical box, of such a size as to pack, when not used, in the body of the microscope. When in use, the broad end of the screen-box is to be slided into the groove from which the external cover at the end has been taken. This method is peculiarly useful in the daytime; as, by screening the large lenses from the light, it may even then be used with satisfaction."

A A shew the body of the microscope.

"The large lens may occasionally be placed on the outer-edge of the screen-box (the other lens being taken out). The view on the grey glass is by this means magnified, and appears to greater advantage. But, besides the grey glass used in the former construction, there is a second in this, placed farther within the body (about where the dotted line is in the sketch); and, when the large lens is in the screen box, I think objects appear better in this than the former way. It has a still greater effect upon those who are unacquainted with the nature of lenses, as it makes them judge the distance and magnitude much greater than they really are, and is, therefore, more pleasing than the grey glass in front."

E shews the bottom board, of mahogany.

"It is scarcely necessary to observe, that only one grey glass can be used at a time, and that both are to be taken out when opake objects are viewed.

"The stage (F) is considerably different from that figured in my essays. It is much more convenient and commodious than the other, and answers with very little trouble, and scarcely any alteration for both transparent and opake objects. A truncated cone can also be here applied for cutting off superfluous rays of light occasionally.

"The method of illuminating the objects is also different. The mode now adopted answers better for opake and transparent objects, throws a stronger light, and is more convenient in application. It consists of two lenses (1 and 2). The larger one is to be placed at the end of the bar next the lamp. The smaller one to be adjusted so as to give a strong light. A third is also added, to be used occasionally with opake objects. It is to be applied close to the large lens. Experience will shew when it is to be used, and when laid aside.

"By moving the bar G (on which these lenses are placed) round about, you bring it so much fronting the stage as effectually to enlighten opake objects (by means of the lamp. The light thus afforded is received directly, and none is lost by reflection.

"As some objects (such as sections of wood) are seen to advantage both as transparent and opake, a frame, containing a plain and a concave mirror, is added to this instrument, serving two purposes: by bringing the bar to the front of the stage, removing the large lens, and putting the miror in its place, the object may be viewed either way, without moving from the seat, by turning the instrument a little round. This experience will discover.

"The light of the sun may be thrown by the plain mirror on the condensing lens so as to produce a strong full field of light on the grey glass. This has a grand effect when the large lens is at the end of the screen-box, and could not at all be applied in this manner in former constructions. It become also an opake solar microscope by turning the bar round to enlighten opake objects.

"By bringing the concave mirror to a focus that will burn objects, a set of very curious and entertaining experiments may be made and exhibited on the grey glass. The object for combustion should be put in the nippers, and a piece of slate tied as a ground on the stage. The ebullition of a piece of alum viewed in this manner is very beautiful; the bubbles, as they rise and pass off rapidly, appear tinged with all the colours of the rainbow.

"There are large-sized magnifiers for the purpose of throwing transparent objects on a screen, in imitation of the solar microscope. By removing the large lenses in front, and the grey glass, and placing the black tin cylinder (represented in the drawing by dotted marks) over the lamp, they may be shewn in that manner to several persons. Thus this instrument supersedes the use of a lantern. The image may be contracted occasionally by one of the large lenses."

With

'With respect to my own improvement, it is certainly trifling in comparison with the former; yet, as it unites those parts of the instrument that were heretofore separate, and thereby not only makes the whole more compact, but keeps the lamp always in the position required, notwithstanding any motion of the machinery for adjusting the focal distance of the different magnifiers, I have found it extremely convenient, and have no doubt of its being thought so by others who may please to adopt it. It is very simple, as the following descriptive reference to the plate will evince.

H, the brass supporter to the arm G, to enable it to sustain the weight of the lamp. This turns round with the bar on the stage pillar at M.

I, a brass cap (soldered to the supporter), and which slips over the slider that carries the lens 2.

K, a strong joint fastened to the said cap, which gives the lamp an horizontal movement when an oblique light is required. At the end of this, the lamp is fixed in such manner as easily to slide in a perpendicular direction to regulate the height of the light.

L, a square piece of brass, to be occasionally screwed into the reservoir of the lamp, to carry the tin cylinder when it is wished to throw transparent objects on a screen.

The fixing of Mr Hill's lamp to it is a convenience in using the instrument; but not essential, and it confines the lamp to this use only, whereas on a stand by itself it may answer as well for family use as for the microscope.

OR, *Cape d'*, in Nova Scotia, is situated on the north side of the Basin of Minas. Some small pieces of copper have been found here.—*Morse*.

ORA *Cabeca Bay*, on the north side of the island of Jamaica, in the West-Indies, has a strong fort on the east side, and Salt Gut westerly; at both these places is good anchorage for large vessels.—*ib*.

ORANAI, or *Ranai*, one of the Sandwich Islands in the N. Pacific Ocean, 9 miles from Mowee and Morotoi. The south point is in lat. 20 46 north, and long. 156 52 west.—*ib*.

ORAN, a considerable city, occupied by the Spaniards, in the province of *Mascara*, in the country of Algiers. It has strong and regular fortifications, and can easily be supplied from Spain with provisions and warlike stores. It lies in 35′ of longitude west from Greenwich, and in 35° 55′ north latitude. Since the year 1732, the Spaniards have held uninterrupted possession of Oran. It has a parish-church, three monasteries, an hospital: and the number of the inhabitants, according to the account given of it by the Spaniards, amount to 12,000. Towards the sea, the city rises in the form of an amphitheatre, and is surrounded with forts and batteries. Close to the city lies a strong castle, *Alcazava* in which the Spanish governor resides. On the highest hill stands Fort St Croix, whose guns command the city and the adjacent country. From this fort they make signals of the approach of ships, and carefully watch the motions of the Moors, who often attempt predatory incursions into the neighbouring districts. A considerable number of Mahomedans take refuge in Oran; they dwell in a distinct part of the city, receive pay from the court of Spain, and render signal services against the Moors. The greatest part of the inhabitants of Oran consists of such as have been banished from Spain; and the same may, in a great measure, be said of the soldiers who compose the garrison. Five regiments are commonly stationed here; but, owing to continual desertion, their strength scarcely equals that of four complete regiments. One of them wholly consists of malefactors, who have been condemned to remain here for life; the rest are such as have been transported for one or more years. There is here likewise a military school. Around the city are pleasant gardens; but it is very dangerous to cultivate them, on account of the Moors and Arabs who frequently lie in ambush among them. The same reason prevents the cultivation of the fields in the vicinity; and the garrison and inhabitants must be supplied with provisions immediately from Spain.

ORANG's *Key*, one of the Bahama islands, in the West-Indies. N. lat. 24 28, west long. 79 37.—*Morse*.

ORANGE, a bay on the north-east coast of the island of Jamaica, E. N. E. of the high mountain, a little within land, under which is Crawford's-Town. Also a bay at the north-west end of the same island, between Green-Island N. and North Negril harbour S. or S. W. —*ib*.

ORANGE, a cape, the east point of Oyapok river, south-east of Cayenne Island. N. lat. 4 20, west long. 50 50.—*ib*.

ORANGE *Key*, or *Cay*, a small island in Orange bay, at the north-west end of the island of Jamaica.—*ib*.

ORANGE, a county of Vermont, which in 1790, contained 10,529 inhabitants. Since that time several other counties have been erected out of it. It is bounded west by part of Addison and Chittenden counties, and east by Connecticut river. It now contains 20 townships. The county-town, Newbury, and the townships south of it, viz. Bradford, Fairlee and Thetford front Connecticut river. It is high land, and sends numerous streams in opposite directions, both to Connecticut river and to Lake Champlain.—*ib*.

ORANGE, a township on the north line of the above county, in the north-east corner of which is Knox's Mountain.—*ib*.

ORANGE, formerly *Cardigan*, a township in Grafton county, New Hampshire, which gives rise to an east branch of Mascomy river. It was incorporated in 1769; contains 131 inhabitants; and is 20 miles east of Dartmouth college.—*ib*.

ORANGE, a township of Massachusetts, situated on the east line of Hampshire county, on Miller's river, 94 miles N. W. by W. of Boston. It was incorporated in 1783, and contains 784 inhabitants.—*ib*.

ORANGE, a mountainous and hilly county of New-York, which contains all that part of the State bounded southerly by the State of New Jersey, westerly by the State of Pennsylvania, easterly by the middle of Hudson's river, and northerly by an east and west line from the middle of Murderer's Creek. It is divided into 8 townships, of which Goshen is the chief, and contains 18,492 inhabitants, of whom 2,098 are electors, and 966 slaves. In this county are raised large quantities of excellent butter, which is collected at Newburgh and New Windsor, and thence transported to New York. On the N. side of the mountains in this county, is a very valuable tract called the *Drowned Lands*, containing about 40 or 50,000 acres. The waters which descend from the surrounding hills, being but slowly discharged

by

by the river issuing from it, cover these vast meadows every winter, and render them extremely fertile; but they expose the inhabitants of the vicinity to intermittents. Wallkill river, which passes through this tract and empties into Hudson's river, is, in the spring, stored with very large eels in great plenty. The bottom of this river is a broken rock; and it is supposed that for £2,000 the channel might be deepened so as to drain off the waters, and thereby redeem from the floods a large tract of rich land, for grass, hemp and Indian corn.—*ib.*

ORANGE, called also *Orangedale*, a town in Essex county, New Jersey, containing about 80 houses, a Presbyterian church, and a flourishing academy, and lies north-west of Newark, adjoining.—*ib.*

ORANGE, a county of Hillsborough district, North Carolina; bounded north by Caswell county, and south by Chatham. The rivers Haw and Enoe in this county have rich lands on their borders. It contains 12,216 inhabitants, of whom 2,060 are slaves. Chief town Hillsborough.—*ib.*

ORANGE, a county of S. Carolina, in Orangeburg district.—*ib.*

ORANGE, a county of Virginia, bounded north by Culpepper, and south by Albemarle. It contains 9,921 inhabitants, including 4,421 slaves. The court-house is situated 20 miles from Culpepper court-house, 30 from Charlotteville, and 273 from Philadelphia.—*ib.*

ORANGEBURG, a district of S. Carolina, bounded south-west by Savannah river; east by the river Santee; and north-east by the Congaree, which divide it from Camden district; south by Beaufort, and south-east by Charleston district. It contains 18,513 inhabitants, of whom 5,931 are slaves. Sends to the state legislature 10 representatives and 3 senators; and, with the district of Beaufort, one member to congress. It is divided into 4 counties, viz. Lewisburg, Orange, Lexington and Winton.—*ib.*

ORANGEBURG, a post town of S. Carolina, and capital of the above district, is on the E. side of the north branch of Edisto river. It has a court house, jail, and about 50 houses; distant 77 miles N. N. W. of Charleston, 36 southerly of Columbia, and 721 from Philadelphia.—*ib.*

ORANGE-MEN, an appellation assumed by certain societies in Ireland, of which the first was formed in the county of Armagh, on the 21st of November 1795, others in some towns of Ulster and Leinster in the year 1797, another in the city of Dublin 1798; and since that period, these societies have spread over the whole of that kingdom. The object of these associations is exhibited in the following authentic *Declaration of the Principles of Orange-men*, published 1799.

"From the various attempts that have been made to poison the public mind, and slander those who have had the spirit to adhere to their king and constitution, and to maintain the laws:—

"We, the Protestants of Dublin, assuming the name of Orange-men, feel ourselves called upon, not to vindicate our principles, for we know that our honour and loyalty bid defiance to the shafts of malevolence and disaffection, but openly to avow those principles, and declare to the world the objects of our institution.

"We have long observed, with indignation, the efforts that have been made to foment rebellion in this kingdom, by the seditious, who have formed themselves into societies, under the specious name of *United Irishmen*.

"We have seen with pain the lower orders of our fellow-subjects, forced or seduced from their allegiance, by the threats or machinations of *traitors*.

"And we have viewed with horror the successful exertions of *miscreants*, to encourage a foreign enemy to invade this happy land, in hopes of rising into consequence on the downfal of their country,

"We therefore thought it high time to rally round the constitution, and there pledge ourselves to each other, to maintain the laws, and support our good king against all his enemies, whether *rebels* to their God or to their country; and by so doing, shew to the world that there is a body of men in this island, who are ready, in the hour of danger, to stand forward in defence of that grand palladium of our liberties, the constitution of Great Britain and Ireland, obtained and established by the courage and loyalty of our ancestors under the Great King William.

"Fellow-subjects, we are accused with being an *institution*, founded on principles too shocking to repeat, and bound together by oaths, at which human nature may shudder: but we caution you not to be led away by such malevolent falsehoods; for we solemnly assure you, in the presence of the Almighty God, that the idea of injuring any one, on account of his religious opinion, never entered into our *hearts:* we regard every loyal subject as our friend, be his religion what it may; we have no enmity but to the enemies of our country.

"We farther declare, that we are ready, at all times, to submit ourselves to the orders of those in authority under his majesty, and that we will cheerfully undertake any duty which they shall think proper to point out for us, in case either a foreign enemy shall dare to invade our coasts, or that a domestic foe shall presume to raise the standard of rebellion in the land. To these principles we are pledged—and in support of them we are ready to spend the last drop of our blood.—(Signed) Thomas Verner, *Grand Master;* John Clau. Beresford, *Grand Secretary;* William James, J. De Joncourt, Edward Ball."

ORANGETOWN, or *Greenland*, a plantation in Cumberland county, Maine, N. W. of Waterford. One branch of Songo river rises in the northern part of this plantation, within about 3 miles of Amariscoggin river, where there is a pond, 2 miles long, called Songo Pond, from thence the stream runs southward. It is very difficult to effect roads through this mountainous country; some of the mountains affording precipices 200 feet perpendicular. The sides of the mountains and vallies are fertile, produce good crops, and in some instances afford wild onions, which resemble those that are cultivated. Winter rye, which is the chief produce, has amounted to 20 bushels an acre. The country in the neighbourhood formerly abounded with variety of game, viz. moose, deer, bears, beaver, racoon, sable, &c. but since it has been inhabited, game has become scarce; deer are extirpated from the vicinity; some moose remain among the mountains, and a few beaver, that are too sagacious to be taken by the most

most crafty hunter. Since the deer have been destroyed, the wolves have wholly left this part of the country. —*Morse.*

Orangetown, in Orange county, New York, is situated on the west side of the Tappan Sea, opposite Philipsburgh, and about 27 miles north of New York city. The township is bounded easterly by Hudson's river, and southerly by the state of New Jersey. It contains 1175 inhabitants, of whom 162 are electors, and 203 slaves.—*ib.*

Orangetown, in Washington county, Maine, is 19 miles distant from Machias.—*ib.*

ORCHARD. As an appendix to this article in the *Encycl.* some of our readers will be pleased with the following means, employed by the Rev. Mr *Germershausen*, for promoting the growth of young trees, and increasing the size and flavour of the fruit in orchards.

Having planted several young plum-trees in an orchard, he covered the ground, for some years, around the trunks, as far as the roots extended, with flax-shows (A); by which means those trees, though in a grass-field, increased in a wonderful manner, and far excelled others planted in cultivated ground. As far as the shows reached, the grass and weeds were choaked; and the soil under them was so tender and soft, that no better mould could have been wished for by a florist.

When he observed this, he covered the ground with the same substance, as far as the roots extended, around an old plum-tree, which appeared to be in a languishing state, and which stood in a grass field. The consequences were, that it acquired a strong new bark; produced larger and better-tasted fruit; and that those young shoots, which before grew up around the stem, and which it was every year necessary to destroy, were prevented from sprouting forth, as the covering of flax-shows impeded the free access of air at the bottom of the trunk.

In the year 1793, he transplanted, from seed-beds, into the nursery, several fruit-trees; the ground around some of which he covered, as above, with flax-shows. Notwithstanding the great heat of the summer, none of those trees where the earth was covered with shows died or decayed; because the shows prevented the earth under them from being dried by the sun. Of those trees around which the ground was not covered as before mentioned, the fourth part miscarried; and those that continued alive were far weaker than the former.

The leaves which fall from trees in autumn may also be employed for covering the ground in like manner; but stones, or logs of wood, must be laid on them, to prevent their being dispersed by the wind. In grass-land, a small trench may be made around the roots of the tree, when planted, in order to receive the leaves. If flax-shows are used, this is not necessary; they lie on the surface of the ground so fast as to resist the force of the most violent storm. The leaves which our author found most effectual in promoting the growth and fertility of fruit trees, are those of the walnut-tree. Whether it is, that, on account of their containing a greater abundance of saline particles, they communicate manure to the ground, which thereby becomes tender under them; or that they attract nitrous particles from the atmosphere; or that, by both these means, they tend to nourish the tree both above and below.

Those who are desirous of raising tender exotic trees from the seed, in order to accustom them to our climate, may, when they transplant them, employ flax-shows with great advantage. This covering will prevent the frost from making its way to the roots; and rats and mice, on account of the sharp prickly points of the flax-shows, will not be able to shelter themselves under them.

ORCHILLA, a weed used in dyeing, which grows in the Canary Islands, and is monopolized by the government. "It is a minute vegetable (says Sir George Staunton), of the lichen kind, growing chiefly upon rocks of a loose texture, and produces a beautiful violet blue colour."

Orchilla, one of the Leeward islands in the West-Indies, situated near the coast of Terra Firma, S. America; between the islands of Tortuga and Reca, 15 or 16 leagues north-west of the former, and 6 or 7 E. and E. by N. of the latter. It is about 8 leagues long. On the S. and S. W. side, the strand is steep and bold, so that a ship may lay her broadside close to the shore; but the north side is foul and rocky. Here is no good water, nor indeed any thing else but shelter from northerly winds, and goat's flesh. It is divided into several small islands, separated from each other by shallow canals. N. lat. 11 52, W. long. 65 15.—*Morse.*

ORDADO *Rock*, near the coast of Peru, is 4 miles south by east of Port Callao. Near it are some smaller ones, and round them from 9 to 16 fathoms water.—*ib.*

ORDEAL. See this article in the *Encyclopædia*, at the end of which we have given, from Dr Henry's History of England, some strong reasons for suspecting that the ordeal, by fire at least, was a gross imposition on the credulity of an ignorant and superstitious age. This suspicion of imposture is raised to certainty by Professor Beckmann, who, in his History of Inventions, gives us the whole process by which the clergy conducted the trial, and brought proofs of innocence or of guilt at their pleasure. The person accused was put entirely under their management for three days before the trial, and for as many after it. They covered his hands (when he was to lift red-hot iron) both before and after the proof; sealed and unsealed the covering. The former was done, as they pretended, to prevent the hands from being prepared any how by art; the latter, that it might be accurately known whether or not they were burnt.

Some artificial preparation was therefore known, else no precautions would have been necessary. It is highly probable, that during the three first days the preventative was applied to those persons whom they wished to appear innocent; and that the three days after the trial were requisite to let the hands resume their natural state. The sacred sealing secured them from the examination of presumptuous unbelievers; for to determine whether the hands were burnt, the three last days were certainly not wanted. When the ordeal was abolished, and this

(A) Shows are the refuse of flax when it is scutched or heckled.

this art rendered useless, the clergy no longer kept it a secret. In the 13th century, an account of it was published by Albertus Magnus, a Dominican monk (A). If his receipt be genuine, it seems to have consisted rather in covering the hands with a kind of paste than in hardening them. The sap of the *althæa* (marshmallow), the slimy seeds of the flea-bane, which is still used for stiffening by the hat-makers and silk-weavers, together with the white of an egg, were employed to make the paste adhere. And by these means the hands were as safe as if they had been secured by gloves.

OREAHOU, or *Oreehou*, a small elevated island, close to the north side of Oneeheow, one of the Sandwich Islands, with which it is connected by a reef of coral rocks. It contains about 4,000 inhabitants. N. lat. 22 2, W. long. 160 8.—*Morse.*

ORFFYREUS's Wheel, in mechanics, is a machine so called from its inventor, which he asserted to be a perpetual motion. This machine, according to the account given of it by Gravesande, in his *Oeuvres Philosophiques*, published by Allemand, Amst. 1774, consisted externally of a large circular wheel, or rather drum 12 feet in diameter, and 14 inches deep; being very light, as it was formed of an assemblage of deals, having the intervals between them covered with waxed cloth, to conceal the interior parts of it. The two extremities of an iron axis, on which it turned, rested on two supports. On giving a slight impulse to the wheel, in either direction, its motion was gradually accelerated; so that, after two or three revolutions, it acquired so great a velocity as to make 25 or 26 turns in a minute. This rapid motion it actually preserved during the space of two months, in a chamber of the landgrave of Hesse, the door of which was kept locked, and sealed with the landgrave's own seal. At the end of that time it was stopped, to prevent the wear of the materials. The professor, who had been an eye witness to these circumstances, examined all the external parts of it, and was convinced that there could not be any communication between it and any neighbouring room. Orffyreus, however, was so incensed, or pretended to be so, that he broke the machine in pieces; and wrote on the wall, that it was the impertinent curiosity of Professor Gravesande which made him take this step. The prince of Hesse, who had seen the interior parts of this wheel, but sworn to secrecy, being asked by Gravesande, whether, after it had been in motion for some time, there was any change observable in it, and whether it contained any pieces that indicated fraud or deception? answered both questions in the negative, and declared, that the machine was of a very simple construction.

Hutton's Dictionary.

ORFORD, a township in Grafton county, New Hampshire, situated on the east bank of Connecticut river, about 11 miles north of Hanover, and opposite to Fairlee in Vermont, 395 miles N. N. E. of Philadelphia. It was incorporated in 1761, and contains 540 inhabitants. The soap-rock, which has the property of fuller's earth in cleansing cloth, is found here; also alum ore, free-stone fit for building, and a grey stone, in great demand for mill-stones, reckoned equal in quality to the imported burr-stones.—*Morse.*

Orford, *Cape*, the north-westernmost point of the large island to the westward of Falkland's Sound in the Falkland's Islands, in the S. Atlantic Ocean, and south-east of Cape Percival.—*ib.*

ORICOU, a new species of the vulture, discovered by Vaillant at Orange river, in South Africa. As he thinks it unquestionably the most beautiful of its genus, and tells, as usual with him, a wonderful story about it, we have given a figure of this vulture in Plate XLI. Our traveller says, that it is more than three feet high, and eight or nine in breadth of wing. Its feathers, the general hue of which is a light brown, are of a particular kind on the breast, belly, and sides, where they are of unequal lengths, pointed, curved like the blade of a sabre, and bristle up distinct from each other. The feathers being thus separated, would disclose to view the skin on the breast, if it were not completely covered with a very thick and beautiful white down, which is easily seen between the ruffled plumage.

A celebrated naturalist has said, that "no bird has eye lashes or eye-brows, or, at least, hair round the eyes like that in quadrupeds." This assertion, advanced as a general law of Nature, is a mistake. Not only the oricou has this peculiarity, but we know of many other species in which it exists; such as, in general, all the calaos, the secretary, and several other birds of prey. Beside these eye-lashes, the vulture in question has stiff black hairs on its throat. All the head and part of the neck are bare of feathers; and the naked skin, which is of a reddish colour, is dashed in certain places with blue, violet, and white. The ear, in its external circumference, is bounded by a prominent skin, which forms a sort of rounded conch, that must necessarily heighten the faculty of hearing in this species. This kind of conch is prolonged for some inches, and descends down the neck; which induced our author to give it the name of *oricou*.

Its strength, he says, must be very considerable, if we may judge from its muscles and sinews; and he is persuaded that there is not a stronger among the whole order of carnivorous birds, not excepting the famous condor, which so many travellers have seen, but of which their descriptions are so different as to render its existence extremely doubtful. But there was no occasion for this reasoning, and those inferences, if what he relates as facts deserve any credit. The oricou which he describes, he first perceived perched on the carcase of a hippopotamos, eagerly devouring its flesh. He shot at it, and wounded it slightly; upon which, "though it had already gorged itself with a considerable quantity of flesh (for upon opening it, he found in its stomach no less a quantity than *six pounds and a half)*, yet its hunger

(A) In his work *De Mirabilibus Mundi*, at the end of his book *De Secretis Mulierum*, Amstelod. 1702, 12mo, p. 100. Experimentum mirabile quod facit hominem ire in ignem sine læsione, vel portare ignem vel ferrum ignitum sine læsione in manu. Recipe succum bismalvæ, et albumen ovi, et semen psylli et calcem, et pulveriza, et confice cum illo albumine ovi succum raphani; commisce; ex hac confectione illineas corpus tuum vel manum, et dimitte siccari, et postea iterum illineas, et post hoc poteris audacter sustinere ignem sine nocumento.

ger and voracity were such, that it struck its beak into the carcase when attempting to take wing, as if desirous of carrying the whole of it away.

"On the other hand, the weight of the flesh it had devoured rendering it the more heavy, it could not easily rise; so that we had time (says he) to reach it before it was on the wing, and we endeavoured to knock it on the head with the but-ends of our muskets. It defended itself a long time with great intrepidity. It bit or struck at our weapons with its beak, and its strength was still so great, that every stroke made a mark on the *barrel of the piece*."

ORIENT, the east, or the eastern point of the horizon.

Orient *Equinoctial*, is used for that point of the horizon where the sun rises, when he is in the equinoctial, or when he enters the signs Aries and Libra.

Orient *Aestival*, is the point where the sun rises in the middle of summer, when the days are longest.

Orient *Hybernal*, is the point where the sun rises in the middle of winter, when the days are shortest.

ORLEANS, the middle of the three northern counties of Vermont. A part of Lake Memphremagog projects into the northern part of it from Canada. It contains 23 townships. It is very high land, and sends its waters in almost every direction of the compass. Clyde, Barton and Black rivers empty into Lake Memphremagog; the waters of many branches of Missiscoui, La Moelle, and Onion rivers, rising here, fall into Lake Champlain; those of Mulhegan and Pasumpsick empty into Connecticut river.—*Morse.*

Orleans, a township in the county of Barnstable, Massachusetts, taken from the southerly part of Eastham, and incorporated 1797.—*ib.*

Orleans, *Isle of*, is situated in the river St Lawrence, a small distance below Quebec, and is remarkable for the richness of its soil. It lies in the middle of the river, the channel is upon the S. side of the island, the N. side not having depth of water at full tide, even for shallops. The S. W. end of the island is called Point Orleans. The coast is rocky for a mile and a half within the S. channel, where there is a careening place for merchant ships. Round Point Levi, and along the S. E. side of the river, the shore is rocky, but the middle of the bason is entirely free.—*ib.*

Orleans, *Old Fort*, is situated on the W. bank of a bend of Missouri river, in Louisiana, a considerable distance from its mouth.—*ib.*

ORODADA PENA, on the coast of Peru, is two leagues due north of Lobos de Payta, and 2 south by west of Payta.—*ib.*

OROMCOTO, a river of New Brunswick, which empties into St John's river. By this passage the Indians have a communication with Passamaquoddy Bay.—*ib.*

ORONDOCKS, an Indian tribe who live near Trois Rivieres, and could furnish 100 warriors about 20 years ago.—*ib.*

ORONOKO, or *Oronoque*, one of the largest rivers of S. America, and is remarkable for its rising and falling once a year only; for it gradually rises during the space of 5 months, and then remains one month stationary, after which it falls for 5 months, and in that state continues for one month also. These alternate changes are regular, and even invariable. Perhaps the rising of the waters of the river may depend on the rains which constantly fall in the mountains of the Andes, (where the river has its source) every year about the month of April; and though the height of the flood depends much upon the breadth or extent of the bed of the river, yet in one part where it is narrowest, it rises to the astonishing height of 120 feet. The mouth of the river is S. by E. of the Gulf of Paria, in lat. 8 30 N. and long. 59 50 W. and opposite to the Island of Trinidad. It is large and navigable, and has many good towns on its banks, that are chiefly inhabited by the Spanish, and is joined also on the E. side by the Lake Casipa. There are two other islands at its mouth, the entrance to which is also somewhat dangerous, as there is frequently a dreadful conflict between the tide of the ocean and the current of the river, that must, for the reasons assigned, sometimes run very rapidly. It is said the river, including its windings, takes a course of 1380 miles, and preserves the freshness of its waters *twelve leagues* from the mouth of that vast and deep channel, within which it was confined. It may be considered, however, as having many mouths, which are formed by the islands that lie before its opening towards the ocean; yet there are only two that are considered as of any use for the purposes of navigation. These are the channels of Sabarima and Corobana, otherwise called Caribbiana. The latter lies in a S. by W. direction, and is also divided into two distinct channels, that afterwards meet again at the island of Trinidad in the mouth of the Grand river. But pilots pretend to say, that the mouth of this great river begins from the river Amugora, reaching from thence to the river Sabarima, and from thence about to the river Caribbiana; and some accounts state its mouths to be 40 in number, as if it were a collection of many rivers, all uniting at the mouth of the great river, and assisting to convey the main stream of that river into the ocean. The west passage or channel of the river Oronoko, called by the Spaniards the Gulf of Paria, lies between Cape Salinas on the main, and the north-west point of the island of Trinidad. It contains several islands, which divide the stream of the river into several branches, particularly the Great Boco, or mouth, which is the easternmost, being about gun-shot wide, but having no soundings, with 300 fathoms, and the Little Boco, or Mouth, which is the westernmost, being almost as wide as the other, and having ground at from 50 to 60 fathoms. At New Cape Araya, on the northward side of the mouth of this river, are salt pits, which yield the finest salt in the world. In some maps, the head-waters are called Inirchia.—*ib.*

OROPESA, a town in the jurisdiction of La Plata, S. America; situated 60 miles N. W. of that city, in the valley of Cochabamba, on a small rivulet which empties into the river Guapay. It has a considerable trade in corn and fruits.—*ib.*

Oropesa, a town of S. America, in Peru, seated at the foot of the mountains, 750 miles from Lima, and 150 N. E. of Potosi. S. lat. 18, W. long. 63 30.—*ib.*

OROTAVA, a town in the Island of Teneriffe, at the bottom of those mountains out of which the Peek rises, neatly built of stone, on an irregular surface. The most remarkable object near it is a dragon's blood tree, of which the trunk measures, at the height of ten feet from the ground, 36 feet in girth. Concerning this

Orotchys. tree there is a tradition current in the island, that it existed, of no inconsiderable dimensions, when the Spaniards made the conquest of Teneriffe, about three centuries ago; and that it was then, what it still is, a land mark, to distinguish the boundaries of landed possessions near it.

Distant about three miles on the sea-coast is the puerto, or sea-port, of Orotava, where is carried on a considerable degree of commerce, principally for the exportation of wine. It is chiefly, as at Madeira, in the hands of a few British commercial houses, which import, in return, the manufactures of Great Britain. Within a mile is a collection of living plants from Mexico, and other parts of the Spanish dominions in America. From hence they are to be transplanted into Spain. It is an establishment of some expence; and, whatever may be its success, it shows a laudable attention, on the part of that government, to the promotion of natural knowledge.

OROTCHYS and BITCHYS, two tribes of Tartars, who were visited by La Perouse in 1787, and of whose manners he gives such an account as renders it difficult to say whether they have the best claim to be called a savage or a civilized people. He fell in with a small village of them on the east coast of Tartary, in a bay to which he gave the name of *Baie de Castrie*, in lat. 51° 29′ north, and long. 139° 39′ east from Paris.

Their village, their employment, their dress, and their apparent ignorance of all religion, bespoke them savages. Their village was composed of four cabins, built in a solid manner, of the trunks of fir-trees, and covered with bark. A wooden bench compassed the apartment round about; and the hearth was placed in the middle, under an opening large enough to give vent to the smoke.

This village was built upon a tongue of low marshy land, which appeared to be uninhabitable during the winter; but on the opposite side of the gulf, on a more elevated situation, and exposed to the south, there was, at the entrance of a wood, another village, consisting of eight cabins, much larger and better built than the first. Above this, and at a very small distance, were three yourts, or subterraneous houses, perfectly similar to those of the Kamtschadales, described in the third volume of Captain Cook's last voyage; they were extensive enough to contain the inhabitants of the eight cabins during the rigour of the cold season; besides, on some of the skirts of this village were seen several tombs, which were larger and better built than the houses; each of them enclosed three, four, or five biers, of a neat workmanship, ornamented with Chinese stuffs, some pieces of which were brocade. Bows, arrows, lines, and, in general, the most valuable articles of these people, were suspended in the interior of these monuments, the wooden door of which was closed by a bar, supported at its extremities by two props.

Their sole employment seemed to be the killing and curing of salmon, of which they eat raw, the snout, the gills, the small bones, and sometimes the entire skin, which they strip off with infinite dexterity. When the stript salmon were carried to the huts, the women, in the most disgusting manner, devoured the mucilaginous part of them, and seemed to think it the most exquisite food. Every cabin was surrounded with a drying place for salmon, which remain upon poles, exposed to the heat of the sun, after having been during three or four days smoked round the fire, which is in the middle of their cabin; the women, who are charged with this operation, take care, as soon as the smoke has penetrated them, to carry them into the open air, where they acquire the hardness of wood.

The bones of the salmon so cured were scattered, and the blood spread round the hearth; greedy dogs, though gentle and familiar enough, licked and devoured the remainder. The nastiness and stench of this people are disgusting. There is not perhaps anywhere a race of people more feebly constituted, or whose features are more different from those forms to which we attach the idea of beauty; their middle stature is below four feet ten inches, their bodies are lank, their voices thin and feeble, like that of children; they have high cheek bones, small blear eyes, placed diagonally; a large mouth, flat nose, short chin, almost beardless, and an olive-coloured skin, varnished with oil and smoke. They suffer their hair to grow, and tie it up nearly the same as we do; that of the women falls loose about their shoulders, and the portrait which has just been drawn agrees equally well with their countenances as those of the men, from whom it would be difficult to distinguish them, were it not for a slight difference in the dress, and a bare neck; they are not, however, subjected to any labour, which might, like the American Indians, change the elegance of their features, if nature had furnished them with this advantage. Their whole cares are limited to the cutting and sewing their clothes, disposing of their fish to be dried, and taking care of their children, to whom they give the breast till they are three or four years of age.

With respect to dress, the men and little boys are clothed with a waistcoat of nankeen, or the skin of a dog or a fish, cut in the shape of a waggoner's frock. If it reach below the knee, they wear no drawers; if it do not, they wear some in the Chinese style, which fall as low as the calf of the leg. All of them have boots of seal's skin, but they keep them for the winter; and they at all times, and of every age, even at the breast, wear a leather girdle, to which are attached a knife in a sheath, a steel to strike a light with, a pipe, and a small bag to contain tobacco. The dress of the women is somewhat different; they are wrapped up in a large nankeen robe, or salmon's skin, which they have the art of perfectly tanning, and rendering extremely supple. This dress reaches as low as the ankle-bone, and is sometimes bordered with a fringe of small copper ornaments, which make a noise similar to that of small bells. Those salmon, the skins of which serve for clothing, are never caught in summer, and weigh thirty or forty pounds.

Though they had neither priests nor temples, they seemed to be believers in sorcery, and took the motion of the Frenchmen's hands, when writing, for signs of magic. Thus far they appeared savages.

Their sacred regard of property, their attention to their women, and the delicacy of their politeness to strangers, would, on the other hand, do honour to the most civilized nation. While Perouse and his people were in the bay, one of the families took its departure on a voyage of some length, and did not return during their stay. When he went away, the master of the family put some planks before the door of his house, to

prevent

prevent the dogs from entering it, and in this ſtate left it full of their effects. "We were ſoon (ſays our author) ſo perfectly convinced of the inviolable fidelity of theſe people, and their almoſt religious reſpect for property, that we left our ſacks full of ſtuffs, beads, iron tools, and, in general, every thing we uſed as articles of barter, in the middle of their cabins, and under no other ſeal of ſecurity than their own probity, without a ſingle inſtance of their abuſing our extreme confidence; and on our departure from this bay, we firmly entertained the opinion, that they did not even ſuſpect the exiſtence of ſuch a crime as theft."

Their attention to their women, ſo uncommon among ſavages was diſplayed in their exempting them from hard labour; in their never concluding a bargain with the Frenchmen without previouſly conſulting their wives; and in their reſerving the pendent ſilver ear-rings and copper trinkets, which they purchaſed, for their wives and daughters. Of the delicacy of their manners to ſtrangers, we ſhall give the following intereſting inſtance in the words of Perouſe's tranſlator:

Obſerving with what repugnance they received preſents, and how often they refuſed them with obſtinacy, "I imagined (ſays Perouſe) I could perceive, that they were perhaps deſirous of more delicacy in the manner of offering them; and to try if this ſuſpicion were well founded, I ſat down in one of their houſes, and after having drawn towards me two little children, of three or four years old, and made them ſome trifling careſſes, I gave them a piece of roſe-coloured nankeen, which I had brought in my pocket. The moſt lively ſatiſfaction was viſibly teſtified in the countenances of the whole family, and I am certain they would have refuſed this preſent, had it been directly offered to themſelves. The huſband went out of his cabin, and ſoon afterwards returning with his moſt beautiful dog, he entreated me to accept of it. I refuſed it, at the ſame time endeavouring to make him underſtand, that it was more uſeful to him than to me: but he inſiſted; and perceiving that it was without ſucceſs, he cauſed the two children, who had received the nankeen, to approach, and placing their little hands on the back of the dog, he gave me to underſtand, that I ought not to refuſe his children.

"The delicacy of ſuch manners cannot exiſt but among a very poliſhed people. It ſeems to me, that the civilization of a nation, which has neither flocks nor huſbandry, cannot go beyond it. It is neceſſary to obſerve, that dogs are their moſt valuable property; they yoke them to ſmall and very light ſledges, extremely well made, and exactly ſimilar to thoſe of the Kamtſchadales. Thoſe dogs, of the ſpecies of wolf dogs, and very ſtrong, though of a middle ſize, are extremely docile, and very gentle, and ſeem to have imbibed the character of their maſters."

ORPHAN's *Bank*, a fiſhing bank of the S. E. point of Chaleur's Bay, on the N. E. coaſt of New Brunſwick, in N. America. On it is from 75 to 30 fathoms water.—*Morse*

ORPHAN's *Iſland*, a ſettlement belonging to Hancock county, Diſtrict of Maine, having 124 inhabitants. —*ib.*

ORRINGTON, a plantation in Hancock county, Diſtrict of Maine, having 477 inhabitants. It lies on the eaſt ſide of Penobſcot river, 16 miles above Buckſtown, and 256 N. N. E. of Boſton.—*ib.*

ORTHODROMICS, in navigation, is great-circle ſailing, or the art of ſailing in the arch of a great circle, which is the ſhorteſt courſe: For the arch of a great circle is *orthodromia*, or the ſhorteſt diſtance between two points or places.

ORUA, *Orubo*, or *Aruba*, the moſt weſterly of the Caribbee Iſlands in the Weſt Indies, called by the Spaniards Las Iſlas de Sottovento. It is on the coaſt of the Spaniſh Main. N. lat. 12 3, W. long. 69 3.—*Morse.*

ORURO, a juriſdiction in the archbiſhopric of La Plata. Its capital is San Phelipe de Aſturia de Oruro, 30 leagues from the city of La Plata.—*ib.*

ORWEL, a townſhip of Vermont, the north-weſternmoſt in Rutland county, and ſituated on the eaſt ſide of Lake Champlain. It contains 778 inhabitants. Mount Independence ſtands in this townſhip oppoſite Ticonderoga, in the ſtate of New York. Near Mount Independence is a chalybeate ſpring.—*ib.*

ORYCTEROPUS, the name given by M. Geoffroy, profeſſor of zoology in the French muſeum of natural hiſtory, to the animal called by other zoologiſts *Myrmecophaga Capenſis*. (See MYRMECOPHAGA, *Encycl.*) He conſiders it as a diſtinct genus, and ſeems indeed to have proved, by a compariſon of the organs of the orycteropus with thoſe of the *tatous daſipus* of Linnæus, and of the *myrmecophagi*, that this genus is intermediate, by its forms and habits, between thoſe two families. It approaches to the *tatous* in its organs of maſtication, and the form of the toes and nails, and in having a ſhort and ſingle cæcum, whilſt that of the myrmecophagi is double, as in birds, by the reuniting of the bones of the os pubis, which are not articulated together in the myrmecophagi. The orycteropus, however, bears a relation to the laſt, ſince it has, like them, a very ſmall mouth, whence its tongue, covered with hair, may be protruded to a conſiderable length. Finally, the habits of the orycteropus reſemble thoſe of the animals to which it approaches the moſt; it does not climb trees, but lives under the earth like the tatous; it feeds like them on roots, but alſo it hunts after anthills, like the myrmecophagi. Its ſnout terminates in a blunt callus; a character which is peculiar to it. It may be diſtinguiſhed in the works of naturaliſts by the following deſcription:

Orycteropus. Molar teeth (ſix) with flat vertices; the body covered with hair.

The orycteropus, as appears from the preceding, connects the tatous with the myrmecophagi and with the *pangolin manis* of Linnæus. The large foſſile ſpecies found in Paraguay, for which Citizen Cuvier has eſtabliſhed a new genus, under the name of *megaterium*, is intermediate between the ſloth and the myrmecophagus; and, laſtly, the aſtoniſhing animal of New Holland, covered with briſtles like the porcupine, ſupported by very ſhort legs, and of very ſingular conformation, and with a head round at the occiput, terminating in a ſnout, without teeth, very ſlender, long, and cylindrical, and deſcribed by Mr George Shaw under the name of myrmecophaga aculeata, appears to have very ſtriking relations to the pangolin and the orycteropus: from hence it follows, that in conſequence

 of

of these important acquisitions, we ought for the future to count, in the number of our natural orders, that of the *edentated*, or *edented*, consisting of the following genera: *Dasipus*, *orycteropus myrmecophaga*, and *aculeata*, *manis*, *myrmecophaga*, *megaterium* et *bradypus*.

OSAGES, an Indian nation who inhabit south of the Missouri, and can furnish 400 warriors.—*Morse*.

OSAGES, a river of Louisiana, which runs eastward to the Missouri.—*ib*.

OSCILLATION, in mechanics, vibration, or the reciprocal ascent and descent of a pendulum.

Axis of OSCILLATION, is a line parallel to the horizon, supposed to pass through the centre or fixed point about which the pendulum oscillates, and perpendicular to the plane in which the oscillation is made.

Centre of OSCILLATION, in a suspended body, is a certain point in it, such that the oscillations of the body will be made in the same time as if that point alone were suspended at that distance from the point of suspension. Or it is the point into which, if the whole weight of the body be collected, the several oscillations will be performed in the same time as before: the oscillations being made only by the force of gravity of the oscillating body.

OSCULATION, in geometry, denotes the contact between any curve and its osculatory circle; that is, the circle of the same curvature with the given curve, at the point of contact or of osculation. See INVOLUTION in this *Suppl*.

OSCULATION also means the point of concourse of two branches of a curve which touch each other. For example, if the equation of a curve be $y = \sqrt{x} + \sqrt[4]{x^3}$, it is easy to see that the curve has two branches touching one another at the point where $x = 0$, because the roots have each the signs $+$ and $-$.

OSNABURG, a small island in the S. Pacific Ocean, having the appearance of the roof of a house. It is about 4 leagues in circuit; is high land; full of cocoa-trees; has no anchoring place, and scarcely affords landing for a boat. It was discovered by Capt. Wallis, and is called *Maitea* by the natives. S. lat. 17 52, W. long. 148 6.—*Morse*.

OSNABURG, another island in the same sea, discovered by Capt. Carteret. S. lat. 22, W. long. 141 34.—*ib*.

OSNABURG *House*, a settlement of the Hudson's Bay Company, in N. America; situated at the N. E. corner of Lake St Joseph, 120 miles W. by S. of Gloucester House. N. lat. 51, W. long 90 15.—*ib*.

OSORNO, an inland town of the kingdom of Chili, situated on the N. bank of the river Buena; 42 miles E. of the sea coast, and 45 S. E. of Baldivia. The adjacent country is far from being fruitful, but very rich in gold mines, which renders the place very populous. S. lat. 40 30, W. long. 71 50 —*ib*.

OSSABAW *Sound* and *Island*, on the coast of the State of Georgia. The sound opens between Wassaw Island on the N. and Ossabaw Island on the S. and leads into the river Ogeechee.—*ib*.

OSSIPEE, or *Osapy*, a township, mountain, and pond, in New Hampshire, in Strafford county, near the E. line of the State. The town was incorporated in 1785, and has 339 inhabitants. The lake lies N. E. of Winnipiseogee Lake, between which and Ossipee Lake is *Ossipee Mountain*, described in the account of New Hampshire. Its waters run E. and, joined by South river, form *Great Ossipee River*, which empties into Saco river, near the division line between York and Cumberland counties, in Maine, between Limerick and Gorham.—*ib*.

OSSNOBIAN, or *Asseneboyne Indians*, a tribe found about the source of Ossnobian or Asseneboyne river, far W. of Lake Superior. They are said by the Moravian missionaries to live wholly on animal food, or at least to confine themselves to the spontaneous productions of nature; giving those who dig the ground, the appellation of *slaves*. Bread is unknown to them. A traveller, who lived some months in their country, offered to some a few remnants of bread, which they chewed and spit out again, calling it rotten wood. These Indians, as well as those numerous nations who inhabit the country from Lake Superior, towards the Shining Mountains, are great admirers of the best hunting-horses, in which the country abounds. The horses prepared by them for hunters, have large holes cut above their natural nostrils, which they say makes them longer winded than others not thus prepared. The Ossnobians have no permanent place of abode, but live wholly in tents, made of buffaloe and other hides, with which they travel from one place to another, like the Arabs; and as soon as the food for their horses is expended, they remove, and pitch their tents in another fertile spot; and so on continually, scarcely ever returning to the same spots again.—*ib*.

OSTICO, a small lake in Onondago county, New York, partly in the S. E. corner of Marcellus, and N. W. corner of the township of Tully. It sends its waters from the N. end, which is eight miles S. westerly of Onondago Castle, by a stream 16 miles long, to Salt Lake.—*ib*.

OSTINES, or *Charlestown*, a considerable town in the island of Barbadoes.—*ib*.

OSWEGATCHIE *River* and *Lake*, in Herkemer county, New York. The river empties into the river St Lawrence, or Cataraqui. *Oswegatchie Lake* is about 19 miles long, from S. W. to N. E. and 7 broad, and sends its waters north-eastward into the river of its name. It is about 10 miles S. E. of The Thousand Lakes, near the entrance into Lake Ontario. There is a fort of the same name, situated on the Cataraqui river, 58 miles N. E. of Kingston, on Lake Ontario.—*ib*.

OSWEGATCHIES, an Indian tribe residing at Swagatchey, on the river St Lawrence, in Canada. They could furnish about 100 warriors, 20 years since.—*ib*.

OSWEGO, a navigable river of New York, which conveys the waters of Oneida, and a number of small lakes, into Lake Ontario. It is more commonly called *Onondago*.—*ib*.

OSWEGO, a fortress situated on the E. side of the mouth of the above river, and south-eastern side of Lake Ontario, in lat. 43 18 N. and long. 76 30 W. It was taken by the British from the French in 1756, and confirmed to them by the peace of 1763. It was delivered up to the United States July 14, 1796. It is about 150 or 160 miles E. by N. of Niagara.—*ib*.

OTABALO, a jurisdiction in the province of Quito, joined on the south to that of San Miguel de Ibarra. The lands are laid out in plantations, and produce great quantities of sugar. The Indians in the villages, as alſo thoſe who are independent, manufacture great variety of cottons, viz. carpets, pavilions for beds, quilts in damaſk work, wholly of cotton, either white, blue, or variegated with different colours; all which are highly valued, both in the province of Quito and Peru, where they are diſpoſed of to great advantage. The wheat and barley here, is ſowed like Indian corn, in little holes, a foot diſtant from each other, putting 5 or 6 corns into each; and they generally reap above an hundred fold. The country is remarkably fertile, and large quantities of cheeſe are made.—*ib.*

OTABALO, the principal village of the above juriſdiction, is large and populous, and ſaid to contain 18,000 or 20,000 ſouls. Among them is a conſiderable number of Spaniards.—*ib.*

OTAHA, one of the Society Iſlands in the S. Pacific Ocean, whoſe north end is in lat. 16 33 ſouth, and long. 151 20 weſt. It has 2 good harbours.—*ib.*

OTAKOOTAI, a ſmall iſland in the S. Pacific Ocean, 4 leagues from Wateeoo, and about 3 miles in circuit. S. lat. 19 15, W. long. 158 23.—*ib.*

OTCHIER, a bay on the north coaſt of S. America, to the weſtward of the river or creek called Urano, and eaſt of Cape Caldero.—*ib.*

OTEAVANOOA, a large and ſpacious harbour and bay on the ſouth-weſt coaſt of the iſland of Bolabola, one of the Society Iſlands. S. lat. 16 30, W. long. 151 43.—*ib.*

OTISFIELD, a plantation in Cumberland county, Diſtrict of Maine, eaſt of Bridgetown in York county, and 152 miles N. N. E. of Boſton. A ſtream from Songo Pond paſſes through the weſterly part of this town, on its way to Sebago. It is very free of ragged hills and mountains. The greateſt part of it affords a growth of beech, maple, aſh, baſs, and birch, and is good land. It contains 197 inhabitants.—*ib.*

OTOGAMIES, an Indian nation in the N. W. Territory, who inhabit between the Lake of the Woods and Miſſiſſippi river. Warriors 300.—*ib.*

OTOQUE, an iſland on the N. Pacific Ocean, or W. coaſt of New-Mexico, ſituated in the Bay of Panama, 17 leagues S. of the city of that name, from whence it is ſupplied with proviſions. N. lat. 7 50, W. long. 81 10.—*ib.*

OTSEGO, a county of New-York, on the S. ſide of Mohawk river, oppoſite the German Flats. The head waters of Suſquehannah, and the Cookquago branch of Delaware, interſect this county. Here are alſo the lakes Otſego, and Caniaderago, which ſend their waters, in an united ſtream, to the Suſquehannah. It contains 9 townſhips, viz. Kortright, Harpersfield, Franklin, Cherry Valley, Dorlach, Richfield, Otſego, Burlington, and Unadilla. It contained, a few years ago, about 1000 inhabitants; but ſuch has been the rapid ſettlement of this county, that in January, 1796, it contained 3237 inhabitants, qualified to be electors. In 1791, when this county was but thinly ſettled, as many as 300 cheſts of maple ſugar, were manufactured here, 400lbs. each. The courts are held at Cooperſtown, in the townſhip of Otſego.—*ib.*

OTSEGO, a townſhip and lake, in the county above deſcribed. The townſhip was taken from Unadilla, and incorporated in 1796. On the E. the townſhip encloſes Lake Otſego, which ſeparates it from Cherry Valley. Lake Otſego is about 9 miles long, and little more than a mile wide. The lands on its banks are very good, and the cultivation of it eaſy. In 1790, it contained 1702 inhabitants, including 8 ſlaves. By the State cenſus of 1796, there were 490 of its inhabitants electors.—*ib.*

OTTAWAS, an Indian nation in the N. W. Territory, who inhabit the E. ſide of Lake Michigan, 21 miles from Michilimackinack. Their hunting grounds lie between Lakes Michigan and Huron. They could furniſh 200 warriors 20 years ago. A tribe of theſe alſo lived near St Joſeph's, and had 150 warriors. Another tribe lived with the Chippewas, on Saguinam Bay, who together could raiſe 200 warriors. Two of theſe tribes lately hoſtile, ſigned the treaty of peace with the United States, at Greenville, Auguſt 3d, 1795. In conſequence of lands ceded by them to the United States, government has agreed to pay them in goods, 1000 dollars a year, forever.—*ib.*

OTTAWAS, a large river of Canada, which empties into the St Lawrence at the Lake of the Two Mountains, 9 miles from Montreal. The communication of the city of Montreal with the high lands, by this river, if not impracticable, is at leaſt very expenſive and precarious, by reaſon of its rapids and falls.—*ib.*

OTTER *Bay*, on the ſouth coaſt of the iſland of Newfoundland, is between Bear Bay and Swift Bay, and near Cape Raye, the ſouth-weſt point of the iſland. —*ib.*

OTTER *Creek*, called by the French *Riviere a Lotris*, a river of Vermont, which riſes in Bromley, and purſuing a northern direction about 90 miles, empties into Lake Champlain at Ferriſburg; and in its courſe receives about 15 ſmall tributary ſtreams. In it are large falls at Rutland, Pittsford, Middlebury, and Vergennes. Between the falls the water is deep and navigable for the largeſt boats. Veſſels of any burden may go up to the falls at Vergennes, 5 miles from its mouth. The head of this river is not more than 30 feet from Batten Kill, which runs in a contrary direction, and falls into Hudſon's river. Its mouth is 3 miles north of *Baſon Harbour.*—*ib.*

OTTER *Creek*, a ſmall ſtream which empties into Kentucky river, in the ſtate of that name, and E. of Boonſborough.—*ib.*

OTTER's *Head*, a ſmall peninſula, projecting from the north-eaſtern ſhore of Lake Superior, and north-weſt of Michipicoton Iſland.—*ib.*

OUADELIM and LABDESSEBA, two tribes of Arabs inhabiting the *Sahara* or Great Deſert of Africa, of whom almoſt nothing was known to Europeans till the publication of Briſſon's narrative of his ſhipwreck and captivity among the latter tribe. He deſcribes the Ouadelim and Labdeſſeba as the moſt formidable of all the interior tribes of Arabs, and as often extending their ravages to the very gates of Morocco. "Their hordes (he ſays) are frequently intermingled with thoſe of the Rouſege, Rathidium, Chelus, Tucanois, and Ouadeli tribes, as they have no diſtinct boundaries, and change their habitations as the deſart affords paſturage and water. They are tall, handſome, ſtout, and vigorous men. Their hair is briſtled, and their nails, which they often uſe in battle, as long as claws; large hanging ears and a long beard give them a ſtern ferocious air. The Ouadelim in particular are fierce, arrogant, and warlike, but ſoon diſpirited by obſtinate reſiſtance,

eſpecially

Ouadelim. especially when they have not a decided superiority in numbers. In their hordes they lodge by families, in tents which are covered with a thick cloth of camels hair, which the women spin and weave upon a loom so small, that they work sitting on the ground. The furniture of their tents consist of two large sacks of leather, in which they keep old clothes and pieces of old iron, three or four goat skins for holding milk and water, two large stones for grinding their barley, a smaller one for driving the pins of their tents, an ozier matting which serves for a bed, a thick carpet for a covering, a small kettle, and some wooden dishes, with pack-saddles for their camels. The person who, besides these articles, possesses a few horses, camels, sheep, and goats, is reckoned wealthy, as there are many Arabs who only possess sheep and goats. Except sore eyes and the cholic, they are subject to few endemic diseases. The first disorder is caused by the reflection of light from the burning sands of the desart, the other proceeds from the verdigrease which contaminates all their victuals. Their kettles are not tinned, and never washed, so that they are quite crusted over with verdigrease, the virulence of which is probably diminished by the quantity of milk they use. When they reside long in one place, they sometimes plough the spots which are moistened by the rain, and sprinkle them with seed in a careless manner. Plentiful crops are often thus produced; but instead of waiting till the grain attains maturity, they cut it down, and dry it over hot cinders. Treachery and perfidy are the innate vices of the Arabs; assassinations are frequent; no man trusts the promise of another; no man makes a written agreement, as the poignard cancels all bonds and obligations. The men often relate their exploits to each other; the embellishing of a story is succeeded by a charge of falsehood, and the poignard solves every difficulty. The ancient rites of hospitality, however, are practised among these tribes in their utmost extent. The Arab, who in the field is a rapacious plunderer, becomes liberal and generous as soon as he enters his tent. War is only a species of rapine, and the victory is decided at the first shock. The Arab is devoid of sanguinary courage; he attacks only to plunder, and never thinks that booty is to be put in competition with his life. When the battle is ended, each party makes graves for the slain, and enclose the tombs with mounds of stones. The ages of the warriors are denoted by the space of ground which the grave occupies, and the funeral procession is closed by the howls of the females.

"The women never assume the name of their husbands, and never eat with them at meals. They are faithful to their husbands, and cannot be divorced except by the decree of the seniors of the horde. The Arabs display their opulence by the ornaments of their women, whose ears, arms, and legs, are generally adorned with rings of gold and silver. An Arab beauty must have long teeth shooting out of her mouth, a body extremely thick, and limbs of the longest size. At the birth of a son, every woman, to testify her joy, blackens her face for 40 days. At the birth of a daughter she only daubs the half of her face during the space of 20 days. A mother treats her son with the same respect as her husband, almost as soon as he is able to walk; she prepares his food, serves him, and eats when he has finished his repast. In the education of their young men, the most important acquisitions are, dexterity in the use of the poignard, skill in embowelling their enemies with their long nails, and a plausible air in uttering a falsehood. More rude and ferocious than the tribes whose territories lie upon the shore of the sea, the Labdesseba and Ouadelim Arabs are also more confined and illiberal in their ideas, not only believing that they are the first nation in the world, but fancying that the sun rises only for them. Brisson relates, that some of them expressed this idea in unequivocal terms. 'Behold (said they) that luminary, which is unknown in thy country. During the night, thou art not enlightened, as we are, by that heavenly body, which regulates our days and our fasts. His children, (the stars) point out to us the hours of prayer. You have neither trees nor camels, sheep, goats, nor dogs. Are your women similar to ours?' 'How long didst thou remain in the womb of thy mother (said another)?' 'As long (replied Brisson) as thou in that of thine.' 'Indeed (said a third, counting the fingers and toes of the Frenchman) he is made like us; he differs only in his colour and language.' 'Do you sow barley in your houses?' said the Arabs, alluding to the ships of the Europeans. 'No (said Brisson), we sow our fields almost in the same season as you.' 'How! (cried several) do you inhabit the earth? we believed that you were born and lived upon the sea.' These Arabs, according to the Turkish proverb, believe that all the world is like their father's house: unacquainted with the manners of other nations, and unaccustomed to reflect upon the causes of national character, every variation from their own customs appears not only ridiculous, but monstrous; every difference of opinion not only absurd, but criminal. This ignorance of the Arabs, conjoined with their local and religious prejudices, enables us to account for the insulting treatment which Brisson and his companions received, without having recourse to inherent depravity of nature." That treatment was indeed shocking.

Brisson had surrendered himself, on his shipwreck, to Sidi Mahomet, a *Talbe* or priest of the tribe of Labdesseba. During the absence of the priest, the Labdesseba, who guarded the captives, were attacked and maltreated by a party of the Ouadelims, and during the bustle which ensued, Brisson had almost lost his life. Instead of compassionating his forlorn situation, the women threw sand into his eyes, as they said, to dry his eye-lids. The Arabs, into whose hands he had fallen, had only come down to the sea-coast to gather wild grain, three days before the shipwreck; and to preserve their booty, they immediately retreated to the interior part of the desart. A guide preceded the horde, to place at intervals small pyramids of stone, to direct their course, at a distance from every hostile tribe. After passing some very high mountains, wholly covered with small greyish pebbles as sharp as flints, they descended into a sandy plain overspread with thorns and thistles. When Brisson was unable to walk, on account of the bleeding of his feet, he was mounted on a camel; the bristly hair and hard trot of which soon excoriated him so much, that the blood run copiously down its flanks. By throwing heated stones into a wooden vessel, filled with barley meal, diluted with water procured on the sea-shore, preserved in a goat's skin, and mixed with pitch to prevent putrefaction

Ouadelim. tion, the Arabs prepared a kind of foup, which they kneaded with their hands, and ate unchewed. They roafted a goat in heated fand, ate its fat raw, and after having devoured the flefh, gnawed the bones, and fcraped them with their nails, threw them to Briffon and his companions, defiring them to eat quickly, and load the camels, that the journey might not be impeded. Proceeding eaftward, they croffed a vaft plain, covered with fmall ftones white as fnow, round and flat as a lentil, where not a fingle plant was produced. The earth beneath their feet refounded dull and hollow, and the fmall ftones pricked them like fparks of fire. The reflection of the rays of the fun from the fand was fcorching; the atmofphere was loaded with a red vapour, and the country appeared as if filled with flaming volcanoes. Neither bird nor infects could be feen in the air. The profound filence was frightful. If a gentle breeze ever arofe, it produced extreme langour, chopping of the lips, burning heat of the fkin, with fmall fmarting pimples. This plain was even fhunned by wild beafts. After traverfing this plain, they entered another, where the wind had thrown up in furrows the fand, which was of a reddifh colour. On the tops of the furrows grew a few fweet-fcented plants, which were devoured by the camels. On quitting this fandy plain, they entered a valley furrounded by mountains, where the foil was white and flimy, and where they found water of a noxious fmell, covered with green mofs, and foon after difcovered a horde of the friendly tribe Rouffye.

After another journey of fixteen days, they arrived at the tents of the Labdeffeba horde, to which Sidi Mahomet belonged. The tents pitched among thick bufhy trees, and the numerous flocks feeding along the fides of the hills, prefented at a diftance an afpect of happinefs and paftoral fimplicity. On approaching near, the trees of beautiful green foliage proved to be only old gummy ftumps, almoft void of branches, fo encircled with thorns that their fhade was inacceffible. The women approached, with loud cries and the moft fawning fervility, to welcome their tyrants, to throw ftones at the Chriftians, and fpit in their faces, while the children imitated the example of their mothers. Briffon, who endeavoured to ingratiate himfelf with his mafter's favourite, not only failed in this, but incurred her implacable refentment, through his irritability, which to the Arab women feemed extremely to refemble petulance. During his refidence with Sidi Mahomet, the hardfhips he endured were almoft incredible. With the exceffive heat, the milk of the fheep, goats, and camels, diminifhed, and then the dogs fared better than the Chriftians, who were forced to fubfift on wild herbs and raw fnails. When the rains fell, and the leaft preffure made the water to fpring up through the fandy foil, the Chriftians flept behind a bufh, unfheltered, on the bare ground. Briffon and his mafter fometimes reafoned about religion; when the latter always anfwered the harangues of the former by declaring, that he preferred a bowl of churned milk to fuch abfurdities. Several of his companions perifhed, and were left by the Arabs to be devoured by the ravens, while in the ftruggles of death. One of them was fuppofed to be murdered by his mafter for milking his camels clandeftinely. An application made by Briffon to the conful at Mogador, by a letter entrufted to a Jewifh merchant was fruftrated through the negligence of the vice-conful; and the Labdeffeba Arabs thought the journey too dangerous to be encountered for the ranfom of their flaves. He was however at laft relieved, through the humanity of his mafter's brother-in-law, who carried him to Morocco, where his ranfom was paid by the Emperor, and whence he returned to France. For a fuller account of thefe two favage tribes, fee *Saugnier's and Briffon's Narratives*; or a very pleafing *Hiftorical and Philofophical Sketch of the Difcoveries, &c. of the Europeans in Northern and Weftern Africa*, publifhed 1799 by *Symington* Edinburgh, and *Verner* and *Hood* London.

Ouais's, ‖ Ouafioto.

OUAIS's *Bay* and *River*, are about 2 leagues round the north point of the ifland of Cape Breton, in the Gulf of St Lawrence, and fouth-fouth-weft of the ifland of Limbach.—*Morse*.

OUANAMINTHE, a French parifh and village on the N. fide of the ifland of St Domingo, about a league and a half W. of Daxabon, in the Spanifh part, from which it is feparated by the river Maffacre; 6 leagues from the mouth of the river, and 5 S. E. of Fort Dauphin.—*ib.*

OUAQUAPHENOGAW, or *Ekanfanoka* is a lake or rather marfh, between Flint and Oakmulgee rivers, in Georgia, and is nearly 300 miles in circumference. In wet feafons it appears like an inland fea, and has feveral large iflands of rich land; one of which the prefent generation of Creek Indians reprefent as the moft blifsful fpot on earth. They fay it is inhabited by a peculiar race of Indians, whofe women are incomparably beautiful. They tell that this terreftrial paradife has been feen by fome enterprizing hunters, when in purfuit of their game, who being loft in inextricable fwamps and bogs, and on the point of perifhing, were unexpectedly relieved by a company of beautiful women, whom they call daughters of the Sun, who kindly gave them fuch provifions as they had with them, confifting of fruit and corn cakes, and then enjoined them to fly for fafety to their own country, becaufe their hufbands were fierce men and cruel to ftrangers. They further fay that thefe hunters had a view of their fettlements, fituated on the elevated banks of an ifland, in a beautiful lake; but in all their endeavours to approach it, they were involved in perpetual labyrinths, and, like enchanted land, ftill as they imagined they had juft gained it, it feemed to fly before them; and having quitted the delufive purfuit, they with much difficulty effected a retreat. They tell another ftory concerning this fequeftered country, which feems not improbable, which is, that the inhabitants are the pofterity of a fugitive remnant of the ancient *Yamafes*, who efcaped maffacre after a bloody and decifive battle between them and the Creeks, (who it is certain, conquered and nearly exterminated that once powerful people) and here found an afylum, remote and fecure from the fury of their proud conquerors. The rivers St Mary and Satilla, which fall into the Atlantic, and the beautiful Little St Juan, which empties into the bay of Appalachi at St Mark's, are faid, by Bartram, to flow from this lake.—*ib.*

OUASIOTO *Mountains* are fituated N. W. of the Laurel Mountains in N. Carolina and Virginia. They are 50 or 60 miles wide at the Gap, and 450 in length, N. E. and S. W. They abound in coal, lime,

lime, and free-stone. Their summits are generally covered with good soil, and a variety of timber, and the intervale lands are well watered.—*ib.*

OUEPAS, a town on the coast of Costa Rica, on the N. Pacific Ocean, and S. of Carthago.—*ib.*

OUIATANON, a small stockaded fort in the N. W. Territory, on the western side of the Wabash river, in lat. 40 38 N. and long. 87 57 W. and said to be about 130 miles southerly of Fort St Joseph. This was formerly a French post. Thus far the Wabash is navigable, 412 miles from its mouth, for batteaux drawing 3 feet water. A silver mine has been discovered here. The neighbouring Indians are the Kickapoos, Musquitons, Pyankishaws, and a principal part of the Ouiatanons. The whole of these tribes could furnish, about 20 years ago, 1000 warriors. The fertility of soil, and diversity of timber in this country are the same as in the vicinity of Post St Vincent.—*ib.*

OUINEASKE, or *Shelburne Bay*, on the E. side of Lake Champlain, sets up S. easterly through the town of Burlington in Vermont into the northern part of Shelburne.—*ib.*

OUISCONSING, a navigable river of the N. W. Territory, which empties into the Mississippi in lat. 43 33, and long. 94 8; where are villages of the Sack and Fox tribes of Indians. This river has a communication with Fox river, which, passing through Winnebago Lake, enters Puan Bay in Lake Michigan. Between the two rivers there is a portage of only 3 miles. On this river and its branches reside the Indians of its name. Warriors 300.—*ib.*

OULIONT, a village of the state of New-York, on the post road from Hudson to the Painted Post. It is 35 miles W. of Harpersfield, and 50 N. E. of Union, on Susquehannah river, and lies on the north side of a creek of its name which empties into Unadilla river.—*ib.*

OUTER *Buoy*, in Hudson's Bay, lies in lat. 51 38 N. and 5 leagues east of North Bluff.—*ib.*

OUTER *Island*, on the coast of Labrador, is in the cluster called St Augustine's Square; S. W. of Sandy Island, and east of Inner Island.—*ib.*

OUTIMACS, a tribe of Indians, in the N. W. Territory, residing between Lakes Michigan and St Clair. Warriors 200.—*ib.*

OVEN's MOUTH *Bay*, in the District of Maine, lies on the S. side of Booth-bay township, in Lincoln county, 12 miles from the shire town, and 190 N. by E. of Boston.—*ib.*

OVID, a township of New-York, in Onondago county. It was incorporated in 1794; is separated from Milton on the E. by Cayuga Lake, and comprehends all the lands in the county on the W. side of Seneca Lake. The centre of the township is 20 miles S. of the W. side of the ferry on Cayuga Lake. In 1796, there were 107 of its inhabitants qualified to be electors.—*ib.*

OWASCO, a lake, partly in the towns of Aurelius and Scipio, in Onondago county, New York. It is about 11 miles long, and one broad, and communicates with Seneca river on the N. by a stream which runs through the town of Brutus. The high road from Kaats' Kill westward, passes towards Cayuga ferry, near the N. end of the lake.—*ib.*

OWEGO, a post-town in Tioga county, New York, on the east branch of the Susquehannah, 20 miles westerly of Union, 34 N. E. of Athens, at Tioga Point, and 284 from Philadelphia. In 1796, 170 of its inhabitants were electors.—*ib.*

OWEGO *Creek*, in Tioga county, serves as the east boundary of the township of its name. It has several small branches which unite and empty through the N. bank of the east branch of Susquehannah river, about 18½ miles W. of the mouth of Chenengo river.—*ib.*

OUYATOISKA *Bay* and *River*, on the coast of Esquimaux, or N. shore of the Gulf of St Lawrence, is to the westward of Natachquoin river.—*ib.*

OWHARREE, a harbour on the northern part of the west coast of Houaheine, one of the Society Islands, 25 leagues N. W. by W. of Otaheite Island. S. lat. 16 44. W. long. 151 8.—*ib.*

OWL's *Head*, a head land on the W. side of Penobscot Bay, in the District of Maine. It has a good harbour on the larboard hand as you go to the eastward. The harbour makes with a deep cove; has 4 fathoms water, and a muddy bottom. It is open to the E. to N. and E. N. E. winds; but in all other winds you are safe. The tide of flood sets to the eastward, and the tide of ebb S. W. through the Muscle Ridges.—*ib.*

OXBOW, *Great*, a bend of the river Connecticut, about the middle of the township of Newbury, in Vermont. It contains 450 acres of the finest meadow land in New England.—*ib.*

OXFORD, a township in Worcester county, Massachusetts. It contains 1000 inhabitants; is 11 miles southward of Worcester, and 54 S. W. of Boston.—*ib.*

OXFORD, a village in Bristol county, Massachusetts.—*ib.*

OXFORD, a parish in the northern part of Derby, in Connecticut, containing 140 families; 17 miles N. W. of New Haven.—*ib.*

OXFORD, a post-town of New York, in Tioga county, 45 miles N. E. of Union, and 20 S. W. of Butternutts. This township, lies between Jericho and Union, and is bounded northerly on Norwich, and westerly by the tract called the Chenengo Triangle. It was incorporated in 1793. Here is an incorporated academy.—*ib.*

OXFORD, a township of New Jersey, situated in Sussex county, on the east bank of Delaware river, 15 or 20 miles N. E. of Easton in Pennsylvania. It contains 1905 inhabitants, including 65 slaves.—*ib.*

OXFORD, a township of Pennsylvania, situated in Philadelphia county. There is one of the same name in Chester county.—*ib.*

OXFORD, a port of entry, on the eastern shore of Chesapeak Bay, in Talbot county. Its exports in 1794 amounted to 6,956 dollars. It is 13 miles S. by W. of Easton, and about 48 S. E. of Baltimore.—*ib.*

OXFORD, a small post-town of N. Carolina, 36 miles from Hillsborough, and about 416 from Philadelphia.—*ib.*

OXYGLYCUS CERASUS, the name given by the editor of Dalzel's History of Dahomy to a very singular fruit produced in that country, as well as in some other parts of Africa. It resembles a small olive in every respect but the colour; being of a dusky reddish hue, changing at the end next the stalk to a faint yellow. The pulp is firm, and almost insipid; the stone is hard like that of the olive. After having chewed one or more of such berries, and spit out or swallowed the

the pulp at pleasure, a glass of vinegar will taste, to the person trying the experiment, like sweet wine; a lime will seem to have the flavour of a very ripe China orange; and the same change is produced on other acids, the ordinary effects of which upon the palate is destroyed in a very unaccountable manner, without effervescence or any sensible motion. Indeed, the effect is very different from neutralization, arising from the mixture of acid and alkali; such combination producing a neutral saline liquor, whilst this miraculous berry seems to convert acids to sweets. Food or drink, not containing any acid, suffer no change by the previous use of this fruit; its effect upon acids continues, even after a meal, though in a much smaller degree. The natives use it to render palatable a kind of gruel called *guddoe*, which is made of bread after it becomes too stale for any other purpose. They describe it as the fruit of a large tree.

Plants six or seven inches high were raised from this fruit by Mr Dalzel, who tried to carry them from Angola to the botanic garden at St Vincent's; but they died on the passage. He preserved the berries in spirits, in syrup, and in a dry form; but they lost their singular quality in all those preparations. The plant is an evergreen, and the leaves in this infant state are like those of the olive.

OXY-Muriatic Acid (See Chemistry-*Index* in this *Suppl.*), is the principal agent in the new process of bleaching (see Bleaching, *Suppl.*); but, till very lately, at least, if not even at present, the bleachers were in the practice of adding some alkali to the acid, notwithstanding the strong objections which M. Berthollet made to that addition, and notwithstanding the proofs urged by Mr. Rupp, that it increases the expence of bleaching about 40 *per cent.* The chief reason for persisting in a practice to which such objections were urged was, that the addition of the alkali deprives the liquor of its suffocating effects without destroying its bleaching powers. Mr Rupp, however, has contrived the following apparatus, in which may be safely used the pure oxy-muriatic acid simply dissolved in water, which is at once its cheapest and best vehicle.

Figure 1. (Plate XLI.) is a section of the apparatus. It consists of an oblong deal cistern ABCD, made water tight. A rib EE of ash or beech wood is firmly fixed to the middle of the bottom CD, being mortised into the ends of the cistern. This rib is provided with holes at FF, in which two perpendicular axes are to turn. The lid AB has a rim GG, which sinks and fits into the cistern. Two tubes HH are fixed into the lid, their centres being perpendicularly over the centres of the sockets FF when the lid is upon the cistern. At I, is a tube by which the liquor is introduced into the apparatus. As it is necessary that the space within the rim GG be air-tight, its joints to the lid, and the joints of the tubes, must be very close; and if necessary secured with pitch. Two perpendicular axes KL, made of ash or beech wood pass thro' the tubes HH, and rest in the sockets FF. A piece of strong canvas M is sewed very tight round the axis K, one end of it projecting from the axis. The other axis is provided with a similar piece of canvas. N are pieces of cloth rolled upon the axis L. Two plain pulleys OO are fixed to the axes, in order to prevent the cloth from slipping down. The shafts are turned by a moveable handle P. Q is a moveable pulley, round which passes the cord R. This cord, which is fastened on the opposite side of the lid (see fig. 2.), and passes over the small pulley S, produces friction by means of the weight T. By the spigot and fausset V, the liquor is let off when exhausted.

The dimensions of this apparatus are calculated for the purpose of bleaching twelve or fifteen pieces of $\frac{7}{8}$ callicoes, or any other stuffs of equal breadth and substance. When the goods are ready for bleaching, the axis L is placed on a frame in an horizontal position, and one of the pieces N being fastened to the canvas M by means of wooden skewers, in the manner represented in fig. 1. it is rolled upon the axis by turning it with the handle P. This operation must be performed by two persons; the one turning the axis and the other directing the piece, which must be rolled on very tight and very even. When the first piece is on the axis, the next piece is fastened to the end of it by skewers, and wound on in the same manner as the first. The same method is pursued till all the pieces are wound upon the axis. The end of the last piece is then fastened to the canavs of the axis K. Both axesare afterwards placed into the cistern, with their ends in the sockets FF, and the lid is put on the cistern by passing the axes through the tubes HH. The handle P is put upon the empty axis, and the pulley Q upon the axis on which the cloth is rolled, and the cord R, with the weight T, is put round it and over the pulley S. The use of the friction, produced by this weight is to make the cloth wind tight upon the other axis. But as the effect of the weight will increase as one cylinder increases and the other lessens, Mr Rupp recommends that three or four weights be suspended on the cord, which may be taken off gradually as the person who works the machine may find it convenient. As the weights hang in open hooks, which are fastened to the cord, it will be little or no trouble to put them on and to remove them.

Things being thus disposed, the bleaching liquor is to be transferred from the vessels in which it has been prepared into the apparatus, by a moveable tube passing through the tube I, and descending to the bottom of the cistern. This tube being connected with the vessels, by means of leaden or wooden pipes provided with cocks, hardly any vapours will escape in the transfer. When the apparatus is filled up to the line *a*, the moveable tube is to be withdrawn, and the tube I closed. As the liquor rises above the edge of the rim G, and above the tubes HH, it is evident that no evaporation can take place, except where the rim does not apply closely to the sides of the box; which will, however, form a very trifling surface if the carpenter's work be decently done. The cloth is now to be wound from the axis L upon the axis K, by turning this; and when this is accomplished, the handle P and pulley Q are to be changed, and the cloth is to be wound back upon the axis L. This operation is, of course, to be repeated as often as necessary. It is plain, that by this process of winding the cloth from one axis upon the other, every part of it is exposed, in the most complete manner, to the action of the liquor in which it is immersed. It will be necessary to turn, at first, very briskly, not only because the liquour is then the strongest, but also because it requires a number of revolutions, when the axis is bare, to move a certain length of cloth in a given

time

time, though this may be performed by a single revolution when the axis is filled. Experience must teach how long the goods are to be worked; nor can any rule be given respecting the quantity and strength of the liquor, in order to bleach a certain number of pieces. An intelligent workman will soon attain a sufficient knowledge of these points. It is hardly necessary to observe, that, if the liquor should retain any strength after a set of pieces are bleached with it, it may again be employed for another set.

With a few alterations, this apparatus might be made applicable to the bleaching of yarn. If, for instance, the pulley O were removed from the end of the axis K, and fixed immediately under the tube H;—if it were perforated in all directions, and tapes or strings passed through the holes, skains of yarn might be tied to these tapes underneath the pulley, so as to hang down towards the bottom of the box. The apparatus being afterwards filled with bleaching liquor, and the axis turned, the motion would cause every thread to be acted upon by the liquor. Several axes might thus be turned in the same box, and being connected with each other by pulleys, they might all be worked by one person at the same time; and as all would turn the same way and with the same speed, the skains could not possibly entangle each other.

OYSTER *Bay*, a township of New-York, situated in Queen's county, Long-Island, extending from the Sound S. to the Atlantic Ocean, and includes Loyd's Neck, or Queen's Village, and Hog-Island. It contains 4,097 inhabitants; of whom 611 are electors, and 381 slaves.—*Morse*.

Oyster *Bay*, a harbour for small vessels in the S. W. limits of the town of Barnstable, in Barnstable county, Massachusetts. It affords excellent oysters; hence its name.—*ib*.

Oyster *Beds*, in Delaware Bay, lie opposite Nantuxet Bay.—*ib*.

Oyster *Point*, on the coast of S. Carolina, where the water does not ebb till an hour and a half after it begins to ebb at the bar of Ashley river, near Charleston. It is best to go in an hour and an half before high water.—*ib*.

Oyster *Pond*, a part of the waters of the Atlantic Ocean, which set up westward into Long-Island, in the State of New-York, between the north-easternmost point of the island called Oyster Pond Point, and Gardner's Island. Off the point are two small isles, one of which is called Plumb-Island.—*ib*.

Oyster *River*, a W. branch of Piscataqua river in New-Hampshire. Durham stands on its S. side, near its junction with the main stream at Helton's Point.—*ib*.

O-YONG-WONGEYK, on Lake Ontario, at Johnson's Landing-Place, about 4 miles eastward of Fort Niagara.—*ib*.

OZAMA, one of the largest rivers of the island of St Domingo, in the West-Indies, and on which the city of St Domingo is situated. It is navigable 9 or 10 leagues from S. to N. One may judge of the enormous volume of water which the confluent stream of Isabella and Ozama sends to the sea, by the red colour it gives it in the time of the floods, and which is perceivable as far as the eye can distinguish. There is a rock at the mouth, which prevents the entrance of vessels drawing more than 18 or 20 feet of water. The river for a league is 24 feet deep; and its banks are 20 feet perpendicular, but N. of the city this height is reduced to 4 feet. This real natural bason has a bottom of mud or soft sand, with a number of careening places. It seldom overflows its banks, except in very extraordinary inundations. The road before the mouth of the Ozama is very indifferent, and lies exposed from W. S. W. to E. It is impossible to anchor in it in the time of the south winds, and the north winds drive the vessels from their moorings out into the sea, which here runs extremely high. The mouth of the river is in lat. 18 18 N. and long. from Paris 72 38 W.—*ib*.

P.

PABLO, *St*, a lake in the jurisdiction of Otabalo, in the province of Quito, 3 leagues in length, and about half a league in breadth. The lake is every where surrounded with a species of rushes called Totoral, among which are vast numbers of wild geese and galarettes. Its waters empty into the Rio Blanco.—*Morse*.

Pablo, *St*, a village on the above lake, inhabited principally by Indians.—*ib*.

Pablo, *St*, a town on the S. coast of the Isthmus of Darien, in the province of Veragua, S. America.—*ib*.

PACAJES, a province of S. America, which is rich in silver mines, though they are not much worked. Here are also mines of talc, called Jaspes Blancos de Verenguela, on account of their transparent whiteness. In this province are an abundance of emeralds.—*ib*.

PACAMORES, a district of Peru, in S. America. The air is temperate, and the earth abounds in gold. An Indian nation of this name inhabit the banks of Amazon river.—*ib*.

PACAYITA, a volcano in Guatimala, in New-Spain. In 1773 the lava which issued from it destroyed the city of St Jago, which was situated in the valley of Panchoi.—*ib*.

PACHACAMA, or *Pachamac*, a famous, fruitful, and pleasant valley in Peru, 4 leagues from Lima, formerly beautified with a magnificent temple built by the Incas, and dedicated to the Creator of the Universe. The Peruvians had in it several idols; but they had so great a reverence for God, whom they called Pachacamac, that they offered him what they esteemed most precious, and durst not look upon him; so that their kings and priests entered his temple with their backs towards his altar, and came out again without daring to to turn about. The ruins of this superb structure, says Jovet, do yet demonstrate its former magnificence and greatness. Such immense treasures had been laid up in it, that Ferdinand Pizarro found to the value of 900,000 ducats in it; although 400 Indians had taken away as much as they could carry; and the Spanish soldiers pillaged it before he came. The cruel Spaniards tortured the natives, but could not extract a discovery of the hidden treasure.—*ib.*

PACHEA, the most northerly of the islands called the Pearl or King's Islands, all low and woody, and about 12 leagues from Panama. Within a league of this island there is anchorage in 17 fathoms.—*ib.*

PACHEGOIA, a lake of New South Wales, in N. America, in lat. 55 N.—*ib.*

PACHEQUE, a fine, but small island on the S. W. side of the bay of Panama, on the coast of the N. Pacific Ocean, and one of the beautiful islands within the semicircular bay from Panama to Point Mala. These islands yield wood, water, fruit, fowls, hogs, &c. and afford excellent harbour for shipping.—*ib.*

PACHUCO, a town of Mexico famous for the silver mines in its vicinity. It is said that within 20 miles there are 1000 of them. It lies 60 miles from the city of Mexico.—*ib.*

PACKERSFIELD, a township of New-Hampshire, Cheshire county, E. of Keene, on the head branches of Ashuelot river. It is 86 miles westerly of Portsmouth, was incorporated in 1774, and contains 721 inhabitants.—*ib.*

PACMOTE, a bay on the east side of the island of Martinico, between Vauclin Bay on the north, and Fere Ance or Creek on the south.—*ib.*

PACOLET, a small river of South Carolina, which rises in the White Oak Mountains, and unites with Broad river, 30 miles above Tyger river, and 24 south of the North Carolina line. Its course is about south-east, and on it are the celebrated Pacolet Springs, 17 miles above its confluence with Broad river.—*ib.*

PADOUCAS, a western branch of Missouri river. The tribe of Indians of this name are said by some to be of Welch origin.—*ib.*

PAGET's *Port*, a small harbour within the great sound in the Bahama Islands, and in the most easterly part of the sound.—*ib.*

PAGUISA, or *Paquisa*, on the west side of South-America, in lat. 21 55 S. and 10 leagues north of the harbour of Cobija, in the bay of Atacama. Haguey de Paguisa, or the watering place of Paguisa, is 15 leagues from Cobija. The whole coast between is high, mountainous and rocky, in the direction of north-north-east.—*ib.*

PAINTED *Post*, a station, so called in New-York State, in Tioga county, on the northern side of Tioga river, between Bath and Newtown; 40 miles N. W. by W. of Tioga Point, or Athens, 58 south-east of Williamsburg on Genessee river, and 230 N. W. of Philadelphia. A post-office is kept here.—*ib.*

PAINTED *Rock* is on French Broad river, by which the line runs between Virginia and Tennessee.—*ib.*

PAINTER's *Harbour*, on the west coast of Cape Breton Island, is nearly due east of East Point in the island of St John's. N. lat. 46 22, W. long. 61 16. —*ib.*

ENCAUSTIC PAINTING is an art of very high antiquity, which, after being lost for many ages, was restored, as is commonly believed, by the celebrated Count Caylus, whose method was greatly improved, first by Mr Josiah Colebrooke, and afterwards by Miss Greenland, who brought the rudiments of her knowledge from Italy (See ENCAUSTIC, *Encycl.*). In that country encaustic painting had employed the attention of various artists and men of learning, such as Requeno, Lorgna, and Astori, &c.; but the best account of it that has fallen under our notice, is in that valuable miscellany called the *Philosophical Magazine*, taken from a work of Giov. Fabbroni, published at Rome in the year 1797.

According to this author, "the knowledge and use of encaustic painting is certainly older than the time of the Greeks and the Romans, to whom the learned Requeno seems to assign the exclusive possession of this art; because the Egyptians, who, with the Etruscans, were the parents of the greater part of the inventions known among mankind, and from whom the Greeks learned so much, were acquainted with and employed encaustic painting in the ancient ages of their greatness and splendour, as is proved by the valuable fragments of the bandages and coverings of some mummies which he had examined. No oil-painting (he says), of only two or three hundred years old, exhibits a white paint which has kept so well as that seen on these fragments; and this circumstance sufficiently proves the superiority of the encaustic method over the common oil-painting, which, notwithstanding the general opinion, cannot, he thinks, have been unknown to the ancients.

"It is impossible (says he) that in Egypt and Phœnicia, where so much use was made of flax, the oil procured in abundance from that plant should have been unknown. Those who have kept oil, or who have spilt any of it, whether nut or lintseed oil, must have remarked that it possesses the property of soon drying by the effects of the atmosphere; and therefore it may be easily believed that mankind must soon have conceived the idea of employing it, particularly for ships, which, as Herodotus says, were painted with red ochre in the earliest periods, and adorned with figures and ornaments. The use of oil afforded painting a much simpler and easier method than that of wax; it must therefore have been first adopted, and the transition from oil to wax must be considered as a step towards bringing the art to perfection; because encaustic painting is not exposed to the irremediable inconveniences that arise in oil-painting, the value of which we extolled through ignorance, and praised as a new invention.

"Oil in general, and in particular drying oil which the painters use, has naturally a strong inclination to combine itself with the vital air or oxygen of the atmosphere, and by imbibing oxygen it becomes dry, and assumes the character of resin; but the colour then becomes darker, as is the case with transparent turpentine, which gradually becomes a black pitch.

"According to the new and more accurate method of decomposing bodies, oil consists principally of hydrogen and carbon. By coming into contact with the atmosphere, and absorbing its oxygen and light, it undergoes a slow and imperceptible combustion, which is not essentially different from the speedy and violent one which it would undergo in the common mode of burning. It first passes, by imbibing oxygen, into the state

 of

of a more or less dark resin; loses gradually its essential hydrogen, which makes a new combination, and afterwards the oxygen itself which has attracted the carbon; and at length leaves behind a thin layer of actual carbon, which in the end becomes black in the course of time, and considerably obscures the oil-painting. By a continuance of the before-mentioned slow combustion, the carbon itself, as it were, burns also: if it be strongly acted upon by the light, it attracts the oxygen of the atmosphere, and again brings forward the carbonic acid or fixed air, which gradually flies off. By this, which I may call the second degree of combustion, the painting must become dusty and friable, like crayon *painting*.

"Hence it appears (says our author) that one can hope only for a transient or deceitful effect from the refreshing of oil-paintings with oil; because the harmony of the tones, which the painter establishes as suited for the moment, does not proceed with equal steps, and cannot preserve itself in the like measure for the course of a few years, as each tint, as they say, ought to increase, or, to speak more properly, to burn in proportion to its antiquity. It thence follows, that mere washing may be prejudicial to an old painting; and that the method of refreshing paintings, as it is called, by daubing over the surface, from time to time, with new drying oil, is highly prejudicial and ill calculated for the intended purpose, since the oil when it becomes dry contracts in its whole surface, carries with it the paint under it, and occasions cracks in the painting. New oil of this kind gives occasion to mineral paints to be restored; but covers the picture with a new coat of resin, and then of carbon, which arises from the gradual combustion, and always causes more blackness, and the decay of the painting which one wishes to preserve.

"Wax, on the other hand, undergoes a change which is very different from that of drying oil. The wax, instead of becoming black by the contact of the atmosphere, increases in whiteness, and, according to its natural quality, is not decompofed in the air, and it does not strongly attract the oxygen of the calces or metallic ashes which are commonly used in painting. Moreover, the so called earths, which are in themselves white, and are never variable either by the presence or absence of oxygen, cannot be employed in oil-painting, because that fluid makes them almost transparent, and causes them to remain as it were without body, and not to produce the wished-for effect. That beautiful white, which may be observed on the before-mentioned Egyptian encaustic, is nothing else than a simple earth, and according to our author's chemical experiments, a chalk which is also unalterable."

That the ancients were once acquainted with the use of oil-painting, and neglected it on account of the great superiority of the encaustic method, our author thinks farther evident from the different accounts which we have of the ancient paintings. "Thus Petronius praises the fresh appearance which the valuable works of Zeuxis and Apelles had, even in this time; but Cicero, on the other hand, speaks of the paintings of the ancients having suffered from blackness. The former speaks of wax-painting, and the latter certainly alludes to paintings in oil. It is well known that paintings with wet chalks or water colours do not become black by age, and that this is the case also with encaustic. Of this any one may be convinced, not only by the expressions of the above quoted authors, but by one's own eyes on surveying the Egyptian fragment alluded to. Galland proves, on various grounds, that a painting was made with oil so early as the reign of Marcus Aurelius; and if no specimens of that period have reached us, this is perhaps to be ascribed to the frail and perishable nature of this species of painting."

Sign. Fabbroni, after some farther observations, calculated to prove that metallic oxyds or calces could not have been employed as pigments on such mummies as still retain their colours fresh, proceeds thus: "Those who are acquainted with the accuracy and certainty of the method not long since introduced into chemical operations, will be convinced, that in 24 grains of the encaustic painting, which I ventured to detach from the above-mentioned Egyptian fragment, in order to subject it to examination, the mixture of an hundredth part of a foreign substance would have been discovered with the greatest certainty; that the resin of Requeno must undoubtedly have been perceptible to me, and that the alkali of Bachelier and Lorgna could not have escaped the counteracting medium. But in this Egyptian encaustic I found nothing except very pure wax, though I varied my analysis in every known method. I must therefore conclude, that modern learned writers, at least in respect to this Egyptian mode of painting, were as far from the truth as the accounts of ancient authors appear to me precise and satisfactory; and that the encaustum with which formerly the fore part of ships and the walls of houses and temples were painted, was something different from soap or resinous crayons.

"I am well aware that it will be asked, In what manner can wax at present be rendered sufficiently liquid for the strokes of the pencil, if it be not converted into powder or soap? This question, in my opinion, can be fully answered from the words of an ancient author, and, in the next place, by experience.

"Vitruvius in particular, book vii. chap. ix. expresses himself in the following clear manner:

'Those (says he) who wish to retain cinnabar on walls, cover it, when it has been well laid on and dried, with Punic wax diluted in a little oil (let this be well remarked); and after they have spread out the wax with a hair brush, they heat the wall by means of a brazier filled with burning coals (hence it is called encaustic painting), and then make it smooth and level by rubbing it with wax tapers and clean cloths, as is done when marble statues are covered with wax. The effect of this wax crust is, that the colour is not destroyed by the light of the sun or the moon (A).'

"It here appears, that the Romans, who copied the Grecian process, which the latter borrowed from the Egyptians, mixed the wax with an oil to make it pliable under the brush; but no mastic, alkali, or honey, as has been ingeniously imagined, and which some have thought might be employed with success. The difficulty

(A) The reader will find the original of this passage, with a translation somewhat different, in the article Encaustic, *Encycl.*

culty now will be confined to point out in what manner this oil was employed. It does not appear that they used those fat oils which are commonly called drying oils; because they could have employed these as we do, without the addition of wax, which, in such a case, would have been entirely superfluous. Fat oils which do not dry would not have been proper for that purpose, as they would have kept the wax continually in the state of a soft pomade or salve. Besides, my experiments (continues the author) would without doubt have shewn me the existence of any oily matter.

"With regard to essential or volatile oils, a knowledge of them is not allowed to the ancients, as the invention of distilling is not older than the eighth or ninth century, and therefore falls in with the period of Geber or Avicenna." Yet it is certain, that, in order to use wax in their encaustic painting, they must have combined it with an ethereal volatile oil, of which no traces should afterwards remain; because this was necessary for the solidity of the work, and because no oil was found in the fragment that was examined. But naphtha is such an oil, much lighter (says our author) than ether of vitriol itself. It is exceedingly volatile, and evaporates without leaving a trace of it behind. On this account it is used when signatures and manuscripts are to be copied; because the paper, which is moistened by it, and so rendered transparent, quickly becomes white and opaque as before by the complete evaporation of the naphtha. That the Assyrians, Chaldeans, and Persians, were well acquainted with the properties of naphtha is known to every scholar; and hence our author thinks it highly probable that it was used by those nations to render wax fit for painting. "It appears to me (says he) that the Greeks, as was the case with many other things, learned encaustic from the Egyptians, who probably derived it from the Assyrians or Chaldeans; and if so, we have discovered the real mixture used for ancient encaustic painting."

To put the matter, however, beyond a doubt, Sign. Fabbroni prepared, for an eminent Saxon painter, a solution of Venetian wax in highly purified naphtha, desiring him to mix up with it the colours necessary for a painting. The artist complied; and both he and our author were astonished, as well as all their friends, at the high tone which the colours assumed, and the agreeable lustre which the painting afterwards acquired when it had been rubbed over with a soft cloth. A similar solution of wax was made for another artist, in which the spirit of turpentine was used instead of naphtha with equal success. Our author therefore concludes, we think with reason, that if he has not discovered the real composition employed by the ancients in their encaustic paintings, he has at least approached much nearer to that discovery than any of his predecessors who have employed their learned labours in the same field of investigation.

PAINTINGS, or Pictures, are often done upon objects from which, when they are valuable, it would be desirable to transfer them. Thus, a connoisseur in painting might naturally wish to transfer an old and valuable picture from the ceiling or walls of his room to stretched canvas; and such a man would consider himself as deeply indebted to the artist who should perform so arduous a task. This task has actually been performed by Mr *Robert Salmon* of Woburn, Bedfordshire, who was honoured by the *Society for the Encouragement of Arts, &c.* with the greater silver pallet, for communicating the method by which he accomplished it.

"The first thing (says Mr Salmon) to be attended to with respect to paintings, either on plastered walls or ceilings, or on boards, is, that the place in which they are be secure from wet or damp. If the paintings are on old walls in large builings, or other places where this cannot be attained by art, then the summer season should be taken for the purpose, as the picture will rarely escape damage, if wet or damp gets at it while under the process. At the same time, care should be taken that the room, or other place, be not overheated; as that would produce equally bad effects.

"These precautions being taken, the next thing is to examine the surface of the painting. If there are any holes in the same, they must be carefully filled up with a paste or putty, made of glue and whiting: this, if the holes are large, should be twice or thrice done, so as entirely to fill them up, and leave the surface even and smooth; but if there are any bruised places, with paint still remaining on the surface of the bruised parts, then this stopping must not be applied, but the securing-canvas, hereafter described, must be pressed down into these places. In the places that are stopped, there will of course appear blemishes when the picture is transferred; but the process is rendered much more certain and sure by being so done. Attention must next be paid to lay down any blisters, or places where the paint is leaving the ground: this is done by introducing, between the paint and the ground, some very strong paste of flour and water; and the surface of the blistered paint being damped with a wet sponge or brush, it may be pressed with the hand home to the ground, to which it will then adhere.

"All the unsound places being thus secured, care must be taken to clear the surface of any grease or dirt, as also of any particles of the paste that may happen to be left on it. The next thing is, to determine the size of the painting meant to be taken off: If it is on a plain surface, a board of the size of the picture must be procured, not less than an inch in thickness, and framed together with well seasoned wood, in small pannels, smooth and flush on one side. This done, a piece of fine open canvas must be provided, such as the finest sort used for hanging paper on; which canvas is to be somewhat larger than the picture, and so sewed together, and the seam so pressed, that it be perfectly smooth and even. This is what Mr Salmon calls the securing canvas; which, being so prepared, is to be stuck on the surface of the picture with a paste made of strong beer, boiled till it is half reduced, and then mixed with a sufficient quantity of flour to give it a very strong consistence. To large pictures on walls or ceilings, the canvas must for some time be pressed, and rubbed with the hand as smooth as possible, working it from the middle to the outside, so as to make it tolerably tight; observing, as it dries, to press it, with the hand or a cloth, into any hollow or bruised places, so that it may adhere to every part of the painting: this done, it is left to dry, which it will generally do in a day or two. When dry, a second canvas, of a stronger and closer sort, and of the same size as the other, is in like manner to be attached on the top of the first. This last will want very little attention, as it will readily adhere to the firſt; and, being dry, attention muſt be paid to take off any ſmall knots or unevenneſs that may be upon the ſurface of it; which done, the whole ſhould be again covered with a thin paſte of ſize and whiting; which is to be pumiced over when dry, ſo as to make the whole perfectly ſmooth and even.

"The painting being thus ſecured, the board, already prepared to the ſize of the picture, is to be put with the ſmooth ſide againſt the ſurface thereof, ſo as exactly to cover as much as is intended to be transferred. The edges of the canvas, which, as before directed, is to be larger than the painting, are then to be pulled tight over, and cloſely nailed to the edge of the board. If the painting is large, and either on a ceiling or wall, the board muſt, by proper ſupports, be firmly fixed againſt it, ſo that it can readily be lowered down when the plaſter and painting are detached.

"The canvas and board being fixed, the painting is to be freed from the wall or ceiling, together with a certain portion of the plaſtering: this, with proper care and attention, may be readily done. If on a ceiling, the firſt thing is to make ſome holes through the plaſtering, round the outſide of the board and painting; and, with a ſmall ſaw, to ſaw the plaſtering from one hole to another, till the whole is diſunited from the other parts of the ceiling: this done, the workman muſt get at the upper ſide of the ceiling, where he muſt free the plaſtering from the laths, by breaking off the keys thereof, and with a chiſel cut out the laths; whereby the plaſtering, together with the picture, will be left reſting on the board and ſupports.

"If the painting is on a brick or ſtone wall, the wall muſt be cut away at top, and down the ſides of the painting; and then, by means of chiſels or ſaws in wooden handles, of different lengths, the wall muſt be cut away quite behind the painting; leaving the ſame, together with the plaſtering, reſting on the board. This operation may ſometimes be done with a ſaw; or, if the wall be not thick, nor the other ſide of much conſequence, the bricks or ſtones may be taken out from that ſide, leaving the plaſtering and painting as before. This laſt method (ſays the author) I have not practiſed: the other, of cutting away ſome part of the wall, I have, and ſee no difficulty, or very great labour, in the operation; but that, of courſe, muſt be various, according to the texture of the wall and mortar.

"If the paintings are on curved ſurfaces, ſuch as the coves of ceilings, then the only difference of operation is, that ſome ribs of wood muſt be cut out, and boarded ſmooth to the curve of the ſurface of the painting, and then fixed up thereto, in place of the before-deſcribed bearing-board; the painting is then to be freed, and left with the plaſtering, reſting on the bearers.

"For paintings on wainſcot or boards, the ſame ſecuring and proceſs is to be exactly followed; only that, as the wainſcot or board can always be cut to the ſize wanted, and laid horizontal, the ſecuring canvas is to be ſtretched thereon, and turned over the edges of the ſame, till it is dry; after which the edges are again to be turned up, and nailed to the board, in the ſame manner as with reſpect to paintings from walls.

"Having, as before deſcribed, in any of the aforementioned caſes, freed the paintings from their original places, you have got them ſecured to two thickneſſes of canvas, with their ſurfaces on the board prepared for that purpoſe; this being the caſe, they can readily be removed to any room or ſhop, to be finiſhed as follows: Having carried the painting into the ſhop or room, which ſhould be moderately warm and dry, but by no means overheated, lay the board on a bench or treſſels, ſo that the back of the picture be uppermoſt, the plaſtering or wood, as may happen, is then to be cleared away, leaving nothing but the body of paint, which will be firmly attached to the ſecuring canvas. To perform this, a large raſp, a narrow plane, and chiſels, will be requiſite. This operation, though difficult to be deſcribed, would ſoon be learned by any one who ſhould make the attempt; nor is it very tedious; and being performed, the picture is ready to be attached to its new canvas, as follows.

"The painting being cleared, and lying on the board, the back thereof is to be painted three or four times over ſucceſſively, with any good ſtrong-bodied paint; leaving one coat to dry before another comes on: a day or two between each will generally be found ſufficient. Each of theſe coats, and particularly the firſt, ſhould be laid on with great care, taking but a ſmall quantity in the bruſh at a time, and laying it very thin. This precaution is neceſſary, to prevent any of the oil or paint from paſſing through any ſmall cracks or holes in the ſurface of the picture; as ſuch oil or paint would run into the paſte, and ſo attach the ſecuring canvas to the picture, as to prevent its being afterwards got off. If any ſuch holes or cracks are obſerved, they ſhould be ſtopped up with the glue and whiting paſte, and the painting then repeated, till a complete coat is formed on the back of the picture. It is then ready for attaching to its canvas, which is done by ſpreading all over the picture a paſte made of copal varniſh, mixed with ſtiff white lead, and a ſmall quantity of any other old fat paint; all which being ſpread equally over with a pallet knife, ſuch a canvas as the firſt ſecuring canvas is laid thereon, and ſtrained and nailed round the edges of the board; in which ſtate it is left till it becomes tolerably dry: then a ſecond canvas, of a ſtronger ſort, muſt be in like manner attached on the firſt, and left till it is perfectly dry and hard. This generally takes about two months; and the longer the painting is left, the more ſecurely it will be attached to its canvas, and leſs liable to crack or fly therefrom. When ſufficiently dry, all the four canvaſſes are to be unnailed from the board, and the edges turned up the reverſe way, and nailed to a proper ſtretching-frame. This is done by unnailing from the board a part on each ſide at a time, and immediately nailing it to the ſtretching-frame, ſo as never to leave the canvas to crack or partially ſtretch, which would damage the picture. In this manner, by degrees, the cloths are entirely detached from the board, and firmly fixed on the ſtretching-frame. The ſuperflous canvas, left larger than the frame, may then be cut off, and the wedges put in the frame, and moderately tightened up. There remains then only to clear the ſurface of the painting from the ſecuring-canvas; which is done by repeatedly waſhing the ſurface with a ſponge and moderately warm water. In doing this, no violence or force muſt be uſed; and, by frequent and gentle waſhings, the paſte will all be worked out with the ſponge. The edges of the outer canvas are then to be cut round, and ſtripped off: the other, next the ſurface of the picture, is to be ſerved in like manner; which

which done, nothing remains but to take the paste clean off, and repair any defects: the picture will then be as strong as if painted on the canvas.

"For taking pictures off walls, without taking the walls down, or cutting away more thereof than the plastering, the following process is proposed:

"The surface of the picture is to be first secured, in the manner before described; but instead of the plain board, a bearer should be prepared with a convex surface, composed of ribs, boarded over, so as to form part of a cylinder, of not less than five feet radius, and as long as the height of the picture. This bearer being prepared, in order to apply it, a floor or platform should be erected, and placed horizontally, with its surface level, and its edge immediately in contact with the bottom of the picture meant to be transferred. The use of this platform is for the above described bearer to rest and move upon; which bearer should be set on its end, with one edge in contact with the wall, at one side of the picture; consequently the other edge will be at some distance from the wall, according to the size of the picture and convexity of the bearer. Being thus placed, the superfluous edge of the securing-canvas should be turned over, and nailed to that edge of the bearer that is next the wall: This done, the operation of cutting away the plastering should be begun; which may be done with the corner and end of a short saw; sawing between the brick-work and plastering, and leaving the thickness, or part of the thickness, of the plastering on the painting fastened to the bearer. When this edge of the picture is freed, the whole height, for nine or ten inches under the edge of the bearer that is farthest from the wall, must then be gently forced nearer; consequently the other edge, together with the painting and plaster that is freed, will leave the wall, and give an opportunity of introducing the saw behind, and cutting away the same to a certain distance farther under; and, by repeating this, the whole of the picture will at length be freed, and left on the bearer. Each time the bearer is removed, and, as it were, rolled on the vertical surface of the wall, care must be taken to turn and nail the securing canvas on the top and bottom edges of the bearer, so as to secure the freed plastering and picture from moving about; and, lastly, before the bearer and plastering be moved, to nail the other edge of the picture in the same way, which will secure the whole to the bearer. This done, the picture and bearer are at liberty to be moved to a proper place, in order to be freed from the remaining plaster. The edges may then be unnailed; the painting and canvas slipped from this bearer on to a plain board; and the new canvas may be then put on; which is to remain till dry, as in other cases.

"It may appear, that the bending of the canvas and plastering to the convex bearer will crack the plaster, and damage the painting; but, from experience (says Mr Salmon) I have observed, that, to a curve of such or even less radius, plastering will bend, without any visible crack, even on the exterior part thereof; and that part next the bearer, not having occasion, in bending, to extend its parts, will consequently be much less liable to be disturbed by such bending."

In clearing the wood from the paintings, our author never made use of aquafortis, or any other liquid; the use of which he conceives would be very tedious, and attended with danger, lest it should get through the paint, and wet or damp the paste by which the securing canvas is fixed. In working off the wood, he generally made use of such planes as by the joiners are called the *levelled rabbit-plane*, and *small rounds*. By the corners of the former, and proper handling of the latter, the wood is cleared off without force or violence: even the smallest particles may, in general, be got off; although in some paintings, and in particular parts of others, he has met with places on which he thought it best to leave some particles, or fine splinters, of wood, but nothing more. Rasps, and sometimes a fine chisel, are useful, to clear off such parts as may be in hollow places, or where particles of wood are left, as above. The time required will be various, according to the manner in which the painting was originally done; some being painted on boards previously prepared with a water colour; others immediately painted with oil on the wood. This last sort is by much the most difficult; the other is more easy, as the previous preparation prevents the wood from imbibing the oil, and consequently admits it to be more easily separated.

PAJARO, *Pajaros*, or *Paxaros*, islands on the coast of Chili, on the South Pacific Ocean. These are 3 or 4 rocks, the largest of which is called Pajaro Ninno, or Paxaro Ninno, and 2 miles N. W. by N. from the southernmost point of the Main, or Point Tortugas, that closes the port of Coquimbo.—*Morse.*

PAJAROS, LES, or *Islands of Birds*, a cluster of small islands on the coast of Chili, 8 leagues N. N. W. of the Bay of Coquimbo, and 7 S. S. E. of the harbour of Guasco. The island of Choros is 4 miles north of these islands, towards the harbour of Guasco.—*ib.*

PAKANOKIT, the seat of *Massassoit*, the famous Indian chief, was situated on Namasket river, which empties into Narraganset Bay.—*ib.*

PALATINE, or *Palentine*, a township in Montgomery county, New York, on the north side of Mohawk river, and west of Caghnawaga. In 1790, it contained 3,404 inhabitants, including 192 slaves. In 1796, 585 of the inhabitants were electors. The compact part of it stands on the bank of the Mohawk, and contains a Reformed Dutch church, and 20 or 30 houses. It is 36 miles above Shenectady.—*ib.*

PALATINE *Town*, in the state of New York, lies on the east bank of Hudson's river, and north side of the mouth of Livingston river, which empties into the former; 11 miles north of Rhynbeck, and 15 southerly of Hudson city.—*ib.*

PALILICUM, the same as Aldebaran, a fixed star of the first magnitude, in the eye of the bull, or sign Taurus.

PALLIFICATION, or PILING, in architecture, denotes the piling of the ground work, or the strengthening it with piles, or timber driven into the ground; which is practised when buildings are erected upon a moist or marshy soil.

PALLISER'S *Islands*, in the South Pacific Ocean, are between 15 and 16 degrees of S. lat. and from 146 to 147 degrees of W. long. From lat. 14 to 20 S. and long. 138 to 150 W. the ocean is strewed with low, half-overflowed islands, which renders it necessary for navigators to proceed with much caution.—*Morse.*

PALM, an ancient long measure, taken from the extent of the hand. See PALMUS, *Encycl.*

PALMA, a town of Terra Firma, in N. America, 50 miles N. W. of St Fe de Bagota. N. lat. 4 30, W. long. 73 40.—*Morse.*

PALMÆ, palms. See *Encyclopædia*. The fubject is introduced here to notice a kind of palm, the product of North America, of which we have the following account by Dr Barton.

"There grows upon the river Mobile a fpecies of palm, which is but little known to naturalifts, but which promifes to be an important article of food to man. It has no ftalk or ftem above ground. The leaves fpread regularly all round, and when fully expanded are flabelliform. In the centre of thefe leaves is produced the receptacle of the fruit, which is of the form and fize of a common fugar-loaf. This receptacle confifts of a vaft number of drupes, or berries, of the fize and fhape of common plums: each is covered with a fibrous, farinaceous, pulpy coating, of confiderable thicknefs. This fubftance is faid to refemble manna in texture, colour, and tafte; or, perhaps, it ftill more refembles moift brown fugar, with particles of loaf fugar mixed with it. It is a moft delicious and nourifhing food, and is diligently fought after in the places where it grows. Upon firft tafting it, it is fomewhat bitter and pungent."

PALMAS, a large river on the weft coaft of the Gulf of Mexico, whofe mouth is in lat. 25 N. and long. 98 36 W. Some of its branches run in a courfe almoft directly eaft from the mountains to the eaftward of the Gulf of California.—*Morse.*

PALMER, a rough and hilly townfhip in Hampfhire county, Maffachufetts, 82 miles W. by S. of Bofton. It is fituated on the fouth fide of Chickopee river, and bounded eaftward by Weftern, in Worcefter county. An act paffed in laft feffion, 1796, to incorporate a fociety to make a turnpike-road between thefe two towns. It was incorporated in 1752, and contains 809 inhabitants.—*ib.*

PALMER'S *River*, a water of Narraganfet Bay, which empties with another fmall river, and forms Warren river, oppofite the town of Warren.—*ib.*

PALMERSTON'S *Ifland*, of which one in particular has been fo named, is in lat. 18 S. and long. 162 57 W. and is the fecond in fituation from the S. E. of a group of 9 or 10, all known by the fame general name. It affords neither anchorage nor water; but if the weather is moderate, a fhip that is paffing the S. Pacific Ocean in this track, may be fupplied with grafs for cattle, cocoa-nuts, fifh, and other productions of the ifland. The principal ifland is not above a mile in circumference; nor is it elevated more than 3 feet above the furface of the fea.—*ib.*

PALMETTO, the moft eafterly point of the bay fo called, on the fouth-weft coaft of the ifland of St Chriftopher's, in the Weft Indies. The fhore is rocky, and a fort protects the bay.—Alfo the moft northerly point of the ifland of Jamaica, having Manatee Bay on the weft, and Ifland Bay on the eaft.—*ib.*

PALMISTE *Point*, on the north fide of the N. W. part of the ifland of St Domingo; three leagues fouth of Point Portugal, the eaft point of the fmall ifland La Tortue, and 5 eaft of Port de Paix.—*ib.*

PALMYRA, a town, and the only port of entry and delivery, in the ftate of Teneffee, conftituted a port of entry by law of the United States, January 31, 1797. —*ib.*

PALOMINOS, fmall iflands on the coaft of Peru, South America; 3 miles weft of St Lawrence Ifland, or St Lorenzo. They have from 13 to 18 fathoms water round them.—*ib.*

PALONQUE, the cape eaft of Nifao Point, at the mouth of Nifao river, on the fouth fide of the ifland of St Domingo, in lat. 18 13 N. and long. 73 2 W. of Paris.—*ib.*

PALTZ, *New*, a townfhip on the W. fide of Hudfon's river, in Ulfter county, New York, about 20 miles N. W. of Newburgh, and 32 north of Gofhen. It contains 2,309 inhabitants, including 302 flaves.—*ib.*

PAMBAMACCA, a lofty mountain in the province of Quito, being one of the pikes of the eaftern Cordilleras.—*ib.*

PAMLICO *Sound*, on the eaft coaft of N. Carolina, is a kind of lake or inland fea, from 10 to 20 miles broad, and nearly 100 miles in length. It is feparated from the Atlantic Ocean, in its whole length, by a beach of fand hardly a mile wide, generally covered with fmall trees or bufhes. Through this bank are feveral fmall inlets, by which boats may pafs; but Ocrecock Inlet is the only one that will admit veffels of burden into the diftricts of Edenton and Newbern. This inlet is in lat. 35 10 N. and opens between Ocrecock Ifland and Core Bank. This found communicates with Core and Albemarle Sounds; and receives Pamlico or Tar river, the river Neus, befides other fmall ftreams.—*ib.*

PAMPELUNA, a town of New Granada, in S. America. In its vicinity are gold mines. N. lat. 6 30, W. long. 71 30. It is 150 miles from Santa Fe, and 200 from Maricaibo.—*ib.*

PAMUNKY, the ancient name of York river, in Virginia; but this name is now confined to the fouthern branch, formed by the confluence of the North and South Anna. This and the northern branch, Mattapony, unite and form York river, juft below the town of De La War.—*ib.*

PANA, an ifland on the coaft of Peru, 7 leagues E. N. E. of Santa Clara, and as far from Guayaquil. At Point Arena, which is the wefternmoft point, all fhips bound farther into Guayaquil Bay ftop for pilots, as there is good anchorage over againft the middle of the town in 5 fathoms, and a foft oozy ground. It is alfo called *Puna.*—*ib.*

PANACA, a burning mountain on the W. coaft of New Mexico, about 3 leagues from the volcano of Sanfonate.—*ib.*

PANADOU, or *Menadou*, a bay on the coaft of Cape Breton Ifland, near the S. part of the Gulf of St Lawrence.—*ib.*

PANAMA is the capital of Terra Firma Proper, S. America; fituated on a capacious bay of its name, on the fouth fide of the Ifthmus of Panama, or Darien, oppofite to Porto Bello, on the N. fide of the ifthmus. It is the great receptacle of the vaft quantities of gold and filver, with other rich merchandize from all parts of Peru and Chili. Here they are lodged in ftorehoufes, till the proper feafon arrives to tranfport them to Europe. The harbour of Panama is formed in its road by the fhelter of feveral iflands, where fhips lie very fafe, at about $2\frac{1}{2}$ or 3 leagues diftant from the city. The tides are regular, and it is high water at the full and change at 3 o'clock. The water rifes and falls

falls confiderably; fo that the fhore, lying on a gentle flope, is at low water left dry to a great diftance. Pearls are found here in fuch plenty, that there are few perfons of property near Panama, who do not employ all, or at leaft part of their flaves, in this fifhery. The Negroes who fifh for pearls muft be both expert fwimmers, and capable of holding their breath a long time, the work being performed at the bottom of the fea. This city is a bifhop's fee, whofe bifhop is the primate of Terra Firma. It was built by the Spaniards, who, in 1521, conftituted it a city, with the ufual privileges. In 1670 it was taken, facked and burnt by John Morgan, an Englifh adventurer. The new town was built in a more convenient fituation, about a league and a half from the former. In 1737, this new town was almoft entirely deftroyed by an accidental fire. It is furrounded with a ftone wall and other fortifications, and the public buildings are very handfome. N. lat. 8 57 48, W. long. 82 5 14.—*ib.*

Panama, a province of Terra Firma, of which the city above-mentioned is the capital. This province is called by moft writers *Terra Firma Proper*. It contains 3 cities, 12 villages, and a great number of *rancheries* or affemblages of Indian huts; thefe are fituated in fmall plains along the fhore, the reft of the country being covered with enormous and craggy barren and uninhabited mountains. It has feveral gold mines; but the pearl fifhery affords a more certain profit, and at the fame time is acquired with much greater eafe.—*ib.*

PANAMARIBO, on the coaft of Surinam, in Guiana, in S. America, is E. S. E. of Demarara, in lat. about 6 N. and long. 56 26 W.—*ib.*

PANECILLO, an eminence near Quito, which fupplies that city with excellent water.—*ib.*

PANIS. There are two Indian nations fo named. The White Panis inhabit S. E. of the Miffouri, and can furnifh 1500 wariors; and the Speckled Panis S. of the Miffouri, 1200 warriors.—*ib.*

PANORAMA, a word derived from παν and οραμα; and therefore employed of late to denote a painting, whether in oil or water colours, which reprefents an entire view of any country, city, or other natural objects, as they appear to a perfon ftanding in any fituation, and turning quite round. To produce this effect, the painter or drawer muft fix his ftation, and delineate correctly and connectedly every object which prefents itfelf to his view as he turns round, concluding his drawing by a connection with where he began. He muft obferve the lights and fhadows, how they fall, and perfect his piece to the beft of his abilities. There muft be a circular building or framing erected, on which this drawing or painting may be performed; or the fame may be done on canvas, or other materials, and fixed or fufpended on the fame building or framing, to anfwer the purpofe complete. It muft be lighted entirely from the top, either by a glazed dome, or otherwife as the artift may think proper. There muft be an inclofure within the faid circular building or framing, which fhall prevent an obferver going too near the drawing or painting, fo as it may, from all parts it can be viewed, have its proper effect. This inclofure may reprefent a room, or platform, or any other fituation, and may be of any form thought moft convenient; but the circular form is particularly recommended. Of whatever extent this infide inclofure may be, there muft be over it (fupported from the bottom, or fufpended from the top) a fhade or roof; which, in all directions, fhould project fo far beyond this inclofure, as to prevent an obferver from feeing above the drawing or painting when looking up; and there muft be without this inclofure another interception, to reprefent a wall, paling, or other interception, as the natural objects reprefented, or fancy, may direct, fo as effectually to prevent the obferver from feeing below the bottom of the drawing or painting; by means of which interception, nothing can be seen on the outer circle but the drawing or painting intended to reprefent nature. The entrance to the inner inclofure muft be from below, a proper building or framing being erected for that purpofe, fo that no door or other interruption may difturb the circle on which the view is to be reprefented. And there fhould be, below the painting or drawing, proper ventilators fixed, fo as to render a current circulation of air through the whole; and the inner inclofure may be elevated, at the will of an artift, fo as to make obfervers, on whatever fituation he may wifh they fhould imagine themfelves, feel as if really on the very fpot.

PANSE, De La, a branch of Wabafh river, in the N. W. Territory.—*Morse.*

PANTON, a townfhip in Addifon county, Vermont, fituated on the E. fide of Lake Champlain, between Addifon and Ferrifburg, and about 87 miles N. of Bennington. It contains 220 inhabitants.—*ib.*

PANUCO, or *Guaftica*, a province of N. America, in New Spain, bounded E. by the Gulf of Mexico, and W. by the provinces of Mechoacan and New Bifcay. The tropic of Cancer divides this province. It is about 55 leagues each way. The part neareft to Mexico is much the beft and richeft, abounding with provifions, and having fome veins of gold, and mines of falt. Other parts are wretchedly poor and barren. —*ib.*

Panuco, the capital of the above-mentioned province; it is the fee of a bifhop, and ftands upon a river of its own name, 17 leagues from its mouth, on the W. fhore of the Gulf of Mexico, and 60 N. W. of the city of Mexico. The river is navigable for large fhips a great way above the city; but the harbour has fo large a bar before it, that no fhips of burden can enter it. N. lat. 23 50. W. long. 99 50.—*ib.*

PAPAGAYO, a gulf on the N. Pacific ocean, and on the W. fide of the Ifthmus of Nicaragua, a fmall diftance from the weftern parts of the lake of Nicaragua, and in lat. about 11 15 N.—*ib.*

PAPALOAPAIN, the largeft river of Guaxaca, in New Spain, called alfo Alvarada. It rifes in the mountains Zoncoliucan, and, being enlarged by the acceffion of leffer rivers, falls into the North Pacific Ocean.—*ib.*

PAPER is an article of fuch importance, and at prefent* of fo enormous a price, that no improvement in its manufacture fhould pafs unnoticed in a work of this nature. The difcovery made in France by M. Bertholet of the efficacy of oxy-muriatic acid in expediting the procefs of Bleaching (fee that article in this *Suppl.*), has contributed effentially to facilitate the manufactures, not only of cotton and linen cloths, but alfo of paper, of which it has even increafed the materials. Formerly writing paper could be made of *unprinted* linen alone; but by means of the procefs of M. Bertholet

* 1801.

Berthollet even printed linen may be made into the finest and whitest paper. In the year 1795, a patent was granted to Mr Elias Carpenter, of Bermondsay, Surrey, for a method of bleaching paper of such materials in the *water-leaf* or *sheet*, and sizing it without drying.

In the preparation of the pulp, the coarser rags are to be macerated for two or three days in a caustic alkaline ley, and wrought into sheets of paper in the usual way; a strong wooden box or trough is then to be procured, of a size proportioned to that of the paper, lined on the inside with white paint, and furnished with several stages of cross bars of glass; the bottom of the box is to be covered with a stratum about one inch deep of caustic ley, and the paper laid by quarter reams, or less, across the glass bar. A hole must be made in the box to admit the beak of an earthen-ware retort, into which must be put manganese and sea salt, in powder, sulphuric acid, and an equal quantity of water impregnated with the steams of burning sulphur (sulphureous acid). The cover of the box is to be made air-tight by luting or slips of paper dipped in paste. The apparatus being thus prepared, the belly of the retort is to be plunged in water, kept boiling, and in a short time the oxy-muriatic gas will be driven into the box, will penetrate the paper, and render it of a dazzling whiteness, while the alkaline ley at the bottom will, by gradually absorbing it, prevent its becoming so concentrated as to destroy or injure the texture of the paper. From three to four pounds of sulphuric acid will suffice for one hundred weight of paper, and the operation will be completed in about eight hours. The sheets as they are taken out of the box are to be sized with the following mixture:

To 1 cwt. of clippings of skin add 14 lb. of alum, 7 of calcined vitriol, and 1 lb. of gum arabic, with a sufficient quantity of water to size 50 reams of fools-cap.

The same method will serve equally well to clean engravings or printing; for though the oxy-muriatic acid discharges all stains, dirt, &c. yet it is incapable of acting on printers ink.

This, however, is not the only improvement in the manufacture of paper derived from modern chemistry. In Crell's *Chemical Annals* for the year 1797, we have an account of some curious experiments made by M. L. Brugnatelli, with the view of rendering

PAPER incombustible, and the writing on it, of course, indestructible by fire. Of all the substances which he tried, he found the liquor of flints the most proper to secure paper from destruction by fire. He dipped a sheet of paper several times in the above liquor fresh made, or daubed it several times over the whole paper with a hair brush, and dried it in the sun or in an oven. Paper prepared in this manner lost some of its softness, became a little rougher than before, and acquired a lixivious caustic taste. In other respects it was not different from common white paper. When this paper was laid upon glowing coals, it did not burn like common paper, but became red, and was converted to a coal, which however did not fall into ashes like the coal of common paper, so that it might therefore be considered as petrified paper. This coal, however, is exceedingly friable; for when it is taken between the fingers, or pressed together in any manner whatever, it drops to pieces. Still the discovery must be a valuable one, if there be any kind of ink of such a nature as that the characters written with it continue visible on this coal. Such an ink M. Brugnatelli made by combining dissolved nitre of zinc with common ink; and found, that the colour of this mixture, though it appeared somewhat pale on common paper, became so dark on prepared paper, that words written with it appeared more conspicuous than words written with common ink. When the paper was burnt, or reduced to a coal, those characters were so visible, in a clear *white* colour on a *dark* ground, that they could be read with as much ease as characters written with the best ink on white paper. If the ingenious author succeed in his attempts to discover a method of rendering his prepared paper less friable when burnt, his discovery will be one of the most important of the present age.

PAPINACHOIS, a bay on the north shore of the river St Lawrence, in N. America, 5 leagues south-west of St Margaret's river. An Indian nation of the same name inhabit the country south of Piretibbe Lake in Lower Canada.—*Morse.*

PAPPA FORD, on Peleson or Clinch river, lies 12 miles from Emery's river, and 10 from Campbell's Station, near Holston.—*ib.*

PAPUDA, on the coast of Chili, and on the S. Pacific Ocean, 5 leagues north of the shoals of Quintero, and 4 from Port Liga The water is very deep in Papuda, but the anchorage is good, and the entrance safe.—*ib.*

PARA, the most northern of 5 colonies or governments, Para, Maragnon, Matto-Grosso, Goyas, and St Paul, in S. America, at which places the Indians have been united in 117 villages, over which a white man presides with despotic sway. The government of Para comprehends that portion of Guiana which belongs to the Portuguese, the most barren and unwholsome country in all these regions.—*ib.*

PARA *Island* is one of the range of islands to the south-east of Sypomba, to the eastward of the great river Amazon, which is the north-west limit of the Brazil coast in S. America. These islands form the great river or bay of Para. About 9 leagues east by south of this island is Cape Cuma, the western boundary of the great gulf of Maranhao. On the island is a fort belonging to the Portuguese. There is also a small river of the same name, at the mouth of which is good riding for large ships, because the island breaks off the sea, and two high points secure it from the north and east winds.—*ib.*

PARA *River* or *Bay*, near the N. W. part of the coast of Brazil, in S. America, has a town of its name at the mouth of it, with a large fort and a platform of cannon at the water's edge, commanding the road. Above this is the castle seated on a high rock, surrounded by a strong stone wall that is also mounted with cannon. The road, within the mouth of the river, is good, having clean ground, and secured by high land on both sides. The mouth of the river is about 6 miles broad at the town; and ships may ride in 15 fathoms, within a cable's length of the shore, and in 10 fathoms close under the fort. This harbour is much frequented for all kinds of provisions which abound here. Tobacco is carried from this to Pernambuco, to be shipped for Europe. The river is about 200 miles long.—*ib.*

PARABOLIC CONOID is a solid generated by the rotation

rotation of a parabola about its axis. This ſolid is equal to half its circumſcribed cylinder; and therefore if the baſe be multiplied by the height, half the product will be the ſolid content.

Parabolic Pyramidoid, is a ſolid figure, thus named by Dr Wallis from its geneſis or formation, which is thus: Let all the ſquares of the ordinates of a parabola be conceived to be ſo placed, that the axis ſhall paſs perpendicularly through all their centres; then the aggregate of all theſe planes will form the parabolic pyramidoid. This figure is equal to half its circumſcribed parallelopipedon. And therefore the ſolid content is found by multiplying the baſe by the altitude, and taking half the product; or the one of theſe by half the other.

Parabolic Space, is the ſpace or area included by the curve line and baſe or double ordinate of the parabola.

Parabolic Spindle, is a ſolid figure conceived to be formed by the rotation of a parabola about its baſe or double ordinate.

Parabolic Spiral, is a curve ariſing from the ſuppoſition that the common or Apollonian parabola is bent or twiſted till the axis come into the periphery of a circle, the ordinates ſtill retaining their places and perpendicular poſitions with reſpect to the circle, all theſe lines ſtill remaining in the ſame place. This figure is ſometimes called the *Helicoid parabola*.

PARABOLOIDES, parabolas of the higher orders. The equation for all curves of this kind being $a^{m-n} x^n = y^m$, the proportion of the area of any one to the complement of it to the circumſcribing parallelogram, will be as *m* to *n*.

PARACENTRIC Motion, denotes the ſpace by which a revolving planet approaches nearer to, or recedes farther from, the ſun, or centre of attraction.

Paracentric Solicitation of Gravity, is the ſame as the vis centripeta.

PARACA, a bay on the coaſt of Peru, 40 leagues S. E. by S. of the port of Callao. Ships receive ſhelter here, when driven out of the harbour of Cangallan or Sangallan, which is 3 leagues S. E. of Carette Iſland, and N. N. W. of the iſland of Lobos.—*Morse*.

PARACHUTE, a kind of large and ſtrong umbrella, contrived to break a perſon's fall from an air-balloon, ſhould any accident happen to the balloon at a high elevation. This contrivance was firſt thought of by Blanchard, who, at different times, by means of the parachute, let fall from his balloon dogs and other animals. He ventured even to deſcend in this manner himſelf; but, whether from the bad conſtruction of his parachute, or from falling among trees, he had the miſfortune to break one of his legs. Citizen Garnerin, as he chooſes to be called, was more ſucceſsful. On the 21ſt of October, 1797, he aſcended from the garden de Mauſſeux at half paſt five in the evening; between the balloon and the car, in which he ſat, was placed the parachute, half opened, and forming a kind of tent over the aërial traveller; and when the whole apparatus was at a conſiderable height, he ſeparated the parachute and car from the balloon. The parachute unfolding itſelf, was, by his weight and that of the car, drawn of courſe towards the earth. Its fall was at firſt ſlow and vertical; but ſoon afterwards it exhibited a kind of balancing or vibration, and a rotation gradually increaſing, which might be compared with that of a leaf falling from a tree. The aëronaut, however, reached the ground unhurt.

This parachute was of cloth, and its diameter, when unfolded, about twenty-five feet. To uſe ſuch inſtruments with ſucceſs, it is neceſſary that the car be ſuſpended at a conſiderable diſtance from the parachute, ſo as that the centre of gravity of the whole ſhall be vertically below the centre of reſiſtance made by the air to the deſcent of the parachute; for if the car be otherwiſe placed, it is evident that the parachute will incline to one ſide, deſcend obliquely, oſcillate, and the ſmalleſt irregularity in its figure will cauſe it to turn round its vertical axis.

PARADISE, a townſhip of Pennſylvania, in York county.—*Morse*.

PARAGUATAN, a kind of wood which grows in Guiana, and promiſes to be of great utility as a dye ſtuff. We have ſeen no botanical deſcription of the tree; but from the report made to the council of trade and mines, by D. Dominique Garcia Fernandez, inſpector of coinage, we learn that its bark, boiled in water, affords a coloured extract which reſiſts the agency of acids for a longer time than brazil or logwood; that the colour may be revived by means of alkalies, after it has been deſtroyed by combination with acids; that vinegar, lemon-juice and tartar, render this colour more brilliant, while they entirely deſtroy the colours of brazil and logwood; that the fecula of the bark of paraguatan fixes and attaches itſelf to wool, cotton, and ſilk; and that the colour is brighter on ſilk than on wool, and brighter on wool than on cotton. The ſame fecula dried is afterwards ſoluble in alcohol, to which it communicates a tinge ſimilar to that afforded by cochineal; but it muſt be confeſſed, that the colour obtained from paraguatan has not the force of that of cochineal, though it is ſuperior to thoſe of madder, brazil wood, and logwood. From theſe facts D. Fernandez conſiders the paraguatan as one of the moſt valuable productions which America furniſhes to Spain.

PARAGUAY, a large river of S. America, which falls into the river La Plata that forms the ſouthern boundary of Brazil. At the diſtance of 100 leagues from the ſea, where this and Parana river fall into the channel, it is at leaſt 10 leagues over.—*Morse*.

PARAIBA, or *Parayba*, the moſt northern province of Brazil, in S. America, lying between Rio Grande to the north, and the river Tamarack to the ſouth, the South Atlantic Ocean to the eaſt, and Figuares to the weſt. It belongs to the Portugueſe, and abounds in ſugar-canes, Brazil-wood, cattle, tobacco, cotton, &c. This diſtrict was given by John III. of Portugal, to the hiſtorian De Barros, but he neglected the peopling of it. Some vagabonds went over in 1560, and in 1591 were ſubdued by the French, who were ſoon obliged to evacuate it. Philip III. cauſed a city to be built upon this royal domain, which is at preſent known by the name of *Notre Dame de Neves*.—*ib*.

Paraiba, the metropolis of the above province, or captainſhip, ſituated on the ſouth bank of a river of its name, three leagues from the ſea; according to others, 10 leagues; the river being navigable for ſhips loaded with 600 or 700 hhds. of ſugar, a conſiderable diſtance above the city. The Dutch captured it in 1635; but the Portugueſe retook it ſoon after. It has many ſtately houses decorated with marble pillars, together with large warehouses and magazines belonging to the merchants. The mouth of the river is well fortified. S. lat. 6 50, W. long. 49 53.—*ib.*

PARALLAX (see *Encycl.*) is used, not only in astronomy, but also in levelling, for the angle contained between the line of true level and that of apparent level. And, in other branches of science, for the difference between the true and apparent places.

PARALLEL RULER, is a mathematical instrument, consisting of two equal rulers, either of wood or metal, connected together by two slender cross bars or blades of equal length, moveable about the points of junction with the rulers. There are other forms of the instrument; some, for instance, having the two blades crossing in the middle, and fixed only at one end of them, the other two ends sliding in grooves along the two rulers, &c.

The use of this instrument is obvious. For the edge of one of the rulers being applied to any line, the other opened to any extent will be always parallel to the former; and consequently any parallels to this may be drawn by the edge of the ruler, opened to any extent.

PARALLELS, or PLACES OF ARMS, in a siege, are deep trenches, 15 or 18 feet wide, joining the several attacks together; and serving to place the guard of the trenches in, to be at hand to support the workmen when attacked. There are usually three in an attack: the first is about 600 yards from the covert-way, the second between 3 and 400, and the third near or on the glacis. It is said they were first invented or used by Vauban.

PARALLELISM OF THE EARTH'S AXIS, is that invariable situation of the axis, in the progress of the earth thro' the annual orbit, by which it always keeps parallel to itself; so that if a line be drawn parallel to its axis, while in any one position, the axis, in all other positions or parts of the orbit, will always be parallel to the same line.

PARAMETER, a certain constant right line in each of the three conic sections; otherwise called also *latus rectum.*

PARAMARIBO, the capital of the Dutch settlement at Surinam, is situated on the right side of the beautiful river Surinam, at about 16 or 18 miles distance from its mouth. It is built upon a kind of gravelly rock, which is level with the rest of the country, in the form of an oblong square; its length is about a mile and a half, and its breadth about half as much. All the streets, which are perfectly straight, are lined with orange, shaddock, tamarind, and lemon trees, which appear in everlasting bloom; while, at the same time, their branches are weighed down with the richest clusters of odoriferous fruit. Neither stone nor brick is made use of here for pavement; the whole being one continued gravel, not inferior to the finest garden walks in England, and strewed on the surface with sea shells. The houses, which are mostly of two and some of three stories high, are all built of fine timber, a very few excepted; most of the foundations are of brick, and they are roofed with thin split boards, called *shingles*, instead of slates or tiles. Windows are very seldom seen in this country, glass being inconvenient on account of the heat; instead of which they use gauze frames: some have only the shutters, which are kept open from six o'clock in the morning until six at night. As for chimneys, there are none in the colony; no fires being lighted except in the kitchens, which are always built at some distance from the dwelling-house, where the victuals are dressed upon the floor, and the smoke let out by a hole made in the roof: these timber houses are, however, very dear in Surinam, one of them having cost above £15,000 sterling. There is no spring water to be met with in Paramaribo; most houses have wells dug in the rock, which afford but a brackish kind of beverage, only used for the negroes, cattle, &c. and the Europeans have reservoirs or cisterns, in which they preserve rain-water for their own consumption; those of nicer taste let it first drop through a filtering stone into large jars or earthen pots, made by the native Indians on purpose, which they barter at Paramaribo for other commodities. The inhabitants of this country, of every denomination, sleep in hammocks, the negro slaves excepted, who mostly lie on the ground: the hammocks used by those in superior stations are made of cotton, ornamented with rich fringe; these are also made by the Indians, and sometimes worth above twenty guineas; neither bedding nor covering is necessary, except an awning to keep off the musquitoes. Some people indeed lie on bedsteads; in that case they are surrounded, instead of curtains, with gauze pavilions, which admit the air freely, and at the same time keep off the smallest insect. The houses in general at Paramaribo are elegantly furnished with paintings, gilding, crystal chandeliers, china jars, &c.; the rooms are never papered or plastered, but beautifully wainscotted with cedar, and Brazil, and mahogany wood.

The number of buildings in Paramaribo is computed at about 1400, of which the principal is the governor's palace, whence there is a private passage through the garden which communicates with Fort Zelandia. This house, and that of the commandant, which has lately been burnt, were the only brick buildings in the colony. The town-hall is an elegant new building, and covered with tiles; here the different courts are held, and underneath are the prisons for European delinquents, the military excepted, who are confined in the citadel of Fort Zelandia. The Protestant church, where divine worship is performed both in French and Low Dutch, has a small spire with a clock; besides which there is a Lutheran chapel, and two elegant Jewish synagogues, one German the other Portuguese. Here is also a large hospital for the garrison, and this mansion is never empty. The military stores are kept in the fortress, where the society soldiers are also lodged in barracks, with proper apartments for some officers. The town of Paramaribo has a noble road for shipping, the river before the town being above a mile in breadth, and containing sometimes above 100 vessels of burden, moored within pistol-shot of the shore. Before Holland became a province of France, and thereby lost her trade, there were seldom fewer than 80 ships at Paramaribo, loading coffee, sugar, cocao, cotton and indigo, for the mother country, including also the Guinea-men that bring slaves from Africa, and the North American and Leeward Island vessels, which bring flour, beef, pork, spirits, herrings, and mackarel salted, spermaceti candles, horses, and lumber; for which they receive chiefly molasses to be distilled into rum. This town

Paramaribo.

town is not fortified, but is bounded by the river on the south-east; by a large savannah on the west; by an impenetrable wood on the north east; and is protected by Fort Zelandia on the east. This citadel is only separated from the town by a large esplanade, where the troops parade occasionally. The fort is a regular pentagon, with one gate fronting Paramaribo, and two bastions which command the river; it is very small but strong, being made of rock or hewn stone, surrounded by a broad fosse well supplied with water, besides some outworks. On the east side, fronting the river, is a battery of 21 pieces of cannon. On one of the bastions is a bell, which is struck with a hammer by the centinel, who is directed by an hour-glass. On the other is planted a large ensign-staff, upon which a flag is hoisted upon the approach of ships of war, or on public rejoicing days. The walls are six feet thick, with embrasures, but no parapet.

Paramaribo is a very lively place, the streets being generally crowded with planters, sailors, soldiers, Jews, Indians, and Negroes, while the river is covered with canoes, barges, &c. constantly passing and repassing like the wherries on the Thames, often accompanied with bands of music; the shipping also in the road adorned with their different flags, guns firing, &c. not to mention the many groupes of boys and girls playing in the water, altogether form a pleasing appearance; and such gaiety and variety of objects serve, in some measure, to compensate for the many inconveniencies of the climate. Their carriages and dress are truly magnificent; silk embroidery, Genoa velvets, diamonds, gold and silver lace, being daily worn, and even the masters of trading ships appear with buttons and buckles of solid gold. They are equally expensive at their tables, where every thing that can be called delicate is produced at any price, and served up in plate and china of the newest fashion, and most exquisite workmanship. But nothing displays the luxury of the inhabitants of Surinam more than the number of slaves by whom they are attended, often twenty or thirty in one family. White servants are seldom to be met with in this colony.

The current money are stamped cards of different value, from five shillings to fifty pounds: gold and silver is so scarce, that the exchange premium for specie is often above 10 *per cent*. A base Dantzic coin called a *bit*, value something less than sixpence, is also current in Surinam. English and Portuguese coin are sometimes met with, but mostly used as ornaments by the Mulatto, Samboe, Quaderoon, and Negro girls. The Negro slaves never receive any paper money; for as they cannot read, they do not understand its value; besides, in their hands it would be liable to many accidents, from fire or children, and particularly from the rats, when it becomes a little greasy.

This town is well supplied with provisions, *viz.* butchers meat, fowls, fish, and venison. Vegetables in particular the country abounds with; besides the luxuries peculiar to this climate, they import whatever Europe, Africa, and Asia can afford. Provisions, however, are excessively dear in general, especially those imported, which are mostly sold by the Jews and masters of ships. The first enjoy extraordinary privileges in this colony; the latter erect temporary warehouses for the purpose of trade, during the time their ships are loading with the productions of the climate. Wheat flour is sold from four-pence to one shilling per pound; butter, two shillings; butcher's meat never under one shilling, and often at one shilling and six pence; ducks and fowls from three to four shillings a couple. A single turkey has sometimes cost one guinea and a half; eggs are sold at the rate of five, and European potatoes twelve, for sixpence. Wine three shillings a bottle Jamaica rum a crown a gallon. Fish and vegetables are cheap, and fruit almost for nothing.

Parana, || Paris.

PARATEE, a bay on the south-west side of the island of Jamaica. It is south-east of Banister Bay, its south-east point is also called *Paratee.—Morse.*

PARAYBA, a river on the coast of Brazil, 10 leagues N. of Port Franceze. The city lies 8 leagues from its mouth. S. lat. 6 50, W. long. 49 53.—*ib.*

PARDUBA, a bay on the coast of Brazil, 10 leagues W. N. W. of Brandihi Bay.—*ib.*

PARHAM *Town* and *Harbour*, on the north side of the island of Antigua, in the West-Indies. The harbour is defended by Byram Fort, at Barnacle Point, on the west side, and farther up by another fort on the E. side. The town is regularly built, and lies at the head of the harbour, and in St Peter's parish.—*ib.*

PARIA, or *New Andalusia*, a country of S. America, and in Terra Firma, bounded on the north by the north sea, and south by Guiana. The sea coast is mostly inhabited, on which there are several towns.—*ib.*

Paria, a jurisdiction in the archbishoprick of La Plata, in S. America, beginning 70 leagues N. W. of that city, and extending about 40 leagues. It has some silver mines; and the cheese made here is much esteemed, and sent all over Peru.—*ib.*

Paria, *Gulf of*, a strait lying between the N. W. part of New-Andalusia, and the southern shore of the island of Trinidad. N. lat. 9 12, W. long. 62 5.—*ib.*

PARINA, a point N. W. of the harbour of Payta, on the coast of Peru. The country within the point is high and mountainous. Between Payta and it, is a large bay, having shoals. The land is low, and some white hills all the way.—*ib.*

PARINA-COCAS, a jurisdiction in the diocese of Guamanga, in the audience of Lima, beginning about 20 leagues south of the city of Guamanga, and extending above 25 leagues. It has excellent pastures, grain, and fruits. The mines of silver and gold are more productive than formerly; and these form the chief branch of its commerce.—*ib.*

PARIS (Francis), a man more famous after his death than during his life, by the miracles which were said to be performed at his tomb. He is generally known by the name of Abbé Paris; and his pretended miracles, with others of like manufacture, have furnished deistical writers, and Mr Hume in particular, with a kind of argument against the reality of the miracles of which we have an account in the Gospel. It is merely that we may state his pretensions fairly, that we have introduced him to the notice of our readers; for in every other respect he is wholly unworthy of their regard. He was the son of a counsellor in Parliament, and had the prospect, if he had chosen it, of succeeding to his father's appointment; but he chose rather to become an ecclesiastic, and he became a very zealous one. He gave up all his possessions to his brother, refused preferment intended for him by the cardinal de Noailles, devoted himself entirely to retirement, and made stockings for his own support, and for the assistance of the poor. He died, perhaps in consequence of his rigorous mode of life, May 1, 1727, at the age of only 37. His brother raised a monument to him in the small churchyard of St Medard, to which the poor and the pious soon began to flock; and after a time it was reported, that, in consequence of their prayers at that tomb, some sick persons had received cures. As Paris had been a rigorous Jansenist, this was a fine opportunity for that sect to gain credit to their cause; the miracles were therefore multiplied, and a variety of persons affected the most singular convulsions.

The minds of the people becoming inflamed by these extravagancies, the court found it necessary to shut up the churchyard, which was done on the 27th of January 1732. On this occasion, some profane wit wrote upon the wall of the place,

> De par le Roy, defense a Dieu,
> De faire miracles en ce lieu.

The convulsions were continued, for a little while, in private houses, but by degrees the matter subsided, and the Abbé Paris was forgotten.

The distinction between miracles exhibited to serve a party, and attested only by those who are zealous in its support, and miracles performed in the sight of unbelievers, who, in spite of their deep-rooted prejudices, were converted by them, is too striking to be overlooked by any, but those who are desirous of drawing a false and impious parallel; yet has Mr Hume dared to represent the miracles performed at the tomb of this saint as outvying in number, nature, and evidence, the miracles of Christ and his apostles—with what truth, the following observations will shew:

1st, It was often objected by the enemies of the saint, and the objection was never confuted by his friends, that the *prostrations* at his sepulchre, like animal magnetism more lately, *produced* more diseases than they *cured*. Such, surely, was not the nature of our Saviour's miracles.

2dly, Though the crowds of sick and infirm persons who flocked to the tomb for relief were, by all accounts, innumerable; yet all the cures, of which the zealous historian of the Miracles could procure vouchers, amounted only to NINE! Now, were thousands, and ten thousands of diseased persons to apply to some circumforaneous quack, in full assurance of his extraordinary abilities and skill in physic, could it surprise any person, if the distempers of *eight* or *nine* of them should take a favourable turn while they were under a course of his useless medicines?

3dly, We do not read that of those nine who were cured by the dead Abbé, the greater part were Jesuits and enemies to the Jansenists; whereas the greater part of our Saviour's miracles were performed upon unconverted Jews, and one of them upon the servant of the high priest, who was thirsting for his blood.

4thly, The cures reported to have been performed at the grave of Paris were all such as might have been accomplished by natural means. Thus, a Spaniard who had lost one eye, and was distressed with an inflammation in the other, hath the inflamed eye gradually cured, but not the lost eye restored. Another person having pricked his eye with an awl, lost the sight of it in consequence of the aqueous humour dropping out; but his sight was restored *whilst* he was paying his devotions to the Abbé—and so it would have been while he was cursing the Abbé, had he continued his execrations for a sufficient length of time.

5thly, None of the cures said to have been performed were *instantaneous*. *All* the worshippers at the tomb persisted for *days*, several of them for *weeks*, and some for *months*, daily imploring the intercession of the Abbé *before* they received relief from their complaints.

6thly, Most of the devotees had been using *medicines* before they applied to the saint, and continued to use them *during the whole time* of their application; whilst it is confessed that the distempers of others had *abated* before they determined to solicit his help.

7thly, Some of the cures attested were *incomplete*, and only of a temporary duration. Thus, the Spaniard was relieved only from the most inconsiderable part of his complaint, and that too but for a very short period; for soon after his return home he relapsed into his former malady, as was fully attested by certificates and letters from Madrid. All this has been completely proved by the Archbishop of Sens; who in his *Pastoral Instruction*, published at the time the miracles were making a noise, has,

8thly, Clearly detected the deceit and little artifices by which those pretended miracles were so long supported. To that work we refer our readers; requesting them, after they have read it, to compare the evidence for the miracles of Paris with the evidence which in the article MIRACLE (*Encycl.*) we have stated for the reality of the Gospel miracles, and to judge for themselves with the impartiality of philosophers.

Paris wrote a few very indifferent books of annotations on the Epistles to the Romans, to the Galatians, and the Hebrews; but few have ever read them, nor would they have rescued the author from oblivion, without the aid of his lying wonders.

PARIS, a thriving township of excellent land in New-York state, Herkemer county. It is south-west of Whitestown 6 miles, from which it was taken, and incorporated in 1792. In 1795, 4 townships were taken from it, viz. Hamilton, Sherburne, Brookfield, and Sangersfield. It contained, by the state census of 1796, 3.459 inhabitants, of whom 564 were electors. Iron ore is found in the vicinity of Paris. Hamilton academy is situated in this town, in Clinton parish, where also a Congregational church has lately been erected, and marks of rapid progress in improvements and wealth are visible.—*Morse.*

PARKER's *Island*, in Lincoln county, District of Maine, is formed by the waters of Kennebeck river on the west, by the sea on the south, by Jeremysquam Bay on the east, and by a small strait, which divides it from Arrowsick Island, on the north. It derives its name from John Parker, who purchased it of the natives in 1650; and a part of it still remains to his posterity. It is in the township of *Georgetown.*—*ib.*

PARKER's *River* takes its rise in Rowley, in Essex county, Massachusetts, and, after a course of a few miles passes into the sound which separates Plumb-Island from the main land. It is navigable about two miles from its mouth, where a bridge crosses it 870 feet long and 26 feet wide, consisting of solid piers and 8 wooden arches.

Parkhurst. arches. It is on the post-road from Boston eastward, and was built in 1758. It is supported by a toll.—*ib.*

PARKHURST (the Rev. John), was the second son of John Parkhurst, Esq; of Catesby in Northamptonshire. His mother was Ricarda Dormer, daughter of Judge Dormer. He was born in June 1728, was educated at the school of Rugby in Warwickshire, and was afterwards of Clare-hall, Cambridge; B. A. 1748, M. A. 1752; and many years fellow of his college.

Being a younger brother, he was intended for the church; but not long after his entering into holy orders his elder brother died. This event made him the heir of a very considerable estate; though, as his father was still living, it was some time before he came into the full possession of it; and when he did come into the possession of it, the acquisition of fortune produced no change on his manners or his pursuits. He continued to cultivate the studies becoming a clergyman; and from his family connections, as well as from his learning and piety, he certainly had a good right to look forward to preferment in his profession; but betaking himself to retirement, and to a life of close and intense study, he sought for no preferment; and, according to the author of the biographical sketch of him published in the Gentleman's Magazine, he lived not in an age when merit was urged forward. Yet, in the capacity of a curate, but without any salary, he long did the duty, with exemplary diligence and zeal, in his own chapel at Catesby, which, after the demolition of the church of the nunnery there, served as a parish church, of which also he was the patron.

When, several years after, it fell to his lot to exercise the right of presentation, he was so unfashionable as to consider church patronage as a trust rather than a property; and, accordingly, resisting the influence of interest, favour, and affection, presented to the vicarage of Epsom, in Surrey, the Rev. Jonathan Boucher, who still holds it. This gentleman was then known to him only by character; but having distinguished himself in America, during the revolution, for his loyalty, and by teaching the unsophisticated doctrines of the church of England to the people of America at the peril of his life, Mr Parkhurst thought, and justly thought, that he could not present to the vacant living a man who had given better proofs of his having a due sense of the duties of his office.

In the year 1754, Mr Parkhurst married Susanna Myster, daughter, and, we believe, heiress of John Myster, Esq; of Epsom. It was thus that he became patron of the living which he bestowed on Mr Boucher. This lady died in 1759, leaving him a daughter and two sons; both the sons are now dead. In the year 1761, he married again Millicent Northey, daughter of Thomas Northey, Esq; by whom he had one daughter, now married to the Rev. Joseph Thomas.

In the year 1753, he began his career of authorship, by publishing, in 8vo, "A friendly Address to the Rev. Mr John Wesley, in relation to a principal Doctrine maintained by him and his assistants." This work we have not seen; but though we have no doubt of its value, we may safely say that it was of very little importance, when compared with his next publication, which was "An Hebrew and English Lexicon, without Points; to which is added, a methodical Hebrew Grammar, without Points, adapted to the use of Learners, 1762," 4to. To attempt a vindication of all the etymological and philosophical disquisitions which are scattered through this dictionary, would be very fruitless; but it is not perhaps too much to say, that we have nothing of the kind equal to it in the English language. He continued, however, to correct and improve it; and in 1778 another edition of it came out much enlarged, and a third in 1792.

His philological studies were not confined to the Hebrew language; for he published a Greek and English Lexicon to the New Testament; to which is prefixed, a plain and easy Greek Grammar, 1769, 4to; a second edition, 1794: and at his death there was in the press a new edition of both these lexicons, in a large 8vo, with his last corrections; for he continued to revise, correct, add to, and improve, these works, till within a few weeks of his death. As, from their nature, there cannot be supposed to be any thing in dictionaries that is particularly attractive and alluring, this continued increasing demand for these two seems to be a sufficient proof of their merit.

He published, "The Divinity and Pre-existence of our Lord and Saviour Jesus Christ, demonstrated from Scripture; in answer to the first Section of Dr Priestley's Introduction to the History of Early Opinions concerning Jesus Christ; together with Strictures on some other Parts of the Work, and a Postscript relating to a late Publication of Mr Gilbert Wakefield, 1787," 8vo. This work was very generally regarded as completely performing all that its title-page promised; and accordingly the whole edition was soon sold off. The brief, evasive, and very unsatisfactory notice taken of this able pamphlet by Dr Priestley, in "A Letter to Dr Horne," &c. shewed only that he was unable to answer it.

Mr Parkhurst was a man of very extraordinary independency of mind and firmness of principle. In early life, along with many other men of distinguished learning, it was also objected to him, that he was an Hutchinsonian; and on this account alone, in common with them, it has been said that he was neglected and shunned.

There is not, in the history of the times, says the biographer already quoted, a circumstance more difficult to be accounted for than the unmerited, but increasing, discountenance shewn to those persons to whom Hutchinsonianism was then objected. Methodists, Papists, and sectaries of any and of every name, all stood a better chance of being noticed and esteemed than Hutchinsonians. Had it even been proved that the few peculiar tenets by which they were distinguished from other Christians were erroneous, the opposition they experienced might have been deemed *hard measure*, because even their opponents allowed their principles to be inoffensive, and themselves to be learned.

Is this a fair state of the case? We think not. The early Hutchinsonians had imbibed all the peculiar notions of their master, and maintained them with a degree of acrimony which would have disgraced any cause. Being in general very little acquainted with the higher mathematics, as Mr Hutchinson himself seems likewise to have been, they censured dogmatically works which, without that knowledge, they could not fully understand; whilst they maintained, with equal

dogmatism,

Parkhurst. dogmatism, as matters of fact, hypotheses, which a moderate share of mathematical science would have shewn them to be impossible. Had they stopt here, no harm would have been done; they might have enjoyed their favourite notions in peace: but unfortunately they accused of Atheism, Deism, or Socinianism, all who thought not exactly as *they* thought, both in natural philosophy, and in theology. Because Newton and Clarke had demonstrated that the motions of the planets cannot be the effect of the impulsion of any material fluid, Hutchinson, with some of his followers, affirmed, that these two illustrious men had entered into a serious design to overturn the Christian religion, and establish in England the worship of the Heathen Jupiter, or the Stoical *anima mundi*. Because the Bishops Pearson, Bull, and others, who had uniformly been considered as the ablest defenders of the Catholic faith, thought not exactly as Hutchinson thought of the filiation of the Son of God, they were condemned by the pupils of his school as *Arians*, or at least *Semi-arians*, and the writer of this sketch has heard a living Hutchinsonian pronounce the same censure, and for the same reason, on the present illustrious Bishop of Rochester, and the no less illustrious Whitaker.

That men, who thus condemned all that before them had been deemed great and good in physical science and Christian theology, should meet with some discountenance while they continued of such a spirit, needs not surely excite much wonder; but that the discountenance is increasing, we believe not be true. The Hutchinsonians, as soon as they became less violent against those who differed from them, had their share of preferment, in proportion to their number, with others; and we doubt not they will continue to have it, while they allow that a man may be no heretic, though he believe not Mr Hutchinson to have been infallible. The late excellent Bishop Horne was an avowed Hutchinsonian, though not an outrageous one like Julius Bate; and we have been told, and have reason to believe, that the Bishop of St Asaph is likewise a moderate favourer of the same system. There may be others on the episcopal bench; but perhaps two out of twenty-six is the full proportion of Hutchinsonian divines of eminence in England. It is true that Mr Parkhurst was a man of great learning and great worth; but before we attribute his want of preferment in the church to his Hutchinsoniasm, it is incumbent upon us to say why Mr Whitaker, who is no Hutchinsonian, is still nothing more than the rector of Ruan-Lanyhorne.

Mr Parkhurst, however, was not, if his biographer deserves credit, a thorough-paced Hutchinsonian; for though he continued to read Hutchinson's writings as long as he read at all, he was ever ready to allow, that he was oftentimes a confused and bad writer, and sometimes unbecomingly violent. To have been deterred from reading the works of an author, who, with all his faults, certainly throws out many useful hints, for fear of being thought a Hutchinsonian, would have betrayed a pusillanimity of which Mr Parkhurst was incapable. What he believed he was not afraid to profess; and never professed to believe any thing which he did not very sincerely believe. An earnest lover of truth, he sought it where only it is to be found—in the Scriptures (A). The study of these was at once the business and the pleasure of his life; from his earliest to his latest years, he was an hard student; and had the daily occupations of every 24 hours of his life been portioned out, as it is said those of king Alfred were, into three equal parts, there is reason to believe that a deficiency would rarely have been found in the eight hours allotted to study. What the fruits have been of a life so conducted, few theologians, it is presumed, need to be informed, it being hardly within the scope of a supposition, that any man will now sit down to the study of the Scriptures without availing himself of the assistance to be obtained from his learned labours. These labours ceased at Epsom in Surry, where this great and good man died, on March the 21st, 1797. Besides the works which we have mentioned, there is in the Gentleman's Magazine, for August 1797, a curious letter of his on the Confusion of Tongues at Babel.

Mr Parkhurst's character may be collected with tolerable accuracy even from this imperfect sketch of his life. His notions of church patronage do him honour; and as a farther instance of the high sense he entertained of strict justice, and the steady resolution with which he practised it on all occasions, an incident which occurred between him and one of his tenants, within these ten years, may here be mentioned. This man falling behind hand in the payment of his rent, which was L 500 *per annum*, it was represented to his landlord that it was owing to his being over rented. This being believed to be the case, a new valuation was made; and it was then agreed that, for the future, the rent should not be more than L.450. Justly inferring, moreover, that if the farm was *then* too dear, it must necessarily have been *always* too dear, unasked, and of his own accord, he immediately struck off L.50 from the commencement of the lease; and instantly refunded all that he had received more than L.450 *per annum*.

Mr Parkhurst was in his person rather below the middle size, but remarkably upright, and firm in his gait. He was all his life of a sickly habit: and his leading so remarkably studious and sedentary a life (it having, for many years, been his constant practice to rise at five, and, in winter, to light his own fire) to the very verge of David's limits of the life of man, is a consolatory proof to men of similar habits, how much, under many disadvantages, may still be effected by strict temperance and a careful regimen. He also gave less of his time to the ordinary interruptions of life than is common. In an hospitable, friendly, and pleasant neighbourhood, he visited little; alleging, that such a course of life neither suited his temper, his health, nor his studies. Yet he was of sociable manners; and his conversation always instructive, often delightful: for his

(A) This is vague language, which is the source of much useless controversy, and therefore ought to be avoided. If by *truth*, in this passage, be meant *religious* truth, we admit the assertion in the only sense in which we think it can have been made. If the author means *all* truth, he writes nonsense; for the Scriptures treat not of *geometry* or *algebra*, where truth is certainly to be found; and *we think* that they have a higher object than even *mechanics* and *astronomy*.

Parkinson.

his stores of knowledge were so large, that he too has often been called a walking library. He belonged to no clubs; he frequented no public places; and there are few men who, towards the close of life, may not, on a retrospect, reflect with shame and sorrow, how much of their precious time has thus been thrown away, or, perhaps, worse than thrown away.

Like many other men of infirm and sickly frames, Mr Parkhurst was also irritable, and quick, warm, and earnest, in his resentments, though never unforgiving. But whether it be or be not a matter of reproach to possess a mind so constituted, it certainly is much to any man's credit to counteract and subdue it by an attention to the injunctions of religion. This Mr Parkhurst effectually did: and few men have passed through a long life more at peace with his neighbours, more respected by men of learning, more beloved by his friends, or more honoured by his family.

Biog. Dict.

PARKINSON (John). Of this ingenious English botanist, one of the first and most industrious cultivators of that science among us, the memorials that remain are very scanty. He was born in 1567, was bred an apothecary, and resided in London. He rose to such reputation in his profession as to be appointed apothecary to King James I.; and, on the publication of his Theatre of Plants, he obtained from the unfortunate successor of that prince the title of *Botanicus Regis primarius*. The time of his death cannot be exactly ascertained; but, as his Herbal was published in 1640, and it appears that he was living at that time, he must have attained his 73d year.

Parkinson's first publication was, his 1. *Paradisi in Sole Paradisus terrestris*, or, A Garden of all Sorts of Pleasant Flowers which our English Ayre will permit to be nursed up: with a Kitchen-garden of all manner of Herbes, Roots, and Fruits, for Meat or Sause, &c. &c. Collected by John Parkinson apothecary, of London, 1629, folio, 612 pages. In this work the plants are arranged without any exact order: nearly 1000 plants are separately described, of which 780 are figured on 129 tables, which appear to have been cut expressly for this work. Parkinson was, it is conceived, the first English author who separately described and figured the subjects of the flower-garden; and this book is therefore a valuable curiosity, as exhibiting a complete view of the extent of the English garden at the beginning of the 17th century. It may, perhaps, be necessary to inform the reader, that Paradisus in Sole, is meant to express the author's name, *Park in Sun*. 2. In 1640 he published his *Theatrum Botanicum;* or Theatre of Plants, or an Herbal of a large extent: containing therein, a more ample and exact History and declaration of the Physical Herbs and Plants than are in other Authors, &c. &c. London, folio, 1746 pages. This work had been the labour of the author's life; and he tells us that, owing to "the disastrous times," and other impediments, the printing of it was long retarded. Dr Pulteney is of opinion, that, allowing for the defects common to the age, Parkinson will appear "more of an original author than Gerard or Johnson, independent of the advantages he might derive from being posterior to them. His theatre was carried on through a long series of years, and he profited by the works of some late authors, which Johnson, though they were equally in his power, had neglected to use. Parkinson's descriptions, in many instances, appear to be new. He is more particular in pointing out the places of growth. Johnson had described about 2850 plants, Parkinson has near 3800. These accumulations rendered the *Theatrum Botanicum* the most copious book on the subject in the English language; and it may be presumed, that it gained equally the approbation of medical people, and of all those who were curious and inquisitive in this kind of knowledge."

Parodical, || Parsons.

PARODICAL Degrees, in an equation, a term that has been sometimes used to denote the several regular terms in a quadratic, cubic, biquadratic, &c. equation, when the indices of the powers ascend or descend orderly in an arithmetical progression. Thus, $x^3 + mx^2 + nx = p$ is a cubic equation where no term is wanting, but having all its parodic degrees; the indices of the terms regularly descending thus, 3, 2, 1, 0.

PARRAMORE, one of the small islands in the Atlantic Ocean, which line the east coast of Northampton county, Virginia.—*Morse*.

PARR's *Point*, is the south-east point of Half-Moon bay, on the north-east side of the island of St Christopher's, in the West-Indies. The coast here is rocky. —*ib.*

Biog. Dict.

PARSONS (James), an excellent physician and polite scholar, was born at Barnstaple, in Devonshire, in March 1705. His father, who was the youngest of nine sons of Colonel Parsons, and nearly related to the baronet of that name, being appointed barrack-master at Bolton in Ireland, removed with his family into that kingdom soon after the birth of his then only son James, who received at Dublin the early part of his education, and, by the assistance of proper masters, laid a considerable foundation of classical and other useful learning, which enabled him to become tutor to Lord Kingston. Turning his attention to the study of medicine, he went afterwards to Paris, where (to use his own words) "he followed the most eminent professors in the several schools, as Astruc, Dubois, Lemery, and others; attended the anatomical lectures of the most famous [Hunaud and De Cat]; and chemicals at the King's Garden at St Come. He followed the physicians in both hospitals of the Hotel Dieu and La Charité, and the chemical lectures and demonstrations of Lemery and Bouldoc; and in botany Jussieu. Having finished these studies, his professors gave him honourable attestations of his having followed them with diligence and industry, which intitled him to take the degrees of doctor and professor of the art of medicine, in any university in the dominions of France. Intending to return to England, he judged it unnecessary to take degrees in Paris, unless he had resolved to reside there; and as it was more expensive, he therefore went to the university of Rheims, in Champaign, where, by virtue of his attestations, he was immediately admitted to three examinations, as if he had finished his studies in that academy; and there was honoured with his degrees June 11. 1736. In the July following he came to London, and was soon employed by Dr James Douglas to assist him in his anatomical works, where in some time he began to practise. He was elected a member of the Royal Society in 1740; and, after due examination, was admitted a licentiate of the college of physicians April 1. 1751; paying college fees and bond stamps of different denominations to the amount of

Parsons. L. 41 : 2 : 8, subject also to quarterage of L. 2 *per annum*. In 1755 he paid a farther sum of L. 7, which, with the quarterage money already paid, made up the sum of L. 16, in lieu of all future payments." On his arrival in London, by the recommendation of his Paris friends, he was introduced to the acquaintance of Dr Mead, Sir Hans Sloane, and Dr James Douglas. This great anatomist made use of his assistance, not only in his anatomical preparations, but also in his representations of morbid and other appearances; a list of several of which was in the hands of his friend Dr Maty, who had prepared an *eloge* on Dr Parsons, which was never used, but which, by the favour of Mrs Parsons, Mr Nichols has preserved at large. Though Dr Parsons cultivated the several branches of the profession of physic, he was principally employed in the obstetrical line. In 1738, by the interest of his friend Dr Douglas, he was appointed physician to the public infirmary in St Giles's. In 1739 he married Miss Elizabeth Reynolds, by whom he had two sons and a daughter, who all died young. Dr Parsons resided for many years in Red Lion Square, where he frequently enjoyed the company and conversation of Dr Stukely, Bishop Lyttleton, Mr Henry Baker, Dr Knight, and many other of the most distinguished members of the Royal and Antiquarian Societies, and that of Arts, Manufactures, and Commerce; giving weekly an elegant dinner to a large but select party. He enjoyed also the literary correspondence of D'Argenville, Buffon, Le Cat, Beccaria, Amb. Bertrand, Valltravers, Ascanius, Turberville Needham, Dr Garden, and others of the most distinguished rank in science. As a practitioner, he was judicious, careful, honest, and remarkably humane to the poor; as a friend, obliging and communicative; chearful and decent in conversation, severe and strict in his morals, and attentive to fill with propriety all the various duties of life. In 1769, finding his health impaired, he proposed to retire from business and from London; and with that view disposed of a considerable number of his books and fossils, and went to Bristol. But he returned soon after to his old house, and died in it after a week's illness, on the 4th of April, 1770. By his last will, dated in October 1766, he gave his whole property to Mrs Parsons; and in case of her death before him, to Miss Mary Reynolds her only sister, "in recompence for her affectionate attention to him and to his wife, for a long course of years, in sickness and in health." It was his particular request, that he should not be buried till some change should appear in his corpse; a request which occasioned him to be kept unburied 17 days, and even then scarce the slightest alteration was perceivable. He was buried at Hendon, in a vault which he had caused to be built on the ground purchased on the death of his son James, where his tomb had a very commendatory inscription.

It would carry us beyond our usual limits to enter into an enumeration of the many curious articles at various times communicated to the public by Dr Parsons, which may be seen in the Anecdotes of Bowyer. We shall therefore close this article with an extract from Dr Maty's Eulogium: "The surprising variety of branches which Dr Parsons embraced, and the several living as well as dead languages he had a knowledge of, qualified him abundantly for the place of assistant secretary for foreign correspondences, which the council of the Royal Society bestowed upon him about the year 1750. He acquitted himself to the utmost of his power of the functions of this place, till a few years before his death, when he resigned in favour of his friend, who now gratefully pays this last tribute to his memory. Dr Parsons joined to his academical honours those which the Royal College of Physicians of London bestowed upon him, by admitting him, after due examination, licentiate, on the first day of April 1751. The diffusive spirit of our friend was only equalled by his desire of information. To both these principles he owed the intimacies which he formed with some of the greatest men of his time. The names of Folkes, Hales, Mead, Stukely, Needham, Baker, Collinson, and Garden, may be mentioned on this occasion, and many more might be added. Weekly meetings were formed, where the earliest intelligence was received and communicated of any discovery both here and abroad; and new trials were made, to bring to the test of experience the reality or usefulness of these discoveries. Here it was that the microscopical animals found in several infusions were first produced; the propagation of several insects by section ascertained; the constancy of Nature amidst these wonderful changes established. His Remains of Japhet, being Historical Enquiries into the Affinity and Origin of the European Languages, are a most laborious performance, tending to prove the antiquity of the first inhabitants of these islands as being originally descended from Gomer and Magog, above 1000 years before Christ, their primitive and still subsisting language, and its affinity with some others. It cannot be denied but that there is much ingenuity, as well as true learning, in this work, which helps conviction, and often supplies the want of it. But we cannot help thinking that our friend's warm feelings now and then mislead his judgment, and that some at least of his conjectures, resting upon partial traditions, and poetical scraps of Irish filids and Welsh bards, are less satisfactory than his tables of affinity between the several northern languages, as deduced from one common stock. Literature, however, is much obliged to him for having in this, as well as in many of his other works, opened a new field of observations and discoveries. In enumerating our learned friend's dissertations, we find ourselves at a loss whether we should follow the order of subjects or of time; neither is it easy to account for their surprising variety and quick succession. The truth is, that his eagerness after knowledge was such, as to embrace almost with equal facility all its branches, and with equal zeal to ascertain the merit of inventions, and ascribe to their respective, and sometimes unknown, authors, the glory of the discovery. Many operations, which the ancients have transmitted to us, have been thought fabulous, merely from our ignorance of the art by which they were performed. Thus the burning of the ships of the Romans at a considerable distance, during the siege of Syracuse, by Archimedes, would perhaps still continue to be exploded, had not the celebrated M. Buffon in France shewn the possibility of it, by presenting and describing a model of a speculum, or rather assemblage of mirrors, by which he could set fire at the distance of several hundred feet. In the contriving, indeed, though not in the executing of such an apparatus, he had in some measure fure been foreftalled by a writer now very little known or read. This Dr Parfons proved in a very fatisfactory manner; and he had the pleafure to find the French philofopher did not refufe to the Jefuit his fhare in the invention, and was not at all offended by the liberty he had taken. Another French difcovery, I mean a new kind of painting fathered upon the ancients, was reduced to its real value, in a paper which fhewed our author was poffeffed of a good tafte for the fine arts: and I am informed that his fkill in mufic was by no means inferior, and that his favourite amufement was the flute. Richly, it appears from thefe performances, did our author merit the honour of being a member of the Antiquarian Society, which long ago had affociated him to its labours. To another fociety, founded upon the great principles of humanity, patriotifm, and natural emulation, he undoubtedly was greatly ufeful (A). He affifted at moft of their general meetings and committees, and was for many years chairman to that of agriculture; always equally ready to point out and to promote ufeful improvements, and to oppofe the interefted views of fraud and ignorance, fo infeparable from very extenfive affociations. No fooner was *this* fociety (B) formed, than Dr Parfons became a member of it. Intimately convinced of the noblenefs of its views, though from his ftation in life little concerned in its fuccefs, he grudged neither attendance nor expenfe. Neither ambitious of taking the lead, nor fond of oppofition, he joined in any meafure he thought right; and fubmitted cheerfully to the fentiments of the majority, though againft his own private opinion. The juft ideas he had of the dignity of our profeffion, as well as of the common links which ought to unite all its members, notwithftanding the differences of country, religion, or places of education, made him bear impatiently the fhackles laid upon a great number of refpectable practitioners: he wifhed, fondly wifhed, to fee thefe broken; not with a view of empty honour and dangerous power, but as the only means of ferving mankind more effectually, checking the progrefs of defigning men and illiterate practitioners, and diffufing through the whole body a fpirit of emulation. Though by frequent difappointments he forefaw, as well as we, the little chance of a fpeedy redrefs, he nobly perfifted in the attempt; and had he lived to the final event, would undoubtedly, like Cato, ftill have preferred the conquered caufe to that fupported by the gods. After having tried to retire from bufinefs and from London, for the fake of his health, and having difpofed of moft of his books with that view, he found it inconfiftent with his happinefs to forfake all the advantages which a long refidence in the capital, and the many connections he had formed, had rendered habitual to him. He therefore returned to his old houfe, and died in it, after a fhort illnefs, April 4. 1770. The ftyle of our friend's compofition was fufficiently clear in defcription, tho' in argument not fo clofe as could have been wifhed. Full of his ideas, he did not always fo difpofe and connect them together, as to produce in the minds of his readers that conviction which was in his own. He too much defpifed thofe additional graces which command attention when joined to learning, obfervation, and found reafoning. Let us hope that his example and fpirit will animate all his colleagues; and that thofe practitioners who are in the fame circumftances will be induced to join their brethren, fure to find amongft them thofe great bleffings of life, freedom, equality, information, and friendfhip. As long as thefe great principles fhall fubfift in this fociety, and I truft they will outlaft the longeft liver, there is no doubt but the members will meet with the reward honeft men are ambitious of, the approbation of their confcience, the efteem of the virtuous, the remembrance of pofterity."

PARTY ARCHES, in architecture, are arches built between feparate tenures, where the property is intermixed, and apartments over each other do not belong to the fame eftate.

Party Walls, are partitions of brick made between buildings in feparate occupations, for preventing the fpread of fire. Thefe fhould be thicker than the external walls; and their thicknefs in London is regulated by act of parliament of the 14th of George III.

PARSONSFIELD, a townfhip of the Diftrict of Maine, in York county, fituated on the New Hampfhire line, between great and Little Offipee rivers; and is 118 miles north of Bofton. It was incorporated in 1785, and contains 655 inhabitants.—*Morse.*

PARTIDO, a fmall ifland, under the high hill of St Martin, in the fouth-weft part of Campeachy Gulf. It lies in the fair way acrofs the bay from Cape Catoche to Vera Cruz.—*ib.*

PARTRIDGEFIELD, a townfhip of Maffachufetts, in Berkfhire county, 26 miles W. N. W. of Northampton, and 128 weftward of Bofton. It was incorporated in 1775, and contains 1041 inhabitants.—*ib.*

PASCAGOULA, a river of the Georgia Weftern Territory, which purfues a S. by E. courfe through Weft Florida, and empties into the Gulf of Mexico, by feveral mouths, which together occupy a fpace of 3 or 4 miles; which is one continued bed of oyfter-fhells, with very fhoal water. The wefternmoft branch has 4 feet water, and is the deepeft. After croffing the bar, there is from 3 to 6 fathoms water for a great diftance, and the river is faid to be navigable more than 150 miles. The foil on this river, like that on all the others that pafs through Georgia into the Gulf of Mexico, grows better as you advance to its fource.—*ib.*

PASCAGOULA, an Indian village on the E. fide of the river Miffiffippi, which can furnifh about 20 warriors. It is about 10 miles above the Tonica village.—*ib.*

PASCATAQUA, or *Pifcataqua*, is the only large river, whofe whole courfe is in New Hampfhire. Its head is a pond in the N. E. corner of the town of Wakefield, and its general courfe thence to the fea is S. S. E. about 40 miles. It divides New Hampfhire from York county, in the Diftrict of Maine, and is called Salmon-Fall river, from its head, to the lower falls at Berwick, where it affumes the name of Newichawannock, which it bears till it meets with Cochecho river, which comes from Dover, when both run

(A) The Society for the Encouragement of Arts, Manufactures, and Commerce. He likewife was affociated to the Economical Society at Berne, Dec. 26. 1763.

(B) A Medical Society inftituted by Dr Fothergill, and other refpectable phyficians, licentiates, in vindication of their privileges: where, it fhould feem, this eulogy was intended to be pronounced.

together in one channel to Hilton's Point, where the western branch meets it: from this junction to the sea, the river is so rapid that it never freezes; the distance is 7 miles, and the course generally from S. to S. E. The western branch is formed by Swanscot river, which comes from Exeter, Winnicot river, which comes through Greenland, and Lamprey river, which divides Newmarket from Durham; these empty into a bay, 4 miles wide, called the Great Bay. The water, in its further progress, is contracted into a lesser bay, and then it receives Oyster river, which runs through Durham, and Back river, which comes from Dover, and at length meets with the main stream at Hilton's Point. The tide rises into all these bays, and branches as far as the lower falls in each river, and forms a most rapid current, especially at the season of the freshets, when the ebb continues about two hours longer than the flood; and were it not for the numerous eddies, formed by the indentings of the shore, the ferries would then be impassable. At the lower falls in the several branches of the river, are landing places, whence lumber and other country produce is transported, and vessels or boats from below discharge their lading; so that in each river there is a convenient trading place, not more than 12 or 15 miles distant from Portsmouth, with which there is constant communication by every tide. Thus the river, from its form, and the situation of its branches, is extremely favourable to the purposes of navigation and commerce. A light-house, with a single light, stands at the entrance of Piscataqua harbour, in lat. 43 4 N. and long. 70 41.—*ib.*

PASPAYA, a jurisdiction in the archbishoprick of La Plata, about 40 leagues to the S. of the city of that name. It is mountainous but abounds in grain, pulse, and fruits.—*ib.*

PASQUOTANK, a county of North Carolina, in Edenton district, N. of Albemarle Sound. It contains 5,497 inhabitants, including 1623 slaves.—*ib.*

PASQUOTANK, a small river of North Carolina, which rises in the Great Dismal Swamp, and, passing by Hertford, falls into Albemarle Sound.—*ib.*

PASSAGE *Fort*, a small town of the island of Jamaica, situated in the road between Port Royal and Spanish Town, 7 miles S. E. of the latter, and at the mouth of Cobre river, where is a fort of 10 or 12 guns. It has a brisk trade, and contains about 400 houses, the greatest part of them houses of entertainment.—*ib.*

PASSAGE *Island* lies across the mouth of the river Cobeca, near the N. W. part of the island of Porto Rico. The harbour for ships is at the E. end of this island.—*ib.*

PASSAGE *Islands*, Great and Little, two of the Virgin Islands, in the West Indies, near the E. end of the island of Porto Rico. N. lat. 18 20, W. long. 64 5. —*ib.*

PASSAGE *Point*, in the Straits of Magellan, lies at the W. end of Royal Reach, and 5 leagues W. N. W. of Fortescue's Bay. S. lat. 53 45, W. long. 73 40. —*ib.*

PASSAIK, or *Pasaick*, is a very crooked river. It rises in a large swamp in Morris county, New Jersey, and its course is from W. N. W. to E. S. E. until it mingles with the Hackinsak at the head of Newark Bay. It is navigable about 10 miles, and is 230 yards wide at the ferry. The cataract, or Great Falls, in this river, is one of the greatest natural curiosities in the state. The river is about 40 yards wide, and moves in a slow, gentle current, until coming within a short distance of a deep cleft in a rock, which crosses the channel, it descends and falls above 70 feet perpendicular, in one entire sheet, presenting a most beautiful and tremendous scene. The new manufacturing town of Patterson is erected on the Great Falls of this river; and its banks are adorned with many elegant country seats. It abounds with fish of various kinds. There is a bridge 500 feet long, over this river, on the post-road from Philadelphia to New York.—*ib.*

PASSAMAQUODDY, a bay and river, near which is the division line between the British province of New Brunswick and the United States of America. The island of Campo Bello, in the N. Atlantic Ocean, is at the middle or W. passage of the bay, in lat. 44 50 N. and long. 66 46 W. The distance from Cross Isle, Machias, to West Passamaquoddy Head, is 9 leagues N. E. by E.; and from the Head over the bar to Allen's Isle, N. N. W. 2 leagues. When you come from the S. W. and are bound into West Passamaquoddy, you must give the Seal Rocks a birth of three quarters of a mile before you haul in from the harbour, as there is a whirlpool to the east of them. The bay is about a league from this point. It is high water here at full and change of the moon, about the same time as at Boston. There are 3 rivers which fall into this bay; the largest is called by the modern Indians, the Scoodick; but by De Mons and Champlain, Etchemins. Its main source is near Penobscot river, and the carrying-place between the two rivers is but 3 miles. The mouth of Passamaquoddy river has 25 fathoms water.—*ib.*

PASSAMAQUODDY *Post Office*, on the above described bay, is kept at a little village at the mouth of Cobscook river, 17 miles this side Brewer's, the easternmost post-office in the United States, 20 N. E. of Machias, 378 N. E. of Boston, and 728 in a like direction from Philadelphia.—*ib.*

PASSAMAQUODDIES, a tribe of Indians who inhabit near the waters of Passamaquoddy Bay.—*ib.*

PASSAO, a cape on the coast of Peru, on the S. Pacific Ocean, under the equator. Long. 78 50 W. —*ib.*

PASSIGRAPHY, the art of writing on any subject so as to be understood by all nations (See *Universal* CHARACTERS in this *Supplement*). In France, where every thing is admired that is new, and every vagary of the imagination of a pretended philosopher thought practicable, a proposal has lately been made to introduce one universal language into the world, constructed by a few metaphysicians on the laws of human thought. And to this language, in its written form, is to be given the name of *passigraphy*. Such readers as think this idle dream worthy their attention (which is far from being the case with us), will find some ingenious thoughts on the history of a philosophic language, in the 2d volume of *Nicholson's Journal of Natural Philosophy, &c.*

PASSO MAGNO, a river of Florida, in lat. 36 N. —*Morse.*

PASSUMPSICK, a small river of Vermont, runs a southern course and empties into Connecticut river, below the Fifteen Mile Falls, in the town of Barnet. —*ib.*

PASSYUNK, a townſhip in Philadelphia county, Pennſylvania.—*ib.*

PASTO, or *St Juan de Paſto*, a town of Popayan in S. America. N. lat. 1 50, W. long. 76 55.—*ib.*

PATAGOA, a river on the coaſt of Brazil, which enters the ocean S. W. of Rio Janeira.—*ib.*

PATAVIRCA, a town of Peru, in the juriſdiction of Santa, or Guarmey, conſiſting of about 60 houſes. It lies on the road leading from Paita to Lima, 67 miles north of that city. About three quarters of a league from this town, and near the ſea-coaſt, are ſtill remaining ſome huge walls of unburnt bricks, being the ruins of a palace of one of the Indian princes. Its ſituation correſponds with the tradition; having on one ſide, a moſt fertile and delightful country, and on the other, the refreſhing proſpect of the ſea.—*ib.*

PATAZ, a juriſdiction in the dioceſe of Truxillo, in S. America. It is ſituated among the mountains, and has a variety of products, of which gold is the chief.—*ib.*

PATEHUCA, or *Patioca*, a town of Mexico, in N. America, having a ſilver mine in its vicinity. N. lat. 21, W. long. 99 58.—*ib.*

PATH OF THE VERTEX, a term frequently uſed by Mr Flamſteed, in his doctrine of the Sphere, denoting a circle, deſcribed by any point of the earth's ſurface, as the earth turns round its axis. This point is conſidered as vertical to the earth's centre; and is the ſame with what is called the vertex or zenith in the Ptolomaic projection.

PATIENCE, an iſland in Narraganſet Bay, Rhode Iſland, and lies ſouth-eaſt of Warwick Neck, three-fourths of a mile. It is about 2 miles long, and 1 broad.—*Morſe.*

PATOWMACK, or *Potomack*, a large and noble river which riſes by two branches, the northern and the ſouthern, which originate in and near the Alleghany Mountains, and forms, through its whole courſe, part of the boundary between the ſtates of Virginia and Maryland. Its courſe is N. E. to Fort Cumberland, thence turning to the E. it receives Conecocheague Creek from Pennſylvania; then purſuing a ſouth-eaſt courſe, it receives the Shenandoah from the S. W. after this it runs a S. E. and S. courſe, till it reaches Maryland Point; thence to its mouth it runs ſouth-eaſterly. In its courſe it receives ſeveral conſiderable ſtreams. The diſtance from the Capes of Virginia to the termination of the tide water in this river is above 300 miles; and navigable for ſhips of the greateſt burden, nearly that diſtance. From thence this river, obſtructed by 4 conſiderable falls, extends through a vaſt tract of inhabited country towards its ſource. Early in the year 1785, the legiſlatures of Virginia and Maryland paſſed acts to encourage opening the navigation of this river. It was eſtimated that the expenſe of the works would amount to £50,000 ſterling, and 10 years were allowed for their completion. Great part is already finiſhed; and the whole it is expected will be completed within a few years, according to the report of the engineers to the Patowmack Company. This noble river paſſes by many flouriſhing towns; the chief of which are, Shepherdſtown, Georgeſtown, Waſhington City, Alexandria, New Marlborough, and Charleſtown, or Port Tobacco. It is 7½ miles wide at its mouth; 4½ at Nomony Bay; 3 at Aquia; 1½ at Hallooing Point; and 1¼ at Alexandria. Its ſoundings are 7 fathoms at the mouth; 5 at St George's Iſland; 4½ at Lower Matchodic; 3 at Swan's Point, and thence up to Alexandria. The tides in the river are not very ſtrong, excepting after great rains, when the ebb is pretty ſtrong; then there is little or no flood, and there is never more than 4 or 5 hours flood, except with long and ſtrong ſouth winds. In order to form juſt conceptions of this inland navigation, it would be requiſite to notice the long rivers which empty into the Patowmack, and ſurvey the geographical poſition of the weſtern waters. The diſtance of the waters of the Ohio to Patowmack, will be from *fifteen* to *forty* miles, according to the trouble which will be taken to approach the new navigations. The upper part of this river, until it paſſes the Blue Ridge, is called, in Fry and Jefferſon's map, *Cohongoronto.*—*ib.*

PATRICK's, *St*, a ſmall town, the chief of Camden county, Georgia, ſituated on Great Satilla river, about 32 miles from its mouth, and the ſame diſtance northweſterly of the town of St Mary's.—*ib.*

PATTERSON, a town in Bergen county, New Jerſey, called ſo in honour of the governor of the ſtate of that name, and now one of the judges of the ſupreme federal court. It was eſtabliſhed in conſequence of an act of the legiſlature of New Jerſey, in 1791, incorporating a manufacturing company with peculiar privileges. Its ſituation on the Great Falls of Paſſaic river, is healthy and agreeable. It now contains about 50 dwelling-houſes, independent of thoſe appropriated for the machinery; and it is certainly one of the moſt convenient ſituations for a manufacturing town of any on the continent. This company was incorporated to encourage all kinds of manufactures, and the ſum of 500,000 dolls. was ſoon ſubſcribed; but for want of experience, and a proper knowledge of the buſineſs, much was expended to little purpoſe; and they were at laſt reduced to the neceſſity of having recourſe to a lottery to aſſiſt them in carrying their plan into execution. It is ſaid that matters are now conducted more judiciouſly, and that the undertaking promiſes to be uſeful to the public, and beneficial to the proprietors. It is 19 miles N. E. of Morriſtown, 10 N. of Newark, and 100 N. E. by N. of Philadelphia. N. lat. 40 12, W. long. 74 57.—*ib.*

PATUCKET, a ſmall village about four miles N. E. of Providence, a buſy place of conſiderable trade, and where manufactures of ſeveral kinds are carried on with ſpirit. Through this village runs Patucket, or Pawtucket river, which empties into Seekhonk river at this place. The river Patucket, called more northerly Blackſtone's river, has a beautiful fall of water, directly over which, a bridge has been built on the line which divides the commonwealth of Maſſachuſetts from the ſtate of Rhode Iſland; diſtant about 40 miles S. by W. of Boſton. The confluent ſtream empties into Providence river about a mile below Weyboſſett, or the Great Bridge. The fall, in its whole length, is upwards of fifty feet; and the water paſſes through ſeveral chaſms in a rock, which, extending diametrically acroſs the bed of the ſtream, ſerves as a dam to the water. Several mills have been erected upon theſe falls; and the ſpouts and channels which have been conſtructed to conduct the ſtreams to their reſpective wheels, and the bridge, have taken very much from the

the beauty and grandeur of the ſcene, which would otherwiſe have been indeſcribably charming and romantic.—*ib.*

PATUXENT, or *Patuxet*, a navigable river of Maryland, which riſes near the ſource of Patapſco river, and empties into the W. ſide of Cheſapeak Bay, between Drum and Hog Iſland Points, 15 or 20 miles N. of the mouth of the Patowmac. It admits veſſels of 250 tons to Nottingham, nearly 40 miles from its mouth, and of boats to Queen Anne, 12 miles higher. Patuxent is as remarkable a river as any in the bay, having very high land on its north ſide, with red banks or cliffs. When you double Drum Point, you come to in 2½ and three fathoms water, where you will be ſecure from all winds.—*ib.*

PAUCAR-COLLA, a juriſdiction in the biſhoprick of La Paz, in South America, bordering on Chucuito. It is ſituated in the mountains, and abounds in cattle. The air is here very cold. The ſilver mine here called Laycacota, was formerly ſo rich, that the metal was often cut out with a chiſel; but the waters having overflowed, the works, it is abandoned.—*ib.*

PAUCARTAMBO, a juriſdiction of the dioceſe of Cuſco, in S. America. It is very fruitful, and lies 80 leagues eaſtward of the city of Cuſco.—*ib.*

PAUKATUCK, a ſmall river which empties into Stonington harbour, and forms a part of the diviſion line between Connecticut and Rhode Iſland.—*ib.*

PAUL's BAY, *St*, on the N. W. ſhore of the river St Lawrence, in N. America, is about 6 leagues below Cape Torment, where a chain of mountains of 400 leagues in length terminate from the weſtward.—*ib.*

Paul's Bay, *St*, on the N. W. coaſt of Newfoundland Iſland. N. lat. 49 50, W. long. 57 55.—*ib.*

PAUL's ISLAND, *St*, an iſland in the ſtrait between Newfoundland and Cape Breton Iſlands. It is about 15 miles north-eaſt of North Cape, in Cape Breton. N. lat. 47 13, W. long. 60 2.—*ib.*

PAUL, *St*, a town of Brazil, S. America, in the captainſhip of St Vincent. It is a kind of independent republic, compoſed of the banditti of ſeveral nations. However, they pay a tribute of gold to the king of Portugal. It is ſurrounded by inacceſſible mountains and thick foreſts. S. lat. 23 25, W. long. 45 52.—*ib.*

Paul, *St*, a town of N. America, in New Mexico, ſituated at the confluence of the two main head branches of the Rio Bravo.—*ib.*

Paul, *St*, the moſt ſoutherly of the Pearl Iſlands, in the Gulf of Panama, S. America. In the north ſide is a ſafe channel; where, if neceſſary, there is a place for careening ſhips.—*ib.*

Paul's, *St*, a pariſh in Charleſton diſtrict, S. Carolina, containing 3 433 inhabitants; of whom 276 are whites, and 3,202 ſlaves.—*ib.*

PAULINGSTOWN, or *Pawling*, a townſhip in Dutcheſs county, New York, lying on the weſtern boundary of Connecticut, and has South and Eaſt Town on the ſouth. In 1790, it contained 4,330 inhabitants, of whom 42 were ſlaves. In 1796, there were 560 of the inhabitants qualified electors.—*ib.*

PAULSBURGH, a townſhip in Graſton county, New Hampſhire, on the head waters of Amonooſuck river, and through which paſſes Androſcoggin river.—*ib.*

PAULUS *Hook*, in Bergen county, New Jerſey, is on the weſt bank of Hudſon river, oppoſite New York city, where the river is 2,000 yards wide. Here is the ferry, which is perhaps more uſed than any other in the United States. This was a fortified poſt in the late war. In 1780 the froſt was ſo intenſe, that the paſſage acroſs the river here was practicable for the heavieſt cannon.—*ib.*

PAWLET, a townſhip in Rutland county, Vermont, having 1,458 inhabitants. It ſtands on the New York line, has Wells on the north, and Rupert, in Bennington county, on the ſouth, and is watered by Pawlet river, which joins Wood creek and the confluent ſtream, falls in South Bay at Fiddler's Elbow. Hayſtack Mountain is in this townſhip.—*ib.*

PAWTUCKET *Falls*, in Merrimack river, are in the townſhip of Dracut.—*ib.*

PAWTUXET, a village in the townſhip of Cranſton, Providence county, Rhode Iſland.—*ib.*

PAXAROS, an iſland on the coaſt of California, in the N. Pacific Ocean. N. lat. 30 18, W. long. 120 45.—*ib.*

PAXTON, *Upper* and *Lower*, two townſhips in Dauphin county, Pennſylvania.—*ib.*

Paxton, a townſhip of Maſſachuſetts, ſituated in Worceſter county, 8 miles weſt of Worceſter, and 55 ſouth-weſterly of Boſton. It was incorporated in 1765, and contains 558 inhabitants.—*ib.*

PAYJAN, a ſmall town in the juriſdiction of Truxillo, in Peru, 8 leagues S. of St Pedro.—*ib.*

PAYRABA, a town and captainſhip in the northern diviſion of Brazil.—*ib.*

PAYTA, or *Paita*, a ſmall ſea port of Quito, on the coaſt of Peru, with an excellent harbour, 11 leagues north of the iſland called Lobos de Payta. Ships from Acapulco, Sonſonnate, Realeijo, and Panama, to Collao, can only touch and refreſh here; and the length of their voyages, by reaſon of the winds being moſt of the year againſt them, occaſions the port to be very much frequented. Yet ſo parched is the ſituation of Payta, that it affords little beſides fiſh, a few goats and freſh water; their chief proviſions being furniſhed by Colan and Piura, the one 3, and the other 14 leagues diſtant. The bay is defended by a fort, and it is ſo ſituated that even muſkets alone can hinder boats from landing, being under a pretty high hill, on the ſummit of which is another fort, that commands the town and lower fort. It had only a fort with 8 guns, when Commodore Anſon took it in 1741. He burnt the town, in which was merchandize to the value of a million and a half of dollars, becauſe the governor refuſed to ranſom it. The plunder, in dollars and plate, amounted to £30,000 ſterling. It was plundered and burnt by Capt. Cavendiſh, in 1587, and by George Spilberg in 1615. There is anchorage in 10½ fathoms about a mile and a half from the town. S. lat. 5 15, W. long. 80 55.—*ib.*

PAZ, *La*, a ſmall juriſdiction of the audience of Charcas, in Peru, S. America. It is ſituated in the mountains, one of which, called Illimani, contains, in all human probability, immenſe riches, for a crag of it being broken off ſome years ſince by a flaſh of lightning, ſuch a quantity of gold was found among the fragments, that it was ſold for ſome time at La Paz for eight pieces of eight per ounce. But the ſummit

of

of this mountain being perpetually covered with ice and ſnow, no attempt has been made to open a mine.—*ib.*

PAZ, *La*, a city of Peru, and capital of the above juriſdiction, is ſituated eaſtward of the lake Titicaca, on the ſide of a valley, among the breaches of the mountains, through which a pretty large river flows. In freſhets, the current of the river forces along huge maſſes of rocks, with ſome grains of gold. In the year 1730, an Indian, while waſhing his feet in the river, found a lump of gold of ſuch a ſize, that the Marquis de Caſtel Fuerte gave 12,000 pieces of eight for it, and ſent it to Spain as a preſent worthy the curioſity of his ſovereign. This city contains, beſides the cathedral, many public edifices, and about 20,000 inhabitants. It is 180 miles north of La Plata, and 350 ſouth-eaſt of Cuſco. S. lat. 15 59, W. long. 64 30.—*ib.*

PAZARO, a cape of N. America, on the W. ſide of the peninſula of California, towards the ſouth end of it, in about lat. 24 N. and long. 113 W.—*ib.*

PAZQUARO, a lake in Mexico, or New Spain.—*ib.*

PEACHAM, a townſhip in Caledonia county, Vermont, lies W. of Barnet on Connecticut river. It contains 365 inhabitants.—*ib.*

PEACOCK, a townſhip in Buck's county, Pennſylvania.—*ib.*

PEAKS OF OTTER are thought to be the higheſt part of the Blue Ridge, or perhaps any other in North America, meaſuring from their baſe. The height is 4,000 feet; which, however, is not one fifth of the height of the mountains of South America.—*ib.*

PEARL FISH, is commonly conſidered as an *aſcidia* (ſee MYTILUS, *Encycl.*); but this is denied by a late author, who ſeems to have paid great attention to the pearl-fiſhery at Ceylon. It has never, he ſays, been accurately deſcribed. It does not reſemble the *aſcidia* of Linnæus; and as he thinks it may form a new genus, he gives the following account of it:

" The fiſh is faſtened to the upper and lower ſhells by two white flat pieces of muſcular ſubſtance, which have been called ears, and extend about two inches from the thick part of the body, growing gradually thinner. The extremity of each ear lies looſe, and is ſurrounded by a double brown fringed line. Theſe lie almoſt the third part of an inch from the outer part of the ſhell, and are continually moved by the animal. Next to theſe above, and below, are ſituated two other double fringed moveable ſubſtances, like the bronchiæ of a fiſh. Theſe ears and fringes are joined to a cylindrical piece of fleſh of the ſize of a man's thumb, which is harder and of a more muſcular nature than the reſt of the body. It lies about the centre of the ſhells, and is firmly attached to the middle of each. This, in fact, is that part of the pearl fiſh which ſerves to open and ſhut the ſhells. Where this column is faſted, we find on the fleſh deep impreſſions, and on the ſhell various nodes of round or oblong forms, like imperfect pearls. Between this part and the hinge (*cardo*) lies the principal body of the animal, ſeparated from the reſt, and ſhaped like a bag. The mouth is near the hinge of the ſhell, enveloped in a veil, and has a double flap or lip on each ſide; from thence we obſerve the throat (*œſophagus*) deſcending like a thread to the ſtomach. Cloſe to the mouth there is a curved browniſh tongue, half an inch in length, with an obtuſe point; on the concave ſide of

this deſcends a furrow, which the animal opens and ſhuts, and probably uſes to convey food to its mouth. Near its middle are two bluiſh ſpots, which ſeem to be the eyes. In a pretty deep hole, near the baſe of the tongue, lies the beard (*byſſus*), faſtened by two fleſhy roots, and conſiſting of almoſt 100 fibres, each an inch long, of a dark green colour, with a metallic luſtre; they are undivided, parallel, and flattened. In general, the *byſſus* is more than three quarters of an inch without the cleft (*rima*); but if the animal is diſturbed, it contracts it conſiderably. The top of each of theſe threads terminates in a circular gland or head, like the *ſtigma* of many plants. With this *byſſus* they faſten themſelves to rocks, corals, and other ſolid bodies; by it the young pearl fiſh cling to the old ones, and with it the animal procures its food, by extending and contracting it at pleaſure. Small ſhell fiſh, on which they partly live, are often found clinging to the former. The ſtomach lies cloſe to the root of the beard, and has, on its lower ſide, a protracted obtuſe point. Above the ſtomach are two ſmall red bodies, like lungs; and from the ſtomach goes a long channel or gut, which takes a circuit round the muſcular column above-mentioned, and ends in the anus, which lies oppoſite to the mouth, and is covered with a ſmall thin leaf, like a flap. Though the natives pretend to diſtinguiſh the ſexes by the appearance of the ſhell, calling the flat ones males, and thoſe which are thick, concave, and vaulted, females, our author, on a cloſe inſpection, could not perceive any viſible ſexual difference."

The pearls are only in the ſofter part of the animal, and never in the firm muſcular column above-mentioned. They are found, in general, near the earth, and on both ſides of the mouth. From the appearance of the ſhell a judgment may be formed, with greater or leſs probability, whether it contains pearls or not. Theſe which have a thick calcareous cruſt upon them, to which *ſerpulæ* (ſea tubes) *Tubuli marini irregulariter intorti*, *Criſta gali Chamar lazarus*, *Lepas tintinabulum*, *Madreporee*, *Millipore*, *Cellipore*, *Gorgoniæ*, *Spongiæ*, and other Zoophytes, are faſtened, have arrived at their full growth, and commonly contain the beſt pearls; but thoſe that appear ſmooth, contain either none, or ſmall ones only.

In the article (*Encycl.*) intitled, *Manner of Fiſhing for* PEARLS *in the Eaſt Indies*, we have moſt unaccountably ſaid, that " the beſt divers will keep under water near *half an hour*, and the reſt not leſs than a quarter!" This is a very great miſtake; for M. *Le Beck* aſſures us, that the time during which a diver is able to remain under water ſeldom exceeds two minutes; and that, even after that ſhort period, he diſcharges, on emerging from the ſea, a quantity of water, and ſometimes a little blood, from his mouth and noſe. We have mentioned the danger which the divers run of becoming a prey to monſtrous fiſhes. Theſe fiſhes are ſharks; of which ſuch a dread is juſtly entertained, that the moſt expert divers will not on any account, deſcend, till the conjurer has performed his ceremonies of enchantment. Theſe conſiſt in a number of prayers, learned by heart, that nobody, probably not even the conjurer himſelf, underſtands, which he, ſtanding on the ſhore, continues muttering and grumbling from ſun riſe until the boats return. During this period, he is obliged to abſtain from food and ſleep, otherwiſe his prayers would have no avail: he is, however, allowed to drink; which privilege he indulges in a high degree, and is frequently so giddy, as to be rendered very unfit for devotion. Some of the conjurers accompany the divers in their boats; which pleases them very much, as they have their protectors near at hand.

Pearl, a small isle or shoal in the West-Indies, in lat. 14 53 N. and long. 79 13 W.—*Morse.*

Pearl, an island in the Gulf of Mexico, towards the mouth of the Mississippi, a few leagues from Dauphin Island; about 6 or 7 miles in length, and 4 in breadth. —*ib.*

Pearl *Islands*, in the Bay of Panama, called also King Islands, situated in the S. Pacific Ocean. They are 12 leagues from the city of Panama. They are low, and produce wood, water, fruit, fowls and hogs; they also afford good harbours for ships. The northernmost is named Pachea; the southernmost St Paul's. N. lat. 7 10, W. long. 81 45.—*ib.*

Pearl, a river which rises in the Chactaw country, in the W. part of Georgia, has a southerly course to the Gulf of Mexico, and is navigable upwards of 150 miles. Its principal mouths are near the entrance at the E. end of the Regolets, through which is the passage to Lake Ponchartrain. It has 7 feet at its entrance, and deep water afterwards. In 1769, there were some settlements on this river, where they raised tobacco, indigo, cotton, rice, Indian corn, and all sorts of vegetables. The land produces a variety of timber, fit for pipe and hogshead staves, masts, yards, and all kinds of plank for ship-building.

PEARN'S *Point*, on the W. side of the island of Antigua, and the W. side of Musketo Cove. Off it are the Five Islands.—*ib.*

PEDEE, a river which rises in N. Carolina, where it is called Yadkin river. In S. Carolina it takes the name of Pedee; and receiving the waters of Lynche's Creek, Little Pedee, and Black river, it joins the Wakkamaw river, near Georgetown. These united streams, with the accession of a small creek on which Georgetown stands, form Winyaw Bay, which about 12 miles below communicates with the ocean.—*ib.*

PEDOMETER (see *Encycl.*), is the name given by Mr Lewin Thugwell to an instrument, which is rather an improved perambulator than the instrument which we have noticed by the name of Pedometer. The chief improvement made by him on the perambulator (see that article, *Encycl.*) is in the size of the wheel, of which the circumference measures 16½ feet, or one pole, adapted to Gunter's concise method of arithmetic, and divided into 25 equal parts, corresponding to the links of his chain for land measuring. There is likewise a contrivance in Mr Thugwell's pedometer, for compelling the attention of the traveller to the instrument at the end of every mile. It is very ingenious, and abundantly simple; but we hardly think it of sufficient importance to fill the space which a complete description of it would occupy in this Work. It is fully described in the *Letters and Papers of the Bath and West of England Society, for the Encouragement of Agriculture*; and likewise in the 6th volume of the *Repertory of Arts and Manufactures*.

PEDRA *Shoals*, in the West-Indies, extend from lat. 17 20 to 30 N. and from long. 79 9 to 79 17 W. —*Morse.*

PEDRAS *Point*, on the coast of Brazil, is 7 leagues E. S. E. from the strait of St John's Island, and 75 from Cape North. Also a point on the same coast 10 leagues W. N. W. of Brandihi Bay.—*ib.*

Pedras, a river on the N. W. side of Punta des Pedras, at the southern extremity of Amazon river.—*ib.*

PEDRO, *St*, a town in the jurisdiction of Lambeyque, in Peru, consisting of 130 houses, mostly inhabited by Indian families. It is washed by the river Pacasmayo, which renders the country round very fertile. It is seated near the S. Sea, 20 leagues from Lambeyque. S. lat. 7 25 49, W. long. 78 20 15.—*ib.*

Pedro, *St*, one of the Marquesas Islands, in the S. Pacific Ocean, called by the natives *Onateyo*; it is about 3 leagues in circuit, and lies S. 4½ leagues from the E. end of La Dominica. S. lat. 9 58, W. long. 158 30. —*ib.*

Pedro, *St*, a town of New-Mexico, N. America, situated on the S. side of Coral river, near the confluence of that river with the Colorado. The united stream runs a short way southward, and falls into the north part of the Gulf of California.—*ib.*

Pedro *Point, Great*, is on the south coast of the island of Jamaica. From Portland Point to this point the course is W. by N. about 11 leagues. About S. ¼ E. distance 14 leagues from Point Pedro, lies the easternmost *Pedro Key*.—*ib.*

Pedro, *Little Point*, on the S. coast of the same island, lies E. of Great Pedro Point, within a shoal partly dry; but has 5 fathoms within and 10 on the outer edge of it.—*ib.*

Pedro *Point, St*, on the coast of Chili, is 8 leagues N. N. E. of Point Qudar, and 14 S. S. W. of Cape Galera. *Port St Pedro* is contiguous to this point.—*ib.*

Pedro, *Port St*, is situated S. W. of the Island of St Catherine, and on the S. E. coast of Brazil, at the entrance of the river La Plata.—*ib.*

Pedro *River, St*, runs westward to the Gulf of Mexico. Its mouth is in about lat. 21 N. and long. 98 W. —*ib.*

PEEK'S-Kill, a small post-town in West-Chester county, New-York, on the E. side of Hudson's river, and N. side of the creek of its name, 5 miles from its mouth. It is 20 miles south of Fish-Kill, and 50 northerly of New-York. In the winter of 1780, Gen. Washington encamped on the strong grounds in this vicinity. —*ib.*

PEGUE, the ancient capital of the kingdom of the same name (see Pegu, *Encycl.*), appears to have been a quadrangle, each side measuring about a mile and a half. It was surrounded by a ditch and wall; which, before the latter tumbled down, and the former was filled up, must have furnished no contemptible defence. The breadth of the ditch appears to be about 60 yards; its depth, where not choked up, about ten or twelve feet; and there is still in it water enough to impede an eastern siege. The wall has been at least 25 feet high, and its breadth at the base not less than 40. It is composed of brick, badly cemented together with clay mortar, and has had on it small equidistant bastions, about 300 yards asunder.

Nothing can exhibit a more striking picture of desolation than the inside of this wall. We have elsewhere given an account of the almost incessant wars between the kings of Pegue and Birma or Barma. In the year

Pegue. 1757, the Birman sovereign carried the city of Pegue by assault, razed every dwelling to the ground, and dispersed, or led into captivity, all the inhabitants. The pagodas, which are very numerous, were the only buildings that escaped the fury of the conqueror; and of these the great pagoda of SHOEMADOO has alone been attended to and repaired.

This extraordinary edifice is built on a double terrace one raised upon another. The lower and greater terrace is about ten feet above the natural level of the ground. It is quadrangular. The upper and lesser terrace is of a like shape, raised about 20 feet above the lower terrace, or 30 above the level of the country.

These terraces are ascended by flights of stone steps, broken and neglected. On each side are dwellings of the *Rahaans* or priests, raised on timbers four or five feet from the ground. Their houses consist only of a single hall. The wooden pillars that support them are turned with neatness. The roof is of tile, and the sides of sheathing-boards. There are a number of bare benches in every house, on which the *Rahaans* sleep. They appear to have no furniture.

Shoemadoo is a pyramid, composed of brick and plaster, with fine shell mortar, without excavation or aperture of any sort; octagonal at the base, and spiral at the top. Six feet from the ground there is a wide ledge, which surrounds the base of the building; on the plane of which are 57 small spires, of equal size, and equidistant. One of them measured 27 feet in height, and 40 in circumference at the bottom. On a higher ledge there is another row, consisting of 53 spires, of similar shape and measurement. A great variety of mouldings encircles the building; and ornaments, somewhat resembling the *fleur de lys*, surround what may be called the base of the spire. Circular mouldings likewise gird this part to a considerable height; above which there are ornaments in stucco, not unlike the leaves of a Corinthian capital; and the whole is crowned by a *tee*, or umbrella of open iron-work, from which rises an iron rod with a gilded penant.

The extreme height of the building, from the level of the country, is 361 feet; and above the interior terrace, 331 feet. On the south-east angle of the upper terrace there are two handsome saloons, or *keouns*, lately erected. The roof is composed of different stages, supported by pillars. Captain Symes, from whose memoir in the Asiatic Researches this account is taken, judged the length of each saloon to be about 60 feet, and the breadth 30. The ceiling of one of them was already embellished with gold leaf, and the pillars lacquered; the other, when he saw it, was not completed. They are made entirely of wood. The carving on the outside is very curious. He saw several unfinished figures intended to be fixed on different parts of the building; some of them not ill shapen, and many exceedingly grotesque. Splendid images of Gaudma (the *Birman* object of adoration) were preparing, which he understood were designed to occupy the inside of these *keouns*.

At each angle of the interior terrace is a pyramidical pagoda, 67 feet in height, resembling, in miniature, the great pagoda. In front of the one in the south-west corner are four gigantic representations in masonry of Palloo, or the *man destroyer*, half beast, half human, seated on their hams, each with a large club on the right shoulder. Pegue.

Nearly in the centre of the east face of the area are two human figures in stucco beneath a gilded umbrella. One standing, represents a man with a book before him, and a pen in his hand. He is called *Thagiamee*, the recorder of mortal merits and mortal misdeeds. The other, a female figure kneeling, is *Maha Sumdre*, the protectress of the universe, as long as the universe is doomed to last: but when the time of general dissolution arrives, by her hand the world is to be overwhelmed, and destroyed everlastingly.

On the north side of the great pagoda are three large bells, of good workmanship, suspended near the ground between pillars. Several deers horns are strewed around. Those who come to pay their devotions first take up one of the horns, and strike the bell three times, giving an alternate stroke to the ground. This act is to announce to the spirit of Gaudma the approach of a suppliant. There are several low benches near the bottom of the pagoda, on which the person who comes to pray places his offering; which generally consists of boiled rice, a plate of sweetmeats, or cocoa-nut fried in oil. When it is given, the devotee cares not what becomes of it. The crows and dogs commonly eat it up in the presence of the donor, who never attempts to prevent or molest the animals.

There are many small pagodas on the areas of both terraces, which are neglected, and suffered to fall into decay. Numberless images of Gaudma lie indiscriminately scattered. A pious Birman who purchases an idol, first procures the ceremony of consecration to be performed by the *Rahaans*, then takes his purchase to whatever sacred building is most convenient, and there places it either in the shelter of a *keoun*, or on the open ground before the temple: nor does he ever after seem to have any anxiety about its preservation, but leaves the divinity to shift for itself.

From the upper ledge that surrounds the base of Shoemadoo, the prospect of the country is extensive and picturesque; but it is a prospect of Nature in her rudest state. There are few inhabitants, and scarcely any cultivation. The hills of *Martaban* rise to the eastward; and the *Sitang* river, winding along the plains, gives here and there an interrupted view of its waters. To the north-north-west, above 40 miles, are the *Galladzet* hills, whence the Pegue river takes its rise; hills remarkable only for the noisome effects of their atmosphere. In every other direction the eye looks over a boundless plain, chequered by a wild intermixture of wood and water.

The present king of the Birmans has entirely altered the system of his predecessors. He has turned his attention to the population and improvement, rather than the extension, of his dominions; and seems more desirous to conciliate his new subjects by mildness, than to rule them through terror. He has abrogated several severe penal laws imposed upon the *Taliens*, or Peguers: justice is now distributed impartially; and the only distinction at present between a Birman and Talien consists in the exclusion of the latter from all public offices of trust and power.

No act of the Birman government is more likely to reconcile the Taliens to the Birman yoke than the restoration of their ancient place of abode, and the preservation and embellishment of the pagoda of Shoemadoo. So sensible was the king of this, as well as of the advantages that must accrue to the state from an increase of culture and population, that some years ago he issued orders to rebuild Pegue, encouraged new settlers by liberal grants, and invited the scattered families of former inhabitants to return and repeople their deserted city.

Pegue, in its renovated state, seems to be built on the plan of the former city. It is a square, each side measuring about half a mile. It is fenced round by a stockade, from 10 to 12 feet high. There is one main street running east and west, which is intersected at right angles by two smaller streets, not yet finished. At each extremity of the principal street there is a gate in the stockade, which is shut early in the evening. After that hour, entrance during the night is confined to a wicket. Each of these gates is defended by a sorry piece of ordnance, and a few musqueteers, who never post centinels, and are usually asleep. There are also two other gates on the north and south sides of the stockade.

The houses of the inhabitants of Pegue are far from commodious, agreeably to European notions of accommodation; but they are at least as much so as the houses of other Indian towns. There are no brick buildings in Pegue, except such as belong to the king, or are dedicated to Gaudma. The king has prohibited the use of brick or stone in private buildings, from the apprehension, that if people got leave to build brick houses, they might erect brick fortifications, dangerous to the security of the state. The houses, therefore, are all made of mats or sheathing-boards, supported on bamboos or posts. Being composed of such combustible materials, the inhabitants are under continual dread of fire, against which they take every precaution. The roofs are lightly covered; and at each door stands a long bamboo, with a hook at the end, to pull down the thatch: also another pole, with a grating of split bamboo at the extremity, about three feet square, to suppress flame by pressure. Almost every house has earthen pots of water on the roof. And there is a particular class of people, whose business it is to prevent and extinguish fires.

PEGUNNOCK, a north-western branch of Passaik river, in New-Jersey, which rises in Sussex county. The town of its name lies between it and Rockaway, another branch south of this river, N.W. of Morristown.—*Morse.*

PEISHCAR, in Bengal, principal in office.

PEISHCUSH, a fine, tribute, or present.

PELHAM, a township of Massachusetts, in Hampshire county 12 miles northeasterly of Northampton, and 85 west of Boston. It was incorporated in 1742, and contains 1040 inhabitants.—*Morse.*

Pelham, a township of Rockingham county New-Hampshire, situated on the south State line, which separates it from Dracut in Massachusetts. It lies on the E. side of Beaver river, 30 miles southwesterly of Exeter, and 36 N. of Boston. It was incorporated in 1746, and contains 791 inhabitants.—*ib.*

Pelham, a township of New-York, situated in West-Chester county, bounded southerly and easterly by the Sound, northerly by the north bounds of the manor of Pelham, including New-City, Hart, and Applesby's Islands. It contains 199 inhabitants; of whom 27 are electors, and 38 slaves.—*ib.*

PELICAN, *Great*, an island a mile long and very narrow, east of the Bay of Mobile in the Gulf of Mexico. Its concave side is towards the east end of Dauphin Island. Hawk's Bay lies between these two islands. *Little Pelican Island* is a small sand key, south-east of Great Pelican. Its eastern curve meets a large shoal extending from Mobile Point.—*ib.*

Pelican *Islands*, on the south coast of the island of Jamaica, are situated off the point so called, westward of Port-Royal harbour.—*ib.*

Pelican, a small island at the southwest point of the island of Antigua.—*ib.*

Pelican *Rocks*, lie in Runaway Bay, on the west side of the island of Antigua, towards the north-west. They lie under water, and are very dangerous.—*ib.*

Pelican *Shoals*, small patches of sand banks about half a mile from the shore of the south-west coast of the island of Barbadoes.—*ib.*

PELL (Dr John), an eminent English mathematician, descended from an ancient family in Lincolnshire, was born at Southwick in Sussex, March 1. 1610, where his father was minister. He received his grammar education at the free school at Stenning in that county. At the age of 13 he was sent to Trinity college in Cambridge, being then as good a scholar as most masters of arts in that university; but though he was eminently skilled in the Greek and Hebrew languages, he never offered himself a candidate at the election of scholars or fellows of his college. His person was handsome; and being of a strong constitution, using little or no recreations, he prosecuted his studies with the more application and intenseness.

In 1629 he drew up the "Description and Use of the Quadrant, written for the Use of a friend," in two books; the original manuscript of which is still extant among his papers in the Royal Society. And the same year he held a correspondence with Mr Briggs on the subject of logarithms.

In 1630, he wrote *Modus supputandi Ephemerides Astronomicas, &c. ad an. 1630 accommodatus;* and, A Key to unlock the meaning of Johannes Trithemius, in his Discourse on Steganography: which Key he imparted to Mr Samuel Hartlib and Mr Jacob Homedæ. The same year he took the degree of Master of Arts at Cambridge. And the year following he was incorporated in the university of Oxford. June the 7th, he wrote A Letter to Mr Edmond Wingate on Logarithms: and, Oct. 5. 1631, *Commentationes in Cosmographiam Alstedii.*

In 1632 he married Ithamaria, second daughter of Mr Henry Reginolles of London, by whom he had four sons and four daughters.—March 6. 1634, he finished his "Astronomical History of Observations of Heavenly Motions and Appearances;" and April the 10th, his *Ecliptica Prognostica*, or Foreknower of the Eclipses, &c. In 1634 he translated "The Everlasting Tables of Heavenly motions," grounded upon the Observations of all Times, and agreeing with them all, by Philip Lansberg, of Ghent in Flanders. And June the 12th, the same year, he committed to writing "The Manner of Deducing his Astronomical Tables out of the Tables and Axioms of Philip Lansberg."—March the 9th, 1625, he wrote "A Letter of Remarks on Gellibrand's Mathematical

Pell. Mathematical Discourse on the Variation of the Magnetic Needle." And the 3d of June following, another on the same subject.

His eminence in mathematical knowledge was now so great, that he was thought worthy of a Professor's chair in that science; and, upon the vacancy of one at Amsterdam in 1639, Sir William Boswell, the English Resident with the States General, used his interest, that he might succeed in that Professorship. It was not filled up, however, till 1642, when Pell was chosen to it; and he read with great applause public lectures upon Diophantus.—In 1644 he printed at Amsterdam, in two pages 4to, "A Refutation of Longomontanus's Discourse," *De Vera Circuli Mensura*.

In 1646, on the invitation of the Prince of Orange, he removed to the new college at Breda, as Professor of Mathematics, with a salary of 1000 guilders a year. His *Idea Matheseos*, which he had addressed to Mr Hartlib, who in 1639 had sent it to Des Cartes and Mersenne, was printed 1650 at London, in 12mo, in English, with the title of *An Idea of Mathematics*, at the end of Mr John Durie's Reformed Library keeper. It is also printed by Mr Hook, in his Philosophical Collections, N° 5. p. 127.; and is esteemed our author's principal work.

In 1652 Pell returned to England; and in 1654 he was sent by the protector Cromwell agent to the Protestant Cantons in Switzerland; where he continued till June 23. 1658, when he set out for England, where he arrived about the time of Cromwell's death. His negociations abroad gave afterwards a general satisfaction, as it appeared he had done no small service to the interest of King Charles II. and of the church of England; so that he was encouraged to enter into holy orders: and in the year 1661 he was instituted to the rectory of Fobbing in Essex, given him by the king. In December that year, he brought into the upper house of convocation the calendar reformed by him, assisted by Sancroft, afterwards archbishop of Canterbury. In 1673 he was presented by Sheldon, bishop of London, to the rectory of Laingdon in Essex; and, upon the promotion of that bishop to the see of Canterbury soon after, became one of his domestic chaplains. He was then doctor of divinity, and expected to be made a dean; but his improvement in the philosophical and mathematical sciences was so much the bent of his genius, that he did not much pursue his private advantage. The truth is, he was a helpless man, as to worldly affairs; and his tenants and relations imposed upon him, cozened him of the profits of his parsonage, and kept him so indigent, that he wanted necessaries, even ink and paper, to his dying day. He was for some time confined to the King's-bench prison for debt; but, in March 1682, was invited by Dr Whitler to live in the college of physicians. Here he continued till June following; when he was obliged, by his ill state of health, to remove to the house of a grandchild of his in St Margaret's church-yard, Westminster. But he died at the house of Mr Cothorne, reader of the church of St Giles's in the Fields, December the 12th, 1685, in the 74th year of his age, and was interred at the expense of Dr Busby, master of Westminster school, and Mr Sharp, rector of St Giles's, in the rector's vault under that church.—Dr Pell published some other things not yet mentioned; a list of which is as follows, *viz.*

Pell, ‖ Pelletier.

1. An Exercitation concerning Easter; 1644, in 4to. 2. A Table of 10,000 square numbers, &c.; 1672, folio. 3. An Inaugural Oration at his entering upon the Professorship at Breda. 4. He made great alterations and additions to Rhonius's Algebra, printed at London 1668, 4to, under the title of an Introduction to Algebra, translated out of the High Dutch into English by Thomas Branker, much altered and augmented by D. P. (Dr Pell). Also a Table of Odd Numbers, less than 100,000, shewing those that are incomposite, &c. supputated by the same Thomas Branker. 5. His Controversy with Longomontanus concerning the Quadrature of the Circle; Amsterdam. 1646, 4to.

He likewise wrote a Demonstration of the 2d and 10th books of Euclid; which piece was in MS. in the library of Lord Brereton in Cheshire: as also Archimedes's Arenarius, and the greatest part of Diophantus's six books of Arithmetic; of which author he was preparing, August 1644, a new edition, in which he intended to correct the translation, and make new illustrations. He designed likewise to publish an edition of Apollonius; but laid it aside, in May 1645, at the desire of Golius, who was engaged in an edition of that author from an Arabic manuscript, given him at Aleppo 18 years before. Letters of Dr Pell to Sir Charles Cavendish, in the Royal Society.

Some of his manuscripts he left at Brereton in Cheshire, where he resided some years, being the seat of William Lord Brereton, who had been his pupil at Breda. A great many others came into the hands of Dr Busby; which Mr Hook was desired to use his endeavours to obtain for the Society. But they continued buried under dust, and mixed with the papers and pamphlets of Dr Busby, in four large boxes, till 1755; when Dr Birch, secretary to the Royal Society, procured them for that body, from the trustees of Dr Busby. The collection contains, not only Pell's mathematical papers, letters to him, and copies of those from him, &c. but also several manuscripts of Walter Warner, the mathematician and philosopher, who lived in the reigns of James I. and Charles I.

Dr Pell invented the method of ranging the several steps of an algebraical calculus, in a proper order, in so many distinct lines, with the number affixed to each step, and a short description of the operation or process in the line. He also invented the character ÷ for division, ⌀ for involution, ш for evolution.*

* Hutton's Mathematical Dictionary.

PELLETIER (Bertrand), was born at Bayonne in 1761, and very soon began to display an insatiable thirst of science. It frequently happens, however, that young men, sincerely desirous of instruction, have no means or place where they can be assisted in the developement of their natural talents, no matter who may point out the direct road to science, and that order and method, without which the efforts of the individual too often lead him from the object of his pursuit, instead of bringing him nearer to it. This was not the case with young Pelletier. He found every advantange in his father's house, where he received the first elements of the art of which he was afterwards the ornament; and his subsequent progress was made under Darcet, who having

Pelletier. ving remarked in him that fagacity which may be called the inftinct of fcience, admitted him among the pupils attached to the chemical laboratory of the college of France. Five years of conftant application and ftudy under fuch a mafter, who was himfelf formed by nature, perfected by experience, and affectionately difpofed towards his pupil, afforded this young man a ftock of knowledge very unufual at his age. He foon gave a convincing proof of this, by publifhing, at the age of 21, a fet of very excellent obfervations on the arfenical acid. Macquer, by mixing nitre with the oxyd of arfenic, had difcovered in the refidue of this operation a falt foluble in water, fufceptible of cryftallization in tetrahedral prifms, which he denominated the neutral arfenical falt. It is the arfeniat of potafh. He was of opinion that no acid could decompofe it; but Pelletier fhewed, that the fulphuric acid diftilled from it does difengage the acid of arfenic. He fhewed the true caufe why the neutral arfenical falt is not decompofable in clofed veffels; and particularly the order of affinity by which the falt itfelf is formed in the diftillation of the nitrate of potafh, and the white oxyd of arfenic. He explains in what refpects this falt differs from what Macquer called the liver of arfenic. Pelletier had been anticipated in this work by Scheele, by Bergman, by the academicians of Dijon, and by Berthollet; but he poffeffed at leaft the merit, in the firft effay of his powers, of having clearly developed all the phenomena of this operation, by retaining and even determining the quantity of gas it was capable of affording. After the fame principles it was that he decompofed the arfenico-ammoniacal falt, by fhewing how, in the decompofition of this laft, the pure arfenical acid is obtained in the form of a deliquefcent glafs. In this work we may obferve the fagacity with which he was enabled to develope all the phenomena of thefe compofitions and decompofitions, by tracing thofe delicate threads of fcientific relation which connect the feries of facts, and are imperceptible to ordinary minds.

Encouraged by the fuccefs of thefe firft works, which he prefented with the fenfibility of grateful attachment to his inftructor, he communicated his obfervations on the cryftallization of fulphur, cinnabar, and the deliquefcent falts; the examination of zeolites, particularly the falfe zeolite of Fribourg in Brifgaw, which he found to be merely an ore of zinc; obfervations on the dephlogifticated or oxygenated muriatic acid, relative to the abforption of oxygen; on the formation of ethers, particularly the muriatic and the acetous; and feveral memoirs on the operation of phofphorus made in the large way; its converfion into phofphoric acid, and its combination with fulphur and moft metallic fubftances.

It was by his operations on that moft aftonifhing production of chemiftry, phofphorus, that he burned himfelf fo dangeroufly as nearly to have loft his life. After the cure of his wound, which confined him to his bed for fix months, he immediately began the analyfis of the various plumbagos of France, England, Germany, Spain, and America, and found means to give novelty and intereft to his work, even after the publication of Scheele on the fame object. The analyfis of the carbonat of barytes led him to make experiments on animals; which prove that this earth is a true poifon, whether it be adminiftered in the form of the native carbonat of barytes, or whether it be taken from the decompofition of the fulphat, even though again combined with another acid. Pelletier, ‖ Pemigewaffet.

Chemifts have given the name of *ftrontian* to a newly difcovered earth, from the name of the place where it was firft found. Pelletier analyfed it, and difcovered it in the fulphat of barytes. He likewife analyfed the verditer of England, of which painters and paper-hangers make fo much ufe. He difcovered a procefs for preparing it in the large way, by treating with lime the precipitate obtained from the decompofition of nitrat of copper by lime. By this procefs, verditer is afforded equal in beauty to that which comes from England. He was likewife one of the firft chemifts who fhewed the poffibility of refining bell metal, and feparating the tin. His firft experiments were made at Paris; after which he repaired to the foundry at Romilly, to verify them in the large way. The following year he was received a member of the Academy of Sciences at Paris, and fhortly afterwards went to La Fere, with Borda and General Daboville, to affift in experiments upon a new gunpowder. Being obliged, in order to render his experiments more decifive, to pafs great part of the day in the open air during a cold and humid feafon, his health, which was naturally delicate, became confiderably impaired. He began to recover his health, when he again became the victim of his zeal for the fcience he fo fuccefsfully cultivated. He had nearly perifhed by refpiring the oxygenated muriatic acid gas. A violent attack of convulfive afthma, which returned during feveral days, was the firft confequence of this unhappy accident. The diforder then feemed to abate; but it was incurable. The affiftance of art was infufficient to fave him; and he died in Paris, on the 21ft of July 1797, of a pulmonary confumption, in the flower of his age.

PEMAQUID, a bay on the fea-coaft of Lincoln county, Diftrict of Maine. It lies eaft of Sheepfcot river, and contains a number of iflands, many of which are under cultivation.—*Morse.*

Pemaquid *Point*, on the weft fide of the above bay, lies 2 miles eaft of Booth Bay, and about 4 leagues northweft of Menhegan Ifland. N. lat. 44 5, W. long. 69 —*ib.*

PEMAGON, a fettlement of the Diftrict of Maine, 7 miles from Denney's river, and 14 from Moofe Ifland. —*ib.*

PEMBROKE, a townfhip of Maffachufetts, in Plymouth county, 31 miles fouth by eaft of Bofton. It was incorporated in 1712, and contains 1954 inhabitants. It lies 18 miles from the mouth of North river; and veffels of 300 tons have been built here.—*ib.*

Pembroke, the *Suncook* of the Indians, a townfhip of New-Hampfhire, in Rockingham county, on the eaft fide of Merrimack river, oppofite to Concord. It lies upon two fmall rivers, Bowcook and Suncook, which run a fouth-by-weft courfe into Merrimack river. In 1728, it was fettled and called *Lovewell's Town*. It was incorporated in 1759, and contains 956 inhabitants.—*ib.*

PEMIGEWASSET, a river of New-Hampfhire, which fprings from the eaftern part of the ridge called the Height of Land. Moofe-Hillock Mountain gives it one branch; another comes from the S. W. extremity of the White Mountains, and a third comes from the townfhip of Franconia. Its length is about 50 miles; its courfe generally S. and it receives from both fides a number of ftreams. Winipifeogee river, comes

from

from the lake of that name, and unites its waters with the Pemigewaffet at the lower end of Sanborntown. From this junction, the confluent ftream bears the name of Merrimack to the fea.—*ib.*

PENDLETON, a county of Virginia, bounded north-weft by Randolph, and fouth by Rockingham counties; watered by the fouth branch of the Patowmack. It contains 2,452 inhabitants, including 73 flaves. Chief-town, Frankford.—*ib.*

PENDLETON, a county of Wafhington diftrict, S. Carolina, on Keowee and Savannah rivers. It contained, in 1795, 9,568 inhabitants, of whom 834 are flaves; and fends three reprefentatives and 1 fenator to the State legiflature. The court-houfe in this county is 33 miles N. N. E. of Franklin court-houfe in Georgia, and 52 weftward of Cambridge. A poft-office is kept at this court-houfe.—*ib.*

PENDULUM (See *Encycl.*). Befides the effects of heat and cold on the length of the pendulum rod, and of courfe on its ifochronifm, it may certainly be worth while, in the conftruction of clocks intended to meafure time with the utmoft poffible exactnefs, to take into confideration the refiftance of the air, which, by its unequal denfity, varying the weight of the pendulum, muft in a fmall degree accelerate or retard its motion. The celebrated David Rittenhoufe, who paid particular attention to this fubject, eftimates the extreme difference of velocity, arifing from this caufe, at half a fecond a day; and he obferves, that a remedy dependent on the barometer will not be ftrictly accurate, as the weight of the entire column of air does not precifely correfpond with the denfity of its bafe. He propofes, therefore, as a very fimple and eafy remedy, that the pendulum fhall, as ufual, confift of an inflexible rod carrying the ball beneath, and continued above the centre of fufpenfion to an equal (or an unequal) diftance upwards. At this extremity is to be fixed another ball of the fame dimenfions (or greater or lefs, according as the continuation is fhorter or longer), but made as light as poffible. The ofcillations of this upper ball will be accelerated by its buoyancy by the fame quantity as thofe of the lower would be retarded; and thus, by a proper adjuftment, the two effects might be made to balance and correct each other.

Our author made a compound pendulum on thefe principles, of about one foot in its whole length. This pendulum, on many trials, made in the air 57 vibrations in a minute. On immerfing the whole in water, it made 59 vibrations in the fame time; fhewing evidently, that its returns were quicker in fo denfe a medium as water than in the air. (This is contrary to what takes place with the common pendulum). When the lower bob or pendulum only was plunged in water, it made no more than 44 vibrations in a minute.

PENGUIN, an ifland in the Atlantic Ocean, about 10 miles N. E. of the coaft of Newfoundland. It has this name from the multitude of birds of that name which frequent it. N. lat. 50 5, W. long 50 30. There is alfo an ifland of the fame name, on the coaft of Patagonia, in the S. Atlantic Ocean, 3 leagues fouth-eaft of Port Defire. It is an uninhabited rock, high at the ends and low in the middle, and is the largeft and outermoft of a number of fmall ifles or rocks, and is about a mufket-fhot from the main land. It abounds in an extraordinary manner, with penguins and feals. It is three-fourths of a mile in length, and half a mile in breadth from E. to W.—*Morse.*

PENNANT (Thomas, Efq.), fo well known in the republic of letters as a writer of travels, and of natural hiftory, was an ancient Briton by birth, having drawn his firft breath in Flintfhire, in 1726. His family has been fettled in that county for many centuries; we learn from himfelf that he received the rudiments of his education at Wrexham, whence he was removed to Fulham. Soon after this he was fent to Oxford; and having made a confiderable proficiency in the claffics, he applied himfelf within the walls of that univerfity to attain a knowledge of jurifprudence; but we do not find that he ever entered himfelf of any of the inns of court, or followed the law as a profeffion.

The ruling paffions of mankind are excited, and the future current of their lives frequently directed, by trivial circumftances. One of the greateft painters of our age was attracted with an irrefiftible impulfe towards his art by the perufal of a treatife on it; and we have the authority of the fubject of this memoir for afferting, that a prefent of Willoughby's Ornithology, at an early period, firft gave him a turn for natural hiftory, which has never once abandoned him through the courfe of a very long life.

Mr Pennant commenced his travels with great propriety at home, where he made himfelf acquainted with the manners, productions, and curiofities, of his native country, before he fallied forth to infpect thofe of other nations. He then repaired to the continent; and not only acquired confiderable additional knowledge relative to his favourite ftudies, but became acquainted, and eftablifhed a correfpondence, with fome of the greateft men of the age.

On his return he married, and had two children, but did not come into the family fortune until he was thirty-feven years of age, at which time he was fettled at Downing.

Having loft his wife, he appears to have fet out once more for the continent, and to have formed an acquaintance with Voltaire, Buffon, Haller, Pallas, &c. He had by this time acquired confiderable reputation as a fcientific man, having commenced his career as an author fo early as 1750. His Britifh Zoology* eftablifhed his reputation as a naturalift; and this received a frefh acceffion of celebrity in confequence of his acquaintance with Linnæus, and his intercourfe by letters with all the celebrated naturalifts in Europe.

Early in life he had undertaken a moft interefting tour to Cornwall; and he now entertained an ardent defire to furvey the works of nature in the northern extremities of the ifland. He accordingly fet out for Scotland, and in 1771 favoured the public with an entertaining account of his Tour†, which was fo well received as to pafs through feveral editions. Not content with the main land of Great Britain, he was ambitious to furvey the iflands in the vicinity, and accordingly penetrated to the Hebrides, and vifited Man.

It is not to be fuppofed that he would leave his own country unexplored; on the contrary, he minutely defcribed all its wonders. He did not fail on this occafion to prefent the world with the refult of his enquiries, for in 1778 he commenced the publication of his Welch Tour.§

In four years after this (1782) appeared the account of

* Four vols. 4to.

† Three vols. 4to.

§ Two vol 4to.

Pennant. of the Journey from Chester to London‡, in which he refutes the vulgar opinion that it is uninteresting; and in two years more his Arctic Zoology, an admirable work, greatly prized both here and in other countries.

‡ One vol. 4to.

In 1790 appeared a quarto volume, simply entitled Of London; in which he observes that this work is compiled from observations, originally made without any view of publication. "Let me request (says he in the preface) the good inhabitants of London and Westminster not to be offended at my having stuffed their Iliad into a nutshell; the account of the city of London and liberties of Westminster into a quarto volume. I have condensed into it all I could; omitted nothing that suggested itself; nor amplified any thing to make it a guinea book. In a word, it is done in my own manner, from which I am grown too old to depart.

"I feel within myself a certain monitor that warns me (adds he) to hang up my pen in time, before its powers are weakened, and rendered visibly impaired. I wait not for the admonition of friends. I have the Archbishop of Grenada in my eye; and fear the imbecility of human nature might produce in long-worn age the same treatment of my kind advisers as poor Gil Blas had from his most reverend patron. My literary bequests to future times, and more serious concerns, must occupy the remnant of my days. This closes my public labours."

Notwithstanding his parting address, the example of the Archbishop of Grenada, and the concluding sentence of "*Valete & Plaudite*," we find Mr Pennant adventuring once more in the ocean of literature, at a late period of his life, and trying his fortune again with all the eagerness of a young author.

He accordingly published the Natural History of the parishes of Holywell and Downing,* within the precincts of the latter of which he had resided about half a century.

* One vol. 4to.

He also presented the public, a very short time before his death, with a splendid work, consisting of 2 vols. 4to. entitled The View of Hindoostan; in the preface to which he candidly states his motives for this new attempt. "I had many solicitations from private friends (says he), and a few wishes from persons unknown, delivered in the public prints, to commit to the press a part, in the form in which the posthumous volumes might hereafter make their appearance. I might have pleaded the imprudence of the attempt at my time of life, of beginning so arduous an undertaking in my 71st year.

"I happily, till very lately, had scarcely any admonition of the advanced season. I plunged into the sea of trouble, and with my papers in one hand, made my way through the waves with the other, and brought them secure to land. This, alas! is finite boasting. I must submit to the judgment of the public, and learn from thence how far I am to be censured for so grievous an offence against the maxim of Aristotle, who fixes the decline of human abilities to the 49th year.

"I ought to shudder, when I consider the wear and tear of 22 years; and feel shocked at the remark of the elegant Delanty, who observes, 'that it is generally agreed among wise men, that few attempts, at least in a learned way, have ever been wisely undertaken and happily executed after that period!'

"I cannot defend the wisdom: yet from the good fortune of my life I will attempt the execution." Pennant.

These valuable volumes are drawn up by Mr Pennant in the manner of his introduction to the Arctic Zoology. The plates, 23 in number, are admirably engraved, and one (the Nipaul pheasant) is beautifully coloured.

In addition to the list of literary labours already enumerated, is a letter on an earthquake felt at Downing, in Flintshire, in 1753; another inserted in the same publication,* in 1756, on coralloid bodies (κοραλλοειδης) collected by him: his Synopsis of Quadrupeds, published in 1771; a pamphlet on the Militia; a paper on the Turkey; and a volume of Miscellanies.

* *Phil. Transf.*

Mr Pennant attained academical honours of all kinds, having had the degree of LL. D. conferred on him by the university in which he was educated, he was a Fellow of the Royal Society, and a member of the Society of Antiquaries, a Fellow of the Royal Society of Upsal in Sweden, a member of the American Philosophical Society, an honorary member of the Anglo-Linnæan Society, &c.

The ample fortune left him by his father enabled Mr Pennant to keep an hospitable table, and also to present the profits of several of his works to public institutions, particularly the Welsh charity-school in Gray's-inn-lane. He encouraged several engravers by his patronage, and was not a little serviceable to the advancement of the fine arts.

In 1776 he married a second time; on which occasion he became united to Miss Mostyn, sister of his neighbour, the late Sir Roger Mostyn, in Flintshire. The latter part of his life was chearful, and he scarcely felt the approaches of old age. He died at his seat at Downing in his 72d year.

He has left several works behind him in MS. under the title of Outlines of the Globe; and as a proof that it will be a very voluminous and interesting publication, it is only necessary to observe, that The View of Hindostan composed the xivth and xvth volumes.

Mr Pennant possessed a well-compacted frame of body, an open and intelligent aspect, an active and chearful disposition, and a vivacity which rendered him always entertaining, as well in conversation as in writing. Though not without a share of irrascibility, his heart was kind and benevolent. He was exemplary in the relations of domestic life, and sensibly felt for the distresses of his poor neighbours, whose relief in seasons of hardship he promoted with great zeal and liberality. His candour and freedom from ordinary prejudices, are sufficiently displayed in his writings; and Scotland was forward to confess, that he was the first traveller from the south side the Tweed, who had visited the country with no unfriendly spirit, and had fairly presented it under its favourable as well as its less pleasing aspects. As a writer, his style is lively and expressive, but not perfectly correct. His principles of arrangement in zoology are judicious, and his descriptions characteristic. If in some of his later works a little vanity appears, and a propensity to think that important to the world which was so to himself, it may readily be pardoned to one who has afforded such copious and valuable entertainment to the public. His name will live with honour in the literary history of his country, and his memory will be cherished with respect and affection by his surviving friends.

Plate XLI.

PENNATULA (See *Encycl.*). A ſpecies of this animal, hitherto undeſcribed, was diſcovered by La Martiniere near Nootka. Its body is of a cartilaginous ſubſtance, and a cylindrical form; its head, armed with two little horns of the ſame ſubſtance, preſents a ſpherical figure flatted at its anterior extremity. This part is covered with ſmall papillæ, ſome of which are viſible at D, and which ſerve the purpoſe of ſmall mouths, by means of which this animal ſucks the blood of fiſhes, making its way as far as poſſible into the fleſh: the extremity of its body, which always projects from the fiſh, appears like the feathers of a pen; theſe feather-like ſubſtances ſerve as excretory veſſels; for on making a ſlight preſſure on the animal, from the greater part of theſe cartilaginous barbs iſſued ſmall drops of a very limpid liquor: at the baſe of theſe barbs, and beneath the body, are placed two large cartilaginous threads, of which our author could not imagine the uſe, for they are not univerſally met with in each individual. The circulation of its blood is readily obſerved, it forms a complete revolution about once in a minute. It is probable that this animal is only able to make its way into the bodies of different fiſh when it is very young; and when it has once buried itſelf there, having abundance of nouriſhment, its head increaſes conſiderably, and the two horns with which it is furniſhed neceſſarily form an obſtacle to its regreſs, which is a remarkable inſtance of the foreſight of Nature, ſince it is deſtined to be nouriſhed at the expenſe of another. The pennatula, of which we have given from Martiniere a figure, was found by him at the depth of more than an inch and an half in the body of a *diodon*.

PENN, *Fort*, ſtands at the mouth of a ſmall creek, on the weſt ſide of Delaware river, in Northampton county, about 21 miles north of the town of Eaſton, and near 70 north of Philadelphia. N. lat. 40 59, W. long. 75 13. The road from Philadelphia to Tioga Point, paſſes through the opening in the Blue Mountains, called *Wind Gap*, about 9 miles ſouth-weſt of this fort.—*Morſe.*

Penn, *Port*, in New-Caſtle county, Delaware, is ſituated on the W. bank of Delaware river, oppoſite to Reedy Iſland.—*ib.*

PENNINGTON, or *Pennytown*, a pleaſant and flouriſhing village in Hunterdon county, New-Jerſey, 9 miles W. of Princeton, and 36 N. E. by N. of Philadelphia. It contains a church for public worſhip, and about 40 houſes.—*ib.*

PENN'S *Rocks*, two cluſters of iſlands in the broadeſt and ſouth-weſt part of Hudſon's Bay, N. America; diſtinguiſhed by the names of E. and W. Penn's.—*ib.*

Penn's, a townſhip of Pennſylvania, on Suſquehannah river.—*ib.*

Penn's *Neck*, in Salem county, New-Jerſey, lies on Old Man's Creek, which is part of the boundary between Salem and Glouceſter counties. It is 12 miles N. E. by N. of Salem, 3½ miles from the Delaware, and 5 below Swedeſborough.—*ib.*

Penn's *Neck*, the name of a range of farms of excellent ſoil, ſituated about a mile and a half ſouth eaſt of Princeton in New-Jerſey, on a point of land formed by Mill-ſtone river and Stony brook. It derived its name from the celebrated legiſlator, William Penn, who formerly owned this tract.—*ib.*

PENNSBOROUGH, *Eaſt* and *Weſt*, two townſhips in Cumberland county, Pennſylvania. There is alſo a townſhip of this name in Cheſter county, Pennſylvania.—*ib.*

PENNSBURY, a ſmall town of Pennſylvania, in Buck's county on a ſmall creek of Delaware river. It was a manor which the celebrated Mr Penn reſerved for himſelf. Here he built a houſe, and planted gardens and orchards; which, with many additional buildings and improvements, ſtill continue.—*ib.*

PENOBSCOT, a bay on the coaſt of Hancock county, Diſtrict of Maine, and called *Norumbega* by the firſt diſcoverer, is about 16 leagues wide from Naſkeag Point and Burnt Coat Iſland, on the E. to the point on which Thomaſtown ſtands, on the weſt ſide of the bay. The chief iſlands it encloſes are Fox, Haut, Long and Deer Iſlands; beſides a number of ſmall iſles, rocks and ledges. Through this bay to the mouth of the river of its name, the weſtern channel goes up by a head-land on the W. called Owl's Head, and between Long Iſland on the W. and Cape Roſier on the E. to Bagaduce Point. The eaſtern channel is between Haut Iſland on the weſt, and Burnt Coat Iſland on the eaſt, and through a reach, called Long Reach, formed by the ſhores of Naſkeag, or Sedgwick, on the E. or N. E. and Deer Iſlands on the W. or S. W. till it unites with the other channel, between Point Roſier and Long Iſland. On a fine peninſula on the eaſt ſide of the bay, the Britiſh built a fort and made a ſettlement, which is now the ſhire-town of the county of Hancock, and is a commodious place for the lumber trade. Haut Iſland, or Iſle of Holt, lies in lat. 44 23 N. and long. 68 10 W. and is the ſouthernmoſt of the large iſles.—*ib.*

Penobscot, the noble river which empties its waters into the above deſcribed bay, is the moſt conſiderable in the Diſtrict of Maine, and riſes by two branches in the high lands. Between the ſource of the weſt fork, and its junction with the eaſt, is Mooſehead Lake, 30 or 40 miles long, and 15 wide. The eaſtern branch paſſes through ſeveral ſmaller lakes. From the forks, as they are called, the Penobſcot Indians paſs to Canada, up either branch, principally the weſt, the ſource of which, they ſay, is not more than 20 miles from the waters which empty into the St Lawrence. At the forks is a remarkable high mountain. From thence down to Indian Old Town, ſituated on an iſland in this river, is about 60 miles, 40 of which, the water flows in a ſtill ſmooth ſtream, and in the whole diſtance there are no falls to interrupt the paſſage of boats. In this diſtance the river widens and embraces a great number of iſlands. About 60 rods below Indian Old Town are the Great Falls, where is a carrying-place of about 20 rods; thence 12 miles to the head of the tide there are no falls to obſtruct boats. Veſſels of 30 tons come within a mile of the head of the tide. Thence 35 miles to the head of the bay, to the ſcite of Old Fort Pownal, the river flows in a pretty ſtraight courſe, and is eaſily navigated. Paſſing by Majabagaduſe on the eaſt 7 miles, and Owl's-Head 20 miles further, on the weſt, you enter the ocean. It is high water here, at full and change, 45 minutes paſt 10. At the entrance of the river is 10 fathoms water. The Indians have a communication from this river to Scoodick river by a portage of 3 miles. This river was the weſtern limits of Nova-Scotia or Acadia, by the treaty of Utrecht.—*ib.*

PENOB-

PENOBSCOTS, a small tribe of Indians who live in Indian Old Town, on an island in Penobscot river. They aver that they have possessed the island, on which their town stands, 500 years. It stands just above the Great Falls, and consists of about 200 acres of land. In a former war, this tribe lost their lands; but at the commencement of the last war, the Provincial Congress forbade any person settling on the lands from the head of the tide on Penobscot river, included in lines drawn six miles from the river on each side; that is, a tract 12 miles wide, intersected by the middle of the river. They, however, consider that they have a right to hunt and fish as far as the mouth of the Bay of Penobscot extends. This was their original right, in opposition to any other tribe, and they now occupy it.—*ib.*

PENSACOLA *Harbour* and *Town*. The harbour is on the N. shore of the Gulf of Mexico, 11 leagues east of Port Lewis, and Mobile, and 158 W. of the islands of Tortuga. It is large, safe from all winds, and has 4 fathoms water at its entrance, deepening gradually to 7 or 8. The bar lies in lat. 30 15 N. and long. 87 14 W. The town of Pensacola, the capital of West-Florida, lies along the beach of the bay, is of an oblong form; about a mile in length, and a quarter of a mile in breadth. It contains several hundred habitations; and many of the public buildings and houses are spacious and elegant. The governor's palace is a large stone building, ornamented with a tower, built by the Spaniards. It is defended by a small fort called St Mary de Galve. The exports from this town, consisting of skins, logwood, dying-stuff and silver dollars, amounted, while in the possession of the British, to £63,000 annually. The average value of imports, for 3 years, from Great Britain, was £97,000. The town and fort of Pensacola surrendered to the arms of Spain, in the year 1781, and with them the whole province. Escambia river, or Shambe, is the largest stream which falls into Pensacola Bay. It admits shallops some miles up, and boats upwards of 50 miles.—*ib.*

PENTECOST, an island in the *Archipelago of the Great Cyclades*. It was discovered by Bouganville, May 22, 1768, and named from the day, being the day of Pentecost. It is two leagues distant from Aurora Island, which is in 15 8 S. lat. and 165 58 E. long. from Paris.—*ib.*

PENUCO, a province of Mexico, separated from that of Angelos, or Tlascala, on the N. by Tuspa river.—*ib.*

PEPCHIDIACHICH, a point or head land on the S. shore of the Great Bay of Chaleurs, near the N. E. extremity of the province of New-Brunswick. It is also called Pepchidichi, and lies W. S. W. of Port David.—*ib.*

PEPIN, a lake, or rather a dilatation of the river Mississippi, where it receives the river Chippeway from the N. E. in lat. 44 5 N. and long. 93 42 W. below the Falls of St Anthony.—*ib.*

PEPPERELL, a township of Massachusetts, on the E. branch of Nashaway river, and on the N. line of Middlesex county. It joins Groton on the south-eastward, and is 40 miles N. by W. of Boston. It was incorporated in 1753, and contains 1132 inhabitants.—*ib.*

PEPPERELBOROUGH, a township in York county, District of Maine, on the N. E. side of Saco river, near the mouth, and which separates it from Biddeford to the southward. It is about 12 miles S. W. of Portland, and 109 N. of Boston. It was incorporated in 1772, and contains 1,352 inhabitants.—*ib.*

PEPUSCH (John Christopher), one of the greatest theoretic musicians of modern times, as we are told, was born at Berlin about 1667; and became so early a proficient on the harpsichord, that at the age of 14 he was sent for to court, and appointed to teach the prince, father of the late King of Prussia. About 1700, he came over to England, and was retained as a performer at Drury Lane: it is supposed that he assisted in composing the operas which were performed there. While he was thus employed, he forebore not to prosecute his private studies; and these led him to enquire into the music of the ancients, and the perusal of the Greek authors upon that subject. The abilities of Pepusch, as a practical composer, were not likely to become a source of wealth to him: his music was correct, but it wanted variety of modulation. Besides, Handel had got possession of the public ear, in the opinion of whose superior merit he readily acquiesced; and chose a track for himself, in which he was almost sure to meet with no obstruction. He became a teacher of music, not the practice of any particular instrument, but music in the absolute sense of the word, that is to say, the principles of harmony and the science of practical composition; and this, not to children or novices, but in very many instances to professors of music themselves.

In 1713, he was admitted to the degree of Doctor in Music at Oxford, and continued to prosecute his studies with great assiduity. In 1724, he accepted an offer from Dr Berkeley to accompany him to the Bermudas, and to settle as professor of music in his intended college there; but the ship in which they sailed being wrecked, he returned to London, and married Francesca Margarita de l'Epine. This person was a native of Tuscany, and a celebrated singer, who performed in some of the first of the Italian operas that were represented in England. She came hither with one Greber, a German, and from this connection became distinguished by the invidious appellation of *Greber's Peg*. Afterwards she commenced a new connection with Daniel Earl of Nottingham, who had defended the orthodox notion of the Trinity against the heretic Whiston; and to this connection Rowe, in imitation of Horace's, "Ne sit ancillæ tibi amor pudori," thus alludes:

> Did not base Greber's Peg inflame
> The sober earl of Nottingham,
> Of sober sire descended?
> That, careless of his soul and fame,
> To play-houses he nightly came
> And left church undefended.

She continued to sing on the stage till about 1718; when having, at a modest computation, acquired above ten thousand guineas, she retired from the theatre, and afterwards married Dr Pepusch. She was remarkably tall, and remarkably swarthy; and, in general, so destitute of personal charms, that Pepusch seldom called her by any other name than Hecate, to which she is said to have answered very readily.

The change in Pepusch's circumstances by Margarita's fortune was no interruption to his studies: he loved

loved music, and he pursued the knowledge of it with ardour. At the instance of Gay and Rich, he undertook to compose, or rather to correct, the music for the Beggar's Opera. His reputation was now at a great height. He had perused with great attention those several ancient treatises on Harmonics, published by Meibomius, and that of Ptolemy by Dr Wallis; and the difficulties which occurred to him on the perusal, were in a great measure removed by his friend De Moivre the mathematician, who assisted him in making calculations for demonstrating those principles on which the harmonic science is founded. In consequence of these studies, he was esteemed, in matters of theory, one of the best musicians of his time. In 1737, he was chosen organist of the Charter-house, and retired, with his wife, to that venerable mansion. The wife died in 1740, before which he lost a son, his only child; so that he had no source of delight left, but the prosecution of his studies, and the teaching of a few favourite pupils, who attended him at his apartments. Here he drew up that account of the ancient genera which was read before the Royal Society, and is published in the Philosophical Transactions for October, November, and December, 1746; and, soon after the publication of that account, he was chosen a Fellow of the Royal Society.

He died the 20th of July, 1752, aged 85; and was buried in the chapel of the Charter-house, where a tablet with an inscription is placed over him.*

* Biog. Dict. new edit.

PEPY'S *Islands*, the same with Falkland Islands. Pepy's Island, described in Commodore Anson's Voyage, lies in lat. 47 S 8 leagues E. of Cape Blanco, on the coast of Patagonia, and was discovered by Capt. Cowley in 1680, who represents it to be commodious for taking in wood and water, and provided with a harbour capable of holding 1000 sail of ships; abounding with fowls, and promising great plenty of fish.—*Morse*.

PEQUANACK, a township of Morris county, New-Jersey; perhaps the same as in some maps is called *Pegunnock*, which is separated from Bergen county, northward by Pegunnock river.—*ib*.

PEQUANNOCK *Point* and *River*. The river is a small stream which runs southward through the towns of Huntington and Stratford in Fairfield county, Connecticut, and empties into a bay in the Sound where vessels may anchor. The point forms the western extremity of the bay near which are some rocks; from thence the outer bar extends N. by N. E. The point is 5 miles S. W. of Stratford river.—*ib*.

PERAMUS, or *Paramus*, in Bergen county, New-Jersey, lies on the point of land formed by the branches of Saddle river, a north water of Passaik; about 18 miles northward of Bergen, 10 west of Tappan, and 21 N. W. by N. of New-York city.—*ib*.

PERCEE, *l'isle*, a small but remarkable island on the west side of the Gulf of St Lawrence, being a perpendicular rock, pierced with two natural arches, through which the sea flows. One of these arches is sufficiently high to admit a large boat to pass freely through it. It is 15 miles south of Cape Gaspee. It is asserted that it was formerly joined to Mount Joli, which lies opposite to it on the continent.—*ib*.

PERCIPANY, a village in Morris county, New-Jersey, situated on a branch of Passaik river, and 6 miles N. of Morristown.—*ib*.

PERCUSSION, Force of Percussion, is the name by which mechanicians distinguish that faculty of producing motion, or making other sensible mechanical impressions on bodies, by means of the stroke of a body in motion. It is nearly the same with *impulse*; only, it would seem that the very scrupulous and refined affect to limit the attention to the *immediate* cause of the motion, or other effect produced; to the something that is different, both from the force supposed to be inherent in the moving body (a hammer for example), and the subsequent motion and penetration of the nail which is driven by it. We may venture to say that it is needless to attempt any investigation of this object. It is hid, with all other causes of all other effects in the universe, in impenetrable darkness. If we reflect on the constitution of our own mind, so far as we can know it by experience and observation, and on the manner in which we draw conclusions, we must see that the knowledge of the efficient cause of any effect is unattainable; for were the intervening something pointed out to us, and clearly conceived by us, we should find it just as necessary to find out why and how this something is connected with each of the events which we observe it invariably to connect.

But a knowledge of the force of percussion, in as far as it may or may not be distinguishable from other forces, is not unattainable. We can learn as much, and no more, concerning this, as concerning any other force: and we can contemplate that circumstance which, in our opinion, is common to it with all other forces, and may perhaps discover other circumstances in which it differs from them. But in all this disquisition, it is plain that it is only events, which we conceive to be the characteristic effects of the cause, that we contemplate.

Percussion, considered as an effect, characteristic of a particular faculty of moving bodies, became an object of anxious research, almost as soon as philosophers began to think of motion and moving forces at all. The ancients (as has been observed in the article Impulsion, *Suppl.*) contented themselves with very vague speculations on the subject. Galileo was the first who considered it as a measurable thing, the object of mathematical discussion; being encouraged by his precious discovery of the laws of accelerated motion, and the very refined measure which these gave him of the power of gravity. It was a measure of the heaviness, not of the weight, of the body; and this was measured by its acceleration, and not by its pressure. Encouraged by this, he hoped to find some such measure of the force of percussion, which he saw so intimately connected with motion; whereas its connection with pressure was far from being obvious. He therefore tried to convert the terms; and as he had found a measure of the pressure of gravity in the acceleration of motion, he endeavoured to find in pressure a measure of the force of percussion arising from this acceleration. He endeavoured to find the number of pounds, whose pressure is equal to the blow of a given body, moving with a given velocity. The velocity was known to him with great precision, by means of the height from which the ball must fall in order to acquire it. It seems pretty clear that percussion may be measured in this way: for a body falling from a height will pierce an uniformly tenacious body to a certain degree, and no further; and experiment shews that this degree of penetration is very precise and constant. The same body, being merely laid on the tenacious body, will penetrate to a small depth by its weight. Laying more weight on it, will make it penetrate deeper; and a certain weight will make it penetrate as deep as the fall did, and no deeper. Thus, percussion seems very easily measurable by weight, or by any pressure similar to that of weight. It appears that Galileo made experiments with this view, and that he was disappointed, and obliged to acquiesce in the opinion of Aristotle, that percussion and weight are incomparable. He proposes, therefore, another experiment, namely, to drop a body into the scale of a balance from greater and greater heights, till at last the blow on the scale raises a weight that lies in the other scale. This offers itself so plausibly, that we are persuaded that Galileo tried it: but as he makes no mention of the results, we presume that they were unsatisfactory.

Neither of these experiments *could* give us a measure of the force of percussion, if this force be any thing different from the forces which are excited or brought into action by percussion, in the manner described in the article Impulsion, *Suppl.* When the ball comes into physical contact with the scale, it begins to compress it. This compression begins to stretch the strings by which the scale is supported. These pull at the arm of the balance, and cause it to press the centre-pin a little harder on its support, and to bend the balance a little, and cause it to pull at the cords which support the other scale. That scale is pulled upwards, diminishing a little its pressure on the ground, and pressing it harder to the incumbent weight. These forces are excited *in succession* from the one scale to the other, and a small moment of time elapses. The reaction of the scale diminishes, but does not instantaneously annihilate, the velocity of the falling ball. It therefore compresses the scale still more, stretches the threads, presses the fulcrum, and bends the balance still more (because the weight in the other scale keeps it down). The velocity of the falling ball is rapidly diminished; the balance is more bent, and pulls more strongly upwards at the threads of the other scale; and thus presses that scale more strongly against the incumbent weight, gradually communicating more and more motion to it, removing it farther from the ground, till, at last, the motion becomes sensible, or so considerable as to disengage some delicate catch as a signal. The experiment is now finished; and the mechanician fondly thinks that, at this instant, the pressure excited by the percussion, between the opposite scale and the under side of the incumbent weight, is just equal, or but a very little superior, to the pressure of the incumbent weight: and, since the arms of the balance are equal, and therefore the pressures on the two scales are equal, he imagines that that weight exerts a pressure equal to the percussion of the falling ball.

But all this is misconception, and also false reasoning. It is not percussion that we are measuring, but the pressures, excited by percussion, on the two scales. And these pressures are the forces of elasticity or expansiveness, belonging to, or inherent in, the particles of the balls and the scales; forces which are brought into action by the approach of those bodies to each other. This reasoning is also erroneous; and we should be mistaken if we think that the pressure actually exerted is equal to that of the weight in the opposite scale. It is greater than the mere pressure of that weight. The reaction of the opposite scale on its load was precisely equal to that weight before the ball was dropped from the hand; and, had the ball been equal to that weight, and simply laid into the scale on which it falls, it would have made no change on the mutual pressures of the scale and the other weight; it would only have relieved the ground from the pressure of that weight, and would have brought it on the threads which support its scale. The pressure of this scale upwards must be increased, before it can start the weight sensibly from the ground. How much it must be increased depends on the springiness of the scales, cords, and beam. By a proper adjustment of these particulars, the apparatus will give us almost any measure of percussion that we choose. For this reason, the improvements made on it by Gravesande are of no value. The same reasoning, nearly, may be applied to the measurements of the force of percussion by means of the penetration of soft bodies.

Galileo mentions another very curious experiment, by which he thought that he had obtained a just measure of percussion. A vessel, filled with water, was suspended on the arm of a balance, with another vessel hanging from it, a great way below. All was exactly balanced by a weight in the opposite scale. By means of a suitable contrivance, a hole was opened in the bottom of the upper vessel, without disturbing the equilibrium. As soon as the water issued, and while it was falling through the air, that end of the balance rose; but when the water struck the lower vessel, the equilibrium was restored, and continued during the whole time of the efflux. Hence Galileo concluded, that the force of the stroke was equal to the weight of the falling water. But we apprehend that the observations made on this in the article Impulsion, *Suppl.* will convince the reader that this conclusion is far from being legitimate. Besides, the stroke, in any one instant, is made by those particles only which strike in that instant, while the whole vein of water between the vessels is neither acting by its weight on the upper vessel, nor by its stroke on the lower; and we should conclude from the experiment, that the force of percussion is infinitely greater than the weight of the striking body. Indeed this is the inference made by Galileo. But if we have recourse to the experiments and reasonings of Daniel Bernoulli, in the article *Resistance of Fluids*, *Encycl.* we shall find that the seeming impulse on the lower vessel is really a most complicated pure pressure, and of most uncertain determination. The experiment is valuable, and gives room for curious reflections. We have repeated it, in a great variety of forms, and with great changes of impulse, and sometimes in such a manner that no impulse whatever can obtain, while at the same time a quantity of water was falling, unsupported by either vessel. In all the trials the equilibrium remained undisturbed. We were obliged to conclude, therefore, that the experiment afforded no measure of percussion. Indeed we were of this opinion before making the trial, for the reasons just now given.

We cannot say that the subsequent labours of philosophers have added much to our knowledge of this matter. Mr Leibnitz had contrived his whimsical doctrine of of *living* and *dead* forces. The action of gravity, or of a spring, is a *vis viva*, when it actually produced motion in the body on which it acts; but when a stone lies on a table, and presses on it, this pressure is a *vis mortua*. Its exertion is made, and in the same instant destroyed, by an opposite *vis mortua*. Each of these exertions would have produced a *beginning* of motion (something different from any the smallest local motion); and the sum of all would, after a certain time, have amounted to a sensible motion and velocity. There seems no distinct conception to accompany, or that can accompany, this language. And as a proof that Leibnitz had no distinct conceptions of the matter, he has recourse to this very experiment of Galileo in support of his genesis of a sensible motion from the continual exertions of the *vis mortua;* and he concludes that the force of percussion is infinitely, or incomparably, greater than pressure, because it is the sum total of an infinity of individual exertions of *vis mortua*. Nothing but the authority which Leibnitz has acquired on the continent, by the zealous efforts of his partizans, could excuse our taking up any time in considering this unintelligible discourse. Surely, if there is such a thing as a *vis viva*, it exists in the moving water, and its impulsions are not continual exertions of a *vis mortua*. Nor is it possible to conceive continual impulse, nor a beginning of motion that is not motion, &c. &c. It is paradoxical (and Leibnitz loved to raise the wonder of his followers by paradoxes) to say that percussion is infinitely greater than pressure, when we see that pressure can do every thing that can be done by percussion. Nay, Euler, by far the most able supporter of the doctrines of Leibnitz about the force of bodies in motion, actually compares these two forces; and, in his commentary on Robins's Artillery, demonstrates, in his way, that when a musket ball, moving with the velocity of 1700 feet per second, penetrates five inches into a block of elm, the force of its percussion is 107,760 times its weight. John Bernoulli restricts the infinite magnitude of percussion to the case of perfectly hard bodies; and, for this reason alone, says, that there can be none such in the universe. But, as this justly celebrated mathematician scouts with scorn the notion of attractions and repulsions, he must allow, that an ultimate atom of matter is unchangeable in its form; which we take to be synonymous with saying that it is perfectly hard. What must be the result of one atom in motion hitting another at rest? Here must be an instantaneous production of a finite velocity, and an infinite percussion. A doctrine which reduces its abettors to such subterfuges, and engages the mind in such puzzling contemplations, cannot (to say the best of it) be styled an EXPLANATION of the laws of Nature. The whole language on the subject is full of paradoxes and obscurities. In order to reconcile this infinite magnitude of percussion with the observed finite magnitude of its effects, they say that the pressure, or instantaneous effort, has the same relation to the force of percussion that an element has to its integral; and in maintaining this assertion, they continually consider this integral under the express denomination of a *sum total*, robbing Leibnitz's great discovery of the infinitesimal calculus of every superiority that it possessed over Wallis's Arithmetic of Infinites, and really employing all the erroneous practices of the method of indivisibles. We look upon the strange things which have been inculcated, with pertinacious zeal in this doctrine of percussion and *vires vivæ*, as the most remarkable example of the errors into which the unguarded use of Calvalerius's Indivisibles, and of the Leibnitzian notion of the infinitesimal calculus, have led eminent mathematicians. It is not true that the pressure, and the ultimate force of percussion, have this relation; nor has the pressure and the resulting motion, which is mistaken for the measure of this ultimate force, any mathematical relation whatever. The relation is purely physical; it is the relation of pure cause and effect; and all that we know of it is their constant conjunction. The relation of fluxion and fluent is not a mathematical or measurable relation, but a connection in thought; which is sufficient for making the one an indication of the other, and the measures of the proportions of the one a mean for obtaining a measure of the proportions of the other. In this point of view, the relation of pressure to motion, as the measure of the force of percussion, *resembles* that of fluxion and fluent, but is not the same.

Much has been said by the partizans of Mr Leibnitz about the incomparableness of pressure and percussion, and many experimental proofs have been adduced of the incomparable superiority of the latter. Bulfinger says, that the pressure of many tons will not cause a spike to penetrate a block of hard oak half so far as it may be driven by a weak man with one blow of a mallet; and that a moderate blow with a small hammer will shiver to powder a diamond, which would carry a mountain without being hurt by its pressure. Nay, even Mr Camus, of the Academy of Paris, a staunch Cartesian, and an eminent mechanician, says that he beat a leaden bullet quite flat with a hammer of one pound weight, without much force; and that he found that 200 pounds weight would not have flattened it more than this blow: and he concludes from thence, that the force of the blow exceeded 200 pounds. These, to be sure, are remarkable facts, and justify a more minute consideration of a power of producing certain effects, which is so frequently and so usefully employed. But, at the same time, these are all very vague expressions, and they do not authorise any precise conclusions from them. Mr Camus saying "without much force," makes his pound weight, and his 200 pound weight, of no use for determining the force of the blow. He would have given more precise and applicable data for his decision, had he told us from what height the hammer should fall in order to flatten the bullet to this degree. But even then we should not have obtained any notion of the force in actual exertion during the flattening of the bullet; for the blow which could flatten the bullet in a longer or a shorter time, would unquestionably have been less or greater.

All the paradoxes, obscurities, and puzzling difficulties, in this subject disappear, if we leave out of our consideration that unintelligible force, which is supposed to preserve a body in motion or at rest; and if we consider both of these states of body as conditions which will continue, unless some adequate cause operate a change; and if we farther grant, that such causes do really exist in the universe, however unknown their nature may be by us; and, lastly, if we acknowledge, that the phenomena of elasticity, expansiveness, cohesion, gravity, magnetism, electricity, are indications of the agency of such causes, and that their actual exertions, and the motions and changes consequent on these exertions, are so invariably connected with particular bodies, that they always accompany their appearance in certain mutual relations of distance and position :—if we proceed thus, all the phenomena of collision will be explained by these causes alone, without supposing the existence and agency of a cause distinct from them all, and incomparable with them, called the FORCE OF PERCUSSION.

For it has been sufficiently demonstrated in the article IMPULSION *(Suppl.)*, that that property of tangible coherent matter, which we call *perfect elasticity*, operates as a pressure during a certain small portion of time on both bodies, diminishing more and more the motion of the one, and augmenting that of the other, as the compression of one or both increases, till at last they separate with sensible velocities. In some very simple or perspicuous cases, we know what this pressure is in every instant of the action. We can tell how many pounds weight, at rest, will exert the same pressure. We can tell the whole duration of this pressure, and the space along which it is exerted ; and, in such a case, we can say with precision what motion will be generated by this continued and varied pressure on the body which was at rest, and what diminution will be made in the motion of the other. All this can be done in the case of a ball A (fig. 1.), moving like a pendulum with a small velocity, and striking a slender elastic hoop B, also suspended like a pendulum. We can ascertain by experiment, before the collision, what pressure is necessary for compressing it one inch, one-half, one-fourth, &c. Knowing this, and the weight of the hoop, and the weight and velocity of the ball, we can tell every circumstance of the collision—how long the compression continues—what is the greatest compression—how far the bodies have moved while they were acting on each other—and what will be the final motion of each :—in short, every thing that affords any mark or measure of a force of percussion. And we know that all this is produced by a force, familiarly known to us by the name of elasticity. Which of all these circumstances shall be called the percussion, or the force of percussion? Is it the ultimate or greatest pressure occasioned by the compression? This cannot be, because this *alone* will not be proportional to the final change of motion, which is generally taken as a measure of the percussion when a change of motion is its only observed effect.

Plate XLI.

We know that another perfectly elastic body, of the same weight, and struck by the same blow, and acquiring the same final velocity by the stroke, may not have sustained the tenth part of the pressure, in any one instant of the collision, if it has only been much more compressible. The greatest mutual pressure in the collision of a billiard ball is perhaps 1000 times greater than it is in a similar collision of a foot-ball of the same weight.

We also know what degree of compression will break this hoop, and what pressure will produce this compression. Therefore, should the fracture of the body be considered as the mark and measure of the percussion, we know what blow will just produce it, and be exhausted by so doing. In short, we know every mark and measure of percussion which this hoop can exhibit.

We can increase the strength of this hoop till it becomes a solid disk ; and we see clearly, that in all these forms the mode of acting is the same. We see clearly that it is the same when, instead of the solid disk, it is an elastic ball ; therefore every thing that can indicate or measure the percussion of an elastic ball, is explained without the operation of a peculiar force of percussion, even when the ball is shivered to pieces by the blow.

Nor is the case materially different when the bodies are soft, or imperfectly elastic. When the struck body is uniformly tenacious, it opposes a uniform resistance to penetration, and its motion will be uniformly accelerated by the action of its own tenacity during the whole time of mutual action, except a trifling variation occasioned by the mere motion of the internal parts, independent of their tenacity. If we knew the weight necessary for merely penetrating this mass, and the weight and velocity of the penetrating body, we can tell how long it must be resisted by this force before its initial velocity will be annihilated, and therefore how far it will penetrate. We have tried this with deal, birch, willow, and other soft woods of uniform texture, and with nails having the body somewhat slenderer than the end, that there might not be an irregularity occasioned by a friction on the sides of the nail, continually increasing as the penetration advanced. We made the hammer fall from a considerable height, and hit the nail with great accuracy in the direction of its length, by fixing it to the end of a long lath, moveable round an axis. The results corresponded with the calculation with all the precision that could be desired.

But it does not result from all this agreement, that the force, exertion, or effect, of a blow with a hammer is equal to the pressure of any number of pounds whatever. They are things that cannot be compared ; and yet the force operating in the penetration by a blow is no way different from a pressure It is a physical blunder to compare the area of the curve, whose abscissa is the depth of penetration, and the ordinates are as the resistances, with any pressure whatever. This area expresses the square of a velocity, and its slips, bounded by parallel ordinates indefinitely near each other, are as the decrements of this square of a velocity, occasioned by a pressure, acting almost uniformly along a very small space, or during a very small time. It is an absurdity therefore to sum up these slips as so many pressures, and to consider the sum total as capable of expressing any weight whatever. Such a paralogism is peculiar to Leibnitz's way of conceiving his infinitesimal method, and it could have no place in the genuine method of fluxions. It is this misconception that has made Mr Leibnitz and his followers suppose that a body, accelerated by gravity, retains in it a sum total of all the pressures of gravity accumulated during its fall, and now forming a *vis viva*. Supposing that it requires a pressure of twenty pounds to press a six pound shot slowly through a mass of uniformly resisting clay ; this pressure would carry it from the top to the bottom of a mountain of such clay. Yet this ball, if discharged horizontally from a cannon, would penetrate only a few yards, even though the clay should resist by tenacity only, independent of the motion lost by giving *motion* to its internal parts. In this experiment, the utmost pressure exerted during the motion of the ball did not much exceed the pressure of twenty pounds. In this comparison, therefore, percussion, so far from appearing infinitely greater than pressure, would appear much less. But there is perhaps no body that resists penetration with perfect uniformity, even though uniformly tenacious. When the ball has penetrated to some depth, the particles which are before it cannot be so easily displaced, even although they had no tenacity, because the particles adjoining are more hemmed in by those beyond them. We have always observed, that a ball impelled by gunpowder through water rises toward the surface (having entered horizontally through the side of the vessel at some depth), and this so much the more rapidly as it entered nearer to the surface. The reason is plain. The particles which must be displaced before the ball, escape more easily upwards than in any other direction. It is for this reason chiefly that a greater weight laid on the head of a nail will cause it to sink deeper into the wood; and thus a great weight appears to be commensurable with a great force of percussion. Also, while a bullet is flattening more and more under a hammer during the progress of a blow, it is spreading under the hammer; more particles are resisting at once, and they find more difficulty in effecting their escape, being harder squeezed between the hammer and the anvil. The same increased resistance must obtain while it is flattening more and more under the quiet pressure of a weight; and thus, too, a greater weight appears to be commensurable with a greater blow.

After all, however, a blow given by a falling body must excite a pressure greater than its mere weight can do, and this in any degree. Thus, suppose AB (fig. 2.) to represent a spiral spring in its natural unconstrained dimensions, standing upright on a table. Let $a\,b$ be the abscissa of a line $a\,d\,h\,k$, whose ordinates $c\,d$, $g\,h$, $i\,k$, &c. are as the elastic reaction of the spring when it is compressed into the lengths $c\,b$, $g\,b$, $i\,b$, &c. Suppose that, when it is compressed into the form CD, it will just support the weight of a ball lying on C. Then $c\,d$ will be a reaction equal to the weight of the ball, and the rectangle $a\,c\,d\,f$ will express the square of the velocity which this ball would acquire by falling freely through $a\,c$. If therefore the ball be gently laid on the top of the spring at A, and then let go, it will descend, compressing the spring. It will not stop when the spring has acquired the form CD, which enabled it to carry the weight of the ball gently laid on it. For in this situation it has acquired a velocity, of which the square is represented by the figure $a\,d\,f$ (See DYNAMICS, *Suppl.* n° 95.). It will compress the spring into the length $g\,b$, such that the area $c\,g\,h\,d$ is equal to the area $a\,d\,f$. If the ball, instead of being gently laid on A, be dropped from M, it will compress the spring into such a length $i\,b$, that the area $a\,i\,k$ is equal to the rectangle $m\,c\,d\,n$; and, if the spring cannot bear so great compression, it will be broken by this very moderate fall.

Thus we see that a blow may do things which a considerable pressure cannot accomplish. The accounts which are given of these remarkable effects of percussion, with the view of impressing notions of its great efficacy, are generally in very indefinite terms, and often without mentioning circumstances which are accessary to the effect. It would be very unfair to conclude an almost infinite power of percussion, from observing, that a particle of sand, dropped into a thick glass bottle which has not been annealed, will shiver it to pieces. When Mr Bulfinger says that a moderate blow will break a diamond which could carry a mountain, he not only says a thing of which he cannot demonstrate the truth, and which, in all probability, is not true; but he omits noticing a circumstance which he was mechanician enough to know would have a considerable share in the effect. We mean the rapidity with which the excited pressure increases to its maximum in the case of a blow. In the experiment in question, this happens in less than the millionth part of a second, if the velocity of the hammer has been such as a man would generate in it by a very moderate exertion. For the blow which will drive a good lath nail to the head in a piece of soft deal with an ordinary carpenter's hammer, must be accounted moderate. This we have learned by experiment to be above 25 feet per second. The connecting forces exerted between the particles of the diamond may not have time sufficient for their excitation in the remote parts, so as to share the derangement among them all, in such a manner that it may be so moderate in each as not to amount to a disunion in any part of the diamond. We see many instances of this in the abrupt handling of bodies of tender and friable texture. It is partly owing to this that a ball discharged from a pistol will go through a sheet of paper standing on edge without throwing it down, which it would certainly do if thrown at it by the hand. The connecting forces, having time to act in this last case, drag the other parts of the paper along with them, and their union is preserved. Also, when a great weight is laid on the diamond, it is gradually dimpled by it; and thus inclosing many parts together in the dimple, it obliges them to act in concert, and the derangement of each is thus diminished.

We flatter ourselves that the preceding observations and reflections will contribute somewhat towards removing the paradoxes and mysteries which discredit, in some degree, our mechanical science. If we will not pertinaciously conjure up ideal phantoms, which, perhaps, *cannot* exist, but content ourselves with the study of that tangible matter which the Author of Nature has presented to our view, we shall have abundant employment, and shall perceive a beautiful harmony thro' the whole of natural operations; and we shall gradually discover more and more of those mutual adaptations which enable an atom of matter, although of the same precise nature wherever it is found, to act such an unspeakable variety of parts, according to the diversity of its situations and the scene on which it is placed. If a mind be "not captivated by the harmony of such sweet sounds," we may pronounce it "dark as Erebus, and not to be trusted."

PERDIDO, a river and bay on the coast of West-Florida. The mouth of the river is about 10 leagues eastward of Mobile Point, and 4 westward of the bar of Pensacola. The entrance is narrow, with a bar of six feet, but afterwards it widens considerably. This was formerly the boundary between Florida and Louisiana, dividing the French and Spanish dominions. The river stretches in one place north-east, where it goes within a mile of the great lagoon west of the entrance of Pensacola harbour.—*Morse.*

PERES *Island*, or *Constantine Peres*, on the coast of Chili, S. America. It is opposite to Port Coral. On this island is a fort called Mansera, and on the back of the island there is an entrance for boats into the harbour of Baldivia.—*ib.*

PERFECT NUMBER, is one that is equal to the sum of all its aliquot parts, when added together. Eucl. lib. 7, def 22. As the number 6, which is $= 1 + 2 + 3$, the sum of all its aliquot parts; also 28, for $28 = 1 + 2 + 4 + 7 + 14$, the sum of all its aliquot parts. It is proved by Euclid, in the last prop. of book the 9th, that if the common geometrical series of numbers 1, 2, 4, 8, 16, 32, &c. be continued to such a number of terms, as that the sum of the said series of terms shall be a prime number, then the product of this sum by the last term of the series will be a perfect number.

PERGUNNA, in Bengal, the subdivision of a district

PERICA, three islands in the bay of Panama, S. America; which give shelter to ships out of the command of the town of Panama.—*Morse.*

PERITAS *Islands*, on the Spanish Main, coast of S. America, 3 leagues westward of Cumana Bay.—*ib.*

PERKINISM, the proper name of what we must think an imposition attempted to be put upon the world by Dr Perkins of North America.

Though the phenomena of electricity had been long familiar to the philosophers of Europe, it is well known that a philosophical theory of these phenomena was first formed by a transatlantic philosopher. In like manner, though the discovery of Galvani, under the name of *animal electricity* (see GALVANISM in this *Supplement*), had occupied the attention of many of the first physicians and philosophers of the old world, it was reserved for a physician of the new, to apply it to the cure of a number of diseases. Every philosopher of America, however, has not the sagacity of the Philadelphian sage; nor must Dr Perkins or his admirers be surprised, if we treat not incomprehensible mysticism with the respect due to a theory founded on facts.

We are told by the son (A) of this rival of Franklin, that before the news of Galvani's discovery had reached America, he had observed several phenomena pointing out the influence of metals in cases of pain. The first remarkable incident that presented itself to his notice was the sudden contraction of a muscle when he was performing a chirurgical operation. This, he observed, regularly took place whenever the point of the metallic instrument was put in contact with the muscle. Struck with the *novelty* of the appearance (Is Mr Perkins sure that the appearance was new?), he was induced to try the points of wood and other substances; and no contraction taking place on these experiments, he thence inferred that the phenomena could be ascribed only to the influence of the metal. About the same time, he observed that, in one or two cases (and if his practice had been great he might have observed that in a thousand cases), a cessation of pain had ensued when a knife or lancet was applied to separate the gum from a tooth previous to extracting it; and in the same year he discovered, that *momentary* ease was given, in a few instances, by the accidental application of a metallic instrument to inflamed and painful tumours previous to any incision.

These are the judicious reasonings and assertions of a dutiful child, who, having probably heard of Leibnitz's claims to some of Newton's discoveries, was determined to put in a similar claim for his father, to a *share*, at least, of the discovery made by the celebrated professor at Bologna. He has not, however, copied with servility the conduct of the Leibnitzians. We do not remember an instance where any of them attempted to elevate the fame or the merits of their master *above* the fame and merits of Newton; but, according to our author, the pursuits of Galvani and his European pupils sink into insignificance, when compared with those of the transatlantic physician.

This is evident; for when the physiologists of Europe were engaged in experimenting on the denuded nerves and muscles of the smaller animals, with a view to ascertain the agency of this incomprehensible property in them, Dr Perkins was prosecuting a series of experiments, which consisted in applying externally, to parts affected with disease, metals, and compounds of metals of every description which occurred to him, and constructed into various forms and sizes. The result proved, that on drawing lightly over the parts affected certain instruments, termed *tractors*, which he formed from metallic substances into pointed shapes, he could remove most of those topical diseases of the human body, where an extra degree of nervous energy or vital heat was present; unless such disease was situated in some of the internal viscera, too remote from the part where the instruments could be applied.

The diseases which have been found most susceptible of the influence of the tractors are, rheumatism, some gouty affections, pleurisy, ophthalmias, erysipelas, violent spasmodic convulsions, as epileptic fits and the locked jaw, the pain and swelling attending contusions, inflammatory tumors, the pains from a recent sprain, the painful effects of a burn or scald, pains in the head, teeth, and indeed most kinds of painful topical affections, excepting where the organic structure of the part is destroyed, as in wounds, ulcers, &c. and excepting also where oils or some other non-conducting substances are present.

But we have other testimonies than those of Dr Perkins and his son for the influence of the tractors. Mr Meigs, professor of natural philosophy at Newhaven, in a letter on Dr Perkins's discovery, conceives the principles of metallic irritability as so little understood, that he will not pretend to explain how the tractors produce their effects; but seems satisfied in finding that the effects are produced. After stating an experiment on his own child, eight years of age, very dangerously ill with a peripneumonic complaint, and to which the tractors gave almost instantaneous relief, he says, "I have used the tractors with success in several other cases in my own family; and although, like Naaman the Syrian,

(A) See a pamphlet, entitled The Influence of Metallic Tractors on the Human Body, &c. by Benjamin Douglas Perkins, A. M. son to the discoverer; or a very good abridgement of it in the first volume of the Philosophical Magazine.

rian, I cannot tell why the waters of Jordan should be better than Abana and Pharpar, rivers of Damascus; yet, since *experience* has proved them so, no reasoning can change the opinion. Indeed, the causes of all common facts are, *we think*, perfectly well known to us; and it is very probable, fifty or an hundred years hence, we shall as well know why the metallic tractors should in a few minutes remove violent pains, as we now know why cantharides and opium will produce opposite effects: viz. we shall know but *very little* about either, excepting *facts*."

Mr. Woodward, professor of natural philosophy at Dartmouth, in a letter also on the same subject, has stated a number of successful experiments in pains of the head, face, teeth, and in one case of a sprain.

Dr Vaughan, a member of the Philadelphia medical society, has lately published an ingenious tract on Galvanism, the object of which is to account for the influence of the tractors in removing diseases. After a citation of numerous experiments made on the nerves and muscles of animals, he observes, " If we only take an impartial view of the operations of Nature herself, and attend diligently to the analytical investigations of the aforementioned experimentalists on this sublime subject, I think the sceptic must admit that the principle of nervous energy is a modification of electricity. As sensation is dependant on this energy, a pleasurable sensation, or what may be termed a natural or healthy degree thereof; then certainly pain, or supersensation, can only depend on an accumulation of the electric fluid, or extra degree of energy in the part affected. On this principle the problem admits of easy solution; namely, that the metals, being susceptible of this fluid, conduct the extra degree of energy to parts where it is diminished, or out of the system altogether, restoring the native law of electric equilibrium."

We trust we are not sceptics; and yet we feel not ourselves inclined to admit any part of this theory. We have seen no proof that nervous energy is a modification of electricity; and we think that we have ourselves proved, that *galvanism* and *electricity* are in many respects different; but we shall not be much surprised if we soon see a *demonstration* by some American or German philosopher, that the soul of man is a composition of silver and zinc. One of these sages has lately discovered, that the symptoms of *putrefaction* do not constitute an *infallible* evidence of death, but that the application of *metals* will in all cases ascertain it beyond the possibility of doubt! A proper application certainly will; for when the Perkinist is doubtful whether his patient be dead or alive, he has only to apply the muzzle of a loaded pistol to his temple, and blow out his brains; after which he may safely swear that the man is dead.

From the *Philosophical Magazine*, we learn that Professor Schumacher at Copenhagen made experiments with tractors of brass and iron on ten patients in Frederick's hospital at Copenhagen. He tried also tractors of ebony and ivory, which are said to have cured a pain in the knee; with others of silver and zinc; and some of copper and lead. By the two last, pains in the knee, arm, and face, are said to have been mitigated. According to M. Klingberg's experiments, this remedy was of use in *malum ischiaticum*; and according to those of M. Steffens, in *malum ischiaticum* and megrim. According to M. Bang, the pains in some cases were increased, and in others allayed. According to M. Blech, the tractors were of use in *hemicrania* and gouty pains in the head; and, according to M. Hahn, in rheumatic pains in both shoulders. The principal document in the Danish collection relating to Perkinism, appears to be a letter of Professor Abilgaard, in whose opinion Perkins's tractors will never acquire much value in medicine, and scarcely even have the merit of being a palliative; but, in a physical point of view, he thinks they deserve the attention of physicians, and particularly of physiologists. Mankind (he says) hitherto have paid too little attention to the influence which electricity has on the human body; otherwise they would know that the effects produced on it by our beds is no matter of indifference. If the feather beds and hair matresses, &c. are perfectly dry, the person who sleeps on them is in an insulated state; but the contrary is the case if they are moist. He three times removed a pain in the knee, by sticking the tractors, one on each side of the knee, so deep through the stockings that the points touched the skin. He removed a rheumatic pain in the head from a lady by the same means. M. Kasn, by the tractors, relieved, in others, gouty pains of the head and megrim; and in himself, a rheumatic pain of the back, which, according to his sensations, was like a constriction in the cellular tissue. M. Herholdt, from his experiments, considers the effect of the tractors as indefinite and relative as that of other remedies. He, however, saw relief given by them in the strangury in a case of syphilis. M. Bang also, at Soroe, freed a man from a violent gouty pain in the thigh, by drawing the tractors 200 times over the affected part. M. Jacobsen likewise found benefit derived from these tractors several times in the common hospital at Copenhagen. M. Tode tried them also in rheumatic pains, tooth-ache, and inflammation of the eyes; and observed that they neither did good nor harm.

On some of the attested cures mentioned in Mr Perkins's pamphlet, an able writer in the Monthly Review has made remarks so very pertinent, that we cannot refuse ourselves the pleasure of transcribing them.

" At page 54 of the pamphlet, we meet (says the reviewer) with a strong proof of the confidence placed in this remedy by several transatlantic philosophers. Dr Willard, it seems, applied a red-hot piece of iron to a wart on his finger, and burnt himself very severely, in order that he might be relieved by the tractors; which are said to have given him ease in two successive experiments. The author adds, ' many have submitted to similar measures, in order to *experience* the effects. I once formed one of five, who burned ourselves so that blisters were raised, to make the experiment; we all obtained relief in a few minutes.'

" This zeal for knowledge is truly edifying; especially as the tractors are generously presented to the public at *only* five guineas a pair; and it is clear that one pair would suffice to cure all the burns and scalds of a large parish. Why are not such luculent experiments repeated here? If Mr Perkins, or any admirer of the discovery, would submit to have a red hot poker run into some part of his body not necessary to life (into *that part where honour's lodged*, according to Butler, for example), in any public coffee-house within the bills of mortality, and would afterward heal the wound

in a

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in presence of the company, in ten minutes, or in half as many hours, by means of the tractors, the most stony-hearted infidel could not resist such a demonstration. Why trifle with internal inflammations, when such an outward and visible sign might be afforded?

"Mr Perkins has taken some pains, in the first part of his pamphlet, to shew that the operation of his rods is not derived from animal magnetism. In our opinion, this is an unnecessary piece of trouble in England, where there is a constant succession of similar pretensions. The *virgula divinatoria*, and the *baguette* of the juggler, are the genuine prototypes of this mystery. We were, indeed, rejoiced, on Dr Perkins's account, to find that the Connecticut Society had only denounced him as a Mesmerist: we trembled lest he should have been put into the inquisitorial hands of the old women as a white witch."

This may be thought too ludicrous a treatment of a discovery which professes to benefit mankind; but to have treated this discovery with seriousness, would have degraded the profession of a scientific critic. As if the very cures pretended to have been performed did not of themselves throw sufficient ridicule over the discovery, Mr Perkins informs us, "that in some instances the metallic influence, when excited by different persons, produces different effects. Experiments made to ascertain the point, proved that there were persons who might use the tractors for any length of time, in diseases which were suitable for the operation, and produce no perceptible effect; when by placing them in the hands of another person, who should perform the operation precisely in the same manner as before, the pain or inflammation would be removed directly." Hence he endeavours to prove that the influence of the tractors is Galvanic, by an argument as absurd as the pretended fact on which it is founded.

"On the application (says he) of zinc and silver to the tongue, the sensation of taste is very slight to some, while with others it is very strong:—when the experiment is applied to the sense of sight, some are hardly sensible of it, while others observe a strong flash." But, not to mention that neither ebony nor ivory can form part of the excitatory arc in *Galvanism*, though we have seen them both employed *successfully* as tractors by a Danish Perkinist, it is enough to observe, that the different effects of the Galvanic metals on different persons depend upon the difference of structure of the organs of sensation in the *patients;* whereas the different effects of the metallic tractors result, according to this account, from the difference of structure in the organs of sense of the various *operators!* Nay, what is still more extraordinary, if any thing can be more extraordinary than this, is, that the value of the tractors depends, not upon the *materials* of which they are made, or the *skill* of the manufacturer, but upon some inconceivable virtue conveyed by Mr Perkins to the *person* of him by whom they are *sold*. This we learn from a pamphlet published by Charles Cunningham Longworthy, surgeon in Bath; who informs us, that he sells tractors by *commission* from Mr Perkins the original manufacturer in London."

After this article was sent to the press, and thus much of it printed, we received, from a friend in London, a copy of Mr Perkins's last publication on the subject *; in which he endeavours to repel the objections urged by Dr Haygarth and others against the influence of the metallic tractors. Had we not been previously convinced of the falsity of Perkinism, the perusal of this pamphlet would have removed from our minds every doubt; for we will venture to say, that it is not in the power of Dr Haygarth, and the whole faculty united, to bring more complete proof than Mr Perkins has here brought, that what he calls his father's *discovery* has no claim to rank otherwise than with the discovery of Mesmer. See *Animal Magnetism*, Encycl.

* *The Efficacy of Perkins's Patent Metallic Tractors, &c.* 1800.

He gives indeed 250 cases, which are attested to have been successfully treated by the tractors; but at least an equal number of cases were attested to have been successfully treated by Mesmer and his partisans; and six times that number of cures were said to have been miraculously performed at the tomb of the Abbé Paris (See Paris in this *Suppl*.) We would willingly allow, however, that these attestations ought to draw the attention of men of science to the subject, did not the author himself betray a want of confidence in the tractors, by his own arguments in their favour, and by his caution to the public against *counterfeits*. He seems indeed to consider their sanative influence as resulting entirely from his *patent*.

Dr Haygarth having said that he performed cures of the same kind with those of which Mr Perkins boasts, by the proper application of tractors made of *wood;* and having added, that "if any person would repeat these experiments, it should be done with due solemnity," in order to work upon the imagination; our author replies, by putting the following question: "Is there a single possessor of the *patent metallic* tractors in England, who has frequently used them, and will say that this fraud is necessary to make *them* perform *cures?*" Instead of answering for the English possessors of these valuable instruments, we beg leave, in our turn, to ask, if there be a single expert chemist in Great Britain who can understand this question in any other sense, than as implying that the virtue of the tractors resides in the *patent?* This, however, appears still more palpable in the caution to the public.

"Among the various artifices (says Mr Perkins) which have been employed by certain interested persons, I have to mention the mean attempt to circulate *false tractors*, and from the failure of these to throw discredit upon the discovery. Three instances of this kind have occurred lately. Complaints having been made to me that my tractors would not cure the diseases for which they are recommended, I was led to make inquiry respecting the cases alluded to; and conceiving them fit subjects for the tractors, I called on the patients to apply them myself. In *both* instances (it was just now in *three* instances) I found they had been using *counterfeit* tractors. Had not this been discovered, the *merit* of the *patent* tractors must have suffered extremely!"

This is very extraordinary. The *character* or *fame* of any thing may indeed be injured by a counterfeit; but we believe this is the first instance of the *merit* or *demerit* of one inanimate substance being increased or diminished by another at a distance from it, of the hardness of steel, for instance, being diminished by the softness of lead! But we beg Mr Perkins's pardon. The *merit* of his tractors consists in their putting money

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ney into his pocket; and *that* merit might certainly be injured by the use of *counterfeits*. Hence, with great propriety, he informs the public, that every *genuine set* is stamped with the words PERKINS'S PATENT TRACTORS, accompanied with a receipt for the five guineas, numbered and signed in the handwriting of the patentee. From these facts we infer (and he must acknowledge the inference to be just), that the virtue of the tractors resides in the *patent*, restricting the making of them to *Benjamin Douglas Perkins*, and not to the *metal* of which they are made. This is indeed most obvious; for he cannot be such a stranger to the state of chemical science in this country, as to suppose that his tractors may not be analysed into their component principles, and, of course, that others may not be made possessing all their virtues except such as result from the patent.

We shall conclude this article in the words of the reviewer already quoted: "To trace the relations and dependencies of projects similar to that of Dr Perkins, would now be a work of more labour than utility. The fund of public credulity is an inexhaustible resource for those who can resolve to levy contributions on it. In vain is the spirit of quackery exorcised in one form; it rises again immediately, 'with twenty ghastly murders on its head, to push us from our stools.' We, who have contemplated the progress of real knowledge during a long course of years, have seen many bubbles like this glitter for a moment, and then disappear for ever. People may talk of Mesmerism, or Perkinism, but we consider all such varieties as belonging to the old and extensive class of Charlatanism."

PERKINS, *Port*, lies on the S. W. of Washington's Isle, on the N. W. coast of N. America.—*Morse*.

PERKIOMIN, a township of Pennsylvania, in Montgomery county.—*ib*.

PERLICAN, *Old*, an indifferent ship road with rocky ground on the E. coast of Newfoundland Island, 2 leagues S. W. by S. of Break Heart Point. Sherwick is the name of its N. point.—*ib*.

PERLICAN, *New*, a noted harbour on the E. coast of Newfoundland Island, 8 leagues W. S. W. of Old Perlican, and 5 leagues from Random Head. It has a wide and safe entrance, and ships may ride in it land-locked from all winds in from 10 to 5 fathoms water.—*ib*.

PERNAMBUCO, a captainship in the northern division of Brazil, whose chief town is Olinda.—*ib*.

PERNAMBUCO, or *Phernambuco*, otherwise called *Panambuco*, a place of considerable trade on the E. coast of Brazil, having a bay or harbour of the same name; situated between Paraiba on the N. and Cape St Augustine on the S. in lat. 8 S. and long. 35 W. Provisions and other articles are brought hither from Para, and from hence great quantities of tobacco are sent off to Europe.—*ib*.

PERNAMBUCO, a river on the coast of Brazil, S. America, southward of Tamerica Island. It is blocked up with sand; and ships enter it from the northward, at the entrance of the Receif harbour, 3 leagues from it. S. lat. 8 30, W. long. 35 7.—*ib*.

PEROUSE (John Francis Galoup de la), the celebrated, though unfortunate, French navigator, was born at Albi in 1741. Of the rank or condition of his father, M. *Milet-Mureau* has given us no information in that meagre eulogy of Perouse which he has inserted in the introduction to his last voyage. It appears, however, that he intended to make his son a seaman, and sent him, at a very early period of life, to the marine school, where the young man became enthusiastically fond of his profession, and laudably ambitious to emulate the fame of the most celebrated navigators.

Perouse.

Being appointed a midshipman on the 19th of November 1756, he behaved, we are told, with great bravery in that station, and was severely wounded in the engagement between the admirals Hawke and Conflans, on the 20th of November, 1759. The Formidable, in which he served, was taken, after a vigorous resistance; and it is probable that Perouse reaped some advantage from his acquaintance with British officers.

On the 1st of October 1764 he was promoted to the rank of lieutenant; and despising a life of ease and idleness, he contrived to be employed in six different ships of war during the peace that subsisted between Great Britain and France. In 1767 he was promoted to the rank of what, in the British navy, is called *master* and *commander*. In 1779 he commanded the *Amazone*, belonging to the squadron of Vice-admiral Count d'Estaing; and when that officer engaged Admiral Byron, the post of La Perouse was to carry his admiral's orders to the whole of the line. He afterwards took the sloop *Ariel*, and contributed to the capture of the *Experiment*—exploits which his eulogist seems to consider as instances of very uncommon heroism; but he soon after performed a greater.

Being, on the 4th of April 1780, appointed captain of the frigate *Astrea*, and being on a cruise with the *Hermione*, these two frigates attacked six English vessels of war, of from 28 to 14 guns each, and took two of them. The French certainly reaped more laurels about that period than they have been accustomed to do in naval wars with Great Britain; but as we have completely forgotten the particulars of this fight, we suspect that it was not altogether so very brilliant a business as M. Milet-Mureau is pleased to represent it.

In the year 1782, La Perouse was dispatched with the Sceptre of 74 guns, and two frigates of 36 guns each, having some troops and field pieces on board, to destroy the English settlements in Hudson's Bay. This task was easily accomplished; for when he had surmounted the difficulties of navigation in a frozen sea, he found nothing on shore to oppose the smallest force. Having destroyed the settlements, he learned that some of the English had fled at his approach into the woods; and his eulogist considers it (such are the dispositions of French republicans) as a most wonderful instance of humanity, that he left to these unfortunate men provisions to preserve them from perishing by hunger, and arms to protect them from the fury of the savages! Perouse, we dare answer for him, was conscious of nothing heroic or extraordinary in this act of beneficence, which he certainly could not have omitted, without incurring both infamy and guilt.

In the year 1785, he was appointed to the command of a voyage round the world; which was unfortunately destined to be his last. Of this voyage, as far as it was accomplished, there is a full account in the hands of every French and English reader; and from that account it appears, that Perouse was admirably qualified to discharge such a trust. He seems to have been an experienced

experienced and ſkilful ſeaman; a man of conſiderable mathematical and phyſical ſcience, uncorrupted by that philoſophiſm which diſgraced many of his attendants; and capable of the utmoſt perſeverance in every laudable purſuit. To theſe qualities he united a proper combination of caution and courage, with a diſpoſition truly benevolent to the various tribes of ſavages whom he viſited. The diſaſters which occurred on the voyage were all, except the laſt, of which nothing is known, occaſioned by the diſobedience of his officers, or their neglecting to follow his advice.

The laſt diſpatches of this great and good man were dated from Botany Bay, February the 7th 1788; and ſince that period, no account of him has been received which is intitled to the ſmalleſt confidence. *M. Milet-Mureau* has indeed given us, at ſome length, the childiſh conjectures of the Society of Natural Hiſtory reſpecting his fate, which, in language equally childiſh, were delivered at the bar of the National Aſſembly; and he has added the ridiculous decree which that body of legiſlative ſciolifts paſſed in conſequence of ſo extraordinary a ſpeech. We will not diſgrace our pages, or inſult the memory of Perouſe, by contributing to the circulation of nonſenſe, which, we are perſuaded, would have made him bluſh for his country.

PERPENDICULAR, in gunnery, is a ſmall inſtrument, uſed for finding the centre line of a piece in the operation of pointing it to a given object.

PERPETUA, *Cape*, on the north-weſt coaſt of N. America. N. lat. 44 6, W. long. 124 8. Variation of the compaſs in the year 1779, 17 50 E.—*Morſe.*

PERQUIMONS, a county of Edenton diſtrict, N. Carolina, bounded W. by Chowan county, and E. by Paſquotank, from which laſt it is ſeparated by the river Paſquotank, a water of Albemarle Sound. It contains 5,440 inhabitants, of whom 1878 are ſlaves. —*ib.*

PERSIAN or PERSIC, in architecture, a name common to all ſtatues of men, ſerving inſtead of columns to ſupport entablatures.

PERSON, a new county in Hillſborough diſtrict, N. Carolina. The court houſe, where a poſt-office is kept, is 26 miles N. of Hillſborough, and 34 E. of Caſwell New Court-houſe.—*Morſe.*

PERTH-AMBOY, a city of New Jerſey, pleaſantly ſituated in Middleſex county, at the head of Rariton Bay, and ſtands on a neck of land included between Rariton river and Arthur Kull Sound. Its ſcite is high and healthy. It lies open to Sandy Hook, and has one of the beſt harbours on the continent. Veſſels from ſea may enter it in one tide, in almoſt any weather. It is a port of entry and poſt town; but although it is admirably ſituated for trade, and the legiſlature has given every encouragement to induce merchants to ſettle here, it is far from being in a flouriſhing ſtate. It contains about 60 houſes, and carries on a ſmall trade to the W. Indies. Its exports for a year, ending 30th Sept. 1794, were to the value of 58,159 dolls. It is 35 miles ſouth-weſt of New York, and 74 north-eaſt of Philadelphia. N. lat. 40 35, W. long. 74 50. —*ib.*

PERU, a new townſhip of New York, in Clinton county, on the weſt ſide of Lake Champlain. It was taken from the towns of Plattſburg and Willſburg, and incorporated in 1792. It is an excellent tract of land, and ſettling faſt. In 1796, there were, of the inhabitants, 120 qualified electors.—*ib.*

PERWANNAH, in the language of Bengal, an order of government, or a letter from a perſon in authority.

PETAGUEL, a territory of S. America, in Brazil, bounded N. by Dele; E. by the S. Atlantic Ocean; S. by the captainſhip of Rio Grande; and W. by Tupuy. It contains mines of ſilver.—*Morſe.*

PETAPA, one of the pleaſanteſt towns of Guatimala, in New Spain. It is ſituated at the weſtern extremity of the valley of Mexico, 25 miles S. E. of Guatimala. There is a rich ſugar plantation in its vicinity.—*ib.*

PETAWONTAKAS, an Indian nation formerly in alliance with the Hurons.—*ib.*

PETER's *Bank*, *St*, a large fiſhing ground off the S. end of Newfoundland Iſland, and extends from Cape Race to St Peter's Iſland, oppoſite Placentia, St Mary and Trepaſſy Bays. It is 1½ degrees of latitude in breadth on the W. ſide. From St Peter's Iſland it decreaſes as it approaches Race Point. It lies W. of the Great Bank, and has on the S. at a conſiderable diſtance, Green and Whale Banks, which are among the ſmalleſt on the coaſt. It has from 45 to 30 fathoms water on it.—*ib.*

PETER's *Bay*, *St*, on the S. coaſt of Cape Breton Iſland, having St Peter's Iſland at its mouth.—*ib.*

PETER's *Fort*, *St*, on the iſland of Martinico, in the Weſt Indies. N. lat. 14 44, W. long. 61 21.—*ib.*

PETER's *Harbour*, *St*, on the N. coaſt of the iſland of St John's, in the Gulf of St Lawrence, about 8 leagues W. of Eaſt Point. Weſt of it are Anguille Bay and Port Chimene.—*ib.*

PETER's *Haven*, *St*, on the E. coaſt of Labrador, lies round the S. E. point of Sadel Bay. N. lat. 56 30, W. long. 60 42.—*ib.*

PETER's *Iſland*, a ſmall iſle on the W. coaſt of St John's Iſland, near to, and N. by W. of, Governor's Iſland, in the narroweſt part of the ſtrait between New Brunſwick and St John's Iſland.—*ib.*

PETER's *Iſland*, *St*, or *St Pierres*, on the ſouthern coaſt of Newfoundland Iſland, lies S. S. W. of the S. E. point of Fortune Bay, and near to, and S. E. of, the S. point of Miquelon Iſland. N. lat. 46 46, W. long 56 17.—*ib.*

PETER's, *St*, one of the Virgin Iſles, in the Weſt Indies, dependent on Virgin Gorda.—*ib.*

PETER's, *St*, a harbour at the W. end of Sydney or Cape Breton Iſland, is a very commodious place for carrying on the fiſhery.—*ib.*

PETER's, *St*, a town at the ſouthern extremity of Cape Breton Iſland. It ſtands on an iſthmus about half a mile broad, which ſeparates the harbour of St Peter from the great lake of that name, alſo called Lake Labrador. It is about 10 miles N. E. of Point Toulouſe. To this harbour veſſels of the greateſt burden can come with ſafety. Before the American revolution, a great fiſhery was carried on here.—*ib.*

PETER, *Lake St*, a part of St Lawrence river, into which empty from the S. and E. Sorel river from Lake Champlain, the river St Francis, and ſome ſmaller rivers, from the N. W. The Maſquinonge, Omachis, &c.

&c. enter the lake. The centre of the lake is 68 miles above Quebec, and 205 N. E. of Kingston, at the mouth of Lake Ontario.—*ib.*

PETER's *Mountain*, in Pennsylvania, lies on Susquehannah river, between Halifax and Harrisburg, in Dauphin county.—*ib.*

PETER *St* and *St Paul*, a river at the bottom of the gulf of Campeachy. Its branches form an island called Tabasco. The bar at the mouth of the eastern branch admits small vessels. At flood there is from 2½ to 3 fathoms water, and very good anchorage within the bar.—*ib.*

PETER's, *St*, a parish of S. Carolina, in Beaufort district.—*ib.*

PETER's, *St*, one of the north-western branches of Mississippi river, which it joins in lat. about 45 6 N. and long. 94 22 W.—*ib.*

PETERS, a township of Franklin county, Pennsylvania.—*ib.*

PETERBOROUGH, a post town in Hillsborough county, New Hampshire. It was incorporated in 1760, and contains 861 inhabitants. It is 73 miles W. by S. of Portsmouth, 18 westerly of Amherst, 16 E. of Keene, and 366 from Philadelphia. N. lat. 42 51, W. long. 71 52.—*ib.*

PETERSBURG, a township of New York, in Rensselaer county, E. of the village of Troy, incorporated in 1793. In 1796 there were 512 of the inhabitants qualified electors.—*ib.*

PETERSBURG, a post town of Pennsylvania, in York county, 2 miles north of the Maryland line. It contains a Roman Catholic church, and about 80 houses. It is 25 miles south-west of York Town, 59 northerly of the Federal City, and 113 west by south of Philadelphia. N. lat. 39 42 30, W. long. 77 4.—*ib.*

PETERSBURG, a small town of Kentucky, situated in Woodford county, on the E. side of Kentucky river, 19 miles W. S. W. of Lexington, and 15 south-south-east of Frankfort. It has a tobacco warehouse, and a few dwelling houses.—*ib.*

PETERSBURG, a post town of Virginia, and a place of considerable trade; situated in Dinwiddie county, on the south-east bank of Appamatox river, just below the falls, about 25 miles south of Richmond. It contains about 300 houses, built irregularly. The Free Mason's Hall is a handsome building; there are several tobacco warehouses, stores of dry goods, and some few neat and commodious dwelling houses. This town is a corporation, and comprehends the village of Blandford, in Prince George's county, and Pawhatan, in Chesterfield county, on the opposite side of the river. It contains 2,828 inhabitants, including 1,265 slaves. The situation of the town is low and rather unhealthy. From the inspector's books it appears, that on an average for the last 10 years, the quantity of tobacco received here has considerably exceeded 20,000 hhds. per annum; and for the last three years the quantity of flour made in this town and within an hundred yards of it, has exceeded 38,000 barrels; at other mills within a few miles, 16,000 barrels per annum; to this add the flour made at the several country mills, and brought to this place for sale, the whole quantity may safely be stated to exceed 60,000 barrels per annum. The whole exports of this town, valued at the usual peace prices, amount to 1,389,300 dolls. besides the value of peach and apple brandy, whiskey, &c. not included. The Indian princess, Pocahontas, the daughter of king Powhatan, from whom descended the Randolph and Bowling families, formerly resided at this place. It is 80 miles W. by N. of Norfolk, 159 S. by W. of Alexandria, and 303 south-west by south of Philadelphia. N. lat. 37 14, W. long. 78 8.—*ib.*

PETERSBURG, a very flourishing post town of Georgia, in Elbert county, in a pleasant and healthful situation, on the point of land formed by the confluence of Broad with Savannah river. Several respectable merchants are settled in this town. It is 15 miles from Elberton, 20 N. by E. of Washington, 50 above Augusta, 73 N. of Louisville, and 836 from Philadelphia. N. lat. 33 46, W. long. 81 32.—*ib.*

PETERSBURGH (St), the capital of Russia, is a city, of which a pretty full historical detail has been given in the *Encyclopædia*. It is introduced here merely on account of its police, which, according to the anonymous author of the life of Catharine II. has a very simple and competent organization, and deserves to be adopted in other great capitals. Excepting the governor, whose office naturally extends to all objects of public welfare, the head police-master is the proper chief of the whole system of police. His office takes in the great compass of this department, but confined to the general objects of public security and order. He is not here, as in some large towns, the formidable copartner of family secrets, and the invisible witness of the actions of the private man. Under the head police-master is the police office, where sit a police-master, two presidents, the one for criminal, the other for civil cases, and two consulters, chosen from the burgher class. To this is committed the care to maintain decorum, good order, and morals: also it is its business to see to the observance of the laws, that the orders issued by government, and the decisions of the courts of justice, are put in force. The attainment of these purposes is effected by the following mechanism:

The residence is divided into ten departments. Each of these has a president, appointed to watch over the laws, the security, and the order of his district. The duties and rights of this office are not less extensive than important. A president must have exact knowledge of the inhabitants of his department, over which a sort of parental authority is committed to him; he is the *censor morum* of his department; his house must not be bolted or barred by night or day, but must be a place of refuge, continually open to all that are in danger or distress; he himself may not quit the town for the space of two hours, without committing the discharge of his office to some other person. The police commando (constables), and the watchmen of his department, are under his orders; and he is attended on all affairs of his office by two serjeants. Complaints against unjust behaviour in the president may be brought to the police office.

Each department is again divided into three, four, or five subdivisions, called quarters, of which, in the whole residence, are 42. Each of these has a quarter-inspector, in subordination to whom is a quarter-lieutenant. The duty of these police-officers is in harmony with that of the president, only that their activity is confined to a smaller circle. They settle low affairs and slight altercations on the fpot, and keep a watchful eye on all that paffes.

The number of the nightly watch in the city amounts to 500. They have their ftations affigned them in watch-houfes at the corners of ftreets: and, befides their proper deftination, are to affift in the taking up of offenders, and in any fervice, by day or night, as their commanders fhall require. Befides thefe, for the execution of the police orders, and to act as patroles, there is alfo a commando of 120 men, who, in cafes of emergency, are fupported by a company of kofaks, or a regiment of huffars.

This machine, confifting of fo many fubordinate parts, preferves in its orderly courfe that fecurity and peace which excite the admiration of all foreigners. The activity of every individual member is unobferved in the operation of the whole; and by fuch a diftribution alone is the attainment of fo complicated an aim practicable.—All the quarter-infpectors of a department repair every morning, at feven o'clock, to their infpector's houfe, to lay before him the report of all that has happened in their quarters during the laft 24 hours; and at eight o'clock, all the infpectors bring together thefe feveral reports into the police-office, whereupon they firft and immediately take into examination the cafes of perfons taken into cuftody during the night. On urgent occafions, the police-office affembles at all hours.

This organization, and the extraordinary vigilance of the police, which is found competent to the bufinefs of a numerous and reftlefs people, render all fecret inquifitions unneceffary. The police has knowledge of all perfons in the refidence; travellers who come and go are fubject to certain formalities, which render it extremely difficult to conceal their place of abode, or their departure from the city. To this end, every houfeholder and innkeeper is obliged to declare to the police, who lodges with him, or what ftrangers have put up at his houfe. If a ftranger or lodger ftays out all night, the landlord muft inform the police of it at lateft on the third day of his abfence from his houfe. The cautionary rules, in regard to travellers quitting the town, are ftill more ftrict. Thefe muft publifh in the newfpapers their name, their quality, and their place of abode, three feveral times, and produce the newfpapers containing the advertifement, as a credential in the government from which they then receive their paffport; without which, it is next to impoffible to get out of the empire. This regulation not only fecures the creditor of the perfon about to depart, but alfo enables the police to keep a clofer infpection over all fufpected inhabitants.

If individuals may be fufpected by the government, becaufe their means of fupport, the company they keep, and their whole courfe of action, are clofely wrapped up in myftery; fo likewife may whole focieties be lefs indifferent to it, if they carefully conceal the object of their connection, or their very exiftence, from the eye of the public. The police watches here, with laudable attention, over fecret focieties of all kinds; and frequently as the fanatical fpirit of religious or political fectaries, or the enthufiafm of pretended myftagogues, have attempted to neftle here, they have never been able to proceed, or only for a very fhort time. Animal magnetifm, Martinifm, Rofycrutianifm, and by whatever other name the conceits of diftempered imaginations may be called, have always been attended with the fame bad fuccefs on this ftage.

From this fketch it will be readily imagined, that the number of impoftors and difturbers of the public peace can be but fmall. Quarrels and affrays in the ftreet or in the cabaks but feldom happen. The perfon attacked calls the neareft watchman; and in a moment both the aggreffor and the aggrieved are taken into cuftody, and led to the next fieja (police-watch-houfe), where the caufe of their quarrel is inquired into, and the aggreffor is punifhed. For matters of fome defcriptions, there is a peculiar tribunal, under the denomination of the oral court, which, on account of its fingularity, deferves to be briefly noticed.

In each quarter of the town are one or more judges of the oral court, who are chofen from the clafs of burghers, and with whom are affociated a few jurats. This court fits daily in the forenoon, and proceeds orally in all the differences that come before it. It, however, keeps a day-book, in which are entered all the caufes and decifions of the court, and which muft be every week laid before the magiftrate. When a charge is brought, the court declares it orally to the prefident of the quarter: whereupon the accufed muft not delay his appearance before the police longer than one day after he has received the fummons. Every caufe muft be determined in one day, or, if the examinations require more time in collecting, in three days. The oral court communicates the decifion to the prefident of the quarter by means of his day-book, in order to its ratification. If either party is not fatisfied with the fentence, he may appeal to the court as appointed in the regulations.

This is a very favourable account of the police of St Peterfburgh; but it is differently reprefented in *Beaujolin's Travels of two Frenchmen through Ruffia*, in 1790—1792. According to him, the police of the capital of that empire is far from being on the moft refpectable footing. There happen, indeed, but few accidents in the night; yet fometimes murders are committed, and efpecially thefts; for which, according to our author, it is exceedingly rare to obtain juftice. When a perfon has been affaffinated in fome place of bad repute, the police-officer is engaged to fecrecy by means of a few rubles; fo that the affair is foon hufhed up, unlefs the deceafed belonged to fome powerful family, whofe intereft makes it neceffary that inquiries fhould be inftituted. When two perfons quarrel, either in the ftreet or in a public-houfe, he who *pays* the inquirer is always in the right: the inferior police-officers are never proof againft money; and the *poor* individual, whether he be in the right or wrong, is almoft fure of a beating.

PETERSHAM, a flourifhing and pleafant townfhip in Worcefter county, Maffachufetts, formerly called by the Indians *Nichewaug*; fituated 28 miles N. W. of Worcefter, and 66 W. of Bofton. Swift river, a branch of Chickopee river, paffes through this town. The foil is rich and fertile, and here are large and excellent orchards.—*Morse.*

PETIT ANSE, a village on the north fide of the ifland of St Domingo, 2½ leagues fouth of Cape Francois.—*ib.*

PETITCODIAK, a river which falls into an arm of the Bay of Fundy, called Chegnecto Channel. The Indians

Indians have a communication from the head of it with St John's river, by a portage across to the head of Kennebecsius.—*ib.*

PETIT-GOUFRE, or the *Little Whirlpool*, in Mississippi river, is 31 miles from Fort Rosalie, and 4 miles from Bayouk Pierre, or Stony river.—*ib.*

PETIT GUAVES, or *Goave*, a jurisdiction, town, and bay, on the N. coast of the S. peninsula of the island of St Domingo, and near the head of the Bay or Bite of Leogane. The jurisdiction contains 5 parishes, and is the unhealthiest place in the colony, the inhabitants being constantly subject to fevers, occasioned by the badness of the waters. Its dependencies, however, are healthy, and are remarkable for the culture of coffee. Its exports from January 1. 1789, to December 31, of the same year, were 27,090 lb. white sugar—655,187 lb. brown sugar—807,865 lb. coffee—50,053 lb. cotton, and 210 lb. indigo. The value of duties on exportation of the above, was 4,127 dollars 97 cents. The town lies on the E. side of the bay, 2¼ leagues westward of Grand Guave, and 14½ W. by S. of Port-au-Prince: N. lat. 18 27, W. long. from Paris, 75 14. Some writers call the great bay, which is commonly called the Bay, Bight, or Bite of Leogane, by the name of Petit Guaves.—*ib.*

PETIT PORT, on the W. side of Newfoundland Island, towards the S. end; is about 5½ leagues N. of Cape Ray, and one S. of Anguille Cape. N. lat. 47 52 30, W. long. 59 15.—*ib.*

PETIT PORT, on the coast of Peru, otherwise called *Portete*, or *Little Port*, lies a short way northward of the equator, and about 5 leagues to the S. E. within the bay from Cape Francis to Cape Passado on the S. by W. There is anchorage in 5 fathoms, and plenty of fresh water near the head land, which is high. It is necessary to sound, on account of the sand-banks, called the *Portetes*.—*ib.*

PETIT TERRE *Island*, near Defeada, in the West-Indies. N. lat. 16 14, W. long. 61 11.—*ib.*

PETITE RIVIERE, a small town in the French part of the island of St Domingo, close to the Spanish division line 1¾ leagues N. by N. W. of Varettes, and separated from it by the river Artibonite; 10 leagues E. by N. of St Marc, and as far N. W. of Mirebalais. N. lat. 19 8, W. long. from Paris, 74 48.—*ib.*

PETIT TROU, is on the north side of the south peninsula of the island of St Domingo, on the point of land which forms the east side of the entrance into the Bay of Baradaires; 4½ leagues westward of Anse a Veau, and 19 easterly of Jeremie.—*ib.*

PETIT TROU, a small cove on the south side of the island of St Domingo, S. by W. of the mouth of Neybe river, and about 5 leagues N. E. of Beate Island. Small barks come to this place from St Domingo city, to fetch the meat, lard, and fowls derived from the chase.—*ib.*

PETIVER (James), a famous English botanist, was contemporary with Plukenet: but the exact time of his birth is not known, nor is much intelligence concerning him at present to be obtained. His profession was that of an apothecary, to which he was apprenticed under Mr Feltham then apothecary to St Bartholomew's hospital*. When he entered into business for himself, he settled in Aldersgate-street, and there continued for the remainder of his life. He obtained considerable business, and after a time became apothecary to the charter house. After the Tradescants, he appears to have been the only person, except Mr Courten and Sir Hans Sloane, who made any considerable collection in natural history, previous to those of the present day. He engaged the captains and surgeons of ships to bring him home specimens, and enabled them to select proper objects, by printed directions which he distributed among them. By these means his collection became so valuable, that some time before his death, Sir Hans Sloane offered him L. 4000 for it. After his death, it was purchased by the same collector. His museum extended his fame both at home and abroad. He was elected into the Royal Society; and becoming acquainted with Ray, assisted him in arranging the second volume of his History of Plants. He died April 20. 1718; and much honour was shewn to him at his funeral, by the attendance of Sir Hans Sloane, and other eminent men, as pall bearers, &c. By future botanists, his name was given to a plant. See PETIVERIA, *Encycl.*

* Pultney's *Sketches of Botany in England.*

He gave the world several publications on various subjects of natural history: 1. *Musei Petiveriani Centuriæ decem*, 1692—1703, 8vo. 2. *Gazophylacii Naturæ, et Artis, Decades decem*, folio, 1702, with 100 plates 3. A Catalogue of Mr Ray's English Herbal, illustrated with figures, folio, 1713, and continued in 1715. 4. Many small publications, which may be found enumerated in Dr Pultney's book. 5. Many papers in the Philosophical Transactions, and a material article in the third volume of Ray's work, entitled, *Plantæ Rariores Chinenses Madraspatanæ, et Africanæ, a Jacobo Petivero ad opus Consummandum Collatæ*, &c. Many of his smaller tracts having become very scarce, his works were collected and published, exclusive of his papers in the Transactions, in 2 vols folio, and one 8vo. in the year 1764.

PETTQUOTTING, a river of the N. W. Territory, which empties into Lake Erie, from the south, near Huron river.—*Morse.*

PHASIANUS (See *Encycl.*). A species of this genus of birds, formerly not described, was sent from Batavia to England by Lord Macartney, or some of his attendants, when they were on their voyage to China. The species to which it seemed to be most nearly allied, in point of general habit or appearance, was the *phasianus curvirostris*, or Impeyan pheasant; an East-Indian bird, described and figured both in Mr Latham's Ornithology, and in the Museum Leverianum. From that bird, however, it differs very considerably. The tail of the latter being in a mutilated state, it was scarce possible to determine, with absolute precision, whether it should be referred to that subdivision of pheasants, which contains those with long or cuneiform tails, or those with rounded ones, as in the Impeyan pheasant. The general colour of this most elegant bird was black, with a gloss of blue, or what, in the language of natural history, may be termed chalybean black, or black accompanied by a steel blue lustre. The lower part of the back was of a peculiarly rich colour, which according to the different directions of the light, appeared either of a deep ferruginous or of the brightest fiery orange-red. This beautiful colour passed in the manner of a broad zone round the whole body; but on the abdomen was of a much more obscure appearance

appearance than on the back, as well as somewhat broken or irregular, especially on the sides. The throat was furnished with a large, and somewhat angular, pair of wattles, uniting with the bare spaces on the cheeks. The feathers on the top of the head, which was of a lengthened form, ran a little backward, so as to give the appearance of an indistinct occipital crest. The beak was remarkable for a more lengthened and curved aspect than in any other bird of this genus, except the Impeyan pheasant. The feathers on the neck, back, and breast, were rounded, and of the same shell-like or scaly habit as those of the turkey. The legs very stout, and were armed with a pair of extremely strong, large, and sharp spurs. Both legs and beak were of a pale colour. Whether this bird be really new or not to the ornithologists of Europe, it may at least be affirmed with safety, that it had never been properly described; nor can the character of any species, hitherto introduced into the books of any systematic naturalist, be considered as a just or competent specific character of the present bird. It may be called the *fire backed pheasant*; and its essential character may be delineated in the following terms: Black pheasant with a steel-blue gloss: the sides of the body rufous; the lower part of the back fiery ferruginous; the tail rounded; the two middle feathers pale yellow brown.—*Sir George Staunton's Account of an Embassy to China, &c.*

PHILADELPHIA, a township in Rutland county, Vermont, about 15 miles E. of Orwell. It contains 39 inhabitants.—*Morse.*

PHILIP, a large island in Lake Superior, in the territory of the United States. It lies towards the south side of the lake, and south-east of Isle Royal.—*ib.*

Philip's, *St*, a parish of S. Carolina, situated in Charleston district.—*ib.*

Philip, *St*, a fort which commands the entrance of Maranhao harbour, on the coast of Brazil.—*ib.*

Philip, *St*, a point within the harbour of Port-Royal. S. Carolina.—*ib.*

PHILIPPEAU, an island on the north side of Lake Superior; N. of Isle Royal.—*ib.*

Philippeau, a bay on the north shore of the gulf of St Lawrence, near the Straits of Bellisle, and partly formed by islands which project southward on its east part, and extend towards the west. The east part of the bay lies in lat. 51 20 north, and long. 55 40 west.—*ib.*

PHILIPPINA, a small town of the province of Guatimala, in New-Spain, situated on a bay of the N. Pacific Ocean. N. lat. 12 50, west long. 91 30.—*ib.*

PHILIPSBURG, a town of New-Jersey, situated in Sussex county, on the east bank of Delaware river, opposite to Easton in Pennsylvania. It is 41 miles north-west of Trenton.—*ib.*

PHILIPSBURGH, or *Philipstown*, a township of New-York, in Dutchess county on the east side of Hudson's river, 28 miles above New-York, near the south end of Tappan Bay. It contains 2,079 inhabitants, including 25 slaves. In 1796, there were 347 of the inhabitants electors. In this township is a silver mine, which yields virgin silver.—*ib.*

PHILOPOLIS, a settlement in Luzerne county, Pennsylvania, 12 or 14 miles westward of Mount Ararat, and at the head of the western branch of Tunkhanock Creek, about 45 miles south-east of Athens, or Tioga Point. N. lat. 41 40, west long. 75 33.—*ib.*

PHILOSOPHIST, a lover of sophistry or false reasoning, in contradistinction to *philosopher*, who is a lover of sound reasoning, true science, and practical wisdom.

END OF THE SECOND VOLUME.

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