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SUPPLEMENT

TO THE

ENCYCLOPÆDIA.

E L E

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^o 27, and 182—233. A very valuable one is likewise described in n^o 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 surprisngly 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:

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

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holes of $1\frac{3}{4}$ th inches in diameter. One of them *f* is in the centre, and it receives the lower end of the glass tube *f b*, 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^o 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^o 2.), to which is joined the circular plate *ab*, 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^o 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 *ab*. 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 ϕo 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 $\frac{1}{8}$ 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

A

is

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is carried by a stalk of gum lac m , enclosing 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 electrify 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 , 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 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-

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fourth, &c. in the same manner as we practised and related in ELECTRICITY (Suppl.), n^o 141, &c.

An example of one or two of those 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, $\frac{1}{145}$. 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 $\frac{1}{8}$ 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 ag 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^o 85. which

was

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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. Transf.* 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

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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 shown 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

Electro-
phorus
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Elephantia-
sis.

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. 2^d, 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. 3^d, 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 venereal 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 Chesapeake 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, Pinequefe, 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.*

Elephantia-
sis
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Elizabeth.

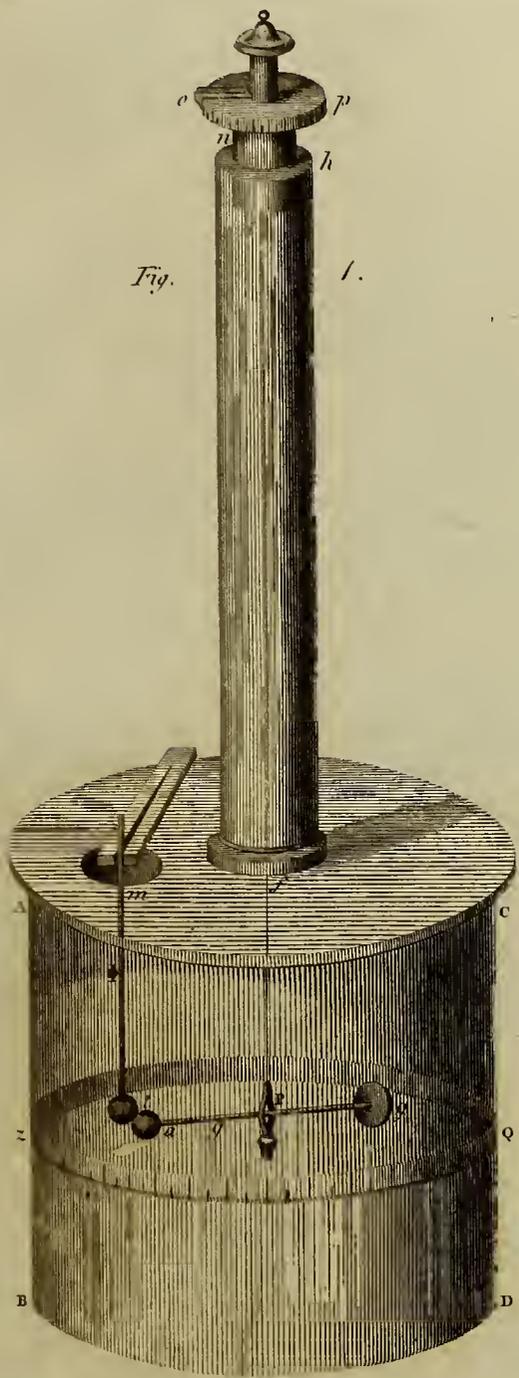


Fig. 1.

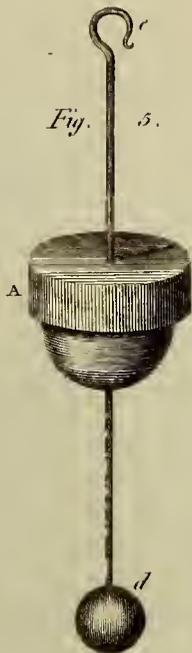


Fig. 5.

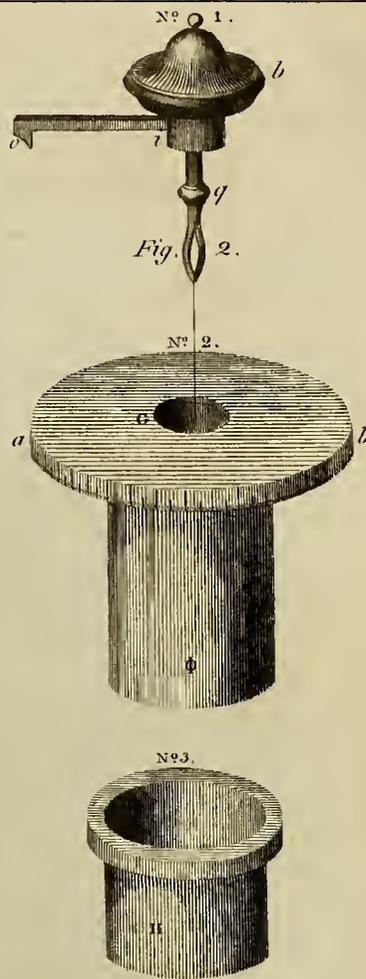


Fig. 2.



Fig. 4.

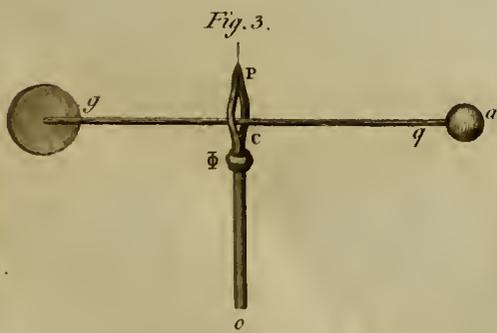


Fig. 3.

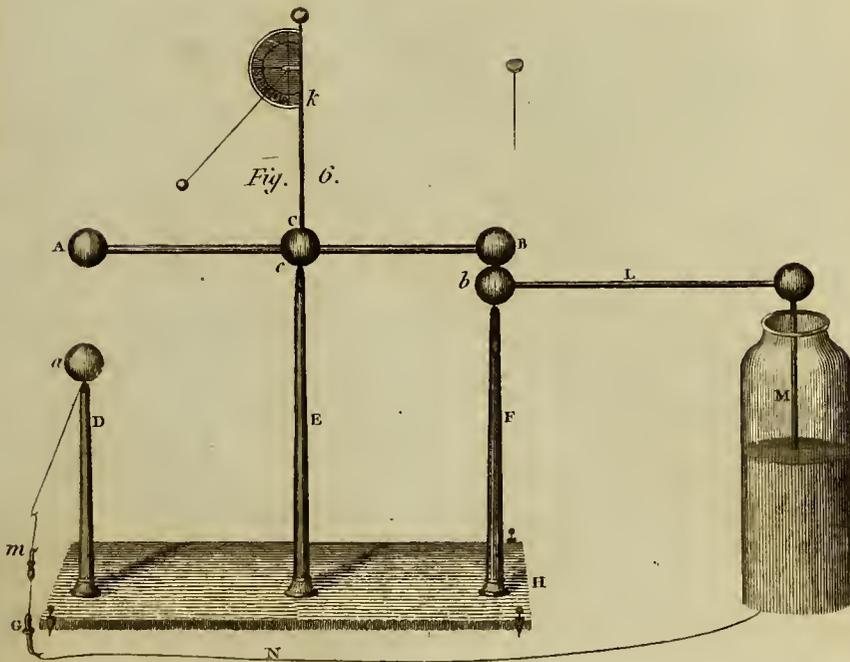


Fig. 6.

Elizabeth's
Island,
Queen
||
Elk.

Elkridge
||
Emmits-
burgh.

ELIZABETH'S ISLAND, QUEEN, in the straits of Magellan, in S. America. Here fresh water, herbs fit for salad, 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 Kill. 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 Chesapeake 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 ellipse, defined by the indefinite equation $ay^{m+n} = bx^m \cdot a - x^n$ 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 elliptoides, expressed by $ay^3 = bx^2 \cdot a - x$; the biquadratic, or surfolid $ay^4 = bx^2 \cdot a - x^2$; &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 curvilinear 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

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

5. Four parts of n^o 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. Hepowdered 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 incli-

ning 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.

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^o 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.

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together, nine parts of minium (red oxyd of lead), six parts of flint glafs, 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 glafs, 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 glafs 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 glafs; 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^o 9. The whole was melted into a beautiful blue glafs; 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 glafs of n^o 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 glafs 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 glafs, 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 glafs 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

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Enfield. 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 remembrance. 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

Enfield
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Engrafting.

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, $5\frac{1}{2}$ 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 is 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 Princetown.—*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,

Engrafting
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Eolipile.

(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
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Episcopacy.

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^o 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 dissent from the worship and dis-

cipline 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 styles its members *BEREANS*, to do justice to the venerable remains of what was once the established church of their native country.

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 partisans 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.

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.

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

Episcopacy.

1
Establishment of Episcopacy in Scotland.

2
No liturgy used in the Scotch church,

3
Except at ordinations.

Episcopacy. 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 every where 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 surprize, 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.

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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.

6
Revival of
ancient usages.

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^o 2. and 3. *Encycl.*); and their brethren, perceiving no authority from Charles I. for these things, and being accustomed to consider them as Popish practices, a violent controversy was ready to burst forth about what every enlightened mind must consider as matters of very little importance.

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

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(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. nimonously 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. 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.

⁷ College of bishops. 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 metropolitanical 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 con-

sent of the bishops of both—thrown into the form of *Episcopacy.* canons; and these canons have continued to be the code of the Scotch Episcopal church down to the present day.

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.

⁹ Political opinions. 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.

¹⁰ Persecution. Upon

Episcopacy.

II
Toleration.

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.

I2
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 Episcopalian has, in every important point, been at all times orthodox.

I3
Their wor-
ship.

We are aware, that they have been represented as unfriendly to the English service; but such a representation 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 Episcopalian; 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*.

Epping
||
Equicurve.

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 Episcopalian, and certainly do not constitute what can, with any propriety, be called an *Episcopal church*.

I4
English
clergymen
in Scotland.

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 1233, 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 de
krane
||
Erkoom.

ERGETT ^{EL KRANE}
ERGETT ^{V'DIMMO} } Two Abyssinian shrubs of
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 elliptical. 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 foot-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 inhabitants 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

Erkoom
||
Escambia.

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. McKinnon, 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 Massachusetts, 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, Almsbury 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 Calvinists.—*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 *Encyclopaedia*, 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.

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 Kanaway, 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 Richmond, and 518. S. W. by W. of Philadelphia.—*Morse*.

SPONTANEOUS EVAPORATION. See WEATHER, n^o 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^o 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.

Eton
||
Eudiometer.

Eudiometer
||
Eudoxus.

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 Nectane-

bis 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 $2^{\circ} 51'$. 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 $1^{\circ} 30'$, others, at $1^{\circ} 16'$, &c. It is the greatest of all the moon's equations, except the equation of the centre. *Hutton's Dictionary.*

EVENTLY EVEN NUMBER. See NUMBER, *Encycl.*

EVENTLY 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 stately 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

Evection
||
Evolute.

Evolute
||
Euphon.

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 employed 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.

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 Leipzig 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.

* In all probability the Harmonica of the Abbé Mazzuchi.

Euphon. marked the whole and half tones by a coating of seal-wax 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 union 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 for-

mer, 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. 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. The stem forms a flattened 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. 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 *Encyclopadia* 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 anti-

tidote

Plate
XXVIII.
fig. 1.

Fig. 2.

Fig. 3.

Eustace
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Exchange.

tidote to the poison of euphorbia; because he squeezed some of the juice into a basin 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 *Eustacia*, 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 Ptolomaic 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 remittes? 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 Hamburg, 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 port 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, flitting 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.

Exegese
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Exeter.

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

Exeter
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Exponential.

£.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 . Expo-

Extra
||
Exuma.

nential 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 hypotenuse, 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 Mississippi, in N. lat. 39. 30.; 16 miles above Jaffion 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 found. 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 Sagatuck, Safo, Peganook, Five Mile, Rodens, Mill, and Mayamus rivers. Several harbors, and a number of small isles lie along the found, 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 *Unguowa* 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 found, 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 Winnborough.—*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 ascribed

* *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.

SUPPL. VOL. II.

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 *Encyclopadia*.

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. Ceder, 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. Obligated, 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 Petersburg 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 hypochondriac 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

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(A) In the collection known under the title of *Liunæi Amanitates Academicæ*.

Falk.

never quitted his bed, nor taken any other nourishment than bread dried in the Swedish manner (*knækebröd*), 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 hypochondriac 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. 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

Falling
Farmer.

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 JEBB, 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 ridicule, 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 university 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 predilection 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.

Farmer.

Farmer
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Farmington.

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, inasmuch 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 intervalles, 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 intervalles; 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 Windfor river and falls into Connecticut river in the town of Windfor, 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 rattlesnake, 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 shriek 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 shriek 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 shriek, 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,

Farmington
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Fascination.

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 falnted the reptile with the contents of my fufee. The report was a talifman that broke the charm. All at once, as if by a miracle, my convulfion ceafed; I felt myfelf able to fly; and the only inconvenience of this extraordinary adventure was a cold fweat, which was doubtlefs the effect of my fear, and of the violent agitation my fenses had undergone."

This instance of fascination differs in one very material circumftance from the two fomewhat fimilar instances mentioned in the *Encyclopædia*. In both thefe, the eyes of the perfons fascinated were fixed on the eyes of the fnake; but here the Dutch Captain was ftrongly attracted towards the ferpent before he faw, or even fufpected that fo formidable an enemy was in his neighbourhood. If the ftory therefore be true, the effect which he defcribes could not poffibly have been the effect of fear, but of fome unfeen influence on his whole nervous fyftem.

The fubject has of late attracted the attention of men of fciences, whofe local fituation gives them an opportunity of making experiments upon different ferpents, with a view to afcertain whether they really poffefs or not this moft unaccountable of all powers. In the year 1796, was printed at Philadelphia, a *Memoir concerning the Fascinating Faculty which has been afcribed to the Rattle-fnake, and other American Serpents*, by Benjamin Smith Barton, M. D. Profeflor of natural hiftory and botany in the univerfity of Pennsylvania. In this memoir, the manner in which the fascinating power is fuppofed to be exerted is thus ftated by the ingenious profeflor:

"The fnake, whatever its fpecies may be, lying at the bottom of the tree or bufh upon which the bird or fquirrel fits, fixes its eyes upon the animal it defigns to fascinate or enchant. No fooner is this done, than the unhappy animal is unable to make its efcape. It now begins to utter a moft piteous cry, which is well known by thofe who hear it, and underftand the whole machinery of the bufinefs, to be the cry of a creature enchanted. If it is a fquirrel, it runs up the tree for a fhort diftance, comes down again, then runs up, and, laftly, comes lower down. 'On that occafion (fays an honeft, but rather credulous writer*), it has been obferved, that the fquirrel always goes down more than it goes up.' The fnake ftill continues at the root of the tree, with its eyes fixed on the fquirrel, with which its attention is fo entirely taken up, that a perfon accidentally approaching, may make a confiderable noife without the fnake's fo much as turning about. The fquirrel, as before mentioned, comes always lower, and at laft leaps down to the fnake, whofe mouth is already wide open for its reception. The poor little animal then, with a piteous cry, runs into the fnake's jaws, and is fwallowed at once, if it be not too big; but if its fize will not allow it to be fwallowed at once, the fnake licks it feveral times with its tongue, and fmoothens it, and by that means makes it fit for fwallowing."

From Dr Barton's memoir, it appears that the North American Indians are by no means of one opinion refpecting the fascinating power of the rattle-fnake. Some

intelligent friends of his, well acquainted with the manners, religious opinions, and fuperftitious prejudices of thofe people, informed him, that though they had often heard the Indians fpeak of the ingenuity of thefe reptiles in catching birds, fquirrels, &c. they did not recollect having ever heard them fay that fnakes charm birds. On the other hand, however, a Mohegan Indian told the Doctor himfelf, that the Indians are of opinion, that the rattle-fnake can charm or bewitch, fquirrels and birds, and that it does this with its rattle, which it fnakes, thereby inviting the animals to defcend from the trees, after which they are eafily caught. According to this Indian, his countrymen do not think that the fnake, in any manner, accomplifhes the bufinefs with its eyes. A Choktah Indian affured the Doctor, that the rattle-fnake does charm birds, &c.; but he was honeft enough to confefs, that he did not know in what manner it does it. The interpreter, through whom the converfation was carried on with this Indian, faid that the fnake charms by means of its rattle.

This opinion of the interpreter was the opinion of Dr Mead. That eminent naturalift, controverting, about fifty years ago, the common opinion, that Providence has furnifhed the rattle-fnake with its rattle to give warning to travellers, was the firft who afferted that this fingular appendage is given to the animal to terrify fquirrels and fmall birds, which are then fo ftupified by the fight of fo formidable an enemy, that at length they drop down and become its prey; and that this is what the Indians call *fascination*. The fame opinion has been adopted by profeflor Blumenbach of Gottingen, who, in his Manual of Natural Hiftory, thus expreffes himfelf on this curious fubject:

"That fquirrels, fmall birds, &c. fall down fpontaneously from trees into the mouth of the rattle-fnake, lying below them, is an undifputed fact; and is the lefs furprifing, as the like phenomena have been remarked in regard to other fnakes, and alfo toads, hawks, and cats; all of which, in certain circumftances, as appears, have the power of drawing towards them fmall animals, merely by fixing their eyes ftedfaftly on them. In regard to the rattle-fnake, this effect is produced by the rattle in its tail, the hissing noife of which makes fquirrels, &c. whether through curiofity, miftake, or terror, feem to approach the animal as it were fpontaneously. At any rate, I know, from the information of intelligent eye-witneffes, that it is a common ftatagem of the young favages in America to conceal themfelves in the bufhes, where they imitate the hissing noife of the rattle-fnake, and by thefe means attract fquirrels, which they are then enabled to catch."

To this opinion Dr Barton oppofes an infuperable objection. It is, that this fascinating power is by no means peculiar to the rattle fnake. With regard to the ftatagem of the favages, he thinks that Dr Blumenbach has been impofed upon; as neither he, nor any other perfon of whom he made the inquiry, ever heard of fuch a ftatagem. The young Indians, he fays, place a reed crofs-wife 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, fo that they can eafily fhoot them: And this praftice may have given rife to the ftory of their imitating the hissing noife of the rattle-fnake.

Some have fuppofed that ferpents, under certain circumftances,

Fascination

Profeflor
Peter Kalm.

Fascination circumstances, 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 effluvia 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 credible 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‡.

‡ 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 *Fascination* fear. It hopped about from the floor of the cage to its roof, 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 awkward, 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

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

FAYETTEVILLE. **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 of 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. **Fear Point** 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 Cheapeake 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 Guatemala, 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 Norte, 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, 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 Chimie*.

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, be 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 unite 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 asperities 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.

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 *lamelle*, 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 *lamelle* 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 described, would pass entirely through the felt, going out at the opposite surface, as each hair follows exactly the direction it acquired at the beginning.

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 burfaries 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

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Fergusson. 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.

Fergusson. 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 hour?

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 mimicry, 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 siren 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 senseless 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 Canonsgate 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, a township in Millin co. Pennsylv-
vania.—*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, Merfenne, 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 spirituousity 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.

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“ 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 spirituousity 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 spirituousity, 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 thereof, 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 desert of Soudah, where no vegetable is seen to grow but the talk, a tree from which the lemon co-

loured wood is taken which forms handles for tools. The passage of the desert 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. Telloouwa 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 Temmiswa, where the caravans of pilgrims from Bornou and Nigritia, by way of Cairo to Mecca, provide their stores for the desert.

In the town or province of Mendrah is a large quantity of *irona*, 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 *albaikque*, 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

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 *zarbes* or one and a half upwards; for smaller articles corn or flour are used as a medium. One grain of gold is equal to $1\frac{1}{2}$ d. 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 desert. 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 fenna. 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.

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*, fenna, 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 Calhna, 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, fenna, 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. $27^{\circ} 20'$, or 260 miles from Mafurata.

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, &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

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Figurate.

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, &c.	Tri. 1, 3, 6, 10	1, 4, 10, 20
1, 3, 5, 7, &c.	Sqrs. 1, 4, 9, 16	1, 5, 14, 30
1, 4, 7, 10, &c.	Pent. 1, 5, 12, 22	1, 6, 18, 40
1, 5, 9, 13, &c.	Hex. 1, 6, 15, 28	1, 7, 22, 50

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

Filter.

dividing the products $1 \times 2, 2 \times 3, 3 \times 4, 4 \times 5, \&c.$ each by the first prod. 1×2 ; the first pyramids by dividing the products $1 \times 2 \times 3, 2 \times 3 \times 4, 3 \times 4 \times 5, \&c.$ by the first $1 \times 2 \times 3$. 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 $\frac{x \cdot x + 1 \cdot x + 2 \cdot x + 3 \cdot \&c.}{1 \cdot 2 \cdot 3 \cdot 4 \cdot \&c.}$; 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 (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 in-croach 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.

A patent

Filter.

A patent has likewise been granted to Mr Joshua Collier of Southwark for a very ingenious contrivance for filtering and sweetening water, oil, and all other liquids. Of this contrivance, which combines the application of machinery with the antiseptic properties of charcoal (See CHEMISTRY N^o 34. *Supplement*), we shall give a detailed account.

Fish oil is one of the liquids which he had it particularly in view to free from all its impurities in smell, taste, and colour; and the chemical process employed by him for this purpose consists in pouring a quantity of any species of fish oil, or a mixture of different sorts of fish oil, into any convenient vessel, which is to be heated to the temperature of 110 or 120 degrees of Fahrenheit's scale, and then adding of caustic mineral alkali, of the specific gravity commonly described as 1.25, or of such strength that a phial containing 1000 grains of distilled water will contain 1250 grains of these 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 stand a sufficient time for the salts and sediments to subside; it is then drawn off into another vessel, containing a sufficient quantity of fresh burnt charcoal, finely powdered, or any other substance possessing antiseptic properties, in a powdered or divided state, with an addition of a small proportion of diluted sulphuric acid, sufficient only to decompose the small quantity of saponaceous matter still suspended in the oil, which appears by the oil becoming clear at the surface: the contents of this vessel are also agitated, and the coaly saline and aqueous particles left to subside; after which the oil is passed through proper strainers, herein after described, and is thereby rendered perfectly transparent and fit for use.

The principle of the improved strainers, or filtering machines, consists in the means applied to combine hydrostatic pressure, which increases according to the perpendicular height of the fluid, with the mode of filtering *per ascensum*, thereby procuring the new and peculiar advantage that the fluid and its sediment take opposite directions. A great advantage attending this invention is, that the dimensions of the chamber in which the sediment is received, may be varied, while the filtering surface remains the same. To adapt the machines not only to the purpose of families, work-houses, hospitals, public charities, the navy, or the merchant service, but also to all the purposes of oil-men, of distillers, of the laboratory, the brewery, &c. chambers of various capacities must be provided for the sediment and precipitated matter. With respect to the oil-trade, the space required is very great, especially for spermaceti, or Brasil bottoms. In the various purposes of the laboratory, no limits can be fixed, but all dimensions will be occasionally required: in distilleries and breweries they may be smaller in proportion; and in that designed for water and for domestic use, a very small chamber will be sufficient. When water is to be sweetened, or freed from any putrid or noxious particles, it passes, in its way to the filtering chamber, through an iron-box, or cylinder, containing charcoal finely powdered, or any other antiseptic substance insoluble in water, the water being forced into it by hydrostatic pressure, through a tube of any sufficient height. This box has two apertures to receive and deliver the fluid, and these are opened and closed by cocks,

Filter.

or screws, or any other method used for such purposes, and being affixed to the machine by other screws, may be easily detached from the same. Thus, whenever the charcoal begins to lose its antiseptic properties, the box is removed and heated till it is red hot; by which means the foreign matter escapes through the small apertures, after which the box is cooled, and the charcoal becomes sweet, pure, and equally fit for use as at first, though the process be ever so often repeated.

Another part of the invention consists in filtering machines in the form of stills, in which charcoal may be repeatedly burned after any fluid substances have passed through it, for the purpose of freeing them either from putrid or noxious particles, or of discharging their colouring matter; which filtering stills are so contrived, that the fluid may pass through in any quantity, without displacing the charcoal: the part of the fluid remaining interspersed among the charcoal, may be driven over by heat, and be employed for many inferior purposes of the arts or manufactures. Lastly, the heat may be raised so as to purify the charcoal, as has been before described in the machines for water. The flue of those stills is so constructed that water may be employed to cool them without the loss of time requisite for their gradually parting with their heat to the surrounding atmosphere, so as to be fit for a subsequent 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 instruments for ascertaining the comparative qualities of oils, which depend in part on the principle of their specific gravities; spermaceti oil, contrasted with other fish oils, being as 875 to 920. For this purpose, a glass vessel of any convenient shape, is made use of, furnished with a bubble also of glass, and a thermometer. If the oil is pure, this bubble sinks, when the mercury rises to a certain standard, by the application of the hand, or any other heat to the vessel containing the oil. If the spermaceti oil is impure, the bubble will still float, though it is of the temperature required; and the degree of impure, or foreign matter, will be shewn by the state of the thermometer at which the bubble sinks.

To determine what tendency oils used for burning have to congeal in cold weather, a freezing mixture is put in a phial of thin glass, or any other convenient vessel; into this a thermometer is immersed, and a single drop of the oil, under experiment, suffered to fall on the outside of the vessel, where it immediately congeals; as the cold produced by the mixture gradually ceases, it is easy to observe by the thermometer at what point of temperature the oil becomes fluid, and runs down the side of the glass.

A short description of this apparatus will make its principles plain to every reader. A (fig. 1.) is the cistern, into which the water or other liquor to be filtered is put. B B is a tube opening into the bottom of the cistern 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 basin rising above the level of the chamber and receiving the filtered liquor. E, The spout by which it runs off into a pitcher or other vessel. F, Another spout furnished with a cock

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Filter
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Fire.

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 basin. 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. I, 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.

Fire.

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^o 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 collec-

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

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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

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that the air becomes too much rarefied for the existence of fire.

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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

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difficulty,

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difficulty, however, we could at last distinguish these stars again behind the thin cloud. There arose, at the same time, a fresh gentle breeze.

“From the time that elapsed between the bursting of the ball, and the explosion which followed, I was inclined to think, that the meteor was at the height of at least seven or eight miles, and that it fell four miles to the north of Mormes. The latter part of my conjecture was soon confirmed by an account which we received, that a great many stones had fallen from the atmosphere at Juliac, and in the neighbourhood of Barbotan. One of these places lies at the distance of about four miles to the north of Mormes, and the other at about the distance of five to the north-north-west.”

M. de Carrits Barbotan, the friend who was with the Professor in the court and garden of Mormes when the meteor first attracted their attention, was at Juliac two days afterwards, and confirmed to him the truth of this circumstance. It appeared, likewise from the account of several intelligent persons, highly worthy of credit, that the meteor burst at a little distance from Juliac, and that the stones which fell were found lying in a space almost circular, about two miles in diameter. They were of various sizes. Some were *seen to fall*, which, when found, weighed 18 or 20 pounds, and which had sunk into the earth from two to three feet. M. de C. Barbotan transmitted one weighing 18 pounds to the academy of sciences at Paris; and M. Baudin was told, that some were found which weighed even 50 pounds. He examined a small one, and found it very heavy in proportion to its size: it was black on the outside; of a greyish colour in the inside, and interspersed with a number of small shining metallic particles. On striking it with a piece of steel, it produced a few small dark red sparks, not very lively. A mineralogist, to whom a like piece of stone from the same meteor was shewn at Paris, described it as a kind of grey slag mixed with calcareous spar, the surface of which exhibited vitrified blackish calx of iron. The Professor was told also, that some stones were found totally vitrified.

Such (says 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 atmosphere.

According to all the observations hitherto made with any accuracy on fire-balls, the height at which they were first perceived was always very considerable, and by comparing the angles under which they were seen from different points, often 19 German miles, and even more; their velocity, for the most part, several miles in a second; and their size always very great, often a quarter of a mile, and even more, in diameter. They were all seen to fall mostly in an oblique direction; not one of them ever proceeded upwards. All of them have appeared under the form of a globular mass, sometimes a little extended in length and highly luminous; having behind it a tail, which, according to every appearance, was composed of flames and smoke. All of them burst after they were seen to move through a large space, sometimes over several districts, with an explosion which shook every thing around. In every instance where there has been an opportunity of observing the fragments that fell after they burst, and which some-

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times have sunk to the depth of several feet into the earth, they were found to consist of scorious masses, which contained iron in a metallic or calcined state, pure, or else mixed with different kinds of earth and sulphur. All the ancient and modern accounts, written partly by naturalists, and partly by others, are so essentially similar, that the one seems to be only a repetition of the other. This conformity in accounts, the authors of which knew nothing of those given by others, and who could have no interest in fabricating similar tales, can scarcely have arisen from accident or fiction, and gives to the related facts, however inexplicable many of them may seem, every degree of credibility.

In the third volume of Pallas's Travels, we have an account of a mass of iron discovered by him in Siberia, which Dr Chladni considers as having been undoubtedly a fire-ball, or the fragment of a fire-ball. This problematical mass was found between Krasnojarsk and Abekansk in the high slate mountains, quite open and uncovered. It weighed 1600 pounds; had a very irregular and somewhat compressed figure like a rough granite; was covered externally with a ferruginous kind of crust; and the inside consisted of malleable iron, brittle when heated, porous like a large sea sponge, and having its interstices filled with a brittle hard vitrified substance of an amber yellow colour. This texture and the vitrified substance appeared uniformly throughout the whole mass, and without any traces of slag or artificial fire.

Dr Chladni shews with a great deal of ingenuity, that this mass neither originated by the wet method, nor could have been produced by art, the burning of a forest, by lightning, or by a volcanic eruption. It appears to him, therefore, in the highest degree probable, that it is of the same nature with fire-balls, or, as they have sometimes been called, *flying dragons*. The Tartars, as we are informed by Pallas, considered this mass as a sacred relic which had dropped down from heaven; and this circumstance Dr Chladni considers as no slight confirmation of his opinion, which he farther supports by the following reasonings:

“1. As fire-balls consist of dense and heavy substances, which, by their exceedingly quick movement, and the friction thence excited by the atmosphere, become electric, are reduced to a state of ignition, and melted by the heat, so that they extend to a great size, and burst; it thence follows, that in places where fragments, produced by the bursting of a fire-ball, have been found, substances endowed with all these properties must also have been found. Iron, however, the principal component part of all the masses hitherto found (and he speaks of many besides that of Pallas), possesses all these properties in a very eminent degree. The weight and toughness of the principal component parts of fire-balls, which must be very considerable, since, with the greatest possible distention, they retain consistence enough to proceed with the utmost velocity through such an immense space without decomposition of their mass, and without their progress being obstructed by the resistance of the air, agree perfectly well with melted iron; their dazzling white light has by many observers been compared to that of melted iron; iron also exhibits the same appearances of flaming, smoking, and throwing out sparks, and all these phenomena are most 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 fossil 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

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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 babblings 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 corvora, 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-

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Fishing.

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Fistula.

Fistula.

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 Carthage, upon the lake Cienega de Tefias.

FISHING Bay, in Maryland, lies on the E. side of Chesapeake 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-Windfor.—*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 fit 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 surprize. 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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Flatbush.

"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 Royalton 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 sissant, or the greater and less lines of defence; or the part of the curtain between the flank and the point where the sissant 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*.

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

Rasant or Rasant 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 ex-

traction. 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 healthy 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 Genesee 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

Flatlands
||
Flintston.

Floating. 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

Floating.

Floating.

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.

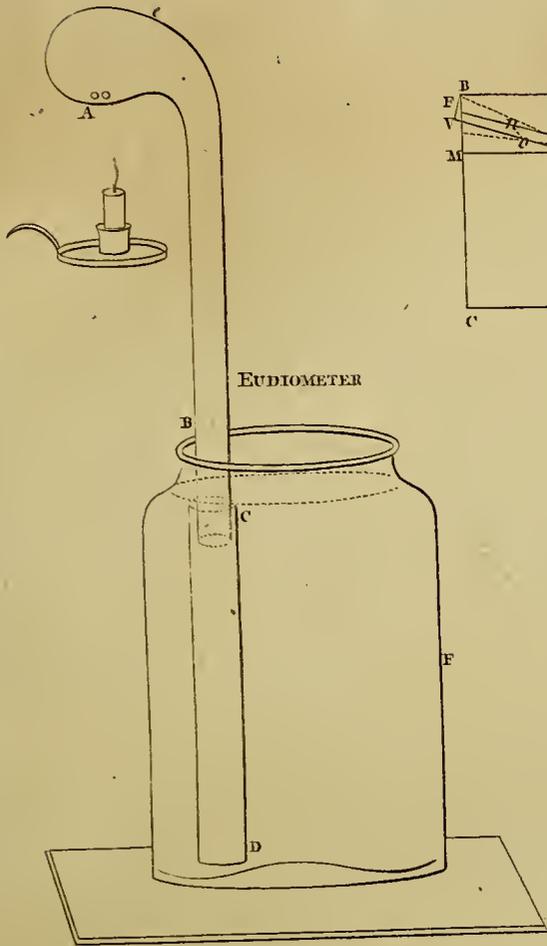
“In ships of war and merchandize, the calculations necessary for this purpose become unavoidably very operose and troublesome; but they may be much facilitated by the experimental method pointed out in the New Transactions of the Swedish Academy of Sciences, first quarter of the year 1787, page 48.

“In river and canal boats, the regularity and simplicity of the form of the vessel itself, together with the compact disposition and homogeneous 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.

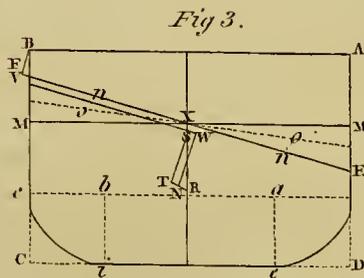
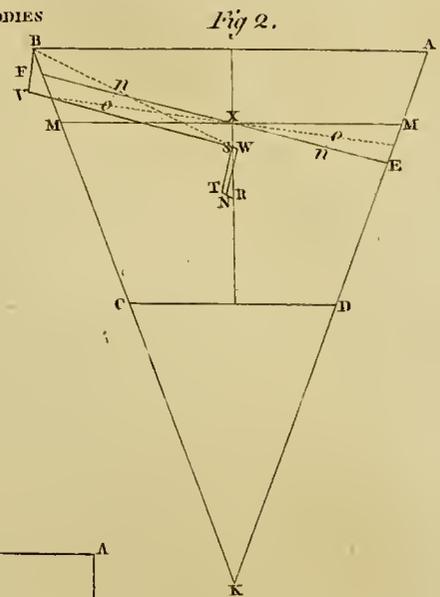
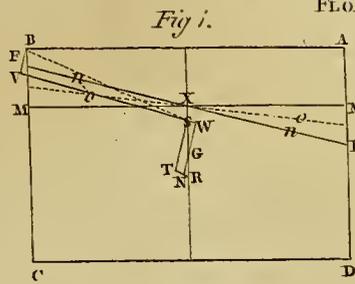
“If the vessel be loaded quite up to the line AB, and the specific gravity of the boat and burden be the same, then the point G is simply the centre of gravity of the section ABCD; but if not, the centres of gravity of the boat and burden must be found separately, and reduced to one by the common method, 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,

Floating.

Plate XXVIII



FLOATING BODIES



EUPHORBIA

Fig 1.



Fig 2.

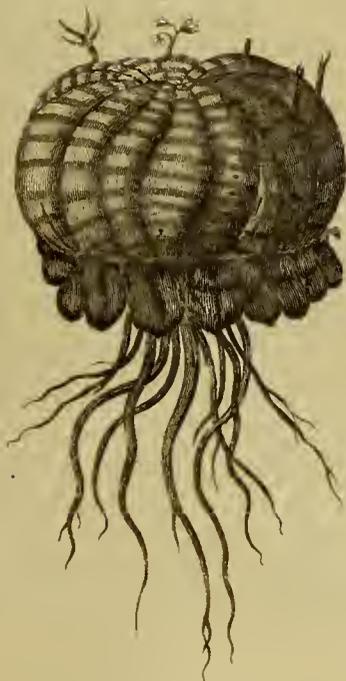
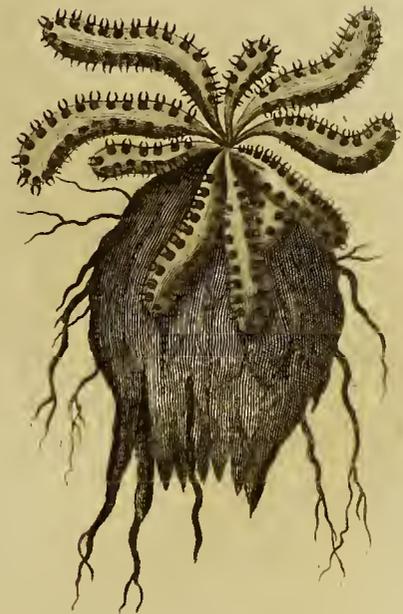
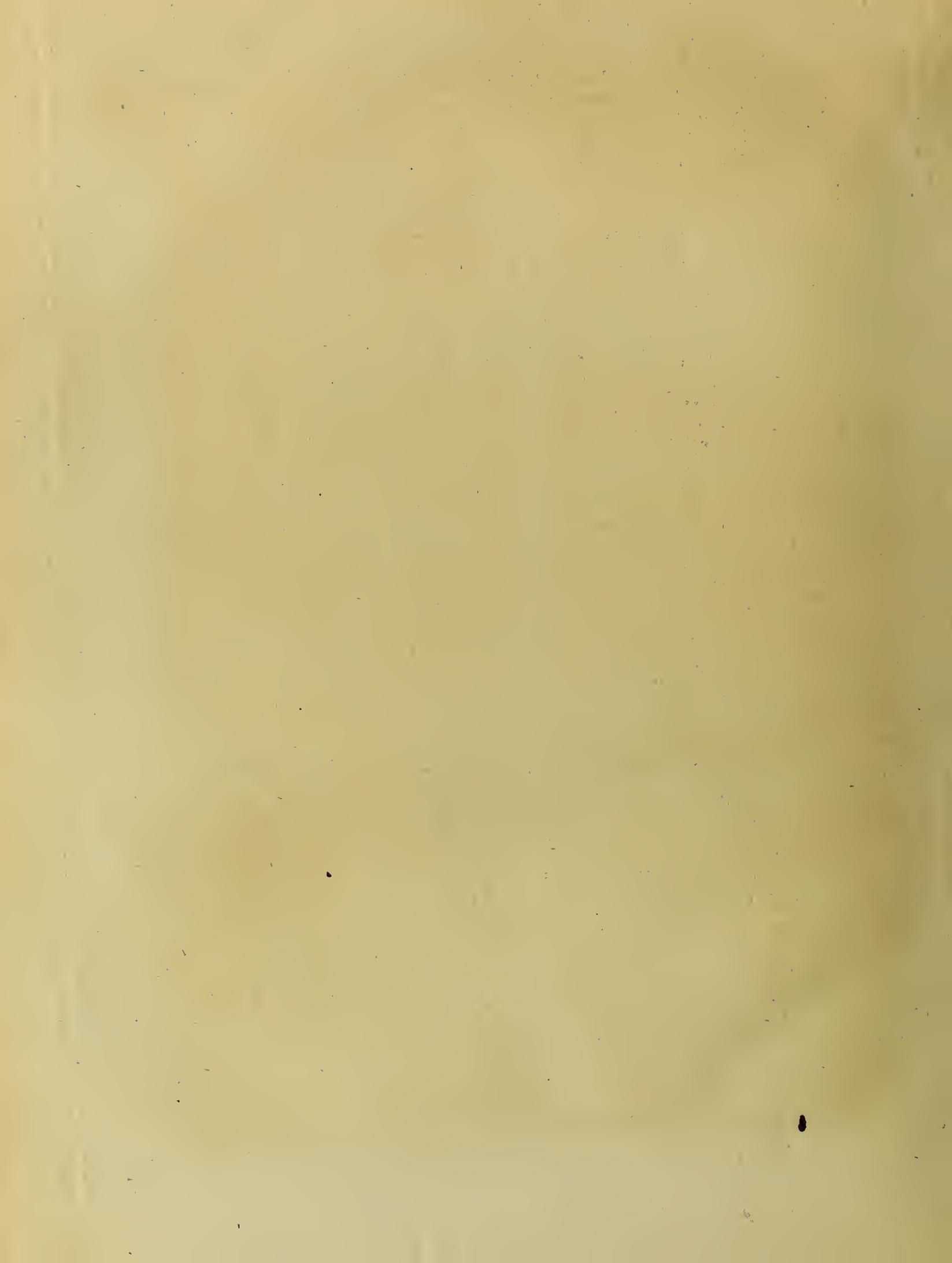


Fig 3.





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 *nn* 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 *nn*; 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 x KF = KM x 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 $\angle E$:: KM : KF, and as the said mean proportional : sine $\angle F$:: KM : KE; therefore ME, MF become known: from whence the area of either triangle MXE or MXF, the distance *nn*, 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 curvilinear 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 *abie* = 1440 square inches, and the altitude of its centre of gravity 12 inches; in like manner, the area of the rectangle *ABcd* 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 x 13.8177 = 12501.98966016
Moment. of the rectan. <i>abie</i>		
Moment. of the rectan. <i>ABcd</i>	}	= 5184 x 48 = 248832
		7528.7808
		278613.98966016

"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 = *nn* = $\frac{2}{3}$ 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 cwt. 28 lbs. will require a weight of 1 ton, 13 cwt. 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 Mississippi,

Florida.

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, Penfacola, 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, cypresses, 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 intervalles between the hilly parts of this country are extremely rich. The principal town in West Florida is Penfacola; 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—Penfacola, 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 Tenfau, 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 guaranteed 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

Florida
||
Fluvanna.

Fogedar
||
Fordyce.

Fordyce.

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 Kishnac 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 Païta, 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 regu-

lar 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 name 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 Divi-

Fordyce. 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 preach-

er 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.

Forester
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Forster.

Forster.

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 Evefham; 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, Boflu's, and Reidfel'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 authorized 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

Forster.

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, increased 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

Forster.

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 dawns of the French revolution, and was the first, says M. Pougens, to promulgate republicanism in Germany.

The *Mayennois*, 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,

Royal Fort 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 re-entering and salient 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 lune*, 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 insensible 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 $6\frac{1}{4}$ 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 Foulah's 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

Foulahs
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Fox.

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 Foola-Torra adjacent to it, lying between the rivers Gambia and Falemé; Foola-doo and Brooko along the upper part of the Senegal river; Waffela 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, Ouifconfin, 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 basin 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; and

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and that this river might take its source in the great lakes to the northward of Canada. Two channels were indeed found, stretching, the one to the east, and the other to the west; but both were very soon terminated by immense glaciers.

In Port des Français the variation of the compass is 28° east, and the dip of the needle 74°. The sea rises there seven feet and a half at full and change of the moon, when it is high water at one o'clock. The sea breezes, or perhaps other causes, act so powerfully upon the current of the channel, that M. Perouse saw the flood come in there like the most rapid river; while, in other circumstances, at the same period of the moon, it may be stemmed by a boat. In this channel he lost two shallops and twenty men. In his different excursions, he found the high water mark to be about 15 feet above the surface of the sea. These tides are probably incident to the bad season. When the winds blow with violence from the southward, the channel must be impracticable, and at all times the currents render the entrance difficult; the going out of it also requires a combination of circumstances, which may retard the departure of a vessel many weeks; there is no getting under way but at the top of high water; the breeze from the west to the north-west does not often rise till toward eleven o'clock, which does not permit the taking advantage of the morning tide; finally, the easterly winds, which are contrary, appeared to him to be more frequent than those from the west, and the vast height of the surrounding mountains never permits the land breezes, or those from the north, to penetrate into the road.

As this port possesses great advantages, M. Perouse thought it a duty incumbent on him to make its inconveniences also known. It seemed to him that this anchorage is not convenient for those ships which are sent out at a venture for trafficking in skins; such ships ought to anchor in a great many bays, and always make the shortest stay possible in any of them; because the Indians have always disposed of their whole stock in the first week, and all lost time is prejudicial to the interests of the owners; but a nation which should form the project of establishing factories similar to those of the English in Hudson's Bay, could not make choice of a place more proper for such a settlement. A simple battery of four heavy cannon, placed upon the point of the continent, would be fully adequate to the defence of so narrow an entrance, which is also made so difficult by the currents. This battery could not be turned or taken by land, because the sea always breaks with such violence upon the coast, that to disembark is impossible. The fort, the magazines, and all the settlements for commerce, should be raised upon Cenotaph Island (A), the circumference of which is nearly a league: it is capable of being cultivated, and there is plenty of wood and water. The ships not having their cargo to seek, but being certain of having it collected to a single point, would not be exposed to any delay: some buoys, placed for the internal navigation of the

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bay, would make it extremely safe and easy. The settlement would form pilots, who, better versed than we are in the set and strength of the current at particular times of tide, would ensure the entrance and departure of the ships. Finally, continues the author, our traffic for otters skins has been so very considerable, that I may fairly presume there could not, in any part of America, be a greater quantity of them collected.

The climate of this coast seemed to Perouse much milder than that of Hudson's Bay in the same latitude. Pines were measured of six feet diameter, and 140 high; while those of the same species at Prince of Wales's Fort and Fort York are of a dimension scarce sufficient for studding sail-booms. Vegetation is also very vigorous during three or four months of the year; and our author thinks, that Russian 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 these pot herbs were seen almost all those of the meadows and mountains of France; such as the angelica, the butter cup, the violet, and many species of grass proper for fodder. The woods abound in gooseberries, raspberries, and strawberries; clusters of elder trees, the dwarf willow, different species of briar which grow in the shade, the gum poplar tree, the poplar, the fallow, the horn-beam; and, finally, superb pines, fit for the masts of our largest ships. Not any of the vegetable productions of this country are unknown in Europe. M. de Martinière, in his different excursions, met with only three plants which he thought new; and it is well known, that a botanist might do the same in the vicinity of Paris.

The rivers were filled with trout and salmon; and as the Indians sold these fish to the French in greater quantities than they could consume, they had very little fishing in the bay, and that only with the line. They caught some ling; a single thornback, some plaice, *fletans* or *faitans*, of which some were more than 100 pounds in weight (B), and a fish resembling the whiting, but a little larger, which abounds on the coast of Provence, where it is known by the name of *poor-priest*. Perouse calls these fish *capelans*. In the woods they met with bears, martens, and squirrels; but they saw no great variety of birds, though the individuals were very numerous.

"If the animal and vegetable productions of this country resemble those of a great many others, its appearance (says our author) can be compared to nothing. The views which it presents are more frightful than those of the Alps and the Pyrenees; but at the same time so picturesque, that they would deserve the visits of the curious, were they not at the extremity of the world. The primitive mountains of granite or schistus, perpetually covered with snow, upon which are neither trees nor plants, have their foundation in the sea, and form upon the shore a kind of quay; their slope is so rapid, that after the first two or three hundred toises, the wild goats cannot climb them; and all

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

(B) This is a flat fish, longer and not so square as the turbot. Its back is covered with small scales; and those which are taken in Europe are much less than the fletans of Port des Français.

Français.

Français.

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.

"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. Chestnut 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,

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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 Francois 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

floop 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-easterlymost 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 Morriltown. 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, 123 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.

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Franklin. 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 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

Franklin. 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 Kinnerlev 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 light-

ning is well known and in general use in America, and in many places in Europe. *Franklin.*

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

Franklin. 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 fought 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 negotiations 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 negotiated. 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.

Franklin.

Franklin 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. Maite; 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 fortrefs 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 grist-mills, 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, Fredericktown.—*ib.*

FREDERICK Co. in Virginia, is bounded N. by Berkeley, 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 Berkeley 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 *Zaney'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 Abbittbe 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 township 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 Chesapeake bay. N. lat. 39. 22. 30.—*ib.*

Frederick-
burg
Fre'gates.

FREDERICKSBURG, a post town in Spotsylvania co. Virginia; situated on the S. W. bank of Rappahannock river, 110 miles from its mouth in Chesapeake 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.*

FREGATES 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 Quinebaugue 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 Goldborough 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.*

French
Freneuse.

Friction.

FRICITION, 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 cor-

responded 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 $41\frac{1}{2}$ 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 $59\frac{3}{8}$ 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 = $16\frac{1}{2}$ feet; then the whole accelerative force

Friction.

Friction.

force (the force of gravity being unity) will be $\frac{M - F}{M + W}$;

hence, by the laws of uniformly accelerated motions, $\frac{M - F}{M + W} \times r t^2 = S$, consequently $F = M - \frac{M \times W \times S}{r t^2}$

To exemplify this, let us take the case of the last experiment, where $M = 7$, $W = 25\frac{3}{4}$, $S = 4\frac{7}{8}$ feet, $t = 4''$; hence $F = 7 - \frac{32\frac{3}{4} \times 4\frac{7}{8}}{16\frac{1}{2} \times 16} = 6.417$; con-

sequently 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 $\frac{1}{800}$ th part of the whole.

5. We come in the next place to determine, whether friction, *ceteris 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, *ceteris 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.

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 $1\frac{3}{8}$ 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 $\frac{1}{2}$ 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, $5\frac{1}{2}$ 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 $7\frac{1}{2}$ 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 $6\frac{1}{4}$ 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, $4\frac{3}{4}$ 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 ex-

periments. *1st,* A body of $12\frac{3}{4}$ 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. *2dly,* 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 $\frac{1}{2}$ 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^o 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 collaries 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

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

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Frigorific.

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^o 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 crystals; 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 4 lb. 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.

Frigorific.

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.

Frigorific
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Frontinac.

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.

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,

Frost
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Fuel.

* *The Philosophical Magazine.*

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.

Fulling.

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 fine-dust, might be employed with great advantage.

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

Fulminat-
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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 matras. The solution being poured off, the residuary black powder and the matras 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 necessary; 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.

Fulminat-
ing.

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-

Function
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Fundy.

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-HUCKRECURT, 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.

Fundy
||
Fust.

G.

Gabori
||
Gaguedi.

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, STR 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 monopetalous, or made of one leaf; it is divided at the top into four segments; where these end, it is covered with a tuft 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 tuft 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 render

Gaguedi
||
Galette.

Calibis
||
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, Sr 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 eligible station to cruize for vessels bound for Callao, N. or S.—*ib.*

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 Pisle 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.*

Galliopolis
||
Galloway.

G A L V A N I S M.

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.

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

Discovery
of galvan-
ism.

Object of
this article

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 lightened. 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 paliades 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.

Almost any two metals will produce the movements; ⁵ The metals. 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.

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. ⁶ Animal and excitatory arcs. 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.

A very numerous train of experiments on galvanism ⁷ Experiments of the French Institute. 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 ani-
mal 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 phenomena to take place.

4. The section or ligature of a nerve interrupts not the galvanic phenomena, 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

K 2

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 carefully 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 morelle (*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 those 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 phenomena 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 phenomena, 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 exa-

mined, 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 phenomena, 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

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

(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 those 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 *idiocærics*.

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.

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 phenomena 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 phenomena 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.

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

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Experiments relating to circumstances different from the arcs.

13
Inferences.

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.

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Experiments on the galvanic susceptibility of animal bodies, &c.

IV. In their experiments upon *the means of varying, diminishing, and renewing 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.

V. *The comparison between the phenomena 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 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

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Comparison of the phenomena of galvanism with those of electricity.

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.

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.

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 Subir of Berlin, in his *Thorie des Plaisirs*, p. 155 (published in 1767), takes notice of the disagreeable taste produced by sil-

ver 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 roof 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 idiosyncrasis 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.

The first writers upon the discovery of Galvani seem almost universally to have taken it for granted, that the

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Phenomena of galvanism supposed to result from electricity;

(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:

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.

"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.

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

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Proofs by which Valli endeavours to support it,

22
Inconclusive and

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This supposition ill founded.

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.

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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 tin-foil, it will be found a very good conductor; but if, with a sharp pen knife, an almost imperceptible division be made across the tin-foil, 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 incontestably, 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.

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And with
the know-
ledge of e-
lectricity.

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 ceiling 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
Incondu-
five like-
wise.

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.

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 $7\frac{1}{2}$ 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 $\frac{1}{10000}$ 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 $1\frac{1}{2}$ 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 $1\frac{1}{2}$ 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 $\frac{47}{10000}$ or $\frac{50}{10000}$ of an inch thick, took a charge, although a cut of $\frac{3}{10000}$ 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,

27
Demonstration, that the phenomena of galvanism and of electricity result not from the same cause.

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 e-
lectricity
and galva-
nism.

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 (1); 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 electrify 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 Wallh 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.

Galvanism differs from electricity in nothing more remarkably than in the mode of its excitement and discharge. ²⁹ Difference in their mode of excitement,

(H) What if it were called *metallorgasm*, which translates exactly metallic irritation, or metallegerfism, from *μεταλλος*, and *εγερσις excitatio*.

(1) 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 (1). 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 ef-
fects.

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.

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.

31
Some men
non-con-
ductors of
galvanism.

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 (κ). 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

(1) 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.

(κ) 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, inasmuch 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 innuated 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 electric

(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 tin-foil, 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 phenomena 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.

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

³²
The galvanic influence probably foreign from animals.

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.

53
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.

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“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

M tainty

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 (kniekehlnerve) 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 Animalis*, 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 lumbar 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.

G A R

Galway
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Garden. 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 Hyannis 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 convi-

G A R

vial 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 breasts, as soon as those ebullitions of youthful passion and inexperience are over, by which

Garden.

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 artificers 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."

Garden.

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; and

Garden. 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 gaiety of his fancy in his earlier days; and a small volume of poems was published, in which the best pieces are, upon good authority, ascribed to Lord Gardenstone. He revised also the memorandums which he had made upon his travels, and permitted them to be sent to press. The two former volumes were published one after another while his Lordship was yet alive; the third after his death. They met with a very favourable reception in the world, and were honoured with the high approbation of the most respectable writers of periodical criticism. They convey much agreeable information, and bespeak an elegant, enlightened and amiable mind. The last volume is filled chiefly with memorandums of his Lordship's travels in Italy; and contains many interesting criticisms upon some of the noblest productions of the fine arts of painting and sculpture.

His Lordship's health had long been declining; and he died a bachelor on the 22d of July 1793, lamented by his relations and friends, by his tenants and humble 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, 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-west-erly 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 *Namquit Point*, 7 miles S. of Providence

Gardner
||
Gaspec.

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 Gaspeians 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, $14\frac{1}{2}$ 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 whalers 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 Whites-town. 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, ST or *Miffire*, 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*.

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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

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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 site 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 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.*

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GEORGETOWN, the chief town of Sussex co. Delaware, is situated 16 miles W. S. W. of Lewistown, and 103 S. of Philadelphia. It contains about 30 houses and has lately been made the seat of the county court.—*ib.*

GEORGETOWN, a post town in Maryland, situated in Kent co. on the E. side of Chesapeake bay, of about 30 houses. It is 9 miles from the mouth of the river Sassafras, being seated on the S. side opposite to Frederick, 60 N. E. of Chester, and 65 S. W. of Philadelphia.—*ib.*

GEORGETOWN, a village of Fayette co. Pennsylvania, situated on the S. E. side 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 western country. It lies 16 miles S. W. of Union.—*ib.*

GEORGETOWN, a post town and port of entry, in Montgomery co. Maryland, and in the territory of Columbia. It is pleasantly situated on a number of small hills, upon the northern bank of Potowmack river; bounded eastward by Rock creek, which separates it from Washington city, and lies 4 miles from the capitol, and 8 N. of Alexandria. It contains about 230 houses, several of which are elegant and commodious. The Roman Catholics have established a college here, for the promotion of general literature, which is at present in a very flourishing state. The building being found inadequate to contain the number of students that applied, a large addition has been made to it. Georgetown carries on a small 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. district of Maine, is situated on both sides of Kennebeck river. It was incorporated in 1716, is the oldest town in the county, and contains 1333 inhabitants. It is bounded southerly by the ocean, westerly by the towns of Harpswell and Brunswick, N. westerly by Bath, and easterly by Woolwich; being entirely surrounded 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 Casco bay, called Stephen's river.

The entrance at the mouth of Kennebeck river, is guided on the E. by Parker's island, belonging to this township. It contains about 28,000 acres of land and salt marsh, and is inhabited by more than one third part of the people of the township. This was the spot on which the Europeans first 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 state. They sent over a number of civil and military officers, and about 100 people. By various misfortunes they were forced to give up the settlement, and in 1608, the whole number who survived the winter returned to England.

There was a tradition among the Norridgewalk Indians, that these planters invited a number of the natives, who had come to trade with them, to draw a small cannon by a rope, and that when they were ranged in a line, the white people discharged the piece, and

thereby killed and wounded several of them. The resentment of the natives at this treacherous murder, obliged the Europeans to reembark the next summer. Georgetown is 15 miles S. of Pownalborough, and 170 N. by E. of Boston.—*ib.*

GEORGETOWN, a post town of Georgia, in the co. of Oglethorpe, 50 miles S. W. of Augusta, surrounded by a poor country; but, nevertheless, exhibits marks of growing prosperity.—*ib.*

GEORGETOWN, a large maritime district in the lower country of S. Carolina, situated in the S. E. corner of the state; bounded N. E. by the state of N. Carolina, S. E. by the ocean, S. W. by Santee river, which divides it from Charleston district, and N. W. by Camden and Cheraw districts. It is about 112 miles from N. to S. and 63 from E. to W. and is divided into the parishes of All Saints, Prince George, and Prince Frederick. It contains, according to the census of 1790, 22,122 inhabitants, of whom 13,131 are slaves. It sends to the state legislature 10 representatives and 3 senators, and pays taxes to the amount of £.3585-12-6.—*ib.*

GEORGETOWN, a post town, port of entry, and capital of the above district, is situated on a spot near which several streams unite their waters, and form a broad stream called Winyaw bay, 12 miles from the sea. Its situation connects it with an extensive back country of both the Carolinas, and would be a place of vast importance, were it not for a bar at the entrance of Winyaw bay, which interrupts the entrance of vessels drawing above 11 feet water, and is in many respects a dangerous place. It contains above 300 houses, built chiefly of wood. The public buildings are a court-house, gaol, and academy; 3 churches, of which the Episcopalians, Baptists, and Methodists have one each. There is here a small trade to the West-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 Charleston, 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 west of the head waters of those rivers which fall into the Atlantic Ocean. This extensive tract of country embraces some of the finest land in the United States, is intersected with a great number of noble rivers, which may be seen by an inspection of the map, and is inhabited (except such parts where in the Indian title has been extinguished) by three nations of Indians, viz. the Muskogulge or Creek, the Chicasaws, and Chicasaws. The Cherokees also have a title to a small portion of the northern part of this territory, on the Tennessee river. These nations together can furnish between 8 and 9000 warriors. About 2000 families of white people inhabit those parts of this territory where the Indian title has been extinguished, chiefly at the Natchez, and the Yazoo river, on the banks of the Mississippi, and a considerable number on the Tombigbee river, and scattered among the Creek Indians. This territory, for reasons 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 description of it and statement of facts relative

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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 coves, 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

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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

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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 wife 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; and on which more dependence is to be placed, than on the most elaborate and elegant descriptions, of interested individuals.

(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 stocks 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 cypresses, 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 per-

fection, and no part of the known world is more favourable for the raising of every kind of stock. The rising grounds, which are clothed 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 31 $\frac{1}{2}$ 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 Stony river, is 4 $\frac{1}{4}$ 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 Louisa 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

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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 Lyinan, 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 Loufa 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 Loufa 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 luxuriance 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 fre-

quent 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 90 yards wide; is boatable 100 miles; that he crossed the country by different routes, 3 or 4 times

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times from the Mississippi 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 Chaftaw settlements, and extend thick to the Chickasaw 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-leaved pine." Other accounts represent it as much the same as that between the Mississippi and Pearl rivers, with the addition of some pine land, and better watered. The streams on which the Chaftaws are settled, as laid down on Coxe's map, are, proceeding from W. to E. the Homachitta, (called by Purcell Hostaphatcha) Chaftaw, 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 Chaftaw 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 Chaftaws, 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 Chaftaws 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 Mississippi. 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 Tanfaw, 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 Tanfaw 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.

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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 intervalles 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 Hacha, or Pea river, which Capt. Hutchins thus describes—"The river Escambia is the most considerable that falls into the Bay of Pensacola. The Chatta Hacha 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 Appalachian, 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. Travelers 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 Tenlaw; thence up the said lake Tenlaw, 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 on 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

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James Gunn, Matthew M^cAllister, 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 money, 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 therefrom, 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. 4 m. 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

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Gerard. 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-foot 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 school-master 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 *Encyclopaedia*.

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

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Gerard.

Gerard. 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.

Gerard. “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

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died first. If it were not, pneumatology would be too far disjointed 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

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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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schirrous

(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 Gordon, who read lectures in the King's College for 63 or 64 years, and whose learning was equalled only by his virtues.

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scirrous 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.

The fruits of this incessant study were, besides the lectures which he read to his different classes, 1st, *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. 4th, Two volumes of *Sermons*; of which the first was published in 1780, and the second in 1782. 5th, 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.

“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.

Gerard.

† The Rev. Skene Ogilvie, Old Aberdeen.

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“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 lectures 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 Berkeley 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 Schenestady.—*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.*

Gerardstown
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German-town.

German-
town
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Germina-
tion.

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 cytibus or pigeon pea (*cytibus cajan*), the *dodonæa angustifolia*, the climbing mimosa (*mimosa scandens*), and new kinds of the *homœa*.—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.

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(A) See Ullar's Fragments of Phytology, Plenck's Physiology, Willdenow's Dendrology, and *Dictionnaire 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 Pfafs 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.

Germin-
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Gesche.

Gettys-
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Gheyssi-
quas.

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 Millertown, 15 from Abbotstown, 36 from Williamsport in Maryland, and 118 W. by S. of Philadelphia.—*Morse.*

GHEYSSQUAS, 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.

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.

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, yanis, and pomegranates; but as these articles are wild, and not assisted 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.

Gheyssi-
quas
||
Ghirgong.

Pennant's
View of
Hindostan.

Ghirgong
||
Gibbon.

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 dismissal 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 *Homers*, 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 vain 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 tutor 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

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the step he had taken; and the old gentleman, in the first fall 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.

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 Trayoriens, 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?

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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 re-

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serve 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.

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,

* See *Le Discours Preliminaire par D'Alambert à l'Encyclopedie.*

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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 Swift's 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

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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 Littéraires 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 Gloucester 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 staidness 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,

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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 acknowledgment, 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 Cræsus, 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 Chi-

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stianity 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 Prietley, 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 foldier, at the storming of Sardis, was preparing to kill Cræsus, 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 Cræsus!'

(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.'

Gibbon. 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 downfall 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 Lemane 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 Galliephrenzy, 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 difficult 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 *Encyclopaedia*. 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 solid

Gibraltar. mafs 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 superficies of the rock, for a considerable extent, bare and open to inspection. In those situations, an observing eye may trace the effects of the slow, but constant, decomposition of the rock, caused by its exposure to the air, and the corrosion of sea salts, which, in the heavy gales of easterly winds, are deposited with the spray on every part of the mountain. Those uncovered parts of the mountain rock also expose to the eye a phenomenon worthy of some attention, as it tends clearly to demonstrate, that, however high the surface of this rock may now be elevated above the level of the sea, it has once been the bed of agitated waters. This phenomenon is to be observed in many parts of the rock, and is constantly found in the beds of torrents. It consists of pot-like holes, of various sizes, hollowed out of the solid rock, and formed apparently by the attrition of gravel or pebbles, set in motion by the rapidity of rivers or currents in the sea.

“Upon the west side of the mountain, towards its base, some strata occur, which are heterogenous to the mountain rock: the first, or highest, forms the segment of a circle; its convex side is towards the mountain, and it slopes also in that direction. This stratum consists of a number of thin beds; the outward one, being the thinnest, is in a state of decomposition, and is mouldering down into a blackish brown or ferruginous coloured earth. The beds, inferior to this, progressively increase in breadth to 17 inches, where the stratification rests upon a rock of an argillaceous nature.

“This last bed, which is 17 inches thick, consists of quartz of a blackish blue colour, in the septa or cracks of which are found fine quartz crystals, colourless, and perfectly transparent. These crystals are composed of 18 planes, disposed in hexangular columns, terminated at both extremities by hexangular pyramids. The largest of those that Major Imrie saw did not exceed one-fourth of an inch in length: They, in general, adhere to the rock by the sides of the column, but are detached

without difficulty. Their great degree of transparency has obtained them the name of *Gibraltar diamonds*.”

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 enveloped in, and cemented by, the calcareous matter which it deposits.

“The bones, in this composition, have not the smallest appearance of being petrified: and if they have undergone any change, it is more like that of calcination than that of petrification, 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 Rofia 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 spongy 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 tex-

ture. 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

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candles proceeded through a narrow passage over crystallized protuberances of the rock till we came to a hollow, which appears to have been opened by some convulsion of Nature. Here, from a bed of gems, arises the salutary fount, clear as the brilliant of the east, and cold as the icicle. We hailed the nymph of the grot, and, prostrating ourselves, quaffed hygean nectar from her sparry urn. When restored to the light of day, we obtained, through the medium of the same gentleman, the key of St George's Hall, at which we arrived by a very intricate and gloomy path to the spacious excavation, which is upwards of 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 *Passé au Heron*.—*ib*.

GILMANTOWN, a township in Strafford co. New-Hampshire, south-westerly of Lake Winnipisogee, 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 of 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

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nand III. about the middle of the last century. At the time of his death, 1667, the father practised his art at Prague and Ratibon. Whether the son followed the same business at the same towns, or removed to Nuremberg, is not very evident from the professor's history; but in the year above-mentioned, some *aqua regia* (nitro-muriatic acid) having accidentally fallen on his spectacles, he was surprised to find the glass corroded by it, and become quite soft. He thus found himself in possession of a liquid by which he could etch writing and figures upon plates of glass.

Such is our information; but if it be admitted (and it would display unreasonable scepticism to question it), Schwanhard must either have improved the nitro-muriatic acid by some means or other unknown to us, or have confined his etchings to some particular kinds of glass; for the *fluoric* is the only acid, with which we are acquainted, that corrodes all glass. (See CHEMISTRY-Index in this Supplement). M. Beckmann indeed seems to think that he had discovered the fluoric acid itself; for in the year 1725 there appeared in a periodical work the following receipt for making a powerful acid, by which figures of every kind can be etched upon glass.

"When the *spiritus nitri per distillationem* has passed into the recipient, ply it with a strong fire, and when well dephlegmated, pour it, as it corrodes ordinary glass, into a Weldenburg flask. Then throw into it a pulverised green Bohemian emerald, otherwise called *hepborus* (which, when reduced to powder, and heated, emits in the dark a green light), and place it in warm sand for 24 hours. Take a piece of glass well cleaned, and freed from all grease by means of a ley; put a border of wax round it, about an inch in height, and cover it all over with the above acid. The longer you let it stand so much the better; and at the end of some time the glass will be corroded, and the figures which have been traced out with sulphur and varnish will appear as if raised above the pane of glass."

That the Bohemian emerald or *hepborus* mentioned in this receipt is green sparry fluor, cannot, says the professor, be doubted; and he seems to have as little doubt of the receipt itself having passed from Schwanhard and his scholars to the periodical work of 1725, from which it has been lately inserted in the *Ökonomische Encyclopedie* of Krunitz. This supposition certainly acquires a considerable degree of probability from the similarity of Schwanhard's method of etching to that which is here recommended, and which is so different from what is now followed. At present, the glass is covered with a varnish either of isinglass dissolved in water, or of turpentine oil mixed with a little white lead, through which the figures to be etched are traced as on copper; but Schwanhard, when he had drawn his figures, covered them with varnish, and then by his liquid corroded the glass around them. His figures, therefore, when the varnish was removed, remained smooth and clear, appearing raised from a dim or dark ground; and M. Beckmann, who persuaded some ingenious artists to make trial of this ancient method of etching, declares, that such figures have a much better effect than those which are cut into the glass.

Before concluding this article, it may be worth while just to mention a proposal which has been lately made to employ glass instead of copper for throwing off prints in the rolling press. That it is possible to use

glass plates of great thickness for this purpose, it would be rash to deny; but the superiority of such plates to those of copper we cannot conceive. If not broken in pieces in the rolling press, they would doubtless last longer; but the expence of them at first would probably be greater, and the engraving on them could not be so fine.

GLASTONBURY, a township in Bennington co. Vermont, having only 34 inhabitants. It has good intervale lands, and lies N. E. of Bennington, adjoining.—*Morse*.

GLASTONBURY, a handsome little town in Hartford co. Connecticut, situated on the east side of Connecticut river, opposite to Weathersfield, and of which it formed a part until 1690. In the township are 2 meeting houses; and on Roaring Brook and other small streams are 17 mills of different kinds and 1 forge.—*ib*.

GLOSSOCOMMON, in mechanics, is a name given by Heron to a machine composed of divers dented wheels with pinions, serving to raise huge weights.

GLOUCESTER *House*, belonging to the Hudson's Bay Company, is situated in New South Wales, on the N. side of the waters which form a communication through a chain of small lakes, between Winnepeg Lake and Albany river. Henley House 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 township in Essex co. Massachusetts, whose east point forms the north side of the bay of Massachusetts. It contains 5317 inhabitants, and is divided into 5 parishes, and has besides a society of Universalists. This is a post-town and port of entry. The harbour is very open and accessible to large ships; and is one of the most considerable fishing towns in the Commonwealth. At the harbour, properly so called, are fitted out annually from 60 to 70 bankers; and from Squam and Sandy Bay, two small out ports, the bay fishery is carried on with great spirit, and to a large amount. The exports for one year, ending Sept. 30, 1794, amounted in value to 229,613 dollars. Thatcher's Island, on which are two lights of equal height, lies close to the S. E. side of the township, which is itself joined to the continent by a beach of sand which is very rarely overflowed by the water. There is a very fine white sand here fit for making glass. 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 Boston.—*ib*

GLOUCESTER, the north-westernmost township, and the largest, in Providence co. Rhode-Island, having Connecticut on the west, and Massachusetts on the north; and contains 4025 inhabitants.—*ib*.

GLOUCESTER *County*, in New-Jersey, is bounded north by Burlington co. south by Salem, Cumberland, and Cape May counties, east by the Atlantic Ocean, and west by Delaware river. Its length on the Delaware is about 30 miles, and on the sea the line is about 22 miles. Great and Little Egg Harbour rivers are both navigable for vessels of 200 tons about 20 miles from their mouths. The streams which fall into Delaware river are navigable for small vessels, a few miles up from their mouths, and afford some shad, rock, herrings, and perch. The adjacent islands are Red Bank, Pett, and Old Man's Creek Islands. The first

Glaston-
bury
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Gloucester.

Gloucester
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Glucina.

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 Piankitanke river, which separates it from Middlesex, east by Mathews co. and Chesapeake 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 alumina.

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 Alatomaha 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 *Gnadenhütten*, 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 islet, 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 *γλυκίνα*, to render sweet. According to this etymology, should not the name be *Glycina*?

Glucina
||
Goat.

Goave

Gold.

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 Hillborough 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^o 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.

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 compression

Gold.

* *Memoirs of the Academy of Sciences at Paris for the year 1790.*

Gold.

tion to which it was subjected. By this management he succeeded in extending the metal to double its length notwithstanding its hardness, and rendering it as thin as strong paper; though the edges were cracked through their whole length like the teeth of a saw. But this accident is not at all surprising, when it is considered that gold, though alloyed simply with copper, whatever may be the cause, does not possess its usual 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 fusion, or unequal mixture of the two metals, he melted the whole ingot over again with the utmost precaution; but in vain. The metal was as brittle as formerly, and would not bear annealing.

He next fused 6 ounces of pure gold of 24 carats with 2 gros, or 6 penny-weights of tin, taking every possible precaution to have the metals completely mixed. When the whole was in perfect fusion, he poured the mixture into an ingot mould, and obtained an ingot rather longer and cleaner than the two former. As soon 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 thickness of one line, or thereabouts, he cut it off for separate treatment. By moderate annealing it maintained its integrity; and, with the exception of a few cracks, it passed the laminating rollers without breaking. As he was fearful, nevertheless, that it might break in some part if he continued to laminate it, he gave it a slight annealing. It had scarcely acquired a cherry-redness between the charcoal, before it broke into five or six parts, some of which were simply bended or twisted, and others flat as they quitted the rollers. Among the annealed pieces of this extremity of the ingot, there was one sufficiently long, though a little curled, which he laminated a second time, with the determination of rendering it very thin without the least annealing. It acquired at least double the length it had at first without breaking; and, if we except the two sides of this plate which were cracked, the body, or main piece, was entire. It was spongy, and might be considered as if formed out of an ingot of common gold containing no tin, but not possessing the whole of its natural ductility.

"It follows, says M. Tillet, from these experiments, that gold, whether fine or alloyed, when perfectly fused with a small portion of the finest tin, acquires rigidity and hardness by the mixture; that it loses somewhat of its distinguishing colour; and that it may, indeed, by careful management, be extended to a certain degree by the hammer, or still better by the rollers; but that, as it cannot be annealed without danger of breaking, it is by this defect deprived of the essential advantage of recovering its original softness after it has been strongly hammer-hardened. It is not but by careful management in the use of the hammer, and by frequent annealing, that artists employed on works of gold and silver succeed in obtaining them without cracks, and bringing them to a state of perfection, without being obliged to have recourse to solder to repair the defects which excessive hardness under the hammer would occasion. How much, therefore, ought gold-workers, who continually have this metal in their

Gold.

hands, to be attentive to prevent the introduction of tin in their workshops, and never to employ such compounds of gold as are subject to break, or even to warp, while annealing? The expence of refining, which they would pay for depurating such compounds, would be of less consequence to them than the loss of time required for the careful management of such gold contaminated by tin, even if they did succeed in using it, and were not often forced to abandon, after much labour, a work nearly finished.

"If it be allowable (continues our author) to form conjectures on the cause of the fracture of plates of gold containing tin, when subjected to the annealing heat, it may be presumed, since tin very speedily melts, while gold requires a strong heat for its fusion, that the parts of the tin intermixed in a sort of proportional equality with those of the gold, tend to separate by a speedy fusion and at a very gentle degree of heat; that they remain without consistence between the parts of the gold, while the latter preserve the whole of their solidity, and do not lose it even by the annealing heat: whence it seems, that the parts of the precious metal, when ignited among the coals, having no longer the solid connection formed by the tin, but, on the contrary, having an infinite number of small cavities occupied by particles of that metal in fusion, must tend to disunion; whereas the same accident does not take place in the pieces which have resisted the annealing, and have been laminated after cooling, because the particles of tin have become solid by cooling, and have recovered their original state of union with the gold.

"This fracture of the compound does not take place with an alloy of gold and copper, for an opposite reason to that which has here been explained; namely, because these two metals require nearly the same heat for their fusion. The effect of annealing being therefore equal upon both, the metals, notwithstanding this treatment, preserve their natural consistence, even though the heat be carried near the point of fusion."

Gold-Leaf. See *Gold-LEAF* (Encycl.) where a full account is given from Dr Lewis of the process of gold-beating. In that article, we have said that gold-leaf ought to be prepared from the finest gold; but Mr Nicholson, who, in all probability, knows much more of the matter than the author from whom our account was copied, assures us that this is a mistake, and that pure gold is too ductile to be worked between the gold-beater's skin. The newest skins will work the finest gold, and make the thinnest leaf, because they are the smoothest. Old skins, being rough or foul, require coarser gold. The finer the gold, the more ductile; inasmuch that pure gold, when driven out by the hammer, is too soft to force itself over the irregularities, but would pass round them, and by that means become divided into narrow slips. The finest gold for this purpose has three grains of alloy in the ounce, and the coarsest twelve grains. In general, the alloy is six grains, or one eightieth part. That which is called pale gold contains three pennyweights of silver in the ounce. The alloy of leaf gold is silver, or copper, or both, and the colour is produced of various tints accordingly. Two ounces and two pennyweights of gold is delivered by the master to the workman, who, if extraordinarily skilful, returns two thousand leaves, or eighty books of gold, together with one ounce and

Gold
Goldoni.

Goldoni.

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 humorous 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 how-

ever 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 Gondolier 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 *Cofali*, 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 Linder* 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.

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 Ogeechee river, about 26 miles east-south-east of Occonee 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 14½ 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

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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 surpris'd, if to the discontent which must have prevail'd 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 disgust'd 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 prettiest figures a grotesque air, which often provok'd 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 freeness of complexion, seem'd best calculated to favour the deception. These heroines, of a new kind, heighten'd the curiosity of the spectators, and render'd the entertainment still more lively and interesting.

To add to the general pleasure, ladies of the first rank consider'd 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 happen'd more than once that the Countess of Al-maviva having left in pledge at the sitting house her borrowed decorations, the owner, to recover them, was oblig'd 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 introduc'd unhappiness into families. Hymen, it is true, amidst these adventures, sometimes interven'd to repair the follies of his brother, and many marriages, which restor'd 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 oblig'd to conceal his jealousy, curs'd in his heart both actors and theatre; while the matronly part of the community, less on the reserve, declaim'd with bitterness against the licentiousness that prevail'd, 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 effect'd 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 detect'd, and traced to its authors; the two theatrical heroes were banish'd from the Cape; and the Company, ashamed of the adventure, dar'd 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 threaten'd the colony. As they daily expected to be attack'd by the British fleet, they had increased the means of defence, and order'd different works and new fortifications to be constructed.

At first, the business was carried on with activity and ardour; because the inhabitants, infligat'd by their private interest, which was then consider'd as involved with that of the public, had voluntarily offer'd their services, and mingled with the workmen. Young and old, soldiers and magistrates, sailors and planters, all solicit'd the honour of co-operating for the general good and common safety. To behold this heterogeneous multitude—some load'd with pick-axes, 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.

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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 mats, 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 com-

pany, 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 that

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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 *Cape Smugglers*, 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 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

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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 beneficence 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 hand 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. Halfway 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 1731, 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, courthouse, 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*.

GOVERNANTE, 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 governante appears to be a new species of *daphne*.

GRACIAS A DIOS, a town belonging to the province of Honduras, or Comaiagua, and audience of Gnatimala. It is situated at the mouth of a river upon a rocky mountain, which has some gold mines in its

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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. $14^{\circ} 36'$ W. long. $84^{\circ} 12'$.—*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 is 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 fang-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 Congarèe, 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, $6\frac{1}{2}$ leagues south-west of Fort Dauphin, and $4\frac{1}{2}$ leagues N. by E. of St Raphael, in the Spanish part of the island, N. lat. $19^{\circ} 34'$, W. long. from Paris $74^{\circ} 30'$.—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.*

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GRAND *Fathers*, several large detached mountains in the south-east corner of Tennessee, in which are the head waters of French, Broad and Cataba 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. $19^{\circ} 54' 30''$ N. and long. $74^{\circ} 9' 30''$ 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

R have

Grand
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Grave
Creek.

Gravesend have been found to contain a chalky substance, supposed to be bones of the human kind.—*ib.*

Great
Ridge.

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^o 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 basin 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 Ogeechee 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; inasmuch 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 midway 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 basin 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 whole 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 *Encyclopaedia*, 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 Afracan, 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

Great
Springs
Green.

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 (*kalkar*), 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 *kislar 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 above-mentioned 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 Beytraege*, by Professor Pallas; or *Philosophical Magazine*, n^o 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 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, Kanawha, Botetourt, and Montgomery counties. It is about 100 miles long and 45 broad; and together with Kanawha 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 Kanawha, 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 clothed 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
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Greenville

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 Ocrecok 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, encom-

passed by Brunswick, Southampton, and Suffex 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 Suffex 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,

Greenville
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Greenwich.

Green-
wood
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Gregory.

ty, Connecticut, and the fourth-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, ΣΤ, 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.

Gregory.

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 javelins 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

Gregstown
Grinding.

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 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 development 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.”

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 tinged 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 without;
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 Danell, 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 humorous 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 Pais. 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

Grose

Groton.

Grotton
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Guada-
laxara.

Ryegate 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 Chesapeake Bay, 5 miles south-south-west of Turkey Point.—*ib.*

GROVE'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 tigers; 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 Guadalajara, 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 Ciudad 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 Quilea, 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 Affiento de Oropefo*, not far from the above town, near the city of Oropefo, 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-

Guamalie
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Guanza-
velica.

Guara
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Guaxaca.

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. $11^{\circ} 31' 36''$. 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. $18^{\circ} 3' 53''$.—*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 woad. 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 Guatemala, 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 Guatemala is built at some distance, is well inhabited, and carries on a great trade. N. lat. $13^{\circ} 40'$, W. long. $90^{\circ} 30'$.—*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. $18^{\circ} 2'$, W. long. $101^{\circ} 10'$. Guaxaca is situated, according to some, in N. lat. $17^{\circ} 45'$, 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 $2^{\circ} 11'$ south lat. $79^{\circ} 17'$ west long. Ciudad Vieja, 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

Guaxaca
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Guayaquil.

Guayara
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Guilford.

es are of wood. It contains about 20,000 inhabitants—Europeans, creoles and other cast; 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 *carucollillo*. The river Guayaquil is the channel of its commerce; and the distance of the navigable part of it, to the custom-house of Babahio 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 matresses 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 surprize.

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
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Guillotine.

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 *Maiden*. See MAIDEN, *Enycl.*

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 infiniment 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

Gulf
Gulf.

of terrors, and probably diminishes the corporeal suffering, 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 falces 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 relics 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 *Encyclopadia* 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

Gunpow-
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Gunpow-
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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.

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 gun-

powder consists in the action of a permanently elastic fluid, similar, in many respects, to common atmospheric 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 phenomena. 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,

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* Transactions of the Royal Irish Academy.

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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 410624 $\frac{1}{2}$ 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 conse-

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consequently 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 supercedes 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.

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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

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posed equal to 1000° of Fahrenheit's scale:—but the elastic force of steam is just equal to the mean pressure of the atmosphere, when its temperature is equal to that of boiling water, or to 212° of Fahrenheit's thermometer; consequently $212^{\circ} + 30^{\circ} = 240^{\circ}$ will represent the temperature, when its elasticity will be equal to the pressure of two atmospheres; and, pursuing the calculation, at 602° or 2° above the heat of boiling linseed oil, its elasticity will be equal to the pressure of 8192 atmospheres, or above *eight times* greater than the utmost force of the fluid generated in the combustion of gunpowder, according to Mr Robins's computation: but the heat in this case is much greater than that of 602° of Fahrenheit; and therefore the elasticity of the steam generated from the water contained in the powder must be much greater than the pressure of 8192 atmospheres. At 722°, the elasticity will be equal to the pressure of 131,072 atmospheres; and this temperature is less than the heat of iron, which is visibly red-hot in daylight, by 355°:—but the flame of gunpowder has been found to melt brass, 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 steam an elasticity equal to the pressure of 131,072 atmospheres. That there is in gunpowder water sufficient for supplying the necessary quantity of steam, the author has very satisfactorily evinced: but we must not pursue his curious investigations any farther. Those who want a fuller account of them, will find it either in the original memoirs themselves, or in a very accurate abridgement of these memoirs in the first volume of Nicholson's *Journal of Natural Philosophy*, &c.

We cannot conclude this article without mentioning a new kind of gunpowder, invented some years ago in France, in which the marine acid is substituted, in equal quantity, for nitre. Dr Hutton tried some of this new powder which was made at Woolwich, and found it of about double the strength of the ordinary sort; but it is not likely to come into common and general use, for the preparation of the acid is difficult and expensive, (See *CHEMISTRY-Index* in this *Suppl.*), and the powder which is made of it catches fire and explodes from the smallest degree of heat, and without the aid of a spark. It is to this circumstance, however, that its superior strength seems to be in a great measure owing.

GUNPOWDER, a river of the western shore of Maryland, whose chief branches unite a little above Joppa, and empty into Chesapeak Bay, about 12 miles above Patapsco river. It is navigable only a few miles, by reason of falls.—*Morse*.

GUNPOWDER NECK, near the head of Chesapeak Bay, is a curious peninsula formed by Gunpowder river, and Bush river.—*ib.*

GUNTER'S CHAIN. See *GEOMETRY, Encyclopaedia*, Part II. chap. 1.

GUT-TIE, a dangerous disease to which oxen and male calves are rendered liable by an improper mode of castration. In some places, and particularly in Herefordshire, the breeders of cattle, when they castrate their calves, open the *scrotum*, take hold of the testicles with their teeth, and tear them out with violence; by which means all the vessels thereto belonging are ruptured. The *vasa deferentia*, entering by the holes of

the transverse and oblique muscles into the abdomen, pass over the ureters in acute angles; at which turning, by their great length and elastic force, the peritoneum is ruptured; the *vasa deferentia* are severed from the testicles, and springing back, form a kind of bow from the urethra, where they are united, over the ureters, to the transverse and oblique muscles, and there again unite, where they first entered the abdomen; the part of the gut that is tied is the jejunum, at its turning from the left side 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 *vasa deferentia*, which, by a sudden motion, or turn of the beast, form a hitch or tie of the string round the bow of the gut (filled with air), similar to what a carter makes on his cart line. This causes a stoppage in the bowels, and brings on a mortification, which, in two days, or four at most, proves fatal: And to this accident is the beast, when castrated as above, liable from the day that he was castrated till the time of his being slaughtered.

The symptoms of the gut-tie are the same as those of an incurable colic, *volvulus*, or mortification of the bowels. The beast affected with this complaint will kick at its belly, lie down, and groan; it has also a total stoppage in its bowels (except blood and mucus, which it will void in large quantities), and a violent fever, &c. To distinguish with certainty the gut-tie from the colic, &c. the hand and arm of the operator must be oiled, and introduced into the anus, through the rectum, beyond the os pubis, turning the hand down to the transverse and oblique muscles, where the vessels of the testicles enter the abdomen. There the string will be found united to the muscles, and is easily traced to the stricture by the hand, without pain to the beast.

From the general view of the agriculture of the county of Hereford, drawn up by Mr Clark of Builth, Breconshire, we learn that Mr Harris farmer at Wickton, near Leominster, had been uncommonly successful in the cure of the gut-tie. That gentleman informs us, that he had cut cattle for this disease from the age of three months to that of nine years; and as it is a matter of great importance, we shall state his method of operating in his own words.

“The only method of cure (says he) that can be safely ventured upon is, to make a perpendicular incision, four inches under the third vertebra of the loins, on the left side, over the paunch or stomach, and introduce the arm to find the part affected; if possible, keep the beast standing by the help of proper assistants. The knife I make use of to sever the string is in the form of a large fish hook, with an edge on the concave side; 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 instrument, by being thus held in the hand, is secured from wounding the surrounding intestines; with it I divide the string or strings, and bring out one or both as circumstances require. Here it is to be observed, that great care must be taken by the operator not to wound or divide the ureters, which would be certain death. I then sew up the divided lips of the peritoneum very close, with a surgeon's needle threaded with strong thread, eight or ten double, sufficiently waxed;

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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.

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HACHA, RÍO 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 surprized and sacked by Sir Francis Drake. N. lat. 11° 30', W. long. 72°.—*Morse*.

HACKETSTOWN, a small post-town in Suffex county, New-Jersey, on the north-west side of Musconegunk 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 Suffex 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.*

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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, Lawience, Southampton, Canfo, and Timmouth. The inhabitants are chiefly Irish, Scotch, and New-Englanders. It has numerous bays, and rivers; the chief of the latter are Shabbennacodie, 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 feat 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 Sumbro, 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 Sebastacook 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 Susquehanna 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, Edgcomb, 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 Pamlico 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 383 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. Susquehanna 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 New-town or Suffex 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.*

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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.—Oriskà 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 enterprise in the manufacturing line, as yet exhibited in the United States. The glass manufactory 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 Schaharie road traverses the settlement. A spacious school-house, 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 prairie and sheet of water on the north-east, about a mile wide, and 2½ 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,

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Hampshire, on the eastern side of Rockingham county, and called *Winicomet* 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 north-west 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 *Keroughton* 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 *Hanfes*, 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 *Clioquist*, 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 *Masbeet* 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 Skitiki's 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 grafs 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 Defart, 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,

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Hancock nia, 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 *Houfe*, 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 Moofe Fort, and 18 below a houfe on the fame 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 30,000 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 unfettled. 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, Kenecoot, 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 Suffex county, New-Jersey, nearly 10 miles S. W. of Newton.—*ib.*

HARDWICK, a small town of Georgia, at the mouth of Ogeechee 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.*

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HARDYSTON, a township in Suffex 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 Susquehanna river and Chesapeake 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, Coopftown, and Belle-Air. The other towns are Havre de Gras at the mouth of Susquehanna, 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 Susquehanna 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.*

HARPETH, 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 Sebasteoagan, 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 *Encyclopaedia*. 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 Suffex.

"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 Analyticae Praxis, ad aequationes 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 Roversal, that these improvements in analysis had been already made these six years in England, and shewed him afterwards Harriot's *Artis Analyticae Praxis*; which,

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Harriot.

Harriot. as Røverval 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 Wittenberg 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 Dimostrazioni intorno alle Macchie 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 geometers 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

Harriot.

Harrisburg
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Hartford.

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 *loci 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 Susquehanna 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. $40^{\circ} 16'$.—*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. $41^{\circ} 44'$, W. long. $73^{\circ} 4'$.—*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

Hartford
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Hasselquist.

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 *Baëck* and Dr *Wargentiu*, 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 princefs. 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 *Baëck*, 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*. *HASSELL-QUISTA, Encycl.*

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 those 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 *slang* 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-mak-
ing.

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

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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

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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 *basin*: the joining of each batt is made good here by shuffling 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.

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Hat-making.

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 fourest 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

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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 straight 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 batts 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 felt-ing might not produce a lighter, cheaper, and stronger article? And how far the mechanical telting, 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 teased, 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 fencga, one pound of starch, and a half a pound of glue, boiled up with as

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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 ciling, 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 mouth.—*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

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Haverhill miles above Dartmouth college, 119 miles N. W. of Portsmouth.—*ib.*

HAWKINS. 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 *Haverstram*, 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 Chesapeake Bay. It contains about 40 houses, 250 inhabitants, and is the port of entry for all the shores of Chesapeake 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 pro-

fession of his first choice, and to embrace that of the law; and was accordingly articulated 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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Hawkins. 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 Muncley, 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

Hawkins. 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.

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 authorized 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.

Hawkins. An event of considerable importance engaged him, in the year 1764, to stand forth as the champion of the county of Middlesex, against a claim then for the first time set up, and so enormous in its amount as justly to excite resistance. The city of London finding it necessary to re-build the gaol of Newgate, the expence of which, according to their own estimates, would amount to L.40,000, had this year applied to parliament, by a bill brought into the House of Commons, in which, on a suggestion that the county prisoners removed to Newgate for a few days previous to their trials at the Old Bailey, were as two to one of the London prisoners, constantly confined there, they endeavoured to throw the burthen of two-thirds of the expence on the county, while they themselves proposed to contribute one-third only. This attempt the magistrates for Middlesex thought it their duty to oppose; and accordingly a vigorous opposition to it was commenced and supported under the conduct of Mr Hawkins, who drew a petition against the bill, and a case of the county, which was printed and distributed amongst the members of both houses of parliament. It was the subject of a day's conversation in the House of Lords; and it produced such an effect in the House of Commons, that the city, by its own members, moved for leave to withdraw the bill. The success of this opposition, and the abilities and spirit with which it was conducted, naturally attracted towards Mr Hawkins the attention of his fellow-magistrates; and the chairman of the quarter sessions dying not long after, he was, on the 19th day of September 1765, elected his successor.

In the year 1771, he quitted Twickenham, and sold his house there to Mr Vaillant; and, in the summer of the next year, for the purpose of obtaining, by searches in the Bodleian and other libraries, farther materials for his history of music, he made a journey to Oxford, carrying with him an engraver from London, to make drawings from the portraits in the music school.

On occasion of actual tumults or expected disturbances, he had more than once been called into service of great personal danger. When the riots at Brentford had arisen, during the time of the Middlesex election in the year 1768, he and some of his brethren attended to suppress them; and, in consequence of an expected riotous assembly of the journeymen Spital-fields weavers in Moorfields in 1769, the magistrates of Middlesex, and he at their head, with a party of guards, attended to oppose them; but the mob, on seeing them prepared, thought it prudent to disperse. In these and other instances, and particularly in his conduct as chairman, having given sufficient proof of his activity, resolution, abilities, integrity and loyalty, he, on the 23d of October 1772, received from his majesty the honour of knighthood.

In 1773 Dr Johnson and Mr Stevens published, in ten volumes octavo, their first joint edition of Shakespeare, to which Sir John Hawkins contributed such notes as are distinguished by his name, as he afterwards did a few more on the republication of it in 1778. An address to the king from the county of Middlesex, on occasion of the American war, having, in 1774, been judged expedient, and at his instance voted, he drew up such an address, and, together with two of his brethren, had, in the month of October in that year, the honour of presenting it.

After sixteen years labour, he, in 1776, published, in

Hawkins. five volumes quarto, his General History of the Science and Practice of Music; which in consequence of permission obtained in 1773, he dedicated to the king, and presented it to him at Buckingham-house on the 14th of November, 1776, when he was honoured with an audience of considerable length both from the king and queen.

Not long after this publication, that is to say in November 1777, he was induced, by an attempt to rob his house, which, though unsuccessful, was made three different nights with the interval of one or two only between each attempt, to quit his house in Hatton-street; and, after a temporary residence for a short time in St James's Place, he took a lease of one, formerly inhabited by the famous admiral Vernon, in the street leading up to Queen Square, Westminster, and removed thither.

By this removal he became a constant attendant on Divine worship at the parish-church of St Margaret, Westminster; and having learnt, in December 1778, that the surveyor to the board of ordnance was, in defiance of a proviso in the lease under which they claimed, carrying up a building at the east end of the church, which was likely to obscure the beautiful painted glass window over the altar there, Sir John Hawkins, with the concurrence of some of the principal inhabitants, wrote to the surveyor, and compelled him to take down two feet of the wall, which he had already carried up above the sill of the window, and to slope off the roof of his building in such 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 Johnson having discovered in himself symptoms of a dropsy, sent for Sir John Hawkins, and telling him the precarious state of his health, declared his desire of making a will, and requested him to be one of his executors. Sir John accepted the office; instructed the Doctor how to make his will: and on his death undertook to be his biographer, and the guardian of his fame, by publishing a complete edition of his works.

Not three months after the commencement of this undertaking, he met with the severest loss of almost any that a literary man can sustain, short of that of his friends or relations, in the destruction, by fire, of his library; consisting of a numerous and well-chosen collection of books, ancient and modern, in many languages, and on most subjects, which it had been the business of above 30 years at intervals to get together. Of this loss, great as it was in pecuniary value, and comprising in books, prints, and drawings, many articles that could never be replaced, he was never heard in the smallest degree to complain; but having found a temporary reception in a large house in Orchard-street, Westminster, he continued there a short time, and then took a house in the Broad Sanctuary, Westminster.

This event, for a short time, put a stop to the progress of his literary pursuits. As soon, however, as he could sufficiently collect his thoughts, he recommenced his office of biographer of Johnson; and completed his intention by publishing, 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 sedulous in his attention to the duties of religion,
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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-earned 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 Igornachois 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 n^o 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

Haycocks
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Heat.

Heat
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Hebron.

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 those 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 Glassbury, 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.*

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Hector
||
Helena.

HECTOR, a military township in the State of New-York, on the east side of Seneca Lake towards 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 Dauphin 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 *Encyclopaedia*, 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 over the island, as to give instant notice of the approach of vessels to any part of it.

In the *Encyclopaedia*, 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,

Helena.

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 Genessee 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. $51^{\circ} 14' 27''$. W. long. $85^{\circ} 5' 54''$.—*Morse*.

HENNIKER, a township in Hillsborough county, New-

Helena
Henniker.

Henlopen New-Hampshire, about 12 miles west of Concord. In 1775, it contained 367, and in 1790, 1127 inhabitants.—*ib.*

|| Henry.
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 lighthouse 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 *cabritos*, 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 Chesapeake 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 Grison, 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 Norway, formed out of *Fairfield*, Feb. 1796.—Schuyler. The following were comprehended originally in *Whitestown*, viz. Paris, Sangerfield, Hamilton, Sherburn, Brookfield, Cazenovia, Westmoreland, Mexico, Rome, Steuben and Floyd. By the State census of 1796 this 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 stony, 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 338 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 bluish grey marble, which has the appearance of being a petrification of scallops, a species of shell common in the vicinity of the lake, together with the common earth of the shore, which is of a marley substance.—*ib.*

HERON, PASS AU, at the bay of Mobile, in W. Florida, is 18 miles E. of Pascagoula river, and has 4 feet water; and from thence to the point which is on the E. side of the bay of Mobile, in N. lat. 30° 17' is nearly 6 miles.—*ib.*

HERRING BAY, lies on the W. side of Chesapeake Bay, Maryland, 26 miles S. of Annapolis, and derives its name from the fish of its name which frequent it.—*ib.*

HERSCHEL, the name by which the French, and most other European nations, call the new planet discovered by Dr Herschel in the year 1781. Its mark or character is H . The Italians call it Ouranos, or Urania; but the English, the Georgian planet, or Georgian 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 5828 inhabitants, of whom 2442 are slaves. Chief town, Wynton.—*Morse.*

|| Hertford.
HERKEMER

Heterodromus
Hillsborough.

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 Stony 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-Windfor 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*.

HILLSBOROUGH, 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 Chesapeake 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, Dawfuskie 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 Piscataqua 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 Hincche 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

Hillsborough
Hingham.

Hinsdale
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donor and founder, Derby School. It is 19 miles S. E. of Boston, and 22 in a like direction from Plymouth. The township is about 4 miles square, consists of two parishes, was incorporated in 1635, and contains 2,085 inhabitants. Here are 6 grist-mills, 3 saw-mills, and a fulling-mill; four of which are tide mills. Two hills in this town, one of which is called Baker's Hill, present extensive and delightful prospects of Boston Bay, its islands, and the adjacent country.—*ib.*

HINSDALE, the S. easternmost township in Vermont, and in Windham county. It contains 482 inhabitants.—*ib.*

HINSDALE, a township in Cheshire county, New-Hampshire, on the east bank of Connecticut river, where the south line of the State strikes the river in 42° 43' 59" N. lat. and is opposite to Hinsdale 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 islands, which by different writers of different nations has been called *Anzuame*, *Anjuan*, *Juanny*, and *Johanna*, and which is described in the *Encyclopædia* under the name of *St JOANNA*. In that article, it is observed, that an anonymous writer has censured the descriptions of this island given by the Abbé Reynal and Major Rooke, as being not only exaggerated, but erroneous; neither the country being so picturesque as the former represents it, nor the inhabitants meriting the respectable character given of them by the latter.

There was not perhaps much propriety in admitting into such a work as the *Encyclopædia* the anonymous censure of descriptions, authenticated by the names of respectable authors; but the best reparation which we can make to those authors, is, to inform our readers, that their descriptions of Hinzuán are confirmed by Sir William Jones, whose testimony, we believe, no man will controvert. That accomplished scholar, who visited the island on his voyage to India, thus describes its appearance from the bay in which the ship rode at anchor.

"Before us was a vast amphitheatre, of which you may form a general notion by picturing in your minds a multitude of hills infinitely varied in size and figure, and then supposing them to be thrown together, with a kind of artless symmetry, in all imaginable positions. The back ground was a series of mountains, one of which is pointed, near half a mile perpendicularly high from the level of the sea, and little more than three miles from the shore, all of them richly clothed with wood, chiefly fruit trees, of an exquisite verdure. I had seen many a mountain of stupendous height in Wales and Swisserland, but never saw one before, round the bosom of which the clouds were almost continually rolling, while its green summit rose flourishing above them, and received from them an additional brightness. Next to this distant range of hills was another tier, part of which appeared charmingly verdant, and part rather barren; but the contrast of colours changed even this nakedness into a beauty: nearer still were innumerable mountains, or rather cliffs, which brought down their verdure and fertility quite to the beach; so that every shade of green, the sweetest of colours, was displayed at one view by land and by water. But nothing conduced more to the variety of this enchanting prospect,

than the many rows of palm-trees, especially the tall and graceful *Areecas*, on the shores, in the valleys, and on the ridges of hills, where one might almost suppose them to have been planted regularly by design. A more beautiful appearance can scarce be conceived, than such a number of elegant palms in such a situation, with luxuriant tops, like verdant plumes, placed at just intervals, and showing between them part of the remoter landscape, while they left the rest to be supplied by the beholder's imagination. The town of *Matsumúddò* lay on our left; remarkable at a distance for the tower of the principal mosque, which was built by Halímah, a queen of the island from whom the present king is descended: a little on our right was a small town called *Bantáni*. Neither the territory of *Nice*, with its olives, date trees and cypresses, nor the isles of *Hieres*, with their delightful orange groves, appeared so charming to me, as the view from the road of *Hinzuán*."

Sir William Jones, speaking of the inhabitants, takes notice of the *Lords*, *Dukes* and *Princes*, of whom we have made mention after major Rooke. "The frigate, (says he) was presently surrounded with canoes, and the deck soon crowded with natives of all ranks, from the high born chief, who washed linen, to the half-naked slave who only paddled. Most of them had letters of recommendation from Englishmen, which none of them were able to read, though they spoke English intelligibly; and some appeared vain of titles, which our countrymen gave them in play, according to their supposed stations: we had *Lords*, *Dukes*, and *Princes* on board, soliciting our custom, and importuning us for presents. In fact, they were too sensible to be proud of empty sounds, but justly imagined, that those ridiculous titles would serve as marks of distinction, and, by attracting notice, procure for them something substantial." He speaks with great respect of the king, whose name was *Ahmed*, as well as of several chiefs whom he saw, and seems to have met with no man of rank on the island whose character was contemptible, but *Selim* the king's eldest son. For the behaviour of that prince, the old sovereign made the best apology that he could, while he privately assured the interpreter, that he was much displeased with it, and would not fail to express his displeasure. He concluded his conversation with a long harangue on the advantage which the English might derive from sending a ship every year from Bombay to trade with his subjects, and on the wonderful cheapness of their commodities, especially of their cowries. Ridiculous as this idea might seem, it showed (says Sir William) an enlargement of mind, a desire of promoting the interest of his people, and a sense of the benefits arising from trade, which could hardly have been expected from a petty African chief, and which, if he had been sovereign of Yemen, might have been expanded into rational projects proportioned to the extent of his dominions.

The master of the frigate learned from one of the chiefs a few curious circumstances concerning the government of *Hinzuán*; which he found to be a monarchy limited by an aristocracy. The king, he was told, had no power of making war by his own authority; but, if the assembly of nobles, who were from time to time convened by him, resolved on a war with any of the neighbouring islands, they defrayed the charges

Hinzuán.

Hinzuau.

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 pretexs 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 *Mayúta*, 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 *Mufsi* 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 *Hinzuau*, 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 *Hinzuau*, 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 *Hinzuau*, 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 *Matfamudo*, 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 *Hinzuau*, 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 tania. 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

Hinzuau
||
Hirundo.

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 Hispa-

niola 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.

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 possessors of men, 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* should make any civil or political distinction between them and the whites who were born in wedlock. To co-operate, as it were, with these factious and false doctrines, the National Assembly issued its famous declaration, in which it was maintained that all mankind are born, 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 majority, that its intention had never been to intermeddle 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. However 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 remonstrances on the part of the factious friends of the negroes. They regarded it as an unwarrantable sanction of the African traffic, and a confession, that the planters of Hispaniola were not colonists, but an independent people.

The colonists themselves, indeed, or rather their representatives, seem to have thought that by this decree they were rendered independent; for in their general assembly they passed an act debarring the king's delegate, the governor general, from negating any of their future acts. This violent measure was far from giving universal satisfaction. The western parishes recalled their delegates, while those of Cape François renounced their obedience to the whole assembly, and petitioned the governor to dissolve it.

During these dissensions, the commander of a ship of the line, which lay in the harbour of Port-au-Prince, gave a sumptuous entertainment to the friends of the governor; on which account the seamen, who declared themselves in the interest of the assembly, thought fit to mutiny; and the assembly, in return, voted their thanks to the mutineers. Some of their partizans, seiz-

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Hispaniola. 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 Hispaniola. the colonial assembly would adopt.

During these dissensions, the negro slaves, into whose minds had been sedulously 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 Intermediaire*, 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 *intermediaire*, by arresting four of their number; and disagreeing among themselves, Santhonax and Polverel dismissed

Hispaniola, misled 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
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Holston.

HOLLAND'S *Islands* are near to, and south of Hooper's Island and Straits in Chesapeake Bay.—*ib.*

HOLLAND'S *Point*, on the west side of Chesapeake Bay, together with Parker's Island, form the mouth of Herring Bay.—*ib.*

HOLLIS, the *Nisittisset* 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 Littlerivers. 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. $36^{\circ} 27'$, W. long. $83^{\circ} 8'$.—*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 Watauga, 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.

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,

Holwell
||
Hona Chitto.

* See CAL-
CUTTA,
Encycl.

in

Hondo
||
Hooke.

in N. lat. 32° , between Pearl and Loofa Chitto rivers, runs southerly 125 miles, and at the town of Manca in West-Florida, a few miles from its mouth, runs W. to Mississippi river. N. lat. $30^{\circ} 25'$.—*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 southward of Balleffe river, granted by the Spaniards to the British, 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-west; and the Mosquito Shore on the north-east; Nicaragua and Guatemala on the south, and Vera Paz on the west. It is about 100 leagues long and 80 broad. It abounds with honey, cotton, fine wool, dye woods in particular, and has some gold and silver mines. The rivers overflow like the Nile, and enrich the land. The air is good, except near the lagoons and low grounds. The soil 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 second grapes are ripe before Christmas. Valladolid is the chief town, where the governor and bishop reside. Truxillo is also a fine town, and very strong by nature; and Omoah is strongly fortified. The Spaniards claim this country; but the English have been long in possession of the logwood tract in the Bay of Honduras, cutting large quantities of it every year. And the Mosquito Indians to the east of this province have entered into treaties with the English; received them into their country, and done them several services. Besides, the Spaniards have no forts in this bay, or in the country of the Mosquitos, only two small towns.—*ib.*

HONEYYOE, a lake in the Genessee country in New-York State, westward of Canandagua Lake, 5 miles long and 3 broad.—*ib.*

HONOMINIES, a river in the N. W. Territory which runs S. S. easterly into Puan Bay. Between the head of this river and Lake Superior is a short portage.—*ib.*

HOOKE (Dr Robert) is said, in the account of him which is published in the *Encyclopædia*, to have laid claim to the inventions of others, and to have boasted of many of his own, which he never communicated. We will not presume to say that this charge is entirely groundless; but we know that it has been greatly exaggerated, and that many discoveries undoubtedly made by him have been claimed by others. Of this the reader will find one conspicuous proof under the article WATCH (*Encycl.*); and perhaps the following history of the inventions to which he laid claim may furnish another. It would be harsh to charge him with falsity in any of them; that is to say, to imagine that he either stole them from others, or did not think, at least, that he was an inventor. And, with respect to many of them, the priority of his claim is beyond dispute.

1656, Barometer, a weather glass.

1657, A scapement, for maintaining the vibration of a pendulum.—And not long after, the regulating or balance-spring for watches.

1658, The double barrelled air pump.—The conical pendulum.—His first employment of the conical pendulum was no less ingenious and scientific than it was original. He employed it to represent the

mutual gravitation of the planets; a fact which he had most systematically announced. He had shewn, that a force, perfectly analogous to gravity on this earth, operated on the surface of the moon and of Jupiter. Considering the numerous round pits on the surface of the moon, surrounded with a sort 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 such matter falls back again to the earth. He saw Jupiter surrounded with an atmosphere, which accompanied him; and therefore pressed on him, as our air presses on the earth:—He inferred, that it was the same kind of power that maintained the sun and other planets in a round form. He inferred a force to the sun from the circulation round him, and he called it a *gravitation*; and said that it was not the earth which described the ellipse, but the centre of gravity of the earth and moon. He therefore made a conical pendulum, whose tendency to a vertical position represented the gravitation to the sun, and which was projected at right angles to the vertical plane; and shewed experimentally, how the different proportions of the projectile and centripetal tendencies produced various degrees of eccentricity in the orbit. He then added another pendulum, describing a cone round the first, while this described a cone round the vertical line, in order to see what point between them described the ellipse. The results of the experiment were intricate and unsatisfactory; but the thought was ingenious. He candidly acknowledged, that he had not discovered the true law of gravitation which would produce the description of an ellipse *round the focus*, owing to his want of due mathematical knowledge; and therefore left this investigation to his superiors. Sir Isaac Newton was the happy man who made the discovery, after having entertained the same notions of the forces which connected the bodies of the solar system, before he had any acquaintance with Dr Hooke, or knew of his speculations.

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 supplying air to a diving bell.—The number of vibrations made by a musical chord.

1664, His *Micrographia* was, by the council of the Royal Society, ordered to be printed; but in that work are many just notions respecting respiration, the composition of the atmosphere, and the nature of light, which were afterwards attributed as discoveries to Mayow and others, who, though we are far from supposing that they stole their discoveries from Dr Hooke, were certainly anticipated by him.

1666, A quadrant by reflection.

1667, The marine barometer.—The gage for sounding unfathomable depths.

1668, The measurement of a degree of the meridian, with a view to determine the figure of the earth, by means of a zenith sector.

1669, The fact of the *conservatio virium vivarum*, and that in all the productions and extinctions of motion, the accumulated forces were as the squares of the final or initial velocities. This doctrine he announces in all its generality and importance, deducing from it all the consequences which John Bernoulli values himself so highly upon, and which are the chief facts ad-

Hooke.

duced 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 catenaria 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 at-

traction for solid bodies, the curvilinear 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 Chesapeake Bay in Maryland, in Baltimore county, 6 miles N. W. of the town of Baltimore.—*ib.*

HOOKTOWN, a village on the east side of Chesapeake 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 Chesapeake Bay, and on the S. W. coast of Dorchester county, Maryland. The island is 7 miles long, and $2\frac{1}{2}$ broad.—*ib.*

HOOSACK, a river of New-York which falls into the Hudson from the east, about 8 miles above the city of Lansburgh. 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 Suffex 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. $49^{\circ} 33'$, E. long. $233^{\circ} 12'$.—*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.

Hopkinson 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 tinged 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 apopleptic 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 4.2 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

Hopkinton
||
Horne.

Horne.

primitive 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 bachelor'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 gentle-

man 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 surpris'd. 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 biased 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 relinquish'd. 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 republish'd 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

Horne.

Horne.

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

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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 etymologi-
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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 Rutherford 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.

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

* See SCOTCH EPISCOPALIANS in this Supplement.

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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 Rensselaer 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

Horse-
neck-field
point.

Hoven-ca-
tle.

Houghton. 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 Tombucroo and Houssa (see these articles in this *Supplement*), to return by the way of the desert, 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.

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 merchandize 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 Senikees 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 bamboo 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-

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 Woollie 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 Woollie.

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 sallow 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 Woollie 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 Houghton. the latter; and that the king of Bondou had taken up his residence in the territory which he had thus obtained.

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 Woollie had cheerfully accepted; but to his great disappointment an ungracious reception, a sudden 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 sunshine.

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 negotiation, 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 Desert, 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 Desert. 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 thereeff, who had visited Houssa, and lived some years at Tombuctoo, he learned, that the former of these cities was the largest that the shereef 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 ac-
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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 Desert, 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.

Those 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 those 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

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ter 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 enterprising 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 *bouguinée*. 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 com-

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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 Company's

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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 Suskahawan 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 *Overlaugh*. 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 Chesapeake 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 ropewalk, 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 as far 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

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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 Lanfinsburg.—*ib.*

HUGHESBURG, a town in Northumberland county, Pennsylvania, called also *Catawessy*, being situated at the mouth of Catawessy 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 sort 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-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.

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 fight, and prolongs life." Thus far from the Breviary. Then follows a confirmation which Prevot gives from his own experience.

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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.

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 Hewison to assist his brother during his absence.

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Mr Hunter served, while the war continued, as senior surgeon on the staff, both in Bellisle and Portugal, till the year 1763; and in that period acquired his knowledge of gun-shot wounds. On his return to England he settled in London; where, not finding the emoluments from his half-pay and private practice sufficient to support him, he taught practical anatomy and operative surgery for several winters. He returned also, with unabated ardour, to comparative anatomy; and as his experiments could not be carried on in a large town, he purchased for that purpose, about two miles from London, a piece of ground near Brompton, at a place called Earl's Court, on which he built a house. In the course of his inquiries, this excellent anatomist ascertained the changes which animal and vegetable substances undergo in the stomach when acted on by the gastric juice; he discovered, by means of feeding young animals with madder (which tinges growing bones red), the mode in which a bone retains its shape during its growth; and explained the process of ossification, by which a dead piece of bone is separated from the living.

His fondness for animals made him keep several of different kinds in his house, which by attention he rendered familiar with him, and amused himself by observing their peculiar habits and instincts; but this familiarity was attended with considerable risks, and sometimes led him into situations of danger, of which the following is a remarkable instance:

Two leopards, which were kept chained in an out-house, had broken from their confinement, and got into the yard among some dogs, which they immediately attacked; the howling this produced alarmed the whole neighbourhood; Mr Hunter ran into the yard to see what was the matter, and found one of them getting up the wall to make his escape, the other surrounded by the dogs; he immediately laid hold of them both, and carried them back to their den; but as soon as they were secured, and he had time to reflect upon the risk of his own situation, he was so much agitated, that he was in danger of fainting.

On the fifth of February 1767, he was chosen a fellow of the Royal Society. His desire for improvement in those branches of knowledge which might assist in his researches, led him at this time to propose to Dr George Fordyce and Mr Cumming, an eminent mechanic, that they should adjourn from the meetings of the Royal Society to some coffee-house, and discuss such subjects as were connected with science. This plan was no sooner established, than they found their numbers increased; they were joined by Sir Joseph Banks, Dr Solander, Dr Maskelyne, Sir George Shuckburgh, Sir Harry Englefield, Sir Charles Blagden, Dr Noothe, Mr Ramsden, Mr Watt of Birmingham, and many others. At these meetings discoveries and improvements in different branches of philosophy were the objects of their consideration; and the works of the members were read over and criticised before they were given to the public. It was in this year that, by an exertion in dancing, after the muscles of the leg were fatigued, he broke his tendo achillis. This accident, and the confinement in consequence of it, led him to pay attention to the subject of broken tendons, and to make a series of experiments to ascertain the mode of their union.

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In the year 1768, Mr Hunter became a member of the corporation of surgeons; and in the year following, through his brother's interest, he was elected one of the surgeons of St George's hospital. In May 1771, his treatise on the Natural History of the Teeth was published; and in July of the same year he married Miss Home, the eldest daughter of Mr Home, surgeon to Burgoyne's regiment of light horse. The expence of his pursuits had been so great, that it was not till several years after his first engagement with this lady that his affairs could be sufficiently arranged to admit of his marrying.

Though after his marriage his private practice and professional character advanced rapidly, and though his family began to increase, he still devoted much of his time to the forming of his collection, which, as it daily became larger, was also attended with greater expence. The whole suit of the best rooms in his house were occupied by his preparations; and he dedicated his mornings, from sunrise to eight o'clock (the hour for breakfast), entirely to his pursuits. To these he added such parts of the day as were not engaged in attending his patients.

The knowledge he derived from his favourite studies he constantly applied to the improvement of the art of surgery, 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 causes of symptoms, which during life could not be exactly ascertained, the judgment of the practitioner being too frequently misled by theoretical opinions, and delusive sensations of the patients.

In the practice of surgery, where cases occurred in which the operations proved inadequate to their intention, he always investigated, with uncommon care, the causes of that want of success; and in this way detected many fallacies, as well as made some important discoveries, in the healing art. He detected the cause of failure, common to all the operations in use for the radical cure of the hydrocele, and was enabled to propose a mode of operating, in which that event can with certainty be avoided. He ascertained, by experiments and observations, that exposure to atmospherical air simply, can neither produce nor increase inflammation. He discovered in the blood so many phenomena connected with life, and not to be referred to any other cause, that he considered it as alive in its fluid state. He improved the operation for the fistula lachrymalis, by removing a circular portion of the os unguis instead of breaking it down with the point of a trochar. He also discovered that the gastric juice had a power when the stomach was dead of dissolving it; and gave to the Royal Society a paper on this subject, which is published in the Philosophical Transactions.

In the winter 1773, he formed a plan of giving a course of lectures on the theory and principles of surgery, with a view of laying before the public his own opinions upon that subject. For two winters he read his lectures *gratis* to the pupils of St George's Hospital; and in 1775, gave a course for money upon the same terms as the other teachers in the different branches of medicine and surgery. But giving lectures was always particularly unpleasant to him; so that the desire of submitting his opinions to the world, and learning their general estimation, were scarcely sufficient to overcome

Hunter. 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

Hunter. 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 foetus.

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 Croonian 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 surgical 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.

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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 scientific 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 surgical 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."

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

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Hunterdon 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 Mufkonetcong 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 Chesapeake 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 Saginum 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 Chewayas and Ottawas, who inhabited round Saginum 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 Michillimackinack 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.

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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 *pefe-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.

SUPPL. VOL. II.

Hygromete-
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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 *Encyclopadia*, 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 *Encyclopadia*, M. Hochheimer was led in the following manner:

Mr Lowitz found at Dmitriewik 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

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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 $1\frac{1}{2}$ 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 lacerated 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.

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 frieze 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.

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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 Baruel), 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

Jacobins.

(A) This term was invented by Abbé Baruel, 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 philosophers 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 aristocrat 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 *Cacoucc*. 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 philosophers 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.

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 ascendancy 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, without 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 regularly 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.

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(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,
||
Jago.

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 *Encyclopaedia*, 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 *kabifera*; 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

Jaloffs. 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 slightly 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 *five*s, as ours does by *ten*s.

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.

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

Jaloffs.
 * *The bisserians of the country.*

Iata,
||
Ice.

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 $15^{\circ} 5' N$. Lat. and $6^{\circ} 48' E$. 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. $19^{\circ} 2'$.—*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.

"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, Ichnography, 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."

ICHOGRAPHY, 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 projections 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;

* Proverbs.
xxv. 15.

Jebb. coln; and on the 25th of September, 1763, he was admitted by the same bishop into priest's orders.

On the 22d of August, 1764, Mr Jebb was collated by Dr Matthias Mawson, bishop of Ely, to the small vicarage of Gamlingay, near Potton, in Bedfordshire, upon the recommendation of Dr Law, master of Peterhouse. On the 17th of the following October, he was elected by the university 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 Cambridgeshire. Upon casting up the votes, there appeared to be for Mr Jebb 91, for Mr Turner 73; and accordingly he was instituted into the same the 15th of December following.

On the 29th of the same month, (December 1764) Mr Jebb married Anne, eldest daughter of the Rev. James Torkington, rector of Little Stukeley, in Huntingdonshire, and of lady Dorothy Sherard, daughter of Philip, second earl of Harborough.

Early in the year 1765, Mr Jebb, together with the Rev. Robert Thorpe, fellow of Peterhouse, and the Rev. George Woolaston, fellow of Sidney college, published, in a small quarto, a comment on those parts of Sir Isaac Newton's *Principia* which more immediately relate to the system of the world. The title of the joint work of these able and judicious philosophers was, "Excerpta quædam e Newtoni principiis philosophiæ naturalis, cum notis variorum." A work, of which the university of Cambridge continues to bear testimony to the excellence, by the general use of it in the course of academical education.

Mr Chappelow professor of Arabic, dying on the 14th of January 1768, Mr Jebb offered himself a candidate for the vacant chair; but it was given to Dr Hallifax, afterwards bishop of Gloucester; a man of deserved celebrity, of whom we regret that it was not in our power to give a biographical sketch.

On July 10. 1769, Mr Jebb was instituted to the vicarage of Flixton, near Bungay, in Suffolk, on the presentation of William Adair, Esq. of Flixton-hall; and on the 4th of April 1770, was instituted to the united rectories of Homersfield and St Cross, parishes contiguous to Flixton, upon the same presentation: being also, in the summer of the same year, nominated chaplain to Robert earl of Harborough. In consequence of the accession of these preferments, though not considerable in themselves, he resigned, some time in the month of October 1771, the rectory of Ovington, which he had received from the university; and Mr Sheepshanks, fellow of St John's college, was elected in his place.

Dr Hallifax succeeding to the professorship of civil law, in the month of October 1770, upon the death of Dr Ridlington, Mr Jebb once more solicited that of Arabic, which Dr Hallifax then vacated: but he had by this time displayed such an innovating spirit in religion, that the university gave the vacant professorship to Mr Craven, a man respected even by Mr Jebb and his friends.

Early in the year 1771, a design was formed of applying to parliament for relief in the matter of subscription to the liturgy, and thirty-nine articles of the Church of England; and in the prosecution of this design Mr Jebb took a very active part. He attended different meetings of the discontented clergy, held at the

Feathers tavern, London, assisted in the drawing up of their petition, and wrote their circular letter, which gave to the public an account of their aims. He busied himself at the same time in making various attempts to bring about what he called a reformation of the university of Cambridge, but finding them fruitless, he retired, on the 25th of June 1772, to Bungay, where he studied French and Italian, and proceeded in a plan of some *political or constitutional lectures*.

He had by this time ceased to read the prayers of the church, though he still continued to preach occasionally; and the Archdeacon of Suffolk, holding, this year, his usual visitation of some neighbouring parishes in the church of Flixton, Mr Jebb preached such a sermon against subscription, as drew upon himself a public rebuke from the Archdeacon, in the presence of the clergy. "Much altercation, (says he) ensued: and for some days I expected a summons 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 cause; and have in part succeeded.*"

He acted much more honourably than this, when, in 1775, he resigned all his preferments in the church: which surely he ought not to have retained one day after his conscience would not permit him to read the prayers of the liturgy. He now resolved to become a physician; and after attending St Bartholomew's hospital in London for six months, as the pupil of Dr William Pitcairn, he received, on the 18th of March 1777, a diploma of Doctor of Physic from the university 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 shewn himself at Cambridge a warm partizan of the revolting colonies; and of course a keen advocate for what he called, and, we doubt not, thought, the civil liberties of mankind. He now signalized himself by "An address to the Freeholders of Middlesex," assembled at Free mason's tavern in Great Queen-street, on Monday, December the 20th 1779, for the purpose of establishing meetings to maintain and support the freedom of election. Upon this occasion, he communicated to James Townsend, Esq. chairman of that meeting, the above address, under the signature of "Salus Publica;" presuming, that if the sentiments "appeared to be founded in reason, they would not be the less regarded on account of their being suggested by an unknown individual."

This address was immediately printed, and very soon passed through three editions, each being enlarged by the addition of fresh matter; and in 1782, followed the fourth edition corrected, which also 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 representatives from certain other petitioning counties, in order to concert measures for the more effectual reform of the present constitution of the house of commons. Soon afterwards he became one of the most active members of "the society for constitutional 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.

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 hypocretiform, 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 characterized: *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.

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 ani-

mal, 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 chestnut-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 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

Jerboa.

||
Jillifree.

Ilignes,
||
Illinois,

order to get quit of them, are frequently obliged to grant their requests. Lat. $13^{\circ} 16'$. Long. $16^{\circ} 10'$ 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. $15^{\circ} 40'$, W. long. $34^{\circ} 28'$.—*ib*.

ILLINOIS, a large navigable river of the N. W. Territory, formed by the confluence of the rivers Plein, and Theakiki, in $41^{\circ} 48'$ N. lat. and in $88^{\circ} 42'$ 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 $38^{\circ} 40'$ N. lat. and in $92^{\circ} 12'$ 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*.

ILLINOIS *Indians* inhabit near Cahokia on the Mississippi. Warriors 260.—*ib*.

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

Object of
the illumina-
nati.

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 inconceivable. 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.

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 cooperate with him in all his views.

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.

"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 freemasonry, 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*.

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*.

"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.

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

Illuminati.

3
The sect divided into classes of4
Preparation and5
The Mysteries.6
The recruiter,7
To pry into the characters of all men.

Illuminati.

2
Art of the founder.

illuminati. 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 inferior 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 negotiations; 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.

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. Bookfellers, 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 doctrines. 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.

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 insinulators. When the choice of the insinuator is approved, the superiors determine which of the insinulators will be best qualified to perform the task of seducing their candidate.

Two different methods were recommended; one of which

illuminati.
9
To be seduced by whatever means;

10
And their characters transmitted to the superiors.

(B) As a specimen of the journals kept by the insinulators, 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 fallow; 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.

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.

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 insinuator) 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 irreconcilable; and scarcely ever does it cease the pursuit of its victims until it has seen them immolated."

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.

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.

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 *Adarpahsch*; 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 go-

Illuminati.

I 3
Into the noviciate.I 4
Period of the noviciate.I 5
Dictionary, geography, calendar, and cypher of the order.

Illuminati.

I 1
Proper methods of seducing men of knowledge,I 2
And young men,

Illuminati. 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.

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?

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?"

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.*19
Minerval
academy;20
Its library.

illuminati.
21
Admission
to the de-
gree of mi-
nor illumi-
nee.

men, as these men were to render themselves successful conspirators, what a blessed world should we see!

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.

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."

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.

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, by 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.

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

illuminati.

23
Scotch no-
vice.

24
Candidates
for higher
degrees
submit to
new trials.

22
Minor illu-
minees
trained for
the degree
of

Illuminati. any esteem for his matters? 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.

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 veil 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.

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,

25
The degree
of Scotch
knight.

26
Preparations
for the priest-
hood.

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.

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.

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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 profelyte 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 concoded your despots in degrading human nature to servitude, and even to the condition of the brute!"

Having wrought up the profelyte to this pitch of frenzy, and enumerated all the evils which, according to Weilhaupt, 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

D d

Illuminati. 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 illumina-
nees ene-
mies to
commerce.

The principal means which Weilhaupt 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 mo-
rality;

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 blas-
phemies 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 profelyte who has heard it without shuddering, may flatter himself with being worthy of this Antichristian priesthood. He is led back to the porch, where he is invested with a white 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*."

31
Preparato-
tory rites

The rites of the preceding degree were in impious derision of the sacrament of the Lord's supper; those of the present are an atrocious mimicry of sacerdotal ordination; at which, as every one knows, the Lord's supper is likewise 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 profelyte, 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."

32
Initiation
to the
priesthood

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.*"

64
Qualifica-
tions 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:

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 feditious 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 usefess sciences shall be cast aside* (c)!

The sign of this degree consisted in extending out the arms to a brother with the hands open; the *gripe* 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

D d 2

hat;

(c) This will naturally surprize our readers; but it could not surprize 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!!

Illuminati.
35
Admission
to this de-
gree.

Illuminati. hat; and on receiving the boots, he was desired to *sear no road* which might lead to the propagation or discovery of *happinefs*. 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 illumined 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 illumined; 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.

"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 patriarchal 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; 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 fall 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.

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!

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 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 *arcopagites*, and to a few other adepts of distinguished merit.

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 * Dr Robi-

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 Baruel*; 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

Illuminati.

42
Rejected
by Spartacus.* Dr Robi-
son's *Proofs*
of a *Conspira-*
cy.

of

Illuminati.

* See
Doig's *Let-*
ter on the
Savage
State.40
The last se-
cret of the
order.41
Proposal
for a female
order.

illuminati.
43
Subordina-
tion of the
illuminees.

of subordination, there is a general division of command as well as of locality. The *candidates* and *novices* are each 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
correspon-
dence;

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 giv-
ing impor-
tance 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*."

"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 Leipzig 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 Leipzig when the

Illuminati. 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 illumined 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 Kadesch*. 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 bastille, 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 Weisshaupt, which very quickly diffused the light of illuminism through the whole kingdom. Instead of *Spartacus*-Weisshaupt, *Cato-Zwack*, and *Philo*-Knigge, we find wielding the firebrands of revolution in the capital of France, *Philip of Orleans*, *Mirabeau*, *Sjeyes*, 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!

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.

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

Illuminati.

49
Reflections on the fundamental principles of illuminism;

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.

illuminati,
||
Imperfect.

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 illuminates.

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. $38^{\circ} 42'$, W. long. $73^{\circ} 25'$.—Morse.

IMPOST, in architecture, a capital or plinth, to a pillar, or pilaster, or pier, that supports an arch, &c.

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.

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 explication 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

Imperial.
||
Impulsion.

Doctrine of
Impulsion.

History of
it.

Impulsion. 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; *Impulsion.* but the anomalies were great, and the analogy was singular and puzzling; it led to many intricate discussions, and science advanced but slowly.

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^o 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 exceeded 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.

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.

² Laws of impulsion discovered by Wallis, Wrenn, and Huyghens.

³ Impulse said to be the only cause of motion.

Impulsion.

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 WHATSOEVER 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 sedge-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.

But this is by no means sufficient authority for de-

termining 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 prevalence of this restriction is evident; and it has also been sufficiently shewn (PHILOSOPHY, *Encycl.* n^o 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 authorized 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^r 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.

Impulsion.
4
The application of this principle is hazardous.

Impulsion. 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 existence of touch is accompanied by the feeling of external 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 at-

Impulsion. tion 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
And pressure is conceived or supposed in almost every production of motion. 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.

Impulsion. 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
Examina-
tion of the
instances of
this percep-
tion.

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 ob-
serve 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. Impulsion.

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 pressure. 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 refile 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 im-
12
Pressure is
the only
distinct no-
tion of a
moving
power.
pulsion.

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. Impulſion, 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 conception 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 impulſiveneneſs 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 irrefiſtible, 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 quiet 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 *Impulſion.* 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^o 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 preſſes this quality to impulſiveneneſs 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 impulſiveneneſs, 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 impulſiveneneſs appears. A

Impulsion. 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.

Impulsion. 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 reaction. 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 in verba* 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 *Impulsion.* to affirm, that *impulsion* is the sole moving force in mechanical nature, and the source of what we call *reflexure*.

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*.

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, 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.

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,

Impulsion. Therefore to be learned only by observing nature.

27
Moving-powers are inherent in all matter. Newton's conjecture improved by Boscovich.

Impulsion.

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
Examina-
tion of the
mutual ac-
tions 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^o 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^o 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 float 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 retiring nor advancing forward; and B moves off with the initial velocity of A. What we wish to

Impulsion. 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.

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 $\frac{1}{100}$ 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.

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

Impulsion.

24
They acquire a common velocity x ;

F f

produce.

Impulsion. 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 $Bx = A \times a - ax$, $= Aa - Ax$; and $Aa = Ax + Bx$, $= A + B \times x$, and $x = \frac{Aa}{A+B}$. *Namely,* $x = \frac{A \times a}{A+B}$. The common velocity is therefore obtained by dividing the primitive quantity of motion by the sum of the quantities of matter.

25

Namely,

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.

26

But this does not continue, and the magnets separate.

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.

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.

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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.

28
Repulsion is a cause adequate to the observed effect.

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

29
Effect when the magnets are unequal.

learn, that the final velocity of B is $2x$, or $\frac{2Aa}{A+B}$; and

the final velocity of A is $\frac{A-B \times a}{A+B}$. 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 $a - \frac{2Ba}{A+B} =$

$\frac{Aa + Ba - 2Ba}{A+B} = \frac{A-B \times a}{A+B}$.

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 *a* and *b*, 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.

30
II. Case. Both magnets in motion in one direction.

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

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fore the difference of the velocities is less than the sum of the velocity a , 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 a 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 $A + B \times x = A \times a + B \times b$, 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 $-\frac{B \times a - b}{A + B}$, and the final velocity of A is $a - \frac{2B \times a - b}{A + B}$. In like manner, the change produced on the velocity of B is $\frac{Aa + Bb}{A + B} - b$, or $+\frac{A \times a - b}{A + B}$, and the final velocity of B is $b + \frac{2A \times a - b}{A + B}$. 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 $a - \frac{2B \times a - b}{A + B}$ is $a - 1 \times \frac{a - b}{1}$, $= a - a + b$, $= b$: and $b + \frac{2A \times a - b}{A + B}$ is $b + 1 \times \frac{a - b}{1}$, $= b + a - b$, $= a$. 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.

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32
Magnets moving in opposite directions.

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 a and β , which the repulsions of the magnets would produce by repelling them from contact to their inactive distance.

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

33
Common velocity = $\frac{Aa - Bb}{A + B}$; but the change is doubled by the subsequent separation.

$= \frac{Aa - Bb}{A + B}$. The velocity lost by A must therefore be $a - \frac{Aa - Bb}{A + B}$, $= \frac{B \times a + b}{A + B}$, and the final velocity will be $a - \frac{2B \times a + b}{A + B}$. The final motion of A will be in the same direction as at first, if a be greater than

Impulsion. $\frac{2 B a + b}{A + B}$, 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 $= \frac{A \times a + b}{A + B}$, and the final velocity

of B is $= b - \frac{2 A \times a + b}{A + B}$.

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 $a \pm b$ 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 $\frac{B \times a \pm b}{A + B}$ and $\frac{A \times a \pm b}{A + B}$.

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.

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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^o 95. and 110. where $v \dot{v} = \frac{f s}{m}$; and therefore $m v \dot{v} = f s$, and $m \times V^2 - v^2$, or

38
CONSERVATIO VIRIUM VIVARUM.

$n \times v^2 - V^2 = \int f s$. 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.

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

These two theorems are not principles, but general facts.

ferens

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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 $\frac{Aa \pm Bb}{A+B}$, 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.*

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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 $= \frac{A \times a - b}{A+B}$, and the

42
The bodies separate with the same relative velocity which they approached.

change of A 's motion was $= \frac{B \times a - b}{A+B}$.

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.

lary. 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.

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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.

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

43
An interposed spring has the same effect with the mutual repulsions.

must be $= a - \frac{2B \times a - b}{A+B}$, and that of B must be $=$

$b + \frac{2A \times a - b}{A+B}$. 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

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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 repulsion*. 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.

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,

$$\text{which we have shewn to be } = \frac{Aa + Bb}{A + B}.$$

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 N^o 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 $\frac{1}{10}$ 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

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45
Internal process of change through the substance of each body.

46
Nature of imperfect elasticity.

Impulsion.

or situation, and will recover it again, exhibiting perfect elasticity, in opposition to very small forces; but if they are forced too far from this situation, they have no tendency to return to it completely, but find intermediate situations, in which they have the very same connections with the surrounding particles; and in this new situation they can again exhibit the same perfect elasticity, in opposition to very small forces. Mr Coulomb conceives such bodies to consist of elastic particles: they manifest perfect elasticity, so long as the forces employed to change their shape do not remove the particles from their present contacts; but if they are removed from these, they slide on to other situations, where they again exhibit the same appearances. To understand this fully, the reader may consult the article BOSCOVICH of this *Supplement*—The fact is sufficient for our present purpose. Now, in this variable constitution, where the particles may take a thousand different situations, and still cohere, it is plain, that when a body has been dimpled by compression, the particles have nothing to bring them back to their first situation when the compressing force is removed: the utmost elasticity to be expected, is that which will not extend to one shift of situation; therefore, the restitution is altogether insensible. This is the case with all soft bodies, such as clay—the same quality is manifested in all ductile bodies, such as lead, soft iron and steel, soft copper, soft gold.

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Effect of
this collision.

Now let one of these bodies strike another. The compression, or the sliding of the particles over each other, requires force, or mutual pressure—This being accompanied by a reaction perfectly equal, must operate, during the compression, precisely as the equal repulsive forces did. It will take as much momentum from A as it gives to B; so that $A a \doteq B b$ will remain invariably the same, and a common velocity will at last obtain, $= \frac{A a \doteq B b}{A + B}$. The compression can proceed no

farther, and the two bodies must now proceed in contact with this velocity.

And thus we see, that in the case of compressible, but unelastic bodies, the changes of motion are produced by the cohesive forces inherent in the bodies; but not inherent in them because they are in motion. We see clearly in this way, how the pendulum used by Robins and his followers gave a true measure of the velocity of the ball. All the while that it was penetrating into the pendulum, overcoming the cohesion as it went in, this cohesion 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 still adhered; and when it broke at last, it had produced equal effects on the ball and on the pendulum in opposite directions. By such a process, the pendulum was gradually accelerated, and acquired its utmost velocity when the ball had ceased to penetrate:

Therefore, this velocity must be $= \frac{A a}{A + \text{pend}^m}$.

What should we now expect to happen in the collision of bodies? Such bodies as exhibit perfect elasticity, when examined by bending, or other fit trials, should have their motions changed precisely like the magnets, or bodies which repel or avoid each

other at sensible distances. Bodies which exhibit no elasticity whatever, should continue in contact after collision. The common velocity in these should be $\frac{A a \doteq B b}{A + B}$. The perfectly elastic bodies should sustain

Impulsion.

changes of motion which are precisely double of the changes sustained by unelastic bodies, and should separate after collision with a relative velocity of recess or separation, precisely equal to their relative velocity of mutual approach. And bodies possessing imperfect elasticity, should sustain changes of motion, which differ from the changes on unelastic bodies, precisely in proportion to the degree of elasticity which they are known to possess. And, lastly, if the changes of motion which obtain in the collision of bodies, are precisely those which would result from the operation of those inherent forces of elasticity and cohesion, NO OTHER FORCE WHATEVER CONCURS IN THEIR PRODUCTION: For we know that those forces *do operate* in the collision; we see the compression and restitution which are their effective causes, and their immediate effects. If any other force were superadded, we should see its effects also, and the motions would be different from what they are.

Now the fact is, that *we have never seen a body that is not, in some degree, compressible*. It has not pleased the Almighty Creator to make any such here below. Assuredly He has not found such to be of use for the purposes He had in view in this our sublunary world. We know of no body that is perfectly unchangeable in its shape and dimensions. It is therefore no loss whatever to us, although we should not be able to say *à priori* what their motions will be in collision. We cannot even fairly guess them, by reasoning from what we observe in other bodies: For it is just as likely that their motions may resemble those of perfectly elastic bodies as those of unelastic bodies; for we find that bodies of the most extreme hardness are generally highly elastic. Diamond, crystal, agate, quartz, and such like, are the most elastic bodies we know. Philosophers, however, rather think that the motions of perfectly hard bodies will resemble those of unelastic bodies; because elasticity supposes compression. We do not pretend to say with confidence, what would be the motion of a single atom of matter (which cannot admit of compression) which is hit by another in motion. We see all the particles of terrestrial matter connected with each other by certain modifications of the general force of cohesion, so as to produce various forms of aggregation; such as aerial fluidity, liquid fluidity, rigidity, softness, ductility, firmness or hardness; all of which are combined with more or less elasticity. These tangible forms result from certain positive properties of the material atoms of which the particles are composed; and, in all the cases which come under our observations, these properties produce pressures of one kind or another; all of which are moving forces. They are inherent in the particles and atoms: therefore when such atoms are in motion, these forces are in a condition which affords occasion for a *continuation* of this pressure that is competent to the production of motion in another particle. But what would be the event of the meeting of atoms divested of such forces, we profess not to know, or even to conceive.

The fact also is, that all the changes of motion, commonly called impulsions, *which have been observed*, are precisely

Impulsion. precisely such as have been described. Unelastic bodies

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The observed effects of collision are perfectly conformable to the propositions now established.

proceed in contact with the velocity $\frac{Aa \rightleftharpoons Bb}{A + B}$. 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).

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 distantis*, 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

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Impulsion. 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 distantis*; 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.

From a collective view of the whole, we think it clear, 50
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, 50
the philosopher attempts to explain gravitation, &c. by impulsion?

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Impulsion. 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 those sollicitations 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.

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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 aerial 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

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Impulsion. 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 aerial 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 aerial 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.* n° 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 $\frac{1}{8000}$ 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 $\frac{1}{8000}$ of an inch, or $\frac{1}{800}$ 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 $\frac{1}{800}$ 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.

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, $\frac{1}{272}$ 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 $\frac{1}{5}$ 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!

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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.

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 rectilinear 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 opaque 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. Trans. 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.

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.

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, with

Impulsion.

And certainly do
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Impulsion
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Still greater
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Observations
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Impulsion. out *separating* the differently colorific rays of which it consists; but it *contains* them all, as may be proved by viewing it through a prism. After some little time, the bubble bursts.

Surely we must infer from this, that there is a certain thickness of the transparent plate which renders it unfit for the vivid reflection of light. Does it not legitimately follow from this, that the unreflecting spot between the lenses ceases to entitle us to say, that they are in contact in that place? All that we can conclude from its appearance is, that the distance still between the glasses is too small to fit the place for the vivid reflexion of light. This conclusion is indisputable. Were it refused, we are furnished with an incontestible proof by the same bountiful hand. Newton ascribed the colours to the reflection of the plate of air between the glasses, and expected the cessation 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 himself mistaken; for the colours still appeared, and he even thought them more brilliant. He then tried the effect of water, expecting that this would diminish their lustre. So it did; and he found that the dimensions of the rings were diminished in the proportion of 4 to 3; namely, the proportion of the refractions of glass and water. By this time Newton had discovered the curious mechanical relation between bodies and the rays of light; and his mind was wholly absorbed by the discovery, 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 discovery would have on the whole of mechanical philosophy, and therefore occupied himself only with such phenomena as suited his present purpose. A most important phenomenon passed unnoticed. In repeating Sir Isaac Newton's experiments, we found that the diameters of the rings decreased in the proportion of 4 to 3 only in certain circumstances. When the upper lens was pressed on the other by a heavy metal ring, so as to produce three or four coloured rings, we found, that when water got between them, sometimes no colours whatever appeared; sometimes there was a ring or two, and the diameters were diminished in a much greater proportion than Newton had assigned. Well assured of the extreme nicety of all his proceedings, we were much puzzled with this discrepancy, and mentioned it to a most respectable and intelligent friend, the late Dr Reid of the university of Glasgow, a mathematician and naturalist of the first rank. He thought it not improbable that the glasses separated from each other, lifting up the weight, by attracting the water into the interstice, in the same manner that we observe wood to swell with moisture. We immediately got an apparatus which compressed the glasses by means of four screws; and now we saw Newton's proportion most strictly observed. But in prosecuting the experiment, we found that the introduction of the water *always* effaced a very small spot. This happened after precautions had been taken to prevent all separation of the glasses. As the proportion of 4 to 3 has a relation to refractive power, although we have not been able to deduce it as a necessary consequence, we nevertheless considered it as a sufficient proof, that the distance of the glasses *had not changed* by introducing the water between them.

Therefore we think ourselves well entitled to conclude, that the disappearance of the black spot was not owing to a separation of the glasses, which admits the water into the empty space; 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 glasses were pressed together with a very great force, they were not in contact.

It deserves remark, that in endeavouring to produce the black spot, when water is between the glasses, we found great and unaccountable anomalies. Sometimes a moderate increase of pressure produced it, and sometimes we were not able to produce it by any pressure. Several lenses were broken in the trial. We are led to think that the thickness which gives the silvery reflection is much greater than the smooth part of an inch, and that it is not the same in all glasses. But we were interrupted in these experiments, and indeed in all active pursuits, by bad health, which has never permitted their renewal. The subject is of great importance to the curious mechanicians, and we earnestly recommend it to their attention. There is something very remarkable in the abrupt cessation of the coloured reflection. At a certain thickness *all* colours are reflected, without separation, producing the whiteness of silver. The smallest diminution of it hinders the *vivid* reflection of *all* colours, and then there seems to succeed a thickness which equally reflects a small proportion of *all* without separation. The finest polish that can be given to glass in the tool of the artist, leaves irregularities which occasion the irregular ragged figure of the spot. It is worth trying, whether smoothing the surfaces (both) by a softening heat will remove this ruggedness. If it does, without destroying the sharp termination, it will prove the abrupt passage from *esse* to *nonesse*.

The last remark to be made on this important experiment in optics is, that the distance between the glasses which is unfit for vivid reflection, cannot be determined by means of the other measurable intervals. It may be equal to many of them taken together. The same must be granted with respect to the thickness of the black spot on the top of the soap bubble. We attempted to measure this thickness by letting a drop (of a known weight) of spirit of turpentine spread on the surface of water. As it slowly enlarged in surface, it decreased in thickness, and produced, in regular order, several of the more compounded colours of the Newtonian series. But before it came to the 20th ring from the centre, it became very irregular and spotty.

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 collision of bodies is brought about by absolute contact in any instance whatever. The glasses are not in contact where there is vivid reflection; and we have no proof that they are in contact in the black spot, however great the compression may be.

It is hardly necessary now to say, that all attempts to explain gravitation, or magnetism, or electricity, or any such apparent action at a distance by the impulsions of an unseen fluid, are futile in the greatest degree. Impulsion, by absolute contact, is so far from being a familiar phenomenon, that it may justly be questioned whether we have ever observed a single instance of it.

Impulsion.

Remark.

60
Contact is not proved in collision.

61
Therefore impulsion cannot explain gravitation;

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 $\frac{1}{28}$ 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 *salutis*.

Impulsion. 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 $A \times a - x = B \times x - b$, 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

We thus avoid many absurdities.

Impulsion. 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 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 know-

ledge 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 synthetic 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 $= \frac{Aa + Bb}{A + B}$; 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.

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.

65
Principle of smallest action.

Answered.

Impulsion.

Leibnitz (see *Phil. Transf.* vol. xliii. p. 423, &c.), and it is equivalent to mv^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 mv , and not msv , 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 $A \times a - x|^2 + B \times x - b|^2$ a minimum: or $Aa^2 - 2Aax + Ax^2 + Bx^2 - 2Bbx + Bb^2$ is a minimum. Therefore $-2Aax + 2Ax^2 + 2Bxx - 2Bbx = 0$, or $2Aa + 2Bb = 2Ax + 2Bx$, and $x = \frac{Aa + Bb}{A + B}$; 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 curvilinear 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.

Impulsion.

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.

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 Cc , so that the line aA , which joins the point of contact a with the centre A, may make an obtuse angle with the line AB, 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 Gbh , touching both balls in the point b . The primary stroke is at a , and acts in the direction aA , although C moved in the direction Cc . Had A been alone, it would have gone off in the direction aA produced. But the force acting in the direction aA is equivalent to the two forces ad and dA , of which dA presses the ball on B at b , and produces the motion. In like manner, another ball E, so laid that bBe is obtuse, will fly off in the direction ED, which may even be opposite to Cc . 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.

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Action of bodies by contact is perpendicular to the touching surface.

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 mn (fig. 3.) be the distance at which a particle repels another, and let P be a particle situated at

Demonstration.

at

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 Eb 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.

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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.

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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 $v = V \times \frac{AF}{AH}$; and then $A \times v$ may

72
Efficient velocity.

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 $A \times v - x$: 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 $\frac{A \times v - x}{B}$. 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 Fg, perpendicular to the momentary radius vector CF. Let Fg be a very minute arch, described in a moment of time. Draw gf perpendicular to FP. Then Ff is the motion Fg 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 $\frac{A \times v - x}{B}$, and A describes a space x . There-

fore Fg will express x . Let Pp be the space described in the same time that Fg is described. Draw pC, cutting GK in the point I. GI is the yielding of the body B to

the impulse, and must therefore be equal to $\frac{A \times v - x}{B}$.

The triangles Ffg and CPF are similar; for the angle CFP is the complement of fFg to a right angle: It is also the complement of PCF to a right angle. Therefore Fg : Ff = FC : CP. But Fg : Pp = FC : CP; because the little arches Fg, Pp have the same angle at C. Therefore Pp = Ff = x . It is plain, that CG : CP = GI : Pp. Therefore CG : CP =

Impulsion. $= \frac{A \times v - x}{B} : x$, and $x = \frac{A \times v - x \times CP}{B \times CG}$, 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

$x \times B \times CG + A \times CP = v \times A \times CP$, and

$x = v \times \frac{A \times CP}{B \times CG + A \times CP}$, = the velocity remain-

ing 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 $= A \times v - x$ 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^o 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 perpendicular to the plane of the lines GP and PF. In this way

we obtain $x = v \frac{A \cdot \int p r^2 + A \cdot B \cdot GP^2}{A + B \cdot \int p r^2 + A \cdot B \cdot GP^2}$.

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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 $A \times v - x$, 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.

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Importance
of this the-
ory to sea-
manship,
&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 se-

veral 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.

Impulsion.

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^o 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.

76
Impulsion
on bodies
confined
to particu-
lar paths.

The case of impulsion made on part of a machine movable round an axis has been considered in the article ROTATION, *Encycl.* n^o 72; where x is shewn to

77
Impulsion
on ma-
chines,
be

Impulsion.

$be = v \times \frac{A. CP^2}{\int p r^2 + A. CP^2}$. But, in this formula, r de-

notes 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.

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 impulses, 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 flank 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

Impulsion: 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 escapements; 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, Merfennus, 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, Merfennus, 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. Gravefande 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 *Gravefande's Nat. Phil.* translated by Desaguliers, vol. i. p. 241. &c.). The proposition, n^o 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,

78
Great loss
of power
by the
yielding
and bend-
ing of the
material.

79
CONCLU-
SION.

Fig. 1.

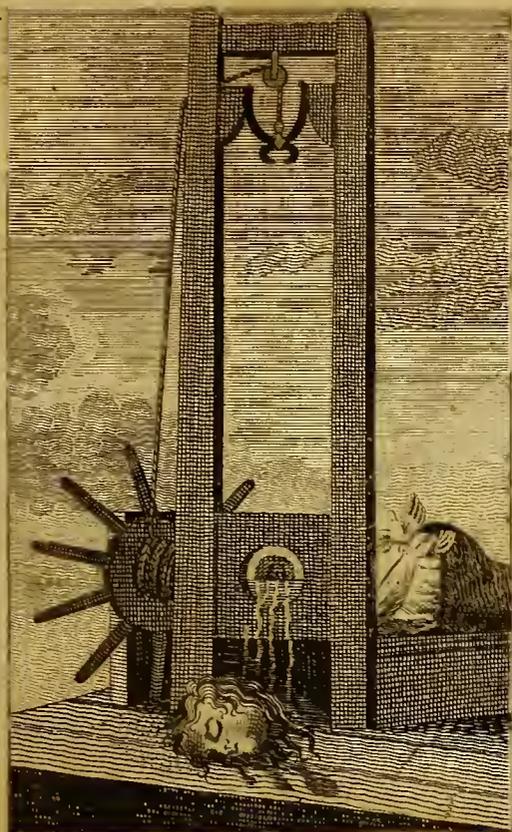
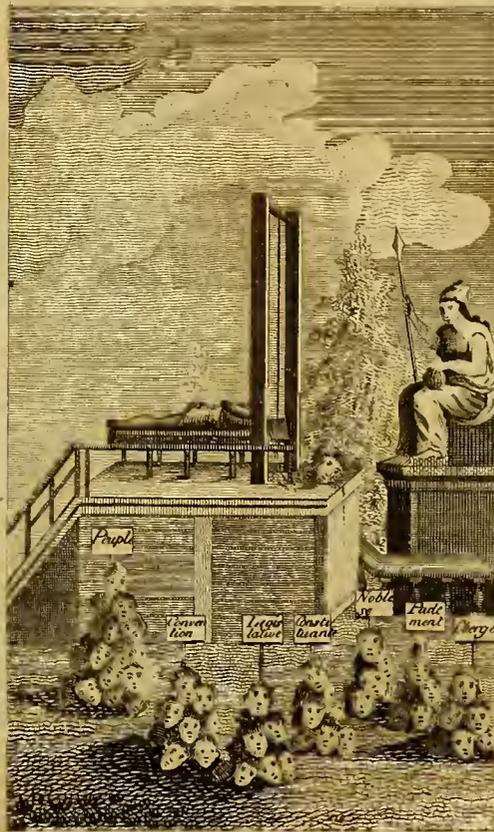


Fig. 2.



IMPULSION

Fig. 1.



Fig. 3.

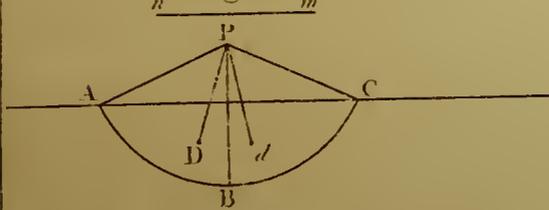


Fig. 5.

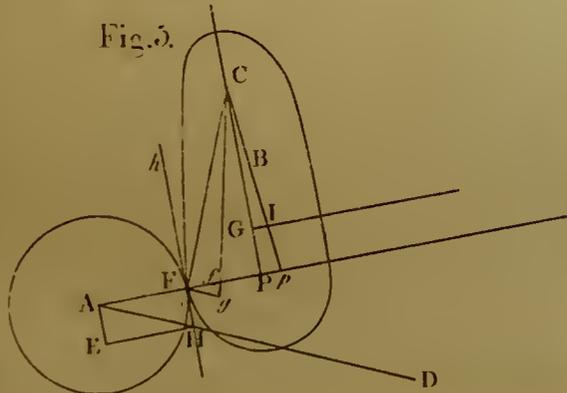


Fig. 2.

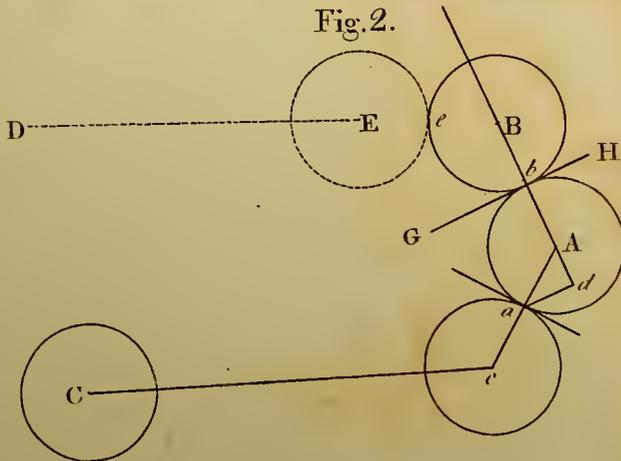
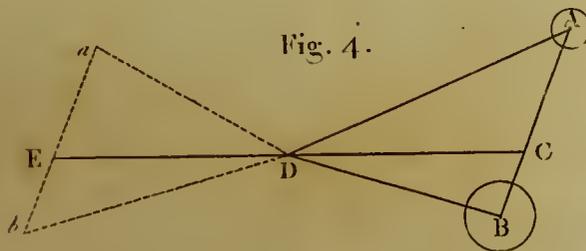
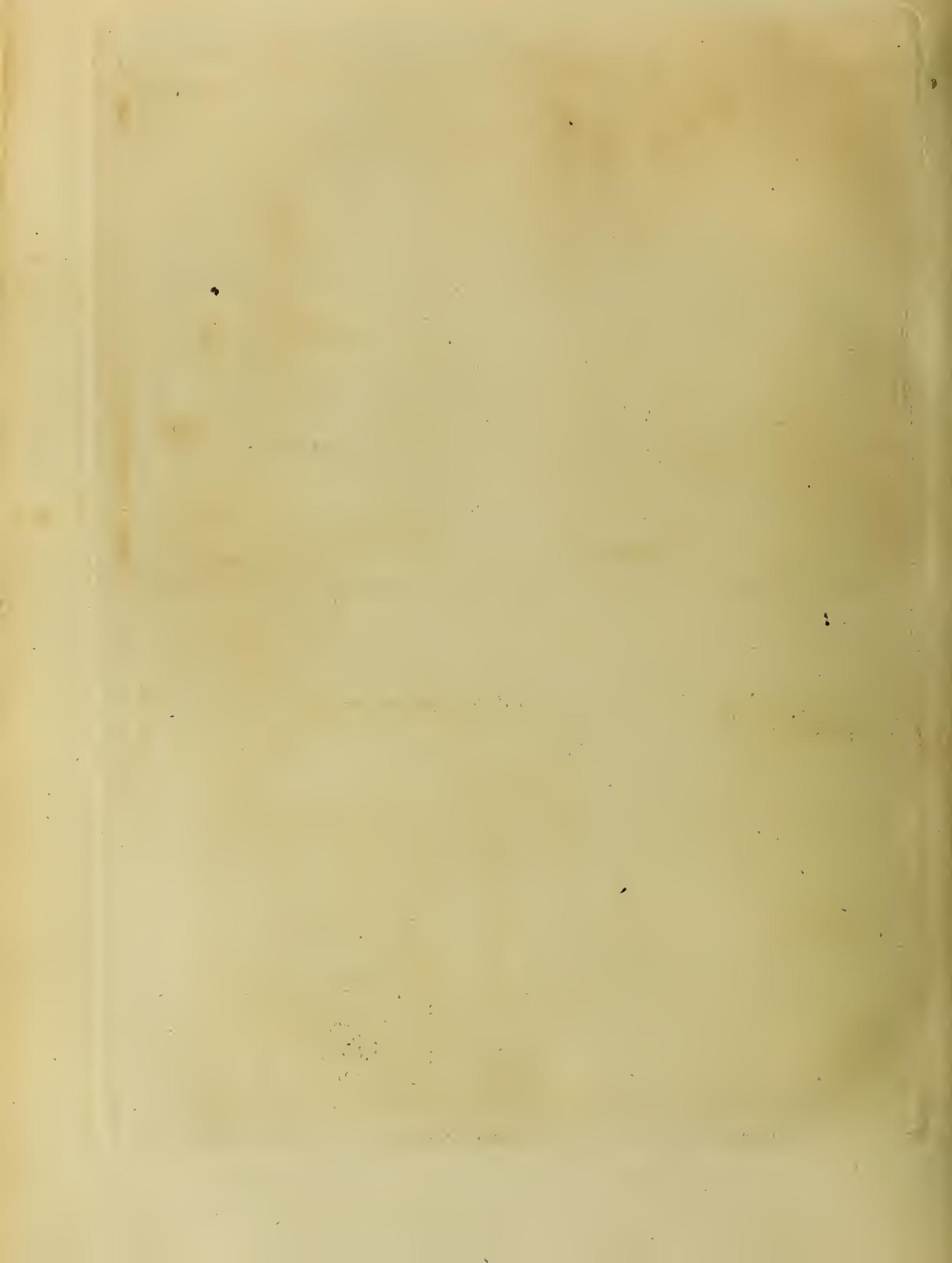


Fig. 4.





impulſion, 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. Auſt. G. G. Leibnitzio. Moguntia 1671.—Leibn. Op. T. II. p. II. 3.

Ejuſdem Theoria Motus Abſtracti. Ibid. 35.

Hermanni Pheronomia. 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^o 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^o 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 Kaefſner, 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 Carretet) ſo named by Surville, lies on the north ſide of the iſlands of Arfacides, 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 0 to the flowing quantity whoſe moment or increment it is; thus, $x0$ the moment of x . In the doctrine of Increments, by Dr Brooke Taylor and Mr Emerton, they are denoted by points below the variable quantities; as $x.$ Some have alſo denoted them by accents underneath the letter, as \acute{x} ; but it is now more uſual to expreſs them by accents over the ſame letter; as \acute{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 Emerton, 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. *En cycl.*

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

Inattendue,
Indeterminatc.

Indetermi-
nate,
||
Indiana.

extremely simple, admits of a very extensive applica-
tion.

“ 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, $A \times mB = C \times mD$. 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 $x + y \times x - y = a \times b$. 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.

$$x = \frac{m^2 a + b}{2m}, \text{ and } y = \frac{m^2 a - b}{2m}.$$

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 Kanaway. 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.*

Indians.

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 basin, 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 $38^\circ 35' 15''$ N. lat. and $111\frac{1}{2}$ miles south of the light-house 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. $27^\circ 30'$, W. long. $80^\circ 40'$.—*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 waste 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 :

Mucogees, commonly-	Gun-men.	Total.
ly called Creeks	5,860	17,280
Chactaws	4,131	13,423
Chickasaws	575	2,290
Cherokees	2,800	8,550
Catabaws	150	490
	<hr/>	<hr/>
	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, Chippewas, Ottawa, Patawatames* of the river of St Joseph, *Patawatames* of Huron, *Miamis, Miamis* and *Eel River, Eel River* tribe, *Miamis, Kickapoo* 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 Alleghany of the western parts of America, and serves as a barrier against the two 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-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, n° 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 *sylogistical*. 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.

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 *a 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 innate

Indian,
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Induction.

* Appendix to Vol. III. of *Sketches of the History of Man.*

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and universal notions, Kant considers as a set of *categories*, from which is to be deduced all such knowledge as deserves the name of science; and he talks, of course, or at least his English translators represent him talking, with great contempt, of inductive reasoning, and substituting syllogistic demonstration in its stead.

As his categories are not familiar to our readers, we shall, in this place, examine syllogisms connected with the categories of Aristotle, which are at least more intelligible than those of Kant, and which, being likewise general notions, must, in argument, be managed in the same way. Now the fundamental axiom upon which every categorical syllogism rests, is the well known proposition, which affirms, that "whatever may be predicated of a whole *genus*, may be predicated of every *species* and of every *individual* comprehended under that *genus*." This is indeed an undoubted truth; but it cannot constitute a foundation for reasoning from the *genus* to the *species* or the *individual*; because we cannot possibly 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 ascertaining, through the medium of induction, what can be predicated, and what not, of a number of individuals, that we come to form such notions as those of *genera* and *species*; and therefore, in a syllogism strictly categorical, the propositions, which constitute the *premises*, and are taken for granted, are those alone which are capable of proof; whilst the conclusion, which the logician pretends to demonstrate, must be evident to intuition or experience, otherwise the premises could not be known to be true. The analysis of a few syllogisms will make this apparent to every reader.

Dr Wallis, who, to an intimate acquaintance with the Aristotelian logic, added much mathematical and physical knowledge, gives the following syllogism as a perfect example of this mode of reasoning in the first figure, to which it is known that all the other figures may be reduced:—

Omne animal est sensu præditum.
Socrates est animal. Ergo
Socrates est sensu præditus.

Here the proposition to be demonstrated is, that Socrates is endowed with sense; and the propositions assumed as self-evident truths, upon which the demonstration is to be built, are, that "every animal is endowed with sense;" and that "Socrates is an animal." But how comes the demonstrator to know that "every animal is endowed with sense?" To this question we are not aware of any answer which can be given, except this, that mankind have agreed to call every being, which they perceive to be endowed with sense, an *animal*. Let this, then, be supposed the true answer: the next question to be put to the demonstrator is, How he comes to know that *Socrates* is an *animal*? If we have answered the former question properly, or, in other words, if it be essential to this genus of beings to be endowed with sense, it is obvious that he can know that Socrates is an *animal* only by perceiving him to be *endowed with sense*; and therefore, in this syllogism, the proposition to be proved is the very first of the three of which the truth is perceived; and it is perceived intuitively, and not inferred from others by a process of reasoning.

Induction. Though there are ten categories and five predicables, there are but two kinds of categorical propositions, viz. Those in which the property or accident is predicated of the substance to which it belongs, and those in which the *genus* is predicated of the *species* or *individual*. Of the former kind is the proposition pretended to be proved by the syllogism which we have considered; of the latter, is that which is proved by the following:

Quicquid sensu præditum, est animal,
Socrates est sensu præditus. Ergo
Socrates est animal.

That this is a categorical syllogism, legitimate in mode and figure, will be denied by no man who is not an absolute stranger to the very first principles of the Aristotelian logic; but it requires little attention indeed to perceive that it proves nothing. The imposition of names is a thing so perfectly arbitrary, that the being, or class of beings, which in Latin and English is called *animal*, is with equal propriety in Greek called ζῷον, and in Hebrew שׂוּן. To a native of Greece, therefore, and to an ancient Hebrew, the major proposition of this syllogism would have been wholly unintelligible; but had either of those persons been told by a man of known veracity, and acquainted with the Latin tongue, that every thing endowed with sense was, by the Romans, called *animal*, he would then have understood the proposition, admitted its truth without hesitation, and have henceforth known that Socrates and Moses, and every thing else which he perceived to be endowed with sense, would at Rome be called *animal*. This knowledge, however, would not have rested upon demonstrative reasoning of any kind, but upon the credibility of his informant, and the intuitive evidence of his own senses.

It will perhaps be said, that the two syllogisms which we have examined are improper examples, because the truth to be proved by the former is self-evident, whilst that which is meant to be established by the latter is merely verbal, and therefore arbitrary. But the following is liable to neither of these objections:

All animals are mortal.
Man is an animal; therefore
Man is mortal.

Here it would be proper to ask the demonstrator, upon what grounds he so confidently pronounces all animals to be mortal? The proposition is so far from expressing a self-evident truth, that, previous to the entrance of sin and death into the world, the first man had surely no conception of mortality. He acquired the notion, however, by experience, when he saw the animals die in succession around him; and when he observed that no animal with which he was acquainted, not even his own son, escaped death, he would conclude that all animals, without exception, are mortal. This conclusion, however, could not be built upon syllogistic reasoning, 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 saw, and of whose mortality therefore he could affirm nothing but from analogy, *i. e.* from concluding, as the constitution of the human mind compels us to conclude,

Induction. 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 hypotenuse 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 geometer, 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 immovable 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 those 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 confi-

dence, 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 corollaries 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.

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. Prout), 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

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Inflammation.* See *Mémoires de l'Académie de Paris*, 1760.† *Journal de Physique*, 1784.

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 Rûde, 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 Nausnitz, 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 Rûde 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 Rûde 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 Petersburg, 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 Petersburg, 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.

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 suspense, 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-foot, 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 foot 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

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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 Petersburg, 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 hempen-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 foot, 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 foot and oil, when the two substances are mixed under certain circumstances, but also the following particulars:

Of the various kinds of foot, 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-foot. In regard to oils, only those experiments succeeded which were made with drying oils, either raw or boiled. The proportions of the foot 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 desiccative, 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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firming 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, lamp-black, 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 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; *Noobeeva*, or Federal; *Tatoo-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. *Noobeeva*, 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 foot.

*Tuta quoque est, salitque oculos, e lacte recenti
Littera: 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

Ink.

Ink.

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. centurie 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. Brofsen, a learned and ingenious apothecary of Montpellier.”

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 washed 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 acetic 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^o 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

Ink,
||
Insects.

Insects. 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 ap-

pendages 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

Institute.

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 Ravallac, 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

Institute.

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 Primaires*, 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. 2^d, Similar instructions as a guide to teachers in the national schools. 3^d, 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^o 184.

Institute. 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 academics.

Accordingly, the French government have founded, 1st, Schools of health (*les écoles de sante*), in Paris, Strasburgh, and Montpellier, 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.

2^d, Two schools for Oriental languages, in the national library, and in the college of France.

3^d, 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.

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Institute. 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 enactment 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." Those 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.

2^d, The National Bibliography was decreed in the sitting of 22^d *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 Biblio-

K k

graphy

Institute.

graphy 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 Méiers*, was decreed in the sitting of the 8th of *Vendémiaire*, 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 Leipzig, by Ernest; and even at Strasburgh, by the celebrated Obeilin: 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 Bibliotecaire*. 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.

Institute.

8th, The new modelling of the Grand National Library, was decreed in the sitting of 25th *Vendémiaire*, 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

Institute.
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Insurance.

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 found 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 præsent, religioni privatæ satisfacere non possint.*” *Cicero de Nat. D'orum.*

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. Insurance.

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 von assurance*, 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
K k 2 further

Insurance. 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:

Age.	Sum Assured £.100.		
	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 empowered 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 Phoenix 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 $S = pR^t$ 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?

$$\text{Yearly. } p = 250, R = 1.05, t = 12.$$

$$0.0211893 = l.R$$

12

$$.2542716 = l.R \times t.$$

$$2.3979400 = l.p.$$

$$l.S = 2.6522116 - L.448 : 19 : 3\frac{1}{4} = \text{Amount.}$$

$$198 : 19 : 3\frac{1}{4} = \text{Comp. interest.}$$

Half

Integral,
||
Interest.

Half yearly, $p = 250$, $R = 1.025$, $t = 24$.

$$0.0107239 = l. R.$$

$$\begin{array}{r} 24 \\ \hline 428956 \\ 214478 \end{array}$$

$$.2573736 = l. R \times t.$$

$$2.3979400 = l. p.$$

$$l. S = 2.6553136 - L.452 : 3 : 7\frac{3}{4} = \text{Amount.}$$

$$\begin{array}{r} 250 \\ \hline 202 : 3 : 7\frac{3}{4} = \text{Interest.} \end{array}$$

Quarterly. $p = 250$, $R = 1.0125$, $t = 48$.

$$0.0053950 = l. R.$$

$$\begin{array}{r} 48 \\ \hline 431600 \\ 215800 \end{array}$$

$$.2589600 = l. R \times t.$$

$$2.3979400 = l. p.$$

$$l. S = 2.6569000 - L.453 : 16 : 8\frac{3}{4} = \text{Amount.}$$

$$\begin{array}{r} 250 \\ \hline 203 : 16 : 8\frac{3}{4} = \text{Interest.} \end{array}$$

Daily, $p = 250$, $R = 1 + \frac{.05}{365} = \frac{365.05}{365}$, $t = 365$
 $\times 12.$

$$\begin{array}{r} 2.5623524 \\ 2.5622929 \end{array}$$

$$.0000595 = l. R.$$

$$\begin{array}{r} 4380 \\ \hline 47600 \\ 1785 \\ 2380 \end{array}$$

$$.2606100 = l. R \times t.$$

$$2.3979400 = l. p.$$

$$l. S = 2.6585500 - L.455 : 11 : 3\frac{1}{2} = \text{Amount.}$$

$$\begin{array}{r} 250 \\ \hline 205 : 11 : 3\frac{1}{2} = \text{Interest.} \end{array}$$

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, *Enycl.*

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 Reginald 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. Transf.* 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 Alata-maha, 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 curvilinear 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.

Intercend-
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Involution.

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tion.

Involutions. 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 unrolled 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 rectilinear 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 demon-

stration, without taking one step in which Euclid or *Involutions.* 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.

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 *Abcdef*, 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 df* 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 *fdA*, the thread is lapped up on the mould, and the whole space ADF*fdA* is folded up like a fan. The detached parts *Cc*, *Dd*, or *Cc'*, *Dd'*, &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 *Ff* gradually lapped up on the mould, we may conceive *Ff* 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 *fdA*, 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

Involution. 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 bBb' ; and thus gives a vast extension to the theory. But at present we shall confine ourselves to the employment of the straight line bBb' , 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 Bb , Cc , Dd , &c. are respectively equal to the arches BA , CA , DA , &c. of the evolute which they have quitted; and that bBb' , cCc' , dDd , &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 $B\gamma\delta\epsilon\phi$ parallel to $bcd\epsilon f$; 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 a will describe a parallel or equidistant curve $a\beta\gamma\delta\epsilon\phi$, lying without $Abc\epsilon f$. From this it appears that $B\gamma\delta\epsilon\phi$ is the complete evolatrix of $FEDCB$, while $bcd\epsilon f$ is the evolatrix of that arch, and the added tangent Bb . In like manner, the lapped up thread ADF , with the added part $F\phi'$, describes the evolatrix $\phi'\epsilon'\delta'\gamma'\beta'A'$.

5. If from any point C of the evolute there be drawn lines Cb , Cc , Cd , Ce , &c. to the evolatrix, those which are more remote from the vertex are greater than those which are nearer. Draw Bb , cC , dD , eE , touching the evolute. Cb is less than $CB + Bb$; that is (2), than Cc . Again, $DC + Cc$ is equal to Dd , which is less than $DC + Cd$. Therefore Cc is less than Cd . Now let Ce cut Dd in r . Then $er + rDE$ is greater than eE . But eE is equal to $dr + rDE$. Therefore er is greater than dr ; and $er + rC$ is greater than $dr + rC$, which is greater than cC . Therefore eC is greater than cC .

6. Hence it follows, that a circle described round any point of the evolute, with a radius reaching to any point of the evolatrix, will cut the evolatrix 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 evolatrix perpendicularly, or a right line drawn through the intersection at right angles touches the evolatrix in that point. Through any point d draw the line mdt at right angles to dD . The part of it md 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 evolatrix 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 teE be another evolved radius, cutting Dd in n : then nd is less than nt , because ndt is a right angle by construction; and therefore ntd is acute. But because $En + nD$ are greater than ED , $En + nd$ are greater than $ED + Dd$, that is; than Ee , and nd is greater than ne . There-

fore, since it is less than nt , it follows that ne is much less than nt , and t lies without the curve. Therefore the whole line mdt is without the curve, except in the point d . It therefore touches the curve in d , and the radius Dd cuts it at right angles in that point. By the same reasoning, it is demonstrated, that all the curves $Abdf$, $a\beta\delta\epsilon\phi$, $A'b'd'f'$, $a'\beta'\delta'\epsilon'\phi'$, 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 evolatrix Adf ; and that from any point in the space within the angle Aof 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 $Abc\epsilon f$ 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 evolatrix, whose vertex is A , be really described, it will coincide with $Abcd$ 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 bcd and $\beta\gamma\delta$, intercepted by the same radii Bb and Dd , may be called *concentric*; and the angles contained between the tangents drawn through their extremities are equal. Thus the angle $\lambda\pi\sigma$ is equal to lpo : but although equidistant, parallel, and containing the same angle between their tangents and between their radii, they are not similar. Thus, the arch $a\beta$ has a curvature at a that is the same with that of any circle whose radius is equal to Aa ; 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 udx be described round the centre D with the radius Dd , it both touches and cuts the evolatrix in the point d , and no circle can be described touching the curve in that point, and passing between it and the circle udx ; For since it touches the curve in d , its centre must be somewhere in the line dD perpendicular to mdt . It cannot be in any point n more remote from d than D is; for it would pass without the arch du , and be more remote than du from the arch dc of the evolatrix. On the other side, it would indeed pass without the arch dx , which lies within the arch de of the evolatrix: but it would also pass without the curve. For it has been already demonstrated (7) that nd is greater than ne ; and the curve would lie between it and the circle dx .

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 udx has therefore the same curvature

Involution.

Involution. 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 evolatrix, and the point of the evolute is the *CENTRE OF CURVATURE* at the point of contact with the evolatrix. The evolute is the geometrical locus of all the centres of curvature of the evolatrix.

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 $57\frac{1}{2}$ 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 great

est when the linear deviation is least. Flexure, or *Involution.* 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 asymptote, the curvature of the evolatrix 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 *a*, we do not recollect that the flexure of the whole arch *Ab* is equal to that of the whole arch *ab*, and the flexure at *A* must either make a part of the whole flexure, or it must be something disparate.

The evolatrix *Abcdf* (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 *AφA''* for its tangent. The curvature of the evolatrix at *A* is called infinitely great. As the thread unlaps from the branch *ABC*, its extremity describes *Abc*. It is plain, that the evolatrix must cut the asymptote *φH* 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 evolatrix may be continued to the vertex of the hyperbola on the other side of the asymptote, by causing the thread to lap upon it, in the same way that Mr Huyghens completed his cycloidal oscillation. Or we may form another evolatrix *aβγδφνδ'β'A''*, by lengthening the thread from *G* to *φ*, the centre of the hyperbola, and supposing that, as soon as the curve *Aδφ* 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

Involutions. 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 $AbdG$ 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

$p^3 : q^3 = q : x$, $= q^3 : x^3$, and $p : q = q : x$;
but $q : p = q : p$; therefore, by composition,
 $p^3 : q^3 = q^3 : px = q^3 : y^2$, and $p : q = q : y$;
therefore $x = y$, 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 Aqp , 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 qB . 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 curvilinear 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 infinite-

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small 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.

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 Bt 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 infinities 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 asymptote 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 asymptotic 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

Involutions. of the evolutes with their evolutrices, 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 evolatrix 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 evolutrices 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 evolatrix, and its length is

found, by taking from the whole length of the thread that part which only touches the curve at its vertex. *Involutions.*

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 evolatrix 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

Involution. 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 evolatrix, 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, = HbA, = KmE, 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 evolatrix. For this purpose, take a point *e* very near to E, and draw the evolving radius *be*, cutting *Ef* (drawn parallel to the base DC) in *o*; draw *en* parallel to the axis of the evolute, cutting *Eo* in *v*; also draw *bhi* parallel to the base, and *Bd* perpendicular to it. If both curves be now referred to the same axis CGF, it is plain that *Bb*, *Bd*, and *db* are ultimately as the fluxions of the arch, abscissa, and ordinate of the evolute, and that *Ee*, *ev*, and *vE*, are ultimately as the fluxions of the arch, abscissa, and ordinate of the evolatrix. 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 evolatrix 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 *Ft* be = *u*, *tE* = *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 $DH^2 = \frac{a^2 - z^2}{4}$. Al-

so $DI = \frac{DH^2}{DA} = \frac{a^2 - z^2}{4 \times \frac{1}{2}a} = \frac{a^2 - z^2}{2a}$. But $DI =$

Ft. Therefore *Ft*, or *u*, = $\frac{a^2 - z^2}{2a}$. Also *w* =

$\frac{\dot{u} \dot{z}}{y}$, 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 $\dot{w} : \dot{u} (= a : \sqrt{2au})$

= $\sqrt{\frac{1}{2}a} : \sqrt{u} = \sqrt{GF} : \sqrt{Ft}$, 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 evolatrix.

When the ordinates of a curve converge to a centre, *Involution.* in which case it is called a radiated curve, it is most convenient to consider its evolatrix in the same way, conceiving the ordinates of both as inscribing 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 evolatrix of a third. This is evident on the slightest inspection. Let *Crqp* (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 *Crq*, 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 *Crqp*. 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 *IvH*: so that PH = PS. S and H are conjugate foci of an infinitely slender pencil; and therefore the spiral *IvH* is the caustic by reflection of RQP for rays flowing from S. If another equal and similar spiral *xvy* roll on *IvH*, its centre *z* will describe the same spiral in another position *wuz*. 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

Involutions. 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 rectilinear 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 curvilinear 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 curvilinear 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 $abcd$ be any other curve whatever. A figure $Emlkbi$ may be found such, that while it rolls along the curve $abcd$, a point in it shall describe the parabola. The process is as follows: Let $Bb, Cc, Dd, \&c.$ be a number of perpendiculars to the parabola, cutting the curve $abcd$ 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 $Eebf$, that the three sides Ee, eb , and bE , shall be respectively equal to the three lines Ee, ef, Ff . 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 $abcd$, and the radii equal to the perpendiculars $Bb, Cc, Dd, \&c.$ Let this figure roll on this base c . While the little side ek moves from its present position, and applies itself to ef , the point E describes an arch Ee 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 bi turns round f till i applies to g , the point E describes another arch Ee round f , first rising up and reaching the parabola in F , when the line bE coincides with fF , and then falling within the parabola till the point b begin to rise again from f by the turning of the rolling figure round the point g . Reversing the motion, the sides $ib, be, ek, \&c.$ apply themselves in succession to the portions $gf, fe, ed, \&c.$ 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 Involutions. 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 curvilinear instead of polygonal, and the point E continues in the parabola, and accurately describes it. It is now a curvilinear 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 $Bb, Cc, Dd, \&c.$ 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 evolatrix 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 bs, es (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 eE approach toward bB , 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 cC , 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

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section (which alone is susceptible of determination by the properties of the involute) is the position of the point of contact, and therefore determines a point of the evolute. The problem is therefore reduced to the investigation of this ultimate intersection of two perpendiculars to the proposed curve, when they coalesce after gradually approaching. This will be best illustrated 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 intersecting 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.

Because the perpendiculars intersect in r, we have $rE : EB = EK : BF$. If therefore we can discover the ratio of EK to BF, we determine the intersection 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 first of these 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 division) $BE : Er = FO : OB$. Now let the point C continually approach to B, and at last unite with it. The intersection r will unite with a point of contact N on the evolute. The ultimate ratio of FO to OB, or of fo to 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 abscissa. Thus have we determined a point of the evolute; and we may, in like manner, determine as many as we please.

But we wish 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, because the point E is always distant 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, because AV and DE are equal, AD is equal to VE, and VE is equal to one-half of DT. Moreover, because BD and NQ are parallel, $DE : EQ = BE : EN = DE : DT$; therefore $DT = EQ$, and $VE = \frac{1}{2}EQ$, and therefore $VE = \frac{1}{2}VQ$; therefore Vt is $\frac{1}{3}$ of Mt , and $\frac{1}{2}MV$. This is a characteristic property of the evolute. The subtangent is $\frac{1}{2}$ of the abscissa; in like manner, as in the common parabola, it is double of the abscissa. We know therefore that the evolute is a paraboloid, whose equation is $ax^2 = y^3$; that is, the cube of any ordinate MN is equal to the parallelepiped whose base is the square of the abscissa 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 demonstrated, that VK is $\frac{1}{2}$ of KG, and $\frac{1}{3}$ of VG; therefore $KG^2 = 4VK^2$, and (in the parabola) $VC^2 = 2VK^2$. Also, because $KV : VC = KG : GR$, 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, because in the paraboloid $VP \times VS^2 = SR^3$, or $VP \times RG^3$

$= VG^3$, we have $8VP \times VK^3 = 27VK \times VK^3$, and $8VP = 27VK$; or $VK : VP = 8 : 27$; or $VP = \frac{27}{8}AV$, or $\frac{27}{8}$ of the parameter of the parabola ABC. The evolute of the conical parabola is the curve called the semicubical parabola, and its parameter is $\frac{27}{8}$ of the conical parabola.

This investigation is nearly the same with that given by Huyghens, which we prefer at present to the method generally employed, because it keeps the principle of inference more closely in view.

Mr Huyghens has deduced a beautiful corollary from it. Since the parabola ABC is described 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 Cz equal to the redundant AV, the remainder zR is equal to the arch RNV of the paraboloid. We may do this for every position of the evolved radius, and thus obtain a series of points V, β , α , δ , ϵ , of the evolatrix of the paraboloid. We have even an easier method for obtaining the length of any part of the arch of the paraboloid, without the previous description of the parabola ABC. Suppose Py the arch of the paraboloid, and yz the tangent; make Pz = $\frac{8}{27}$ of the parameter, and describe the arch Puv 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 himself, with great justice, 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 second curve that has been so rectified, the cycloid alone having been rectified by plain geometry a very few years before by Sir Christopher 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 also by Mr Van Heuraet, a Dutch gentleman of rank, and an eminent mathematician. But both of these gentlemen had done it by means of the quadrature of a curve, constructed from the paraboloid after the manner of Dr Barrow, *Lecl. Geom.* XI. Nor was this a solitary discovery in the hands of Mr Huyghens, as the rectification of the cycloid had been in those of Sir Christopher Wren; for the method of investigation furnished Mr Huyghens with a general rule, by which he could evolve every species of paraboloid and hyperboloid, two classes of curves which come in the way in almost every discussion in the higher geometry. He observes, 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 subtangent to the sum of the subtangent and ordinate of a curve constructed on the same abscissa, having its ordinates equal to the subnormals DE, de, VK, &c. In the conic sections the ratio is constant, because the line so constructed is a straight line; and, in the parabola, it is parallel to the axis. See farther properties of it in Barrow's *Lecl. Geom.* XI.

From this investigation, Mr Huyghens has deduced the following beautiful theorem:

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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,

$$\left. \begin{array}{l} \text{If } a x = y^2 \\ a^2 x = y^3 \\ a x^2 = y^3 \\ a x^3 = y^4 \\ a^3 x = y^4 \\ \text{\&c.} \end{array} \right\} \text{ then } BN = \begin{cases} BE + 2 BZ \\ \frac{1}{2} BE + \frac{1}{2} BZ \\ 2 BE + 3 BZ \\ 3 BE + 4 BZ \\ \frac{1}{3} BE + \frac{4}{3} BZ \\ \text{\&c.} \end{cases}$$

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 Dd and Ee ; and therefore the ratio of Dd to Ee 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 asymptote. 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 *Encyclopadia*; but is in-

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correctly stated = $\frac{a+4}{2\sqrt{a}}$, instead of $\frac{a+4x}{2\sqrt{a}}$. The

theorem also from which it is deduced ($r = \frac{z^2}{xy}$)

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 $AbcdEef$ (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 bi, cg, dk ; draw the chords bc, cd , producing dc till it meet the ordinate bi in a , produce cg to the circle in f , and join bf, df ; draw bh, cm , perpendicular to the ordinates; then bb, cm, bc, md, bc, cd , are ultimately proportional to the first fluxions of the abscissa AE , the ordinate cg , and the arch Ac ; also ab , the difference between dm and cb is ultimately as the second fluxion of the ordinate. The triangle abc is similar to ddf ; for the angle abc is equal to the alternate angle bdf , which is equal to ddf , standing on the same segment. The angle acb is equal to bfd , standing on the segment bcd ; therefore the remaining angles bac and ddf are equal; therefore $ab:bc = bd:df = \frac{1}{2}bd:\frac{1}{2}df$. Now let the ordinates bi and dk continually approach the ordinate cg , and at last unite with it; we shall then have bc ultimately equal to $\frac{1}{2}bd$, and cg ultimately equal to $\frac{1}{2}df$. Therefore, ultimately, $ab:bc = bc:cg$, and $cg = \frac{bc^2}{ab}$.

Let u, v, w , represent the variable abscissa, ordinate, and arch. We have, for the fluxionary expression of the ordinate of the equicurve circle, $v = \frac{w^2}{u}$ (v must have the negative sign, because, as the arch increases, v diminishes). In the next place, it is evident that, ultimately, $bh:bc = cg:cC$, and $cC = \frac{cg \times bc}{bh}$. If r be the radius of the equicurve circle, we have $u:\dot{w} = v:r$, and $r = \frac{v \dot{w}}{u}$. But we had $v = \frac{w^2}{u}$. Sub-

stitute this in the present equation, and we obtain $r = \frac{w^3}{u \dot{w}}$. Lastly, observe that $\dot{w}^2 = \dot{u}^2 + \dot{v}^2$, and $\dot{w} = \sqrt{\dot{u}^2 + \dot{v}^2} = \frac{\dot{u}^2 + \dot{v}^2}{\dot{w}}$. Therefore $\dot{w}^3 = \frac{\dot{u}^2 + \dot{v}^2}{\dot{w}}$, and we have $r = \frac{\dot{u}^2 + \dot{v}^2}{u \dot{w}}$, as the most general flux-

ionary 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

Involutions. fame 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 $D G$, parallel to the diameter $A E$; 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 $r = \frac{z^3}{-x y}$ or $r = \frac{x^2 + y^2}{-x y}$, 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 $= \frac{z^3}{y x}$. Or, lastly, we might suppose (and this is very usual) the arch z to increase uniformly. In this case $r = \frac{z \dot{y}}{\dot{x}}$: 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 $r = \frac{z^3}{y \dot{x} - x \ddot{y}} = \frac{z^3}{y \dot{x} + \frac{x^2 \dot{x}}{y}}$
 $= \frac{y z^3}{y^2 + x^2 \times x} = \frac{y z}{x}$.

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 $C p$ and $D p$. If we suppose \dot{x} constant, then, $c C$ being $= \frac{z^3}{-x y}$, we have $D p (= D n + g c, = D n + \frac{\dot{y}}{z} \times c C) = x + \frac{y \dot{z}^2}{-x y}$; and $p C (= c g - c n, = \frac{x}{z} \times c C - c n) = \frac{z^2}{-y} - y$. But if we suppose \dot{y} constant; then, $c C$ being $= \frac{z^3}{y x}$, we have $D p = x + \frac{z^2}{x}$, and $p C = \frac{z \dot{x}^2}{y x} - y$. And if \dot{z} be constant, then, $c C$ being $= \frac{y z}{x}$, we shall have $D p = x + \frac{\dot{y}^2}{x}$, and $p C = \frac{x \dot{y}}{x} - y$.

These formulæ are so many general expressions for determining both the curvature or 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 $\dot{y} = \frac{1}{2} a^{\frac{1}{2}} x^{-\frac{1}{2}} = \frac{a^{\frac{1}{2}} \dot{x}}{2 x^{\frac{1}{2}}}$, and (making \dot{x} constant)

$$\ddot{y} = -\frac{1}{2} \times \frac{1}{2} a^{\frac{1}{2}} \dot{x} x^{-\frac{3}{2}} = -\frac{a^{\frac{1}{2}} \dot{x}^2}{4 x^{\frac{3}{2}}}$$

$$\dot{z} (= \sqrt{x^2 + y^2}) = \frac{\dot{x}}{2} \sqrt{\frac{4x+a}{x}}$$

$$\text{curvature} \left(= \frac{z^3}{-x y} \right) = \frac{a + 4x}{2 \sqrt{a}}$$

At the vertex, where $x = 0$, the formula becomes $= \frac{1}{2} a$.

$$\text{Again, } D p \left(= x + \frac{y \dot{z}^2}{-x y} \right) \text{ becomes } \frac{1}{2} a + 3 x;$$

and therefore $V p = 3 x$, = the abscissa of our evolute. Likewise $c p$, its ordinate, $\left(= \frac{z^2}{-y} - y \right)$

$$= \frac{4 x^{\frac{3}{2}}}{\sqrt{a}}; \text{ and } C p^2 = \frac{16 x^3}{a}; \text{ and } C p^2 \times a = 16 x^3.$$

But $V p = 3 x$, and $V p^3 = 27 x^3$. Therefore $C p^2 \times \frac{1}{3} a = x^3$, = $\frac{1}{27}$ th $V p^3$, and $\frac{1}{3} a \times C p^2 = V p^3$. Therefore the evolute $V C$ is a semicubical parabola, whose parameter is $\frac{2}{3} a$, as was shewn by Mr Huyghens.

$$\text{The arch } V C \text{ is } = \frac{a + 4x}{2 \sqrt{a}} - \frac{1}{2} a.$$

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 $\ddot{y} = n \times n-1 \times a x^{n-2} \dot{x}^2$; therefore $\dot{z} (= \sqrt{x^2 + y^2}) = \dot{x} \sqrt{1 + n^2 a^2 x^{2n-2}}$; $c C \left(= \frac{z^3}{-x y} \right) = \frac{1 + n^2 a^2 x^{2n-2}}{-n \times n-1 \times a x^{n-2}}$; $D p \left(= x + \frac{y \dot{z}^2}{-x y} \right) = x - \frac{x + n^2 a^2 x^{2n-2}}{n-1}$; $C p \left(= \frac{z^2}{-y} - y \right) = \frac{1 + 2n-1 \times n a^2 x^{2n-2}}{-n-1 \times n a x^{n-2}}$; and $D V = -\frac{n^2 a^2 x^{2n-2}}{n-1}$.

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 $V C$ of the evolute. If $n = \frac{1}{2}$, the formula becomes $\frac{a^2}{2}$; but if n be greater than this, $V C$ will be $= 0$; and if it be less, $V C$ 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

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Involutions. 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 rectilinear abscissa, but as diverging from a centre. This is also the usual way of conceiving all spirals and evolutrices 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 z, y, p. The triangles PCp, and Tpt or TPt are also ultimately similar; as also the triangles PST and p o P. Therefore, ultimately,

$$Tt : Pp = PT : PC$$

also $Pp : po = PS : PT$

therefore $Tt : po = PS : PC$, or, $\dot{p} : \dot{y} = y : r$, and

$$r = \frac{y \dot{y}}{\dot{p}}$$

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

$$ST = \frac{by}{a}; \text{ and therefore } PC \left(= \frac{y \dot{y}}{\dot{p}} \right) = \frac{a y \dot{y}}{b \dot{y}} = \frac{a y}{b}.$$

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 re-

lation 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 inconsistencies 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

great

Involutions. great discovery, and worthy of his genius. It naturally led the way to a much greater discovery. A circle may cut a curve in more points than two: It may cut a conic section in four points; all expressed by one equation, having four roots or solutions. What if three of these roots should be equal? This not only indicates a closer union than a mere contact, but also gives indication of the flexure of the intervening arch. For, before the union, the intersections were in the arch both of the curve and of the circle; and therefore the distinction between the union of two and of three intersections must be of the same kind with that between a straight line and an arch of *this* circle. The flexure of a circle being the same in every part, it becomes a proper index; and therefore the circle, which is determined by the coalescence of three intersections, was taken as the measure of the curvature in that point of the curve, and was called the **CIRCLE OF CURVATURE**, the **EQUICURVE CIRCLE**. There is a certain progress to this coalescence which must be noticed. Let ABD (fig. 4.) be a common parabola, EBF a line touching it in B , and BO a line perpendicular to EBF . Taking some point O in the other side of the axis for a centre, a circle may be described which cuts the curve in four points a, b, c , and d . By enlarging the radius, it is plain that the points a and b must separate, as also the points c and d . Thus, the points b and c approach each other, and at last coalesce in a point of contact B , with the parabola, and with its tangent. In the mean time, a and d have retired to A and D . If we now bring the centre O nearer to B , the new circle will fall wholly within the last circle ABD ; and therefore both A and D will again approach to each other, and to B , which still continues a point of contact. It is plain that A will approach faster to B than D will do. At length, the centre being in o , the point A coalesces with B , and we obtain a circle $\epsilon B \delta$, touching the curve in B , and cutting it in δ : Consequently the arch $B \epsilon \delta$ is wholly within, and $B \varphi \delta$ is wholly without the parabola; and the circle both touches and cuts the parabola in B . Here is certainly a closer union, at least on the side of a . But perhaps a farther diminution of the circle may bring it closer on the side of D . Join $B \delta$. Let a smaller circle be described, touching the parabola in B , and cutting it in φ . Draw φc parallel to δB . It may be demonstrated that the new circle cuts the parabola in c . Now the arch between c and φ being without the parabola, the arch BC must be within it; and therefore this circle is within the parabola on both sides of B , and is more incurvated than the parabola. We have seen, that a circle greater than $\epsilon B \delta$ is without the parabola on both sides of B ; and therefore is less incurvated than the parabola. Therefore the individual circle $\epsilon B \delta$ is neither more nor less curve than the parabola in the point B . Therefore the circle indicated by the coalescence of three intersections is properly named the equicurve circle; and, since we measure all curvatures by that of a circle, it is *properly* the circle of curvature, and its radius is the radius of curvature.

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.

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Involutions. 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 evolatrix 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

M m

presumed

Involutions. presumed to say that the presence of four interfections in an osculation is not warranted by the equation expressing those interfections.

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 evolatrix $A b d f$; and therefore two circles may be described round that point, each touching the curve. Each contact is the union of two interfections. 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 interfections.

But when two such circles are described round a point s , so as that both may touch the evolatrix $A a f$, the point s is in the interfection 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 evolatrix, from without inwards, in some point more remote from A . The contact at the extremity e of the radius $e E$ 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 interfection on the side next the other contact, sometimes beyond it, and sometimes between the contacts. As the contacts approach, the interfections also approach, still retaining their characters as interfections, 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 interfections as interfections. 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 100th 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

Involutions. Let TK move toward EB, always keeping parallel to it, till it coincide with it, or even pass it. Then, while the point K describes KB, it is evident that since TK is greater than TQ, TM must be less than TR, and the point M must always be found between T and R. The arch ME of the curve must be nearer to the tangent than the arch RE of the circle. If any circle be now described touching TE in E, and cutting off from EB a smaller chord than EB, it is clear that the whole of this segment must be within the segment BRE; therefore this smaller circle does not pass between ERB and the curve EMH. But since we see that the curve lies without the circle, in the vicinity of E, perhaps a greater circle than ERB may pass between it and the curve. A greater circle, touching at E, must cut off a chord greater than EB. Let Erb be such a circle, cutting EB in b , and TQ in q . Tq is necessarily greater than TQ. For since b is beyond B, and the arch BKF lies in the angle QBb, the circle Erg must cross the curve FKB in some point; suppose F. Then while K is found in the arch FB, the point q must be beyond K, or Tq must be greater than TK. Now $Tr \times Tq = TE^2 = TM \times TQ$. Therefore $TM : Tr = Tq : TQ$. Therefore Tq being greater than TQ, Tr must be less than TM, and the point r must lie without the curve, and the arch Er does not pass between EMH and the circle ERB. In like manner, on the other side of EB, it will appear, that when the curve BKF falls within the circle which touches EMH in E, and cuts off the chord EB, the arch of the curve corresponding to the arch BKF, lying within the circle, also lies within the circle. For TK' being less than TQ', TM' is greater than TR', and the curve is within the circle. And, by similar reasoning, it is evident that a circle cutting off a greater chord falls without both the circle ERB and the curve, and that a circle less than ERB must necessarily leave some part of the curve BKF without it; and therefore TK' will be greater than Tq', and the corresponding point r' must be without the curve. All circles therefore touching TE in E fall without both ER and EM, or within them both, according as they cut off from EB a chord greater or less than EB, and no circle can pass between them when the rectangle $MT \times TK$ is always equal to ET^2 , and the focus of the point K passes through B; that is, ERB is the equicurve circle at E.

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 Em be another curve, touching TE in E, such, that the conjugate curve kB , which always gives $Tm \times Tk = TE^2$, also passes through B. Then, by what has now been demonstrated, the two curves EM and

Involutions. Em 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 Bk pass between BK and BQ, the curve Em must pass between the curve EM and the circle ER. Em 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 asymptote. 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 rectilinear angle can be contained as an unit in the curvilinear 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 curvilinear angles incomparable with each other. Yet are they magnitudes of one kind; because the smallest rectilinear 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 limitem,*"

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.

$$\text{For } TR : TM = TK : TQ$$

$$\text{Therefore } RM : TR = KQ : KT$$

$$\text{Or } RM : KQ = TR : TK ; = TR \times TQ : TK \times TQ, = TE^2 : TK \times TQ.$$

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 \times TQ inversely; and when KQ is given, RM is less in proportion as KT \times TQ is greater. In the very neighbourhood of E and B, it is plain that KT \times TQ is very nearly equal to EB², and therefore ultimately RM : KQ = ET² : EB².

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 line edbca, 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 cb will be united with the circular arch dc 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 *Involution.* attention.

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 $\frac{\text{fluxion of evolute}}{\text{fluxion of evolutrix}}$ ex-

presses the rate of the variation of curvature in this spiral. Now let *abcd* (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 *pB*, *po*, B*m*, *on*; join *pm*, and draw B*q* perpendicular to *pm*. It is evident that *mn* 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 *qp* : *qB* = *qB* : *qM*, = *pB* : B*m*; therefore the ratio of these infinitesimal arches *mn* 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 *mn* and B*o* are ultimately as those fluxions,

$$\text{and } \frac{B_o}{mn} \text{ is equivalent to } \frac{r}{z}, \text{ where } z \text{ is the arch of the}$$

spiral, and *r* the evolved radius of the other. Accordingly,

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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 r 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 $\frac{r}{z}$. Thus, in the curve ABC (fig. 8.), let AB be $= z$, $AD = x$, $DB = y$, $BN = r$, and $BE = p$; we have $\frac{Nn}{Bb} = \frac{r}{z}$. Now $DB :$

$BE = y : p$, $= Dd : Bb$, $= \dot{x} : \dot{z}$. Therefore $\dot{z} = \frac{p \dot{x}}{y}$, and $\frac{r}{z} = \frac{y \dot{r}}{p \dot{x}}$. Now, in every curve which we can express by an equation, we can obtain all these quantities p , y , r , and z , and can therefore obtain the measure of the variation of curvature. It also deserves particular notice, that this investigation of $\frac{r}{z}$ 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 evolatrix 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 evolatrixes 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

Involutions.

lines of unequally varying curvature, and becomes a very good standard of comparison. In the parabola ABC (fig. 8.) let the parameter be $2a$. The equation is then $2ax = y^2$; $DE = a$; p , or $BE = \sqrt{a^2 + y^2}$ $DQ = a + 2x$ (by what was formerly demonstrated).

Moreover, $DB : BE = DQ : BN$; and $BN = \frac{pa + 2px}{a} = r$. These equations give $2a\dot{x} = 2y\dot{y}$, $= 2p\dot{p}$ and $\frac{a\dot{p} + 2x\dot{p} + 2p\dot{x}}{a} = \dot{r}$. 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 $\dot{r} = \frac{a\dot{p} + 2x\dot{p} + 2p}{a}$.

With these values of y , p , r , we obtain a numeric value of $\frac{y r}{p}$ 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 $2x = y^2$; $\dot{x} = \frac{1}{2}$, $y (= \sqrt{2x}) = 1$; $\dot{y} (= \frac{a}{y}) = 1$; $p (= \sqrt{a^2 + y^2}) = \sqrt{2}$; $\dot{p} (= \frac{a}{p}) = \frac{1}{\sqrt{2}}$; and $\dot{r} (= \frac{a\dot{p} + 2x\dot{p} + 2p}{a}) = \sqrt{2} \times 3$. Therefore $\frac{y r}{p} = 3$, = 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 $x = z$. This gives $y = 2$; $\dot{y} = \frac{1}{2}$; $p = \sqrt{5}$; $\dot{p} = \frac{1}{\sqrt{5}}$, and $\dot{r} = 3\sqrt{5}$. Wherefore $\frac{y r}{p} = 6$, which is the index of variation.

Moreover, since p and 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 semi-cubical parabola.

In like manner, it may be shewn, that in all the conic sections $\frac{r}{z}$ is always proportional to the rectangle of the ordinate DB and the subnormal DE , or to $DB \times DE$. In the parabola, whose equation is $2ax = y^2$, we have $\frac{r}{z} = \frac{3y}{a}$. In an ellipse, whose equation is

$2ax - bx^2 = y^2$, we have $\frac{r}{z} = \frac{3-3b}{a} \times DB \times DE$, and in the hyperbola, whose equation is $2ax + bx^2$, $\frac{r}{z}$ is $= \frac{2+3b}{a} \times DB \times DE$. 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 . (fig. 5.)

Involutions,
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Joan.

(fig. 5.) $\frac{r}{z}$ is = tan. \angle 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 curvilinear 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.

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.

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*.

Joan,
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John.

‡ *Histoire de la Pucelle par l'Abbé Lenglet. See also Mélanges Curieux Monstrelet; and the manuscript authorities cited by the continuator of Velly.*

* Villaret
Histoire de France,
tom. xv.
p. 72.

† Pasquier
Histoire d'Orleans,
liv. vi.

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. $47^{\circ} 32'$, W. long. $52^{\circ} 21'$. 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. $47^{\circ} 32'$, W. long. $52^{\circ} 29'$.—*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 $10\frac{1}{2}$ 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 Talahafschete. The swamp called Ouaquaphenogaw is said to be its source, which is 100 miles by land from Talahafschete, 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 clothed 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 Oromosto river, by which the Indians have a communication with Passamaquoddy; the Nashwach and Madamkifwick, on which are rich intervalles 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, 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 $45^{\circ} 46'$, and $47^{\circ} 10'$ N. lat. and between $44^{\circ} 22'$, and $46^{\circ} 32'$ 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

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Johnstown.

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 Tadoufac. 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 Suffex 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. Caghnaawaga 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.*

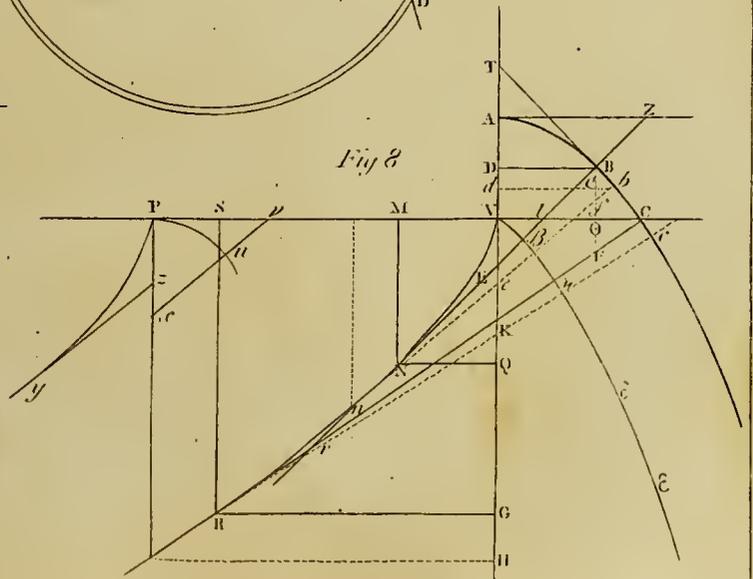
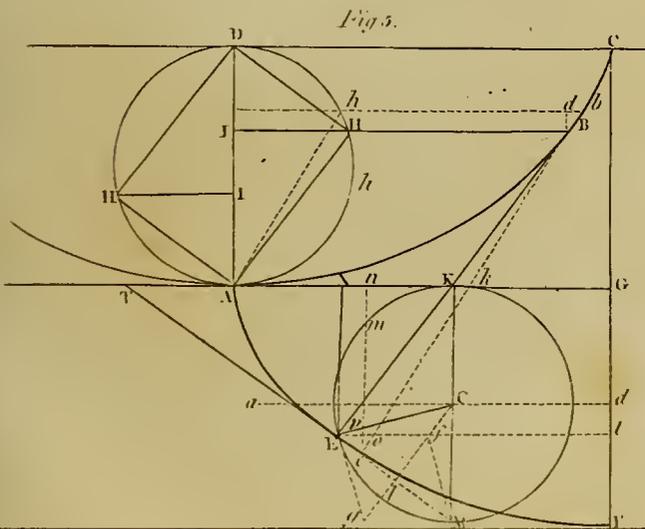
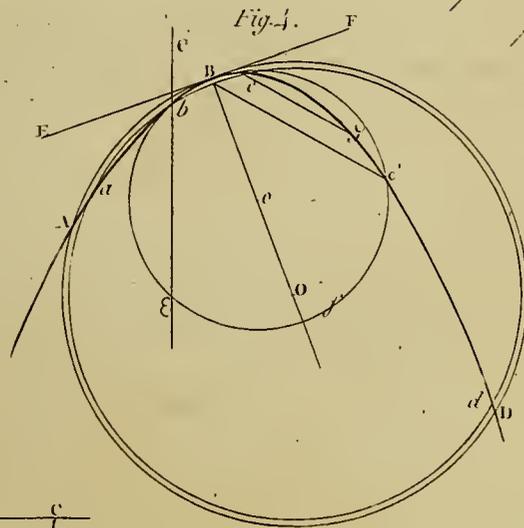
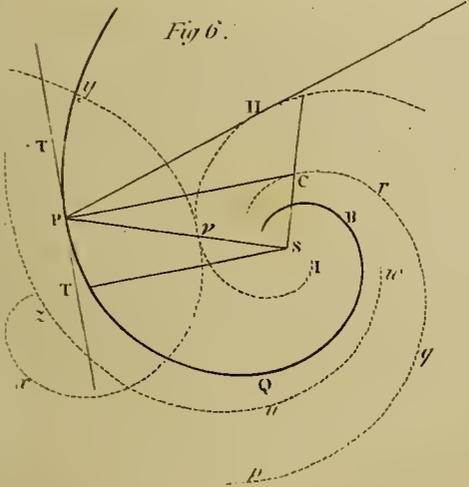
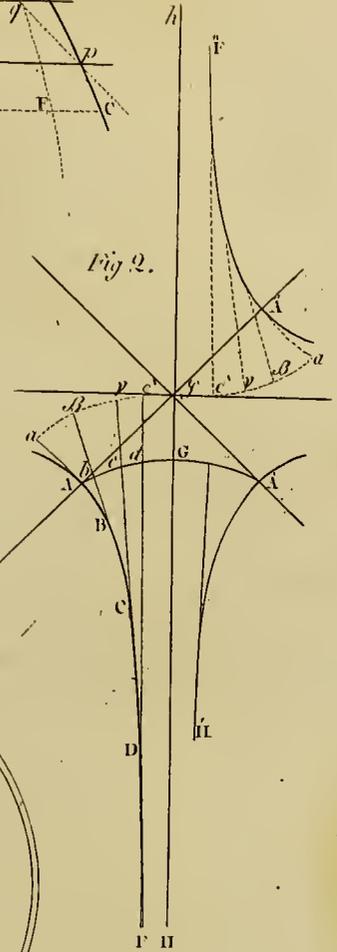
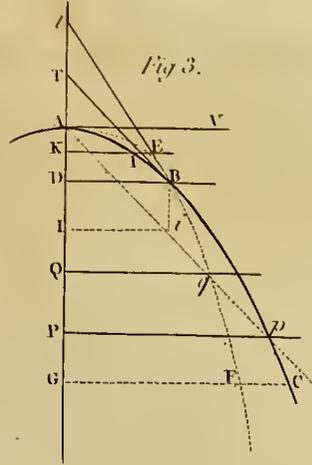
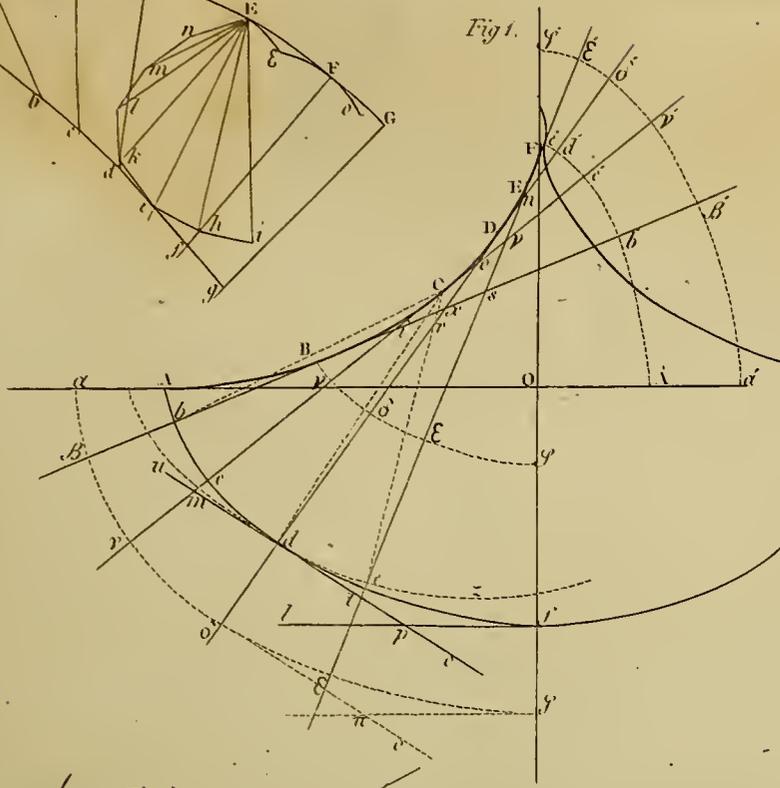
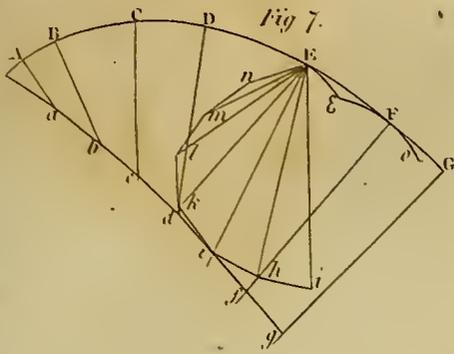
JONAS'S SOUND, the most northern inlet on the western coast of Sir Thomas Smith's Bay, lying near the arctic circle, in latitude 76°.—*ib.*

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 solitudes 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 Shab, connu sous le nom de Thabmas 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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Jones.



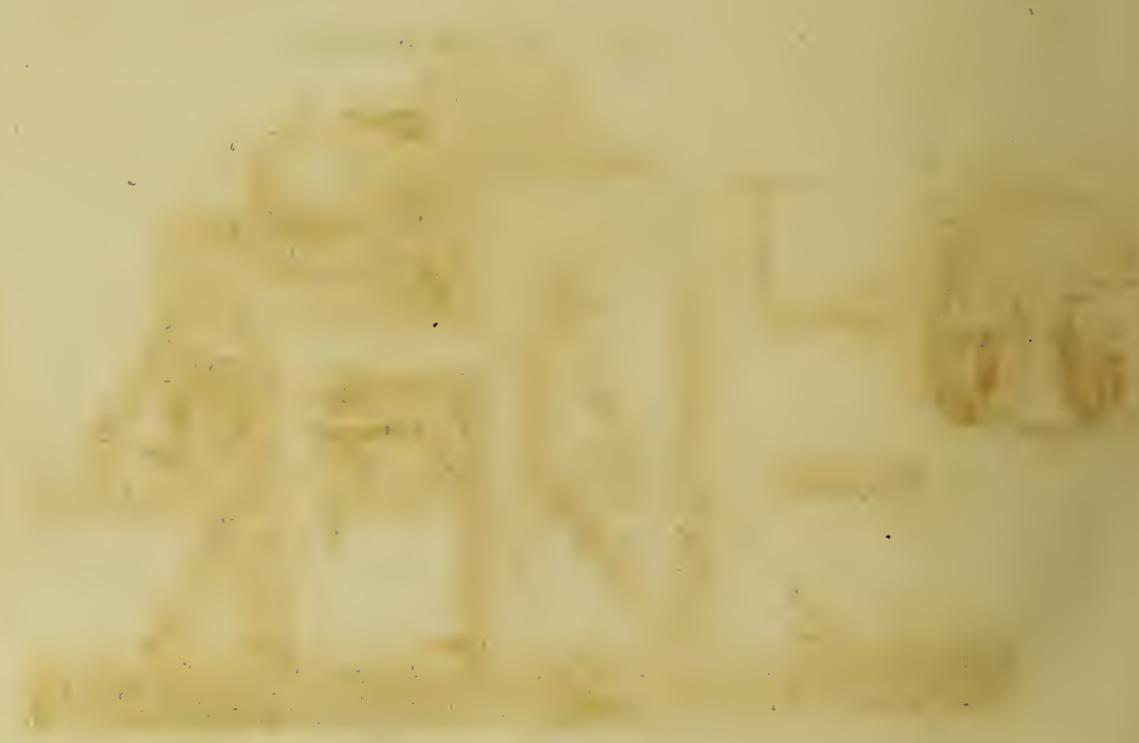
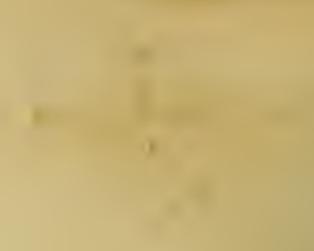


Fig 9.

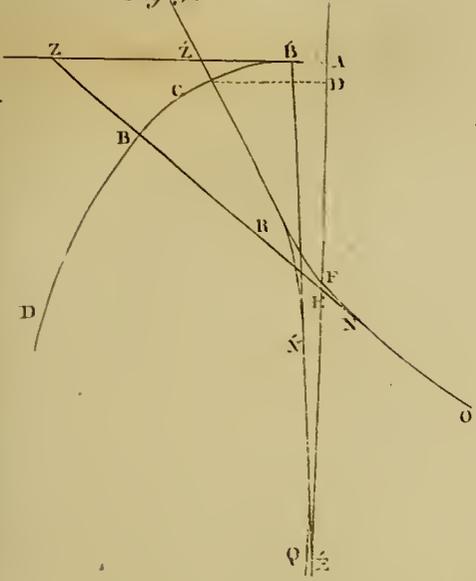


Fig 10.

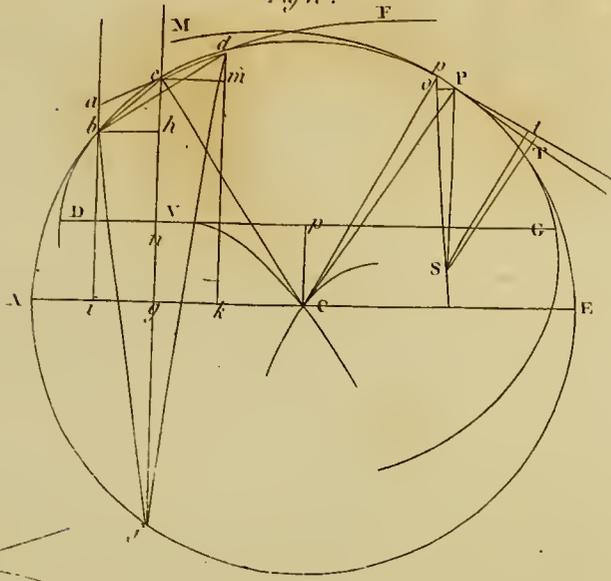


Fig 12.

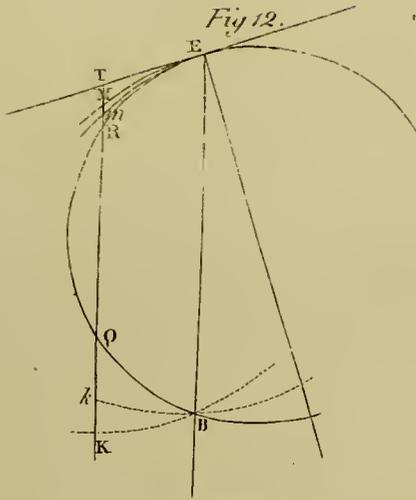


Fig 13.

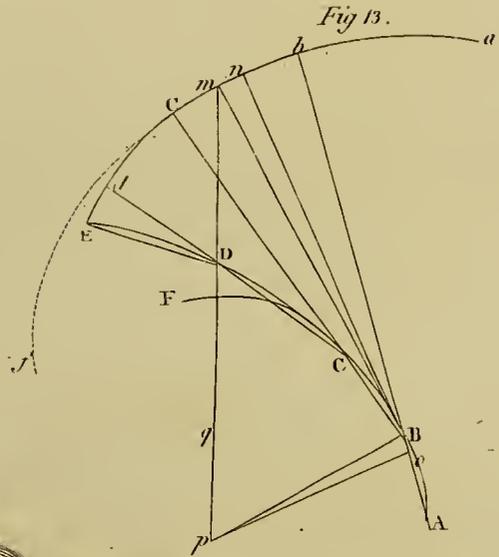
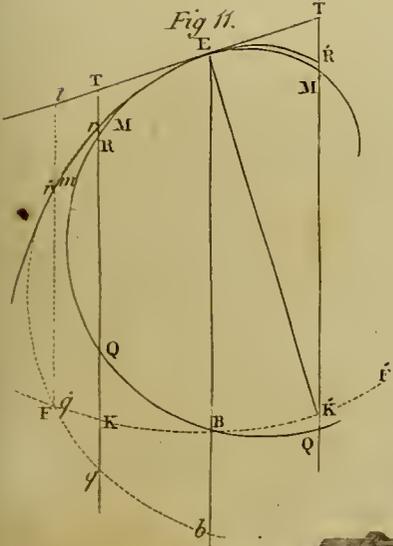
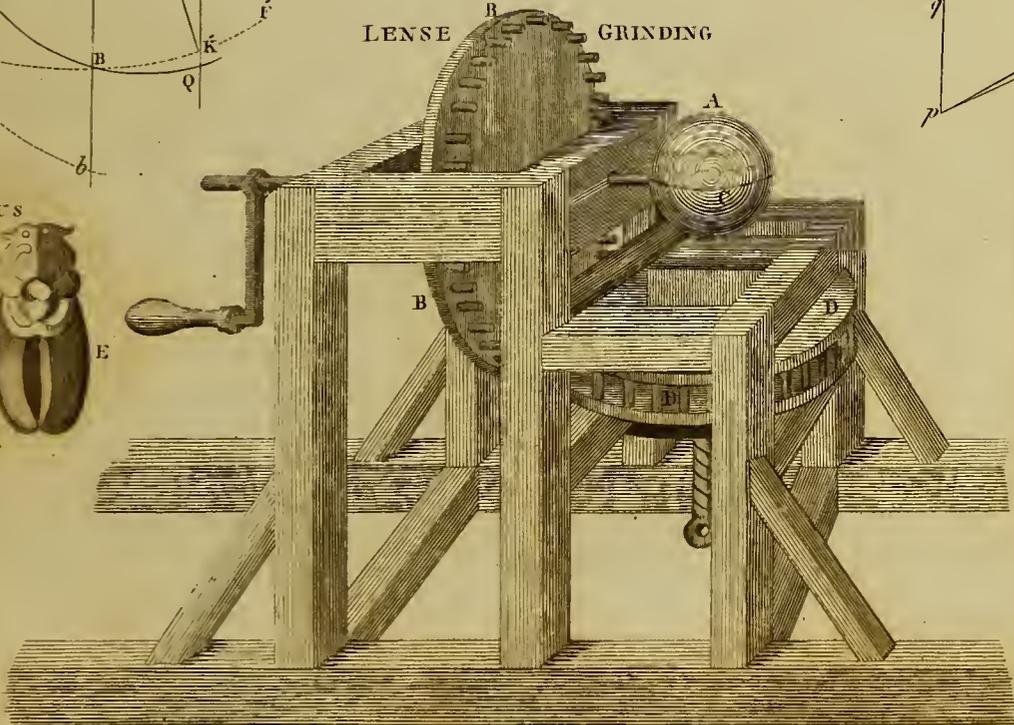


Fig 11.



LENSE GRINDING



ONISCUS



Fig 1.

ONISCUS

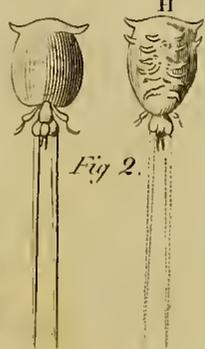
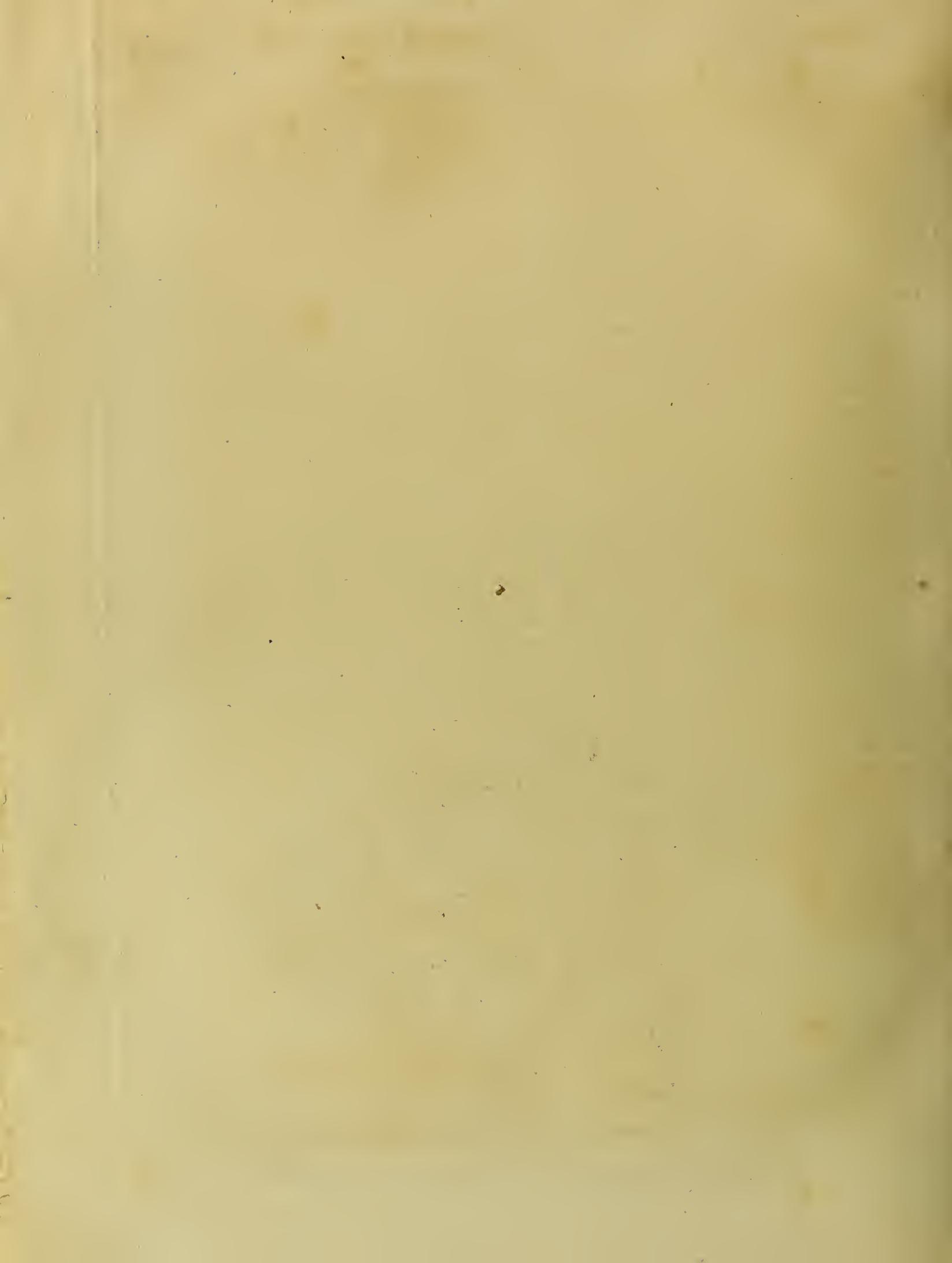


Fig 2.



Jones.

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

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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.*

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)."

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(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 Archidiaconus.
 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 iudicii acumen, vel uberius eruditionis copia.
 Egrediis hæc cum dotibus naturæ, tum doctrinæ subsidiis,
 Infuper 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 constans 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.

* Preface to
 the History
 of Nadir
 Shah, 1773.

Jones.

In 1771 Mr Jones published *Dissertation sur la Littérature Orientale*, 8vo, and this was followed by *Lettre à Monsieur A** Du P***, dans laquelle est compris l'Examen de sa Traduction des Livres attribués 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 Linguae Persarum*, and to add in their proper place an Appendix subjoined to Gehanaguire's Persian 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 addict 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 *Poesios Asiaticae Commentariorum Libri Sex, cum Appendice: subjeitur 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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Jones. 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 those 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 com-

mentaries 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."

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 Koraisih, with accounts of some Himyarick poets; on the manners of the Arabs in the

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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.

"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,

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* *Law of Bailments.*

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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 period, 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 Coshas, &c. 3. A grammar of the Sanscrit language, from Panini, &c. 4. A dictionary of the Sanscrit language, from the 32 original vocabularies and Nirukti. 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 Khulasa. Of the Casiah.

Persia.—19. The history of Persia, from authorities in Sanscrit, Arabic, Greek, Turkish, Persian ancient

and modern, Firdausi’s Khrofrau 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-tfu, 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:

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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'ôca*, 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 monandriffs, &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;

Jones,
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Jonesia.

Jonesia,
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Joppa.

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 stamiferous and pistiliferous ring crowns the mouth of the tube. *Stamens*, filaments generally seven; and seven mult, 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. *Antbers* 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 chestnut."

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; *aa* 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; *aa*, 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 sort 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 $37^{\circ} 51'$ north, and in Long. $135^{\circ} 20'$ 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.*

JOKE, 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 Joke, 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 35 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. $23^{\circ} 3'$.—*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 $6\frac{1}{2}$ 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. $42^{\circ} 14'$, W. long. $86^{\circ} 10'$. 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*,

Jordan's
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Journals.

Journals, *ſtr*, 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.

Befides 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 Louiſiana, which runs ſouth-eaſtward into the Miſſiſſippi, in N. lat. $41^{\circ} 5'$, 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 JEST, 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. $42^{\circ} 43'$, W. long. $70^{\circ} 50'$.—*Morſe*.

IPSWICH, NEW, a townſhip in Hillsborough county, New-Hampſhire, containing 1241 inhabitants, ſituated on the weſt ſide of Souhegan 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 $146^{\circ} 30'$, 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

Ipſwich,

Iron.

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 *ochre* 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, dis-

Iron.

agreeable 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 altringents.

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

Iron.

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 $\frac{1}{5}$ 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 juxtaposition 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 fumach 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 fumach and the bark of the alder tree or oak for gall when dyeing cotton red. "I can safely assert (says he), that it is impos-

ble 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 Tierra.—*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 Genesee 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

Iron banks,
Isabel.

Isabella,
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Isles.

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 639 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

Juan.

JUAN.

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 clothing 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 faranne 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 neighbour-

hood, 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 goodwill 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 $48^{\circ} 20'$ N. Lat. and 124° W. Long.

JUAN, St, the capital of California in N. America. N. lat. $26^{\circ} 25'$, W. long. $114^{\circ} 9'$.—*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 fourth-easternmost point of Rhode-Island State, situated on the sea-coast of Washington county, in South-Kingston township.—*ib*.

JUDOSA BAY, in Louisiana, 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 Liberkuhn 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.

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Jugglers.

Jugglers.

“ But, if the arts of juggling served no other end than to amuse the most ignorant of our citizens, it is proper that they should be encouraged for the sake of those who cannot enjoy the more expensive deceptions of an opera. They answer other purposes, however, than that of merely amusing: they convey instruction in the most acceptable manner, and serve as an agreeable antidote to superstition, and to that popular belief in miracles, exorcism, conjuration, sorcery, and witchcraft, from which our ancestors suffered so severely.”

Surely this reasoning, as well as the cause in which it is brought forward, is unworthy of the learning of Beckmann. It is indeed true, that jugglers spend their money freely, and that their arts afford them the means of subsistence; but it is very seldom, as our author must know, that they subsist either comfortably or innocently. Is it innocent to entice the ignorant and labouring poor, by useless deceptions, to part with their hard-earned pittance to idle vagabonds? or is the life of those vagabonds comfortable, when it is passed amid scenes of the most grovelling dissipation? Jugglers spend indeed their money, for the most part, on the spot where it is gained; but they spend it in drunkenness, and other seducing vices, which corrupt their own morals and the morals of all with whom they associate; and therefore their stay in a place should certainly *not* be encouraged. Could it be proved that the solar microscope would never have been invented, had not a Savoyard juggler contrived a similar machine to amuse children and the rabble, some stress might be laid on the service which such wretches have rendered to science: but where is the man that will suppose the philosophy of Bacon and Newton to rest upon the arts of juggling? or who considers the refinements of science 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 most indecent scenes by means of puppets, and keeping the mob in a constant roar. Is he innocently employed? or will any good man say that there is not room for him in the armies which on the Continent are fighting in the cause of God and humanity?

Our author endeavours to strengthen his reasoning by proving, which he does very completely, the antiquity of juggling. “ The deception (says he) of breathing out flames, which at present excites, in a particular manner, the astonishment of the ignorant, is very ancient. When the slaves in Sicily, about a century and a half before our æra, made a formidable insurrection, and avenged themselves in a cruel manner for the severities which they had suffered, there was amongst them a Syrian named Eunus, a man of great craft and courage, who, having passed through many scenes 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 slaves; and, as is usual on such occasions, confirmed his divine mission by miracles. When, heated by enthusiasm, he was desirous of inspiring his followers with courage, he breathed flames or sparks among them from his mouth while he was addressing them. We are told by historians, that for this purpose he pierced a nut-shell at both ends, and having filled it with some burning substance, put it into his mouth and breathed through it.

“ This deception, at present, is performed much bet-

ter. The juggler rolls together some flax or hemp, so as to form a ball about the size of a walnut; sets it on fire; and suffers it to burn till it is nearly consumed; he then rolls round it, while burning, some more flax; and by these means the fire may be retained in it for a long time. When he wishes to exhibit, he slips the ball unperceived into his mouth and breathes through it; which again revives the fire, so that a number of weak sparks proceed from it; and the performer sustains no hurt, provided he inspire the air not through the mouth but the nostrils.

“ For deceptions with fire the ancients employed also naphtha, a liquid mineral oil, which kindles when it only approaches a flame. (See *ΝΑΡΗΘΑ*, *Encycl.*) Galen informs us, that a person excited great astonishment by extinguishing a candle and again lighting it, without any other process than holding it immediately against a wall or a stone. The whole secret of this consisted in having previously rubbed over the wall or stone with sulphur. But as the author, a few lines before, speaks of a mixture of sulphur and naphtha, we have reason to think that he alludes to the same here. Plutarch relates how Alexander the Great was astonished and delighted with the secret effects of naphtha, which were exhibited to him at Ecbatana. The same author, as well as Pliny, Galen, and others, has already remarked that the substance with which Medea destroyed Creusa, the daughter of Creon, was nothing else than this fine oil. She sent to the unfortunate princess a dress besmeared with it, which burst into flames as soon as she approached the fire of the altar. The blood of Nessus, in which the dress of Hercules, which took fire likewise, had been dipped, was undoubtedly naphtha also; and this oil must have been always employed when offerings caught fire in an imperceptible manner.

“ In modern times, persons 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 aside the deception sometimes practised on the spectators, the whole of this secret consists in rendering the skin of the soles of the feet and hands so callous and insensible, that the nerves under them are secured from all hurt, in the same manner as by shoes and gloves. Such callosity will be produced if the skin is continually compressed, singed, pricked, or injured in any other manner. Thus do the fingers of the industrious sempstress become horny by being frequently pricked; and the case is the same with the hands of fire workers, and the feet of those who walk bare footed over scorching sand.

“ In the month of September 1765, when I visited (says our author) the copper-works at Awestad, one of the workmen, for a little drink money, took some of the melted copper in his hand, and after shewing it to us, threw it against a wall. He then squeezed the fingers of his horny hand close to each other; put it a few minutes under his arm-pit, to make it sweat, as he said; and, taking it again out, drew it over a ladle filled with melted copper, some of which he skimmed off, and moved his hand backwards and forwards, very quickly, by way of ostentation. While I was viewing this performance, I remarked a smell like that of singed 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 saw done at Amsterdam, but

Jugglers.

Jugglern.

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*.”

* Haller,
Elementa
Physiolog.

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.

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. $48^{\circ} 51'$, W. long. $65^{\circ} 10'$.—*Morse*.

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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. $42^{\circ} 5'$, W. long. $88^{\circ} 44'$.—*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*.

JUNIOR CREEK, a northern branch of the Little Kanaway, 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.”

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 $14^{\circ} 15'$ N. Lat. and $7^{\circ} 20'$ 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'

Kaarta,
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Kaats.

Kabobiquas,
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Kaats.

KAAATS' KILL, or *Catkill*, 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.*

KAAATS' 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 fufees, 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 mouths. The consequence was, that when he asked any thing, the answer had frequently no relation to the question; and for this inconvenience 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 fufee, 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 fufee, 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 latter

Kabobiquas.

Kabobi-
quas.

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 Caffies, 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.

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 bare-legged, 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

Kabobi-
quas.

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, crosses, 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.

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 Whitestown, 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 Bamboouk; on the west, by Bondou and Fouta 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

Kabobiquas,
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Kajaaga.

Kajaaga,
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Kainfi.

hills of the interior, make the scenery on its banks very picturesque 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 Kaffon. 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 Kaffon, 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 Pisania, 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 Kaffon. 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 kainfi; 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 chase of the kainfi 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 chase of the kainfi 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 kainfi 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 surpris'd 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

Kainfi,
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Kamt-
schatka.

(A) This we think incredible.

Kamt-
schatka.

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 *ibas*, 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 Can-

ton; 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 Caltries, 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 fables 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 asperision 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

P p 2

bottom

Kamt-
schatka.

(A) Not less than thirty degrees of Reaumur's thermometer.

Kanawa,
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Kanem.

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 basin 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 Philippines, 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 *ostrags* 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 $53^{\circ} 1' N.$ Lat. and $156^{\circ} 30' E.$ 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. $24^{\circ} 32'$ Long. $22^{\circ} 57'$. 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, how-

ever 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 36^{th} 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
so

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Kant.

Kantuffa. so many others have failed to perform, we have applied for assistance to an illustrious Frenchman, who has resided many years in Germany, who is master of both languages, who is a profound metaphysician, and whose name, were we at liberty to publish it, would reflect lustre upon our Work. From him we have reason to expect a clear and comprehensive view of the *Critical Philosophy*, as Kant terms his system; but should we be disappointed of our expectation, we shall, under that title, lay before our readers a *specimen* of the system from the different views of it which have been published in our own tongue.

KANTUFFA, a species of thorn peculiar to Abyssinia, is thus described by Mr Bruce: The branches stand two and two upon the stalk; the leaves are disposed two and two likewise, without any single one at the point, whereas the branches bearing the leaves part from the stalk: at the immediate joining of them are two thick thorns placed perpendicular and parallel alternately; but there are also single ones distributed in all the interstices throughout the branch.

The male plant has a one-leaved perianthium, divided into five segments, and this falls off with the flower. The flower is composed of five petals, in the middle of which rise ten stamina or filaments, the outer row shorter than those of the middle, with long stigmata, having yellow farina upon them. The flowers grow in a branch, generally between three and four inches long, in a conical disposition, that is, broader at the base than the point. The inside of the leaves are a vivid green, in the outside much lighter. It grows in form of a bush, with a multitude of small branches rising immediately from the ground, and is generally seven or eight feet high. Our author saw it when in flower only, never when bearing fruit. It has a very strong smell, resembling that of the small scented flower called mignonet, sown in vases and boxes in windows, or rooms, where flowers are kept.

Our author represents the *kantuffa* as so very troublesome, that it renders travelling through some places of Abyssinia almost impossible. The soldier screens himself from it by a goat's, a leopard's, or a lion's skin thrown over his shoulder, of which it has no hold. As his head is bare, he always cuts his hair short before he goes to battle, lest his enemy should 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 species of raiment they wear. If their cloak is fine muslin, the least motion against it puts it all in rags; but if it is a thick, soft cloth, as those are with which men of rank generally travel, it buries its thorns, great and small, so deep in it, that the wearer must either dismount and appear naked, which to principal people is a great disgrace, or else much time will be spent before he can disengage himself 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 issued, every year immediately before the king commences any march, in these 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 beasts, especially the Guinea fowl, know how

well it is qualified to protect them. In this shelter, the hunter in vain could endeavour to molest them, were it not for a hard-haired dog, or terrier of the smallest size, who being defended from the thorns by the roughness of his coat, goes into the cover, and brings them and the partridges alive one by one to his master.

KAPPAS, a tribe of Illinois Indians, in Louisiana: they lie a little above the Souths. This nation was formerly very numerous before the discovery of the Mississippi. The country they inhabit has good pasturage.—*Morse.*

KAPPAS *Old Fort*, in Louisiana, stands on the Mississippi, at the mouth of the river St Francis. It was built by the French principally for a magazine of stores and provisions, during the wars with the Chicasaws; by whom their Illinois convoys were constantly attacked and frequently destroyed.—*ib.*

KARATUNK, or *Carytunk*, a plantation in Lincoln county, District of Maine, consisting of about 20 families or 103 inhabitants. It is the uppermost on Kennebeck river, 14 miles north of Brookfield.—*ib.*

KASKASKIAS *Village* lies on the S. W. bank of the river of the same name, a water of the Mississippi, in the N. W. Territory, opposite Old Fort, and 12 miles from the mouth of the river, but not half that distance from the Mississippi. It contains 80 houses, many of them well built; several of stone, 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 stocks of black cattle, swine, &c.—*ib.*

KASKASKIAS, an Indian nation near the river of their name in the N. W. Territory. They can furnish 250 warriors. Three miles northerly of Kaskaskias is a village of Illinois Indians, of the Kaskaskias tribe; containing about 210 persons, 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 sum 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 course is S. S. W. and near its mouth it turns to the S. S. E. and flows into the Mississippi river 84 miles from the Illinois. It runs through a rich country, abounding in extensive natural meadows, and numberless herds of buffalo, deer, &c. High grounds lie along the east side of the river, the banks being composed of lime-stone and free-stone, and are from 100 to 130 feet high, divided in many places by deep cavities, through which many small rivulets pass before they fall into the Mississippi. The sides of these hills, fronting the river, are in many places perpendicular, and appear like solid pieces of masonry, of various colours, figures, and sizes.—*ib.*

KASKASKUNK, a town of the Delawares, between Great Beaver creek and Alleghany river, in Pennsylvania. Here the Moravian missionaries had a settlement. It is 40 miles north of Pittsburg.—*ib.*

KASKINOMPA, a small river which runs west, into the Mississippi from the State of Tennessee, in N. lat. 36° 28'. On the north side of its mouth is an iron mine.—*ib.*

KASSON, a populous kingdom in North Africa, of which the capital *Kooniakary* is placed by Major Rennel

Kasson.

Rennel in $14^{\circ} 33' N.$ Lat. and $8^{\circ} 43' W.$ Long. The king who reigned when Mr Park was in the country was extremely kind to our traveller, though his son plundered him unmercifully, like other rapacious chiefs of that savage country. From the top of a high hill, at some distance from the capital, "I had (says Mr Park) a most enchanting prospect of the country. The number of towns and villages, and the extensive cultivation around them, surpassed every thing I had yet seen in Africa. A gross calculation may be formed of the number of inhabitants in this delightful plain, by considering, that the king of Kasson can raise four thousand fighting men by the sound of his war drum."

At Teefee, a large unwall'd town, where our author resided for some days, he had an opportunity of observing the customs of the inhabitants, who consisted partly of Pagans and partly of Bushreens, *i. e.* of negroes converted to Mahomedanism. Though these people possess both cattle and corn in abundance, rats, moles, squirrels, snakes, locusts, &c. are eaten without scruple by the highest and lowest. Another custom, still more extraordinary, is, that no woman is allowed *to eat an egg*. This prohibition, whether arising from ancient superstition, or from the craftiness of some old Bushreen who loved eggs himself, is rigidly adhered to; and nothing will more affront a woman of Teefee than to offer her an egg. The custom is the more singular, as the men eat eggs without scruple in the presence of their wives, and Mr Park never observed the same prohibition in any other of the Mandingo countries.

Our author was present at a palaver held by the governor of Teefee on a very extraordinary occasion; of which we shall give his account at full length, because it shows how free men are reduced to slavery in North Africa. "The case was this. A young man, a Kafir, of considerable affluence, who had recently married a young and handsome wife, applied to a very devout Bushreen, or Mussulman priest, of his acquaintance, to procure him saphies for his protection during the approaching war. The Bushreen complied with the request; and in order, as he pretended, to render the saphies more efficacious, enjoined the young man to avoid any nuptial intercourse with his bride for the space of six weeks. Severe as the injunction was, the Kafir strictly obeyed; and without telling his wife the real cause, absented himself from her company. In the mean time it began to be whispered at Teefee, that the Bushreen, 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 first, the good husband was unwilling to suspect the honour of his sanctified friend, and one whole month elapsed before any jealousy rose in his mind; but hearing the charge repeated, he at last interrogated his wife on the subject, who frankly confessed that the Bushreen had seduced her. Hereupon the Kafir put her into confinement, and called a palaver upon the Bushreen's conduct. The fact was clearly proved against him; and he was sentenced to be sold into slavery, or to find two slaves for his redemption, according to the pleasure of the complainant. The injured husband, however, was unwilling to proceed against his friend to such extremity, and desired rather to have him publicly flogged before the governor's gate. This was agreed to, and the sentence was immediately executed. The culprit was tied by the hands to a strong

Kasson.

stake; and a long black rod being brought forth, the executioner, after flourishing it round his head for some time, applied it with such force and dexterity to the Bushreen's back, as to make him roar until the woods resounded with his screams. The surrounding multitude, by their hooting and laughing, manifested how much they enjoyed the punishment of this old gallant; and it is worthy of remark, that the number of stripes was precisely the same as are enjoined by the Mosaic law, *forty, save one.*"

The method of converting the negro nations to the religion of the Arabian Impostor is a very singular one; and Mr Park saw the whole people of Teefee converted in an instant. During his residence in that town an embassy of ten people belonging to Almami Abdulkader, king of Foota Torra, a country to the west of Bondou, arrived at Teefee; and desiring Tiggity Sego the governor to call an assembly of the inhabitants, announced publicly their king's determination, to this effect: "That unless all the people of Kasson would embrace the Mahomedan religion, and evince their conversion by saying eleven public prayers, he (the king of Foota Torra) could not possibly stand neuter in the present contest, but would certainly join his arms to those of Kajaaga." A message of this nature, from so powerful a prince, could not fail to create great alarm; and the inhabitants of Teefee, after a long consultation, agreed to conform to his good pleasure, humiliating as it was to them. Accordingly, one and all publicly offered up eleven prayers, which were considered a sufficient testimony of their having renounced Paganism, and embraced the doctrines of the prophet.

Our author relates a story, which we cannot refuse ourselves the pleasure of inserting, because it exhibits a very pleasing picture of the affection and gratitude of the Pagan negroes. In his train was a blacksmith, who had lived some years on the Gambia, and who now returned to his own country *Kasson*. "Soon after we came in sight of Jumbo, his native town (says Mr Park), his brother, who had by some means been apprised of his coming, came out to meet him, accompanied by a singing man: he brought a horse for the blacksmith, that he might enter his native town in a dignified manner; and he desired each of us to put a good charge of powder into our guns. The singing man now led the way, followed by the two brothers; and we were presently joined by a number of people from the town, all of whom demonstrated great joy at seeing their old acquaintance the blacksmith, by the most extravagant jumping and singing. On entering the town, the singing man began an extempore song in praise of the blacksmith, extolling his courage in having overcome so many difficulties; and concluding with a strict injunction to his friends to dress him plenty of victuals.

"When we arrived at the blacksmith's place of residence, we dismounted and fired our muskets. The meeting between him and his relations was very tender; for these rude children of nature, free from restraint, display their emotions in the strongest and most expressive manner. Amidst these transports, the blacksmith's aged mother was led forth, leaning upon a staff. Every one made way for her; and she stretched out her hand to bid her son welcome. Being totally blind, she stroked his hands, arms, and face, with great care, and seemed highly delighted that her latter days were blessed by his return,

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return, and that her ears once more heard the music 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 nose and the colour of the skin, there is none in the genuine sympathies and characteristic feelings of our common nature.

“During the tumult of these congratulations, I had seated myself apart, by the side of one of the huts, being unwilling to interrupt the flow of filial and parental tenderness; and the attention of the company was so entirely taken up with the blacksmith, that I believe none of his friends had observed me. When all the people present had seated themselves, the blacksmith was desired by his father to give them some account of his adventures; and silence being commanded, he began; and after repeatedly thanking God for the success 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 success in those parts; and the dangers he had escaped in returning to his native country. In the latter part of his narration, he had frequently occasion to mention me; and after many strong expressions concerning my kindness to him, he pointed to the place where I sat, and exclaimed, *affille ibi siring*, “see him sitting there.” In a moment all eyes were turned upon me; I appeared like a being dropped from the clouds; every one was surprised that they had not observed me before; and a few women and children expressed great uneasiness at being so near a man of such an uncommon appearance. By degrees, however, their apprehensions subsided; and when the blacksmith assured them that I was perfectly inoffensive, and would hurt nobody, some of them ventured so far as to examine the texture of my clothes; but many of them were still very suspicious; and when by accident I happened to move myself, or look at the young children, their mothers would scamper off with them with the greatest precipitation. In a few hours, however, they all became reconciled to me.” With these worthy people our author spent the greater part of two days in feasting and merriment; the blacksmith accompanied him to the capital; and declared, that he would not leave him while he resided there.

KATERS KILL, a western branch of Kaats’ Kill, in New-York State.—*Morse*.

KATHIPPACAMUNCK, an Indian village situated on the north side of Wabash river, at the mouth of Rippacanoë creek, and about 20 miles above the Lower Weau towns. In 1791, before its destruction by Generals Scott and Wilkinson, it contained 120 houses, 80 of which were shingle roofed. The best houses 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 small degree of order and civilization.—*ib*.

KAWAKUSICA, or *Kowfaki*, a lake in the District of Maine, laid down in late maps as the head of Passamaquoddy river. N. lat. 46° 3′.—*ib*.

KAYADAROSSORA CREEK, in New-York State, about 12 miles west of the confluence of Fish-creek and Hudson’s river. The celebrated springs of Saratoga, 8 or 9 in number, are situated on the margin of a marsh formed by a branch of this creek. Also

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. coast of America, lies in north lat. 59° 49′, east long. 216° 58′. In the neighbourhood of this island, Captain Cook discovered several other islands.—*ib*.

KEATE (George, Esq; F. R. S.), descended of an ancient and honourable family, was born about the year 1729 or 1730, and received his education at Kingston school, under the Rev. Mr Woodeson. From thence he went to Geneva, where he resided some years; and during his stay there, became acquainted with Voltaire, with whom he continued to correspond many years after he returned to England. After finishing the tour of Europe, he settled as a student in the Inner Temple, was called to the bar, and sometimes attended Westminster Hall; though he did not meet with encouragement enough to induce his perseverance in his profession, nor indeed does it seem probable that he had sufficient application for it. His first literary performance was “Ancient and Modern Rome,” a poem, written at Rome in the year 1755, printed in the year 1760, and received with considerable applause. The next year he published “A Short account of the Ancient History, Present Government, and Laws, of the Republic of Geneva, 8vo.” This work was compiled during the author’s residence at Geneva; is a very useful one; and is dedicated to Monsieur de Voltaire; to whom he says, “When I reflect, that it was in this Republic, whose government I have attempted to describe, that I was first introduced to your acquaintance; when memory renews the hours of social mirth and refined entertainment which your hospitality and conversation afforded me—I cannot but rejoice in this occasion of expressing my gratitude; proud that, as your friendship distinguished the author of these pages in a foreign country, your name may at home adorn his labour.” It was at one time the intention of Voltaire to translate this account into French, though he afterwards relinquished the design.

The next year, 1762, he produced an “Epistle from Lady Jane Gray to Lord Guildford Dudley;” and in 1763, “The Alps,” a poem; the subject 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 distinguished. Of all the poetical works of Mr Keate, this is entitled to the highest praise for truth of description, elegance of versification, and vigour of fancy.

Continuing to employ the press, in 1764 he published “Netley Abbey,” which he afterwards, in 1769, enlarged and reprinted: and, in 1765, produced “The Temple Student, an Epistle to a Friend;” humourously rallying his own want of application to the study of the law, his preference of the belles lettres, and his consequent want of success in his profession. The death of Mrs Cibber in 1766, of whose merits as an actress he entertained the highest opinion, gave occasion for a poem to her memory, which celebrates her excellent performances on the stage, and laments the loss the theatre would sustain by her death.

In February 1769, he married Miss Hudson; and about the same time published “Ferne; an Epistle to M.

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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'refs Nature, and the world his school,
On soaring pinions borne, to him was given
Th' ærial 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 burgeses 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 1799, 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 sculp-

Keate.

ture 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, *En cycl.*), 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

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 Doddsley 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 Doddsley. 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 ta-

ken. 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 Cobbeconte, 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 basin 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 Taconet 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.*

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

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Kennicott. 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 Chesapeake Bay, bounded E. by New-Castle, and part of Kent county, Delaware, and W. by Chesapeake 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 Chesapeake 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 site 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

Kermes,

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 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 *vermilion*, 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 cinabar.

KERSHAW, a county of Camden district, S. Carolina, on Watree 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 Outagamies, &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 *Kennelworth*, 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 Poughkeepsic.—*ib*.

KINDERHOOK, a post-town in Columbia county,

Kershaw,
Kinderhook.

Kinderhook,
Kingbury.

New-York, on the east side of Hudson's river; 13 miles north of Hudson city, 29 S. by E. of Albany, 145 north of New-York, and 25 W. by N. of Stockbridge in Massachusetts. The township contains 4,661 inhabitants; of whom 411 are electors, and 638 slaves.—*ib.*

KINDERHOOK *Landing*, in the above township, is situated under the bank of the river, surrounded with an uncleared barren country, has about 15 or 20 houses, and nearly as many stores and other buildings; 20 miles S. of Albany. The town, through which the stage to New-York runs is about 5 miles east of the *Landing*.—*ib.*

KING-POST, or KING-PIECE, is a piece of timber set upright in the middle, between two principal rafters, and having struts or braces going from it to the middle of each rafter. See ROOF, *Encycl.*; and CARPENTRY, *Suppl.*

KINGSESS, a township in Philadelphia county, Pennsylvania.—*Morse.*

KING AND QUEEN, a county of Virginia, on Mattapany river, which separates it from King William's county. It is about 25 miles long and 20 broad, and contains 9,377 inhabitants, including 5,143 slaves.—*ib.*

KING GEORGE, an ancient fort on the borders of East-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 slaves.—*ib.*

KINGS, a maritime county of New-York, "containing all that part of the State, bounded easterly by Queen's county; northerly, by New-York county; westerly, partly by Hudson's river, partly by the ocean; and southerly by the Atlantic Ocean, including Coney Islands." This fertile tract of land, situated on the W. end of Long-Island, and separated from Staten-Island by the Narrows, contributes largely to the supply of the New-York market with vegetables, roots, fruits, butter, &c. It is divided into 6 townships, and contains 4,495 inhabitants, including 1,432 slaves. Chief towns, Brooklyn and Flatbush.—*ib.*

KING'S, a county of Nova-Scotia, comprehending the lands on the S. W. and S. sides of the Basin of Minas. The Habitant is navigable for vessels of 40 tons a little way up. The Canaid for vessels of 160 tons, 4 or 5 miles; and the Cornwallis is navigable for vessels of 100 tons 5 miles, for those of 50 tons 10 miles farther. There are considerable settlements on these rivers, and they afford a good portion of fine lands for tillage, and for herbage, and some excellent meadows. In the rivers are found a great abundance of shad of an excellent kind; and in the Basin of Minas are fine cod-fish, haddock, bass, and flat-fish of different kinds.—*ib.*

KING'S BRIDGE, a post-town of New-York, 15 miles north of New-York city, and 29 south-west of Stamford in Connecticut. The bridge here connects New-York island with the main land. It was strongly fortified during the war. The heights about it are commanding.—*ib.*

KINGSBURY, a township in Washington county, New-York, bounded easterly by the tract of land called the Provincial Patent. It contains 1120 inhabitants.—*ib.*

KING'S, or PEARL ISLAND, a small island in the Bay of Panama. It belongs to Spain, and is famous for its pearl fishery; and lies in N. lat. 7° 12', W. long. 81° 36'.—*ib.*

King's,
Kingston.

KINGSTON, or ESOPUS, a post-town of New-York, situated in Ulster county, on the W. side of Hudson's river, six miles W. of Rhinebeck, and on the E. side of Esopus Kill, or Creek. It was destroyed on the 15th of October, 1777, by order of General Vaughan, commanding a fleet which sailed up the Hudson, when large quantities of stores were consumed. It is rebuilt on a regular plan, and contains about 150 houses, a court-house, jail, a Dutch Reformed church, and an academy. It is most pleasantly situated upon and surrounded by a spacious plain. It is 56 miles S. of Albany, and 109 N. of New-York. N. lat. 41° 56', W. long. 73° 56'. The township contains 3929 inhabitants, of whom 556 are electors, and 302 slaves.—*ib.*

KINGSTON, a township in Addison county, Vermont, containing 101 inhabitants.—*ib.*

KINGSTON, a township in Plymouth county, Massachusetts, on the western part of Plymouth Bay, bounded northerly by Duxborough, and contains 1004 inhabitants. There is here a slitting and rolling mill. The town was incorporated in 1707. It is 38 miles S. E. of Boston.—*ib.*

KINGSTON, a township in Rockingham county, New-Hampshire, lying on the road which leads from Exeter to Haverhill, in Massachusetts, 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-Jersey, three miles N. E. of Princeton, and 15 S. W. of Brunswick; an elevated and pleasant spot.—*ib.*

KINGSTON, the chief town of Lenoir county, Newbern district, N. Carolina. It is a post-town, situated in a beautiful plain on the N. side of Neus river, and contains a court-house, jail, and about 30 houses. It is 40 miles W. of Newbern, and 24 from Waynesborough.—*ib.*

KINGSTON, a township in Luzerne county, Pennsylvania.—*ib.*

KINGSTON, a town of Georgetown district, S. Carolina. It is situated on the W. side of Wakkamau river, and contains an Episcopal church, and about 30 houses. It is 41 miles N. by E. of Georgetown, and 103 N. N. E. of Charleston. N. lat. 33° 51', W. long. 79° 1'.—*ib.*

KINGSTON, a village in Talbot county, Maryland, situated on the eastern side of Choptank river, 4 miles below the Forks.—*ib.*

KINGSTON, formerly called *Frontinac*, is situated on the northern part of Lake Ontario, at the mouth of its outlet Iroquois river; 200 miles southward of Montreal, and 150 northward of Niagara. Here the King's stores are kept and guarded by one company of men. Part of Old Fort Frontinac is now standing, the best part of which is the magazine. Kingston contains about 100 houses. Large vessels go no farther than this place; thence to Niagara, &c. stores and merchandize are conveyed in boats.—*ib.*

KINGSTON, the capital of the island of St Vincents, in the West-Indies, and the seat of government, lies

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 Pamunsky 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.*

KJONTONA, 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 vir-

tues 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

Kippis,
||
Kishtac.

Kiskeman-
itas,
||
Knoxville.

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 Harroditown, and about 12 southerly of Danville.—*ib.*

KNOWLTON, a township in Suffex 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 Ten-

nessee, 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, ferrated, 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 petals; 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, ed the sabre that cut it immediately, the stain has not yet left it.

Koraquas. "When the tree grows old, the branches wither, and, in place of milk, the inside appears to be full of powder, which is so pungent, that the small dust which I drew upon striking a withered branch, seemed to threaten to make me sneeze to death, and the touching of the milk with my fingers excoriated them as if scalded with boiling water; yet I everywhere observed the wood-pecker piercing the rotten branches with its beak, and eating the insects, without any impression 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 consistence of gum, and that the kol-quall may be at most but a variety of the *euphorbia officinarum*? From our author's observation, the kol-quall appeared to thrive best on poor, sandy, stony earth, at no great distance from the sea. The Abyssinians employ the milky juice in tanning to take off the hair from the skins, and they make no other use whatever of the tree.

KOONA, a species of *ECHITES* (for which see *Encycl.*), very common in the woods of North Africa. It is a shrub, of which the leaves, when boiled with a small quantity of water, yield a thick black juice, into which the negroes dip a cotton thread. This thread they fasten round the iron of their arrows, in such a manner that it is almost impossible to extract the arrow when it has sunk beyond the barbs, without leaving the iron and the poisoned thread in the wound. The poison of the kooona is said to be very deadly.—*Park's Travels.*

KORAQUAS, a tribe of Hottentots inhabiting a district of South Africa, which M. Vaillant places on the confines of the Nimiqua country (See *NIMIQUEAS, Suppl.*). When our author visited them, the whole tribe was assembled for the election of a chief: and not agreeing among themselves, some blood had been shed, and much more would have been shed, had they not unanimously made choice of him. When he first joined them, the whole horde paid attention to nothing but their quarrel. To see their warmth, one might have supposed 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 spoke at the same time; each endeavoured to drown his neighbour's voice by his own; their eyes sparkled with fury; and amidst this confusion, while they threatened each other in turns, the noise they made became truly dreadful.

Unarmed, and without any precaution, though surrounded by this enraged multitude, our author walked calmly along in the midst of them; and when he reached the kraal, he ordered his tent to be immediately formed, as if he had been surrounded by friends and relations. This appearance, raised suddenly, and as if by magic, before the eyes of the horde, with his fusées, horses, and tent, objects which were all new to them, filled them with admiration. Men, women, and children, motionless, and with their mouths wide open, all stood looking at them with profound silence. Anger, hatred, and every violent passion, seemed by their countenances to be extinguished, and to have given place to more tranquil emotions, to ignorant surprise, and stupid astonishment. Infancy is naturally curious; it is

struck with every thing it sees; and the savage, in this respect, is only a grown-up child. As these savages seemed to wish that he would permit them to examine more closely whatever excited their admiration, he readily condescended to gratify their desire. They approached, surveyed, and handled every thing. But the principal object of general curiosity was his person. They seemed as if they would never be satisfied with looking at his dress. 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 surprised to see his skin white, each felt it, as if desirous to ascertain that what they saw was real.

This comedy continued till the evening; and at length, when the moment of separation arrived, M. Vaillant caused to be hinted to the whole company, that if, two hours after sun-rise next morning, they should not be agreed respecting the choice of a chief, he would immediately leave them. He added, however, that if, on the other hand, they came and presented to him a chief, elected by general consent, he would then load them all with presents, and bestow on him a distinction which would raise him above all his equals, and render the horde one of the most celebrated in the whole country. "But what was my surprise (says he) when I learned the same evening, that on my head the burden of the crown was deposited!" He acquiesced, however; assuring them, that if they would promise 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 strong, and consequently formed by nature for ruling the feeble multitude. He therefore named Haripa chief; and the people appearing to approve of his choice, he commanded silence, and causing the new monarch to approach, placed on his head, with great solemnity, a Dutch grenadier cap, of which the copperplate on the front was ornamented with the arms of Holland. This symbol, *viz.* a lion rampant, having in one of his fore-paws seven arrows, and in the other a naked sabre, could not fail to please the savages, as it exhibited a representation of the weapons peculiar to them, and of the most formidable animal of their country. They testified their admiration in the most expressive manner; and imagined that, superior to kings, the white man during the night had by magic made this crown, merely to adorn their chief, and to afford them pleasure. Vaillant then affixed to the skin, which formed Haripa's dress, several rows of glass beads; gave him a girdle made of a string of very large ones; ornamented his arms with tin bracelets, and suspended from his neck a small padlock, shaped like a butterfly, the key of which had been lost. 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 ships which trade in the Indian seas.

During the ceremony of installation, the whole horde, dumb and motionless through admiration, seemed lost in ecstasy. Haripa himself, though highly gratified, did not dare to make the least movement, and observed a gravity altogether risible. When the inauguration was finished, and he was completely dressed, our author presented

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 assegays 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.

Notwithstanding 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 Hotten-

tots; 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, 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 Pannela, 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, surpris'd 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

Kortright,
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Krishna.

Krisna.

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 Horatzæ, 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 Tunguddra 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 Nair'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 de-

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nied the title of Rajah, instead of which he has the diminutive Râil 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 *Encyclopedia*; 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 founded 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

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Kuara,
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Kumi.

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 $24^{\circ} 33'$ north; its longitude $120^{\circ} 56'$ east from Paris.

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^o 14, and return to N^o 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 chase. 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 independent 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. $127^{\circ} 20'$.—*Morse*.

Kuriles,
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Kyuquot.

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tory.

LABDASSEBA, a tribe of savage Arabs who inhabit the desert 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.

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 folder round the wicks; and the glass retorts were frequently melted

Labora-
tory.

Laboratory.

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 smoking. This cylinder has three branches like a chaffing-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 $2\frac{1}{2}$ 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 $2\frac{1}{4}$ 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 $8\frac{2}{3}$ 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.

Laboratory.

* *Journal*,
August
1798,
note, page
212.

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.

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.

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

Labrador,
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Lacsha.

Lacina.

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 $\frac{3}{4}$ ds 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 $\frac{3}{4}$ ds 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 incubrances: 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 flies 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 *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. $18^{\circ} 47'$, W. long. from Greenwich $139^{\circ} 28'$.—*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 Cabela 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

Ladies,
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Lamanon.

Lamanon.

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 philosophers 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 *rué 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

Lamanon.

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, laden 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
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Lamanon,
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Lamp.

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 character, 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 bijareques 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, with out 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.*

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 volatilized 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

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instantly

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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 ap-

Lamp.

pear 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 in-

tensity 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.

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 $\frac{2}{81} \frac{5}{9}$, and the common lamp $\frac{1}{81} \frac{6}{9}$, 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.

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.

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.

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.

2
Of the relative quantities of light emitted by an Argand's lamp and by a common wax candle.

3
Of the fluctuations of the light emitted by candles.

4
Of the relative quantities of bees-wax, tallow, olive-oil, rape-oil, and linseed-oil, consumed in the production of 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.

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 $\frac{1}{16}$ 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 counter-

balance 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 $\frac{819}{1000}$ ths of a Bavarian pound.

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 colseed, 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.

Lamp.

— of spermaceti ditto.
 — of common lamps.

Lampa,
 ||
 Lancaster.

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
		10	10.000	23.77	23.77
		9 246	8.549	14.18	16.59
Common lamps with	Oil of cole-seed	6.774	4.588	8.81	19.2
		6 524	4.556	9.14	20.06
		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.

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 1736, and that he (the writer), so early as 1764, was one of a party who sailed up the fough 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

Lancaster,
||
Landaff.

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 found on the western coast of Sir Thomas Smith's bay. The southernmost part lies in N. lat. $74^{\circ} 20'$. 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 Chesapeake 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 *Nashuavogg* 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 intervals of land. Cumberly 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 Plue 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 courthouse, 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.

Land's,
||
Lantern.

Lantern,
||
Lapis.

scraped and flanted off, so as that the pieces overlapping each other shall not together exceed the thickness of the plate in any other part. By applying the edges, thus prepared, immediately to each other, and pressing them with pincers, they intimately adhere, and incorporating, form one substance, similar in every respect to the other parts; and thus uniform pieces of horn may be prepared to almost any extent. It is a contrivance little known elsewhere, however simple the process appears to be; and perhaps some minute precautions are omitted in the general description, which may be essential to its complete success.

Such lanterns as these would be very proper for military store houses; and Rochon of the *National Institute* was employed, since the commencement of the present war, to make them, if he could, for the marine store-houses of France. While he was thus engaged, however, it occurred to him, that he might supply the pressing wants of the navy without horn, merely by filling up the interstices of wire-cloth with fine transparent glue. In carrying this thought into execution, he at first tinned the iron wires of the sieve cloth he made use of; but afterwards found it more convenient, in every respect, to give it a slight coating of oil paint to preserve it from rust. The glue he made use of was afforded by boiling the clippings of parchment with the air-bladders and membranes of sea fish; materials which he used, not from any notion that they were preferable to isinglass, but because they were the cheapest he could procure. He added the juice of garlic and cyder to his composition, in such proportions as he found to communicate great tenacity, and somewhat more of transparency than it would have possessed without them. Into this transparent and very pure glue or size he plunged his wire cloth, which came out with its interstices filled with the compound. It is requisite that the size should possess a determinate heat and consistence, concerning which experience alone must guide the operator.

When this prepared wire cloth is fixed in the lantern, it must be defended from moisture by a coating of pure drying linseed oil; but even in this state it is not fit to be exposed to the weather. The ease with which these lanterns are repaired in case of accident, by a slight coating of glue, is pointed out as a great advantage by the inventor; who likewise informs us, that they were used in the expedition to Ireland as signal lanterns, though contrary to his wishes.

LAPIS FUNGIFER, a species of earth found near Rome, Naples, and Florence, of which the following account is taken from the *New Transactions of the Royal Academy of Sciences at Stockholm* for the year 1797: Near Naples the lapis fungifer is found in the chalk-hills like a white stalactites, intermixed with a great many fine roots of shrubs; and near Florence there is a species of it, consisting 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 siliceous earth, 23 argillaceous earth, 7 calcareous earth, and 20 calx of iron, with some white magnesia and vegetable alkali. It is well known, that when this friable species of stone is preserved in cellars and moistened with water, it produces abundance of eatable mushrooms, which in Italy are

highly esteemed and brought to the first tables. Hence the origin of its name.

LAPIS LAZULI, a small rock surrounded with and almost covered by the sea on the coast of Nova-Scotia. It is about 2 miles from Monano Island, and shews the passage into St John's river.—*Morse*.

LARDIZABALA, a new genus of plants belonging to the *diœcia hexandria* of Linnæus. It is a native of Chili, and is thus described in Peroufe's Voyage, from drawings sent to France by La Martiniere. The leaves are alternate, on footstalks inflated at their base. Each leaf is bi-ternate, that is to say, it is divided into three leaflets, each of which is again subdivided into three oval sharp-pointed folioles, which, when young, are entire, but afterwards become obscurely lobed. The flowers, disposed in simple and pendent clusters, grow towards the top of the stem and of the branches in the axillæ of the leaves. The plant is diœcious. At the base of each cluster of blossoms are two small, rounded, oval, floral leaves.

MALE FLOWER.—*Calyx* formed of six expanding leaves, oblong oval, and obtuse, of which the three outermost are the largest. *Corolla* composed of six sharp lanceolated petals, opposite to, and shorter than, the leaves of the calyx. A cylinder rises from the centre of the flower of the length of the petals, terminated by six oblong bilocular anthers, which open from below.

FEMALE FLOWER.—*Calyx*, similar to that of the male flower, but larger. *Corolla* inserted beneath the pistil, composed of six petals, rarely entire, but generally bifid or trifid at their summit: shorter than the leaves of the calyx. *Stamina* six, having the same insertion as the corolla; filaments distinct, broad, very short, surrounding the pistil; *anthers*, six, upright, oblong, acuminate, barren. *Seed bud*, cells, from three to six, oblong, gibbous on the outside, of nearly the length of the corolla; styles none; stigmata, sitting, oblong, permanent. *Berries*, equal in number to the cells, oblong, acuminate (divided into six cells, containing several angular seeds. *Flora Peruviana*).

The general character of the lardizabala evidently places this new genus among the family of the *menispermæ*, to which it is related by its climbing stalk, its bunches of diœcious flowers, by its six petals, stamina, and leaves of its calyx, by its pistil, composed of from three to six cells, which contain as many seeds. It differs from the known genera of this order only in its fruit, which, instead of being monospermous, contains several seeds. This character, which requires the introduction of a new section into the *menispermæ*, strengthens 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 same flower several fruits, with numerous seeds, differ in this particular from all the genera of the *menispermæ*; and by placing between them the lardizabala, we establish a natural transition. In order to confirm these resemblances, it only remains to examine the inside of the fruit, and particularly the structure of the seeds. Those of the *menispermæ* are reniform, at least on the inside, inclosed in a hinged pericarpium, and containing in their upper part a very small dicotyledonous embryo. The characters that we have given of the lardizabala render probable a similar structure in its seeds.

Lapis,
||
Lardizabala.

Large,
||
Latus.

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 Shecatia 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 cimafium, 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; *larne* in French signifying a tear.

LATACUNGA, *Affiento of*, the first jurisdiction to the southward of that of Quito, in Peru. The word *affiento* 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 $55^{\circ} 14' 30''$ S. lat. On its W. side is a river, which is sometimes fordable, but generally passed over a bridge. This *affiento* 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 *affiento* 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 *affiento* 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 *affiento*, 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 tucuyos. The inhabitants of Fugili, 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 Alleghany 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 Kanaway breaks through the Laurel Ridge in its way to the Ohio, in N. lat. $38^{\circ} 30'$, W. long. $81^{\circ} 19'$. 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, chestnut, 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^o 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

of

Latus,
||
Lava.

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 charac-

ter 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 (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 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.

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 opuscles, 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 *conversations*, 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 geometers. 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 geometers, 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, 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*.

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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.

T t

With

Leacock,
||
Lead.

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 Sherucket 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 Muscomy 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 Belkows's Falls at Walpole.—*ib.*

LEBANON, a post-town of Pennsylvania, situated on the south side of Quitapahilla 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.

This design being frustrated by his not obtaining a passage to Nootka Sound, he determined to travel over land to Kamtschatka. 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 Peterburgh. 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 Billings, an Englishman, whom he had known on board Captain Cook's ship. From thence he went to Oczakow, on the coast of the Kamtschatka 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

Ledyard.

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 tinkets, 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 ar-

duous 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.

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 Heboken 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 Russell, 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 Bolton; was incorporated in 1777, and contains 1,170 inhabitants. Housatonic 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.*

Ledyard,
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Leeds.

Leeds,
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Leicester.

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 Frederickburg, 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 Hapae, 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 Loudon 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 Fredericktown in Maryland, 46 north-west of Alexandria, and 64 E. S. E. of Winchester.—*ib.*

LEESBURG, or *Leefstown*, 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 *Lecha*, a river which rises in Northampton county, Pennsylvania, about 21 miles east of Wyoming Falls, in Susquehanna 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:

Leming-
ton,
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Lemion.

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 hepatic 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 hepatic solution itself contains a muriat of iron highly oxygenated, and that therefore *in this process muriatic acid is generated?* This conclusion seemed authorized 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

Lemon,
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Lenfes.

of our readers will be pleased to know a simple method by which they may obtain it in great purity. In the article CHEMISTRY (*Suppl.*), n^o 476, we have shewn from Scheele and Dizé, how to obtain the citric acid perfectly pure, and in the form of crystals; but here we mean nothing more than to shew how it may be completely separated from that slimy substance with which it is always mixed in the lemon, without allowing it time to spoil or to acquire any disagreeable taste during the separation. This we are enabled to do by M. Brugnatelli, who, in the 2d volume of the *Annali di Chimia*, informs us, that he expressed in the common manner the juice of perfectly ripe lemons, and strained it through a piece of linen. In half an hour he strained it again, to free it from a little slimy matter which had settled at the bottom of the vessel. He then added to the juice a certain quantity of the strongest spirit of wine, and preserved the mixture for some days in a well-corked bottle. During that time there was a considerable deposit, which to all appearance was of a slimy nature, and which he separated by filtering paper. If the fluid was too thick to pass through the filter, he diluted it again with spirit of wine. After this operation, the deposit remained on the paper, which was entirely covered with it; and he obtained, in the vessel placed below, the purest acid of lemons combined with spirit of wine.

If it be required to obtain the acid perfectly pure, nothing is necessary but to separate from it the spirit of wine, which can be best effected by evaporation. The acid of the lemons assumes, after it has been freed from the spirit of wine and the moisture combined with it, a yellowish colour, and becomes so strong, that by its taste it might be considered as a mineral acid.

It is not necessary to evaporate the spirit of wine in a close vessel, if the experiment is made only on a small scale; nor is there any danger that in open vessels any of the acid will be lost, as it is too fixed to be volatilised by the same degree of heat at which spirit of wine evaporates. This acid has peculiar properties, which deserve farther examination.

LEMPSTER, an inconsiderable township in Cheshire county, New-Hampshire. It was incorporated in 1761. In 1775 it contained 128 and in 1790—414 inhabitants.—*Morse*.

LENOIR, a county of Newbern-district, N. Carolina, surrounded by Glasgow, Craven, Jones, and Dauphin. It contains 2,484 free inhabitants, and 957 slaves. Chief town, Kingston.—*ib.*

LENOX, the shire town of Berkshire county, Massachusetts. It is a pleasant and thriving town, and has a court-house and gaol. Housatonic river passes through the town. It lies east of Washington, south of Pittsfield, 17 miles south-westerly of Chester, and 145 miles north of Boston.—*ib.*

LENSES (see LENS and DIOPTRICS, *Encycl.*), are either blown or ground.

Blown: LENSES are used only in the single microscope; and the usual method of making them has been to draw out a fine thread of the soft white glass called *crystal*, and to convert the extremity of this into a spherule by melting it at the flame of a candle. But this glass contains lead, which is disposed to become opaque by partial reduction, unless the management be very carefully attended to. We are informed, however, by Mr Ni-

cholson, that the hard glass used for windows seldom fails to afford excellent spherules. This glass is of a clear bright green colour when seen edgewise. A thin piece was cut from the edge of a pane of glass less 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 distance of about an inch from the lower end. The glass became soft, and the lower piece descended by its own weight to the distance of about two feet, where it remained suspended by a thin thread of glass about one five-hundredth of an inch in diameter. A part of this thread was applied endwise to the lower blue part of the flame of the candle without the use of the blow-pipe. The extremity immediately became white-hot, and formed a globule. The glass was then gradually and regularly thrust towards the flame, but never into it, until the globule was sufficiently large. A number of these 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 observes, may prove an acceptable piece of information to those eminent men (and there are many such), whose narrow circumstances, or remote situations, are obliged to have recourse to their own skill and ingenuity for experimental implements.

Ground LENSES, are such as are ground or rubbed into the desired shape, and then polished. Different shapes have been proposed for lenses; but in the article OPTICS, n^o 251 (*Encycl.*), it has been shewn that, after all, the spherical is the most practically useful. By many of the methods of grinding, however, the artificer, with his utmost care, can only produce an approximation to a truly spherical figure; and, indeed, gentlemen have, for the most part, nothing to depend on for the sphericity of the lenses of their telescopes, but the care and integrity of the workmen. In the 41st volume of the Transactions of the Royal Society of London, a machine is described by Mr Samuel Jenkins, which, as it is contrived to turn a sphere at one and the same time on two axes, cutting each other at right angles, will produce the segment of a true sphere merely by turning round the wheels, and that without any care or skill in the workmen. The following description of this machine will enable our readers fully to comprehend its construction, and the mode of using it: A is a globe covered with cement, in which are fixed the pieces of glass to be ground. This globe is fastened to the axis, and turns with the wheel B. C is the brass cup which polishes the glass: this is fastened 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 demonstrably, that the pieces of glass ground by this double motion must be formed into the segments of spheres.

LEO X. is a pontiff to whom learning, and art, and science, are so deeply indebted, that not to give a sketch of his life and character, in a Work of this kind, would be an unpardonable omission. A character of him is indeed given in the *Encyclopadia*; but it is so far from the truth, that it is difficult to conceive the prejudices under which the writer must have laboured by whom it was drawn up.

Leo, whose name, before his elevation to the pontificate, was *Giovanni de Medici*, was the second son of Lorenzo

Lenfes,
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Leo.

Plate
XXXII.

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 con-

Leo.

clave, 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.

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

Leogane,
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Leonin-
ster.

* Dr Ro-
berfsön.

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."

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 *Stelle Informes*, or unformed stars. See *ASTRONOMY*, n^o 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 Genave, and on the north side of the south peninsula the isles Reffis 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 Baradares, 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, 6½ 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 Faulkland'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; 24,526,650lbs. brown sugar; 3,025,604lbs. coffee; 855,447 cotton; 169,305lbs.

Leon,
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Les Cayes.

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 Abacon. 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.

Biographical
Dictionary. 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.

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 authorized 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 Johnion. 18.

Several

Leslie.

Leslie.

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 Germans; 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

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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 plagiarist.

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 plagiarist. 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 *Encyclopadia*, 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 *Encyclopadia*. 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

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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?

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 imparting 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 Clair* 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 Ab-

bé'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 Suffex 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.

* See *Quantity* (*Encycl.*), *Astronomy*, *Dynamics*, *Impulsion*, and *Harrriot*, in this *Suppl.*

Lewis-
town,
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Lexington.

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 musketoos 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. $38^{\circ} 6'$, W. long. $75^{\circ} 18'$.—*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 Cishicoquillis 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. $40^{\circ} 33'$, W. long. $77^{\circ} 23'$.—*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. $38^{\circ} 6'$, W. long. $85^{\circ} 8'$. 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 Lexington, 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 Frederickstown, 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 book to be

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* *History of
Inventions,*
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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 *poncion*, 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, Rucellai or Rucellai, several of whom have distinguished themselves as statesmen and men of letters. This family are descended from a Ger-

man 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 *respia*, 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.

“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

Lichen.

* Lib. xxvii. c. 9.
† *Nova Plantarum genera Florentie*, 1729.

(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.

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Light.

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 lark 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 Goshachguenk; 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, $\frac{1}{30}$ 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 $\frac{1}{25}$ 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 $\frac{1}{2}$ 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 Kington, 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 $\frac{1}{2}$ 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,

Ligonier,
||
Lima.

Lima.

8 to the west, and 6 to the east, besides other streets which run obliquely south-eastward. The 15 streets, running north and south, are crossed by 8 others running east and west, besides several to the southward, not parallel to the former, and others in the eastern parts, which have different directions. The figure of the town is nearly quadrilateral. A diagonal line running east and west, would be 18 furlongs in length; and the southern perpendicular, about 7 furlongs, and the northern about 4 furlongs; so that the city stands on a space of ground nearly equal to a mile and a quarter square. The northern side for about three quarters of a mile next the river, is fortified mostly by redans; the rest of the circuit is inclosed with 34 hollow bastions and their intermediate curtains. The whole is faced with a brick wall, and surrounded with a ditch, but has no covered way, glacis, nor outworks. Eight gates, besides that at the bridge, furnish a communication with the adjacent country. The city stands about 6 miles from Callao, which is the sea-port to Lima, and 180 north-west of Guamanga. The white people in Lima are estimated at about 15,000, and the whole number of inhabitants are about 60,000. One remarkable fact is sufficient to demonstrate 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, caused the streets to be paved with ingots of silver, amounting to 17 millions sterling. All travellers speak with amazement of the decorations of the churches with gold, silver, and precious stones, which load and ornament even the walls. The only thing that could justify these accounts, is the immense riches and extensive commerce of the inhabitants. The merchants of Lima may be said 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 southern provinces are conveyed, in order to be exchanged at the harbour of Lima, for such articles as the inhabitants of Peru stand in need of. The fleet from Europe and the East-Indies land at the same harbour; and the commodities of Asia, Europe, and America, are there bartered for each other. But all the wealth of the inhabitants, all the beauty of the situation, and the fertility of the climate of Lima, are insufficient to compensate for the disaster which threatens, and has sometimes actually befallen them. Earthquakes are very frequent.

Since the year 1582, there have happened about fifteen concussions, besides 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 such violence, that in little more than three minutes, the greatest part, if not all the buildings, great and small, in the whole city, were destroyed; burying under their ruins those inhabitants who had not made sufficient haste into the streets and squares, the only probable places of safety in those terrible convulsions of nature. At length the dreadful effects of the first shock ceased, but the tranquillity was of short duration; concussions returning so repeatedly, that the inhabitants, according to the account sent of it, computed 200 in the first 24 hours; and to the 24th of February, the following year, 1747, when the narrative was dated, no less than 450 shocks were observed: some of which, if less permanent, were equal to the first in

violence. The fort of Callao, at the very same hour, tumbled into ruins. But what it suffered from the earthquake in its buildings, was inconsiderable, when compared with the terrible catastrophe which followed. For the sea, as is usual on such occasions, receding to a considerable distance, returned in mountainous waves, foaming with the violence of the agitation, and suddenly overwhelmed Callao and the neighbouring country. This was not, however, performed by the first swelling of the waves: For the sea retiring further, returned with still greater impetuosity, the stupendous water covering both the walls and other buildings of the place; so that whatever had escaped the first, was now totally overwhelmed by those 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 devastation. Here were then 23 ships and vessels, great and small, in the harbour, of which 19 were sunk, and the other four, among which was a frigate called St Fermin, carried by the force of the waves to a considerable distance up the country. This terrible inundation extended to other parts of the coast, as Cavallos and Guanape; the towns of Chancay, Guaura, and the vallies Della Baranco, Sape, and Pativilca, underwent the same fate as the city of Lima. According to an account sent to Lima after this accident, a volcano in Lucanos burst forth the same night, and ejected such quantities of water, that the whole country was overflowed; and in the mountain near Patas, called Conversiones de Caxamarquilla, three other volcanoes burst, discharging frightful torrents of water; and in the same manner as that of Carguayrasso. Lima is the see of an archbishop, and the seat of an university. The inhabitants are very debauched; and the monks and nuns, of whom there are great numbers, are no more chaste than the rest 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 several observations made for that purpose, stands in lat. $12^{\circ} 2' 31''$ S. and its long. is $75^{\circ} 52'$ W. The variation of the needle is $9^{\circ} 2' 30''$ easterly.—*ib.*

LIMBE, a village in the N. W. part of the island of St Domingo, 7 leagues west by south of Cape Francois.—*ib.*

LIMBERS, in artillery, a sort of advanced train, joined to the carriage of a cannon on a march. It is composed of two shafts, wide enough to receive a horse between them, called the *fillet horse*: these shafts are joined by two bars of wood, and a bolt of iron at one end, and mounted on a pair of rather small wheels. Upon the axle-tree rises a strong iron spike, 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 township in York county, Maine, situated near the confluence of Little Ossipee river with Saco, and opposite Gorham in Cumberland county. It was incorporated in 1787, contains 411 inhabitants and is 114 miles northerly of Boston.—*Morse.*

LIMERICK, a township in Montgomery county, Pennsylvania.—*ib.*

LIMESTONE CREEK, in Tennessee, is the north-eastern branch of Nolachucky river. It rises 22 miles south of Long-Island in Holston river.—*ib.*

LIMIT

Lima,
Limestone.

Limit,
||
Lincoln.

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 $7\frac{1}{2}$ measuring in a straight line south-east of Cape Francois. N. lat. $19^{\circ} 37'$.—*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. $41^{\circ} 46'$, W. long. $73^{\circ} 37'$. 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.*

Lincoln,
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Litchfield.

Litiz,
||
Little.

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 Susquehanna. 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. east-ern 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 Maldonada 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 Gallan

Little.
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Lobos.

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 $14^{\circ} 40' S.$ —*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 $11^{\circ} 30' S.$ 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. $6^{\circ} 25'$ and $6^{\circ} 45' S.$ 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 easternmost 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 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 *surfsolid*, 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 *Tabula Britannica*, 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 $15\frac{1}{2}^{\circ}$ to $18\frac{1}{2}^{\circ}$ N. lat. The whole coast is overspread with islets, 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.

Local,
London
Cove.

London-
derry,
||
Long-
Island.

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 Hempstead

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 Hempstead 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 Isle, or White river, which runs westerly into the river Wabash. The mouth of White river is in N. lat. $38^{\circ} 58'$ W. long. $90^{\circ} 7'$.—*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. $30^{\circ} 30'$ 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, *Kenapaco-maquá*, 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 $34^{\circ} 50'$. 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. $0^{\circ} 20'$, W. long. $80^{\circ} 20'$.—*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 (*En cycl.*) 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

Loudon,
||
Louis.

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 Fauquier 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 Mocaripe, 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 site 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 Ouisconsin, 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 Kanaway.—*ib*.

LOUSA CHITTO, or *Loofa 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 39½ 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,

Louis,
||
Louif-
bourg.

Louisiana. vember, and lasts till May or June; sometimes the frosts set in sooner, and are more intense; as particularly in 1745, when by the middle of October a great part of the harbour was already frozen. The town of Louisbourg stands on a point of land, on the S. E. side of the island; its streets are regular and broad, consisting for the most part of stone houses, with a large parade at a little distance from the citadel; the inside of which is a fine square, near 200 feet every way. On its N. side, while possessed by the French, stood the governor's house and the church: the other sides were taken up with barracks, bomb proof; in which the French secured their women and children during the siege. The town is near half a mile in length, and 2 in circuit. The principal trade of Louisbourg is the cod fishery, from which vast profits accrue to the inhabitants; the plenty of fish being remarkable, and at the same time better than any about Newfoundland. N. latitude $45^{\circ} 54'$, west longitude $59^{\circ} 55'$.—*ib.*

LOUISIANA, a Spanish province of North-America, bounded E. by the Mississippi, S. by the gulf of Mexico, W. by New-Mexico, and N. by undefined boundaries. Both sides of the Mississippi were under the French government till the peace of 1762; when the eastern side was ceded to the king of Great Britain; and the day before the preliminaries of peace were signed, his Christian Majesty ceded to Spain all his territories to the westward of the Mississippi, together with the town of New Orleans; with a stipulation that the French laws and usages should not be altered: this precaution, however, proved afterwards of no avail.

Louisiana is intersected by a number of fine rivers, among which are St Francis, the Natchitoches, the Adayes, or Mexicano river, the Missouri, Rouge, Noir, and many others which are described under their respective 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 Mississippi and its branches, from the bay of Mexico to Ohio river, a distance 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 some plantations of sugar canes; but it is not a crop to be depended upon, as the frost has sometimes been too powerful for that plant. The chief articles of exportation are indigo, cotton, rice, beans, myrtle wax, and lumber.

The climate is said to be favourable for health and to the culture of fruits of various kinds, and particularly for garden vegetables. 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 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.

While the United States were engaged in the revolution war against England, the Spaniards attacked and possessed themselves of all the English posts and settlements on the Mississippi, from the Ibberville up

to the Yazoo river, including the Natchez country; and by virtue of this conquest have since peopled and governed an extent three degrees north of the United States south boundary, claiming the exclusive navigation of the other. This business has been amicably settled by the treaty of 1796.

The Mississippi, on which the fine country of Louisiana is situated, was first discovered by Ferdinand de Soto, in 1541. Monsieur de la Salle was the first who traversed it. He, in the year 1682, having passed down to the mouth of the Mississippi, and surveyed the adjacent country, returned to Canada, from whence he took passage to France. From the flattering accounts which he gave of the country, and the consequent advantages that would accrue from settling a colony in those parts, Louis XIV. was induced to establish a company for the purpose. Accordingly, a squadron of four vessels, amply provided with men and provisions, under the command of Monsieur de la Salle, embarked with an intention to settle near the mouth of the Mississippi. But he unintentionally sailed a hundred leagues to the westward of it, where he attempted to establish a colony; but, through the unfavourableness of the climate, most of his men miserably perished, and he himself was villanously murdered, not long after, by two of his own men. Monsieur Ibberville succeeded him in his laudable attempts. He, after two successful voyages, died while preparing for a third. Crozat succeeded him; and in 1712, the king gave him Louisiana. This grant continued but a short time after the death of Louis XIV. In 1763, Louisiana was ceded to the king of Spain, to whom it now belongs.—*ib.*

LOUISTOWN, in Talbot county, Maryland, lies on the west side of Tuckahoe creek, about 4 miles north of King's Town, and 7 or 8 north-east of Easton.—*ib.*

LOUISVILLE, the present seat of government of Georgia, situated in Burke county, in the lower district 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 state-house, a tobacco warehouse, and about 30 dwelling-houses. Large quantities of tobacco are inspected here, and boated down to Savannah. The convention for the revival of the constitution sat in this town in May, 1795, and appointed the records to be removed, and the legislature to meet here in future. A college, with ample and liberal endowments, is instituted here. It is 52 miles S. E. of Augusta, and 100 N. W. of Savannah.—*ib.*

LOUISIADE, *Land of*, discovered and named by Bougainville in 1768, is probably a chain of islands, forming a south-eastern continuation of New Guinea. The coast seen by the Dutch *Geelwink* Yacht in 1705, is a small distance north of Louisiade.—*ib.*

LOVE-COVE, a fine opening to the westward of Whale Cove, in New North Wales.—*ib.*

LOVELL'S POND, in New-Hampshire, lies at the head of the eastern branch of Salmon Fall river.—*ib.*

LOWANG, a Chinese island of some extent in the neighbourhood of the CHUSAN-Isles, which see in this *Supplement*. Some of the gentlemen belonging to the British embassy went ashore on Lowang, which they described as naked both of trees and of cattle. They examined particularly a small level plain recovered from the sea, which was kept out by an embankment of earth,

Louisiana,
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Lowang.

Lowang,
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Loxa.

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 Rippacanoë 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 Païta, and north-westerly of Borja. It is the capital of a jurisdiction of the same name, and lies in lat. $5^{\circ} 10'$ S. long. $77^{\circ} 10'$ 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. $27^{\circ} 27'$, W. long. $78^{\circ} 5'$.—*ib*.

LUCAYONEQUE, another of the Bahama isles, which lies about 9 leagues further east than the former; whose 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 knolls. A branch joins it from the south.—*ib*.

LUCIA, ST, called by the French, Sainte Aloufie, 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 sustic. The air is reckoned healthy, the hills not being so high as to intercept

Loxodromic,
||
Lucia.

Lucid,
||
Luciole.

Luciole.

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 Carenage, 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 1773; 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 daytime 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

Ludamar. 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,
Lurgan.

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 Susquehanna 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 site 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 Merlignash 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 Ptolemy's catalogue, but 24 in the Britannic catalogue.

LURGAN, a township in Franklin county, Pennsylvania.—*Morse*.

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LUTTERELLE, an island in Machias Bay, in Lutterelle, the District of Maine.—*ib.*

LUTTERLOCK, a township in Orleans county, in Vermont, north of Craftsborough, Iraaburgh, 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 Susquehanna river and its tributaries, which furnish numerous and excellent mill-feats. 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 Susquehanna, 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 Maddison, 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

Y y

12 miles

Lutterelle,
Lynchburg.

Lyndebo-
rough,
||
Lynn.

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 Bilymead 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 *Saugus* 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, Marble-

head, &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 Chesapeake 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 Comte 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.*

Lynnfield,
||
Lystra.

M.

Maatea,
||
Macas.

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 Yaguarfongo; 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

Mac-
Cowan's
||
Machan-
gara.

Machias. 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 Mechiffes, 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 2½ 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.*

Machias.

M A C H I N E R Y.

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 contriv-

ance. 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

Augustan age was the most respectable of all those which were not essentially connected with the management of state affairs. It appears that the architects were all Greeks, or the pupils of Greeks, altogether different from the members of the *Collegium Murarium*, the corporation of builders and masons. The architecture of temples, stadiums, circuses, amphitheatres, seems to have been monopolised, by state authority, by a society which had long subsisted in Asia, connected by certain mysterious bonds, both civil and religious. We find it in Syria; and we learn that it was brought thither from Persia in very ancient times. From thence it spread into Ionia, where it became a very eminent and powerful association, under the particular protection of Bacchus, to whom the members had erected a magnificent temple at Teos, with a vast establishment of priests and priestesses, consisting of persons of the first rank in the state. They were the sole builders of temples and stadiums throughout all Greece and the Lesser Asia; and the contractors for the machinery that was employed in the theatres, and in the great temples, for the celebration of the high mysteries of paganism. By the imperfect accounts which remain of the Eleusinian and other mysteries, it appears, that this machinery must have been immense and wonderful, and must have required a great deal of mechanical skill. This indeed appears, in the most convincing manner, to any person who reflects on the magnificent structures which they erected, which excite to this day the wonder of the world, not only on account of their magnificence and incomparable elegance, but also on account of the mechanical knowledge that seems indispensably necessary for their erection. This will ever remain a mystery. There are no traces of such knowledge to be found in the writings of antiquity. Even Vitruvius, writing expressly on the subject, has given us nothing but what is in the lowest degree of elementary knowledge.

This association of the Dyonisiacs undoubtedly kept their mechanical science a profound secret from the uninitiated, the profane. They were the engineers of antiquity, and Vitruvius was perhaps not one of the initiated. He speaks of Myro and other Greek architects in terms of respect which border on veneration. Perhaps the modern association of free masons 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 considers their works with scientific attention, can doubt of their being deeply versed in the principles of mechanics, and even its more refined branches. They appear to have carried the art of vault-roofing almost to its acmé of perfection; far outstripping their Grecian instructors in their knowledge of this most delicate branch of their art.

It were greatly to be wished that some such institution did yet exist, where men might be induced by the most powerful motives to accomplish themselves in the knowledge necessary for attaining eminence in their profession.

We have been informed (and we thought our authority good), that the King has signified his intention of patronising an institution of this kind. We heard, that it was proposed to institute degrees similar to our university degrees, and proceeding on similar conditions of a regular education or standing, which

would ensure the *opportunities* of information, and also on an examination of the proficiency of the candidate. This examination, being conducted by persons eminent in the profession, perhaps still exercising it, would probably be serious, because the successful candidate would immediately become a rival practitioner. Such an institution would undoubtedly prevent many gross impositions by unlettered mill-wrights and pump-makers, who now seldom appear under any name but that of engineer, although they are frequently ignorant even of the elements of mechanical science, and are totally unacquainted with the higher mathematics; without which it is absolutely impossible for them to contrive a machine well suited to the intended purpose, or to say with any tolerable precision what will be the performance of the engine they have erected. Yet these are questions susceptible of accurate solution, because they depend on the unalterable laws of matter and motion.

All who have a just view of the unspeakable advantages which this highly favoured land possesses in the superiority and activity of its manufactures, and who know how much of this superiority should be ascribed to the great improvements which have been made in practical mechanics within these last thirty years, will join us in wishing success to some such institution as that now mentioned.

We were naturally led to these reflections when we turned our thoughts to machinery in general, and observed what is done in this country by the native energy of its inhabitants, unassisted by such scientific instructions as they might have expected from the pupils of a Newton, their countryman, under the patronage of the best of Sovereigns, eminently knowing in these things, and ever ready to encourage those sciences and arts which have so highly contributed to the national prosperity. What might not be reasonably expected from British activity, if those among ourselves who have knowledge and leisure had been at the same pains with the members of the foreign academies to cultivate the Newtonian philosophy, and particularly the more refined branches of mechanics, and to deduce from their speculations maxims of construction fitted to our situation as a great manufacturing nation? But such knowledge is not attainable by those who are acquainted only with the imperfect elements contained in the publications read by the bulk of our practitioners. Much to this purpose has been done on the continent by the most eminent mathematicians; but from want of individual energy, or perhaps of general security and protection, the patriotic labours of those gentlemen have not done the service to their country which might have been reasonably expected. Indeed, their dissertations have generally been so composed, that only the learned could see their value. They seem addressed only, or chiefly, to such; but it is to those authors that our countrymen generally have recourse for information concerning every thing in their profession that rises above mere elementary knowledge. The books in our language which profess to be systems of mechanics rarely go beyond this: they contain only the principles of equilibrium. These are absolutely necessary 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 state of equilibrium. The machine must 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 *Encyclopædia*, 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 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 IMPULSED 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 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^o 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

liarily, 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.

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

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Examined

* Page 7.

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.

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 sink 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, *sua mathefi 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.

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.

7
Mechanical equilibrium.

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.

8
Distinctions must be made in the nature of the powers applied to working machines.

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 swiuple with a momentum sufficient for shaking off the ripe grains from the stalk. We had sufficient proof of this, by taking off the swiuple 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 fending 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 artificers 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.

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

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The inertia of the machine itself must also be considered,

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 $\frac{1}{20}$ 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.

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Measure of
it by A-
montons.

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^o 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

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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.

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

$$\frac{p m - r + f n}{x m^2 + a + y n^2} \quad (\text{I.}) \text{--- See ROTATION, n}^\circ 64, \text{ \&c. } \textit{Encycl.}$$

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,

$$\text{Velocity of impelled point} = \frac{p m^2 - r + f m n}{x m^2 + a + y n^2} \quad (\text{II.})$$

15
Velocity of the working point.

$$\text{Velocity of working point} = \frac{p m n - r + f n^2}{x m^2 + a + y n^2} \quad (\text{III.})$$

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

$$\text{of } p \text{ is now } \frac{p m^2 - r m n}{p m^2 + r n^2}.$$

Let g be the velocity which gravity generates in a second. Then it will generate the velocity $g t$ in the moment 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 = $g t - \dot{v}$. For, had it fallen freely, it would have acquired the velocity $g t$, whereas it only acquires the velocity \dot{v} . In like manner, had r fallen freely, it would have acquired the velocity $g t$. But, instead of this, it is raised with the velocity $\frac{n}{m} \dot{v}$. The

change on it is therefore = $g t + \frac{n}{m} \dot{v}$. 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.

$$\text{That is, } p \times g t - \dot{v} \times m = r \times g t + \frac{n}{m} \dot{v} \times n$$

$$\text{Or } p m g t - p m \dot{v} = r n g t + r \frac{n^2}{m} \dot{v}$$

$$\text{Or } p m^2 g t - p m^2 \dot{v} = r m n g t + r n^2 \dot{v}$$

$$\text{Or } \frac{p m^2 - r m n}{p m^2 + r n^2} \times g t = \frac{p m^2 + r n^2}{p m^2 + r n^2} \times \dot{v}$$

$$\text{That is, } p m^2 + r n^2 : p m^2 - r m n = g t : \dot{v}$$

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 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;

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Angular motion of the machine.

14
Velocity of the impelled point.

g 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 $p m^2 + a + y n^2$ will be to $p m^2 - r + f m n$ 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 $= \frac{p m n - r + f n^2}{p m^2 + a + y n^2} s$.

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 $\frac{2}{8} s$, $= \frac{1}{4} s$. 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.

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,

$$\text{Work done} = \frac{p m r n - r + f r n^2}{p m^2 + a + y n^2} g t. \quad (\text{IV.})$$

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 $r + f r n^2$, 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 $n = 0$, 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 $r + f$, and of x to $a + y$, 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 $r + f$, and of x to $a + y$, 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 . Let 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 vari-

able magnitude in the formula $\frac{p m r n - r + f r n^2}{p m^2 + a + y n^2}$, 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

$$= m \frac{\sqrt{x^2 (r + f)^2 + p^2 x (a + y)} - x (r + f)}{p (a + y)}$$

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Perform-
ance of the
machine.

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Proportion
of the ma-
chine
which
gives the
greatest
work.

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 $= \frac{r+f}{2a+y} \times \left(\sqrt{\frac{p^2 a+y}{r+f^2 x} + 1} - 1 \right) g t$. 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 $= \frac{p}{2 \sqrt{x a + y}}$. 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

$2r$ to p , or $n = m \times \frac{p}{2r+f}$. In this case, the velocity of the working point is $\frac{p^2}{4x(r+f) + \frac{ap^2}{4(r+f)}}$.

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

$$n = m \frac{\sqrt{p^2 \times r + f^2 + p^3 \times a + r} - p \times r + f}{p \times a + r}$$

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

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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 $p r m n - r + f r n^2$ 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 $r + f = \frac{21}{20} r$, 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 $\frac{2}{3}$ 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

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 $\frac{pmn - r + fn}{am^2 + a + yn^2}$ 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.

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. 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 $pm - r + fn$, or $p - fm - rn$, 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 again, 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.

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 con-

tinually; and, in a certain state of motion, $r + fn$ 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.

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 those 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

3. Increase of resistance very imperfectly known.

20
Causes why machines do not continually accelerate.

1. Increase of friction.

2. Resistance of air.

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 by 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 preponderance, 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 necessary velocity for a continued discharge.

21. These and similar examples shew the great difference between the statical and dynamical equilibrium of machines, and the necessity of a scientific attention by all who wish to improve practical mechanics. Without this, and even a pretty refined attention, we cannot see the connection between a copious supply of water to the bucket wheel and a plentiful discharge by the pump. We believe, that the greatest part of those employed in erecting machines conceive it as owing to the greater weight of water impelling the wheel with greater force; but we see that there is no difference in the pressures on the mill at rest, and the mill doing its work steadily and uniformly, with any velocity, however great. Without keeping the notions of that part of the impelling power which supports distinct from that of the part which accelerates, we shall 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 pressure excited by it at the working point; that is, without perceiving in what cases it is opposed to inertia, and in what to the mechanical properties of tangible matter. This only can inform us at what rate the resistance varies by a change of velocity; and when it happens that this augmentation, necessarily accompanied by an augmentation of all the frictions, and the resistance of the air, is in equilibrio with the whole of the impelling power, and all acceleration is at an end.

22. The chief cause is a real diminution of power. Lastly, another chief cause of the finally uniform motion of machines is, that, in most cases, an increase of velocity produces a real diminution of impelling power. We hardly know any exception to this besides the employment of *one* descending weight as a power or first mover. Most of the powers which we employ reside in bodies external to the machine; and these bodies must be put in motion, and continued in that motion, in order to continue their pressure on the impelled point. Frequently a great part of the power is employed in giving this necessary motion to the external matter, and the remainder only is employed in pressing forward the machine. We mentioned a remarkable instance of this in the operation of thrashing. Now, the power thus employed must increase 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 diminished. The acceleration is therefore diminished, and may cease. At *last* the actual pressure is so much diminished, that it is no more than what is necessary for overcoming the increased resistance of the work, the increased friction. The machine therefore accelerates no more, but moves uniformly.

This cause very general. This cause of the diminution of power by an increase of velocity, obtains in all cases where the strength of animals, of springs, the force of fired gunpowder, &c. is exerted. In some cases, the visible effect is not very considerable; as in the employment of a strong spring, the force of gunpowder, and a few others. In the action of animals, this defalcation of power is very great when the velocity is considerable. Nay, even in the action of gravity, although it acts as strongly on a bo-

dy in rapid motion as on one at rest, yet when gravity is not the immediate agent, but acts by the intervention of a body in which it resides, the necessity of previously moving this body frequently diminishes the acceleration which it would otherwise produce. Thus, in an overshot wheel, if the water be delivered into the bucket with a velocity (estimated in the direction of the part of the wheel into which it is delivered) less than that of the rim of the wheel, it must retard the motion; for it must be immediately dragged into that motion; that is, part of the accelerating overplus, already acting on the wheel, must be employed in accelerating this new bucket of water, and this must lessen the general acceleration of the machine. Hence we learn, that the water must be delivered on the wheel with a velocity that is at least not less than that of the wheel's motion.

The case in which we see this diminution of power on machines most distinctly is, when water or wind, acting by impulse alone, is our moving power. Since the mutual impulses of bodies depend entirely on their relative motions (see *IMPULSION, Suppl.*), it follows, that when the velocity of the impelled point is augmented, the impulsion, or effective pressure, must be diminished. Nay, this velocity may be so increased, that there shall be no relative motion, and therefore no impulsion. If the floats of an undershot wheel be moving with the velocity of the stream, they remain conjoined in their progress, but without any mutual action. Therefore, when an undershot wheel is set into a running water, the first impulses are strong, and accelerate the wheel. This diminishes the next impulsion and acceleration: but the wheel is still impelled and accelerated; less and less in every succeeding moment, as it moves faster; by and bye, the acceleration becomes insensible, 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 discern the very small additions which are still made to the velocity. All this happens generally after a very moderate time, by reason of various other obstructions.

It obtains in all machines actuated by impulsion.

Animal action is subject to the same variation. We know, that there is a certain rate at which a horse can run, exhausting or employing his whole strength. If he be made to drag any the smallest load after him, he must employ part of his force on it, and his speed will be checked. The more he is loaded with a draught, the slower he will run, still employing all his strength. The draught may be increased till he is reduced to a trot, to a walk, nay, till he is unable to draw it. Now, just inverting this process, we see, that there is a certain strain which will sufficiently tire the horse without stirring from the spot, but which he could continue to exert for hours. This is greater than the load that he can just crawl along with, employing his strength as much as would be prudent to continue from day to day. And, in like manner, every lesser draught has a corresponding rate, at which the horse, employing his whole working strength, can continue to draw at during the working hours of a day. At setting out, he pulls harder, and accelerates it. Following his pull, he walks faster, and therefore pulls less (because we are still supposing him to employ his whole working strength). At last he attains that speed which occupies his whole strength in merely continuing the pull.

Or by the force of animals.

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 $3\frac{1}{2}$ pounds, or $\frac{1}{4}$ 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 pul-

ley. 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 equilibrio 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. :

In all working machines which have acquired a uniform motion, the performance of the machine is equal to the momentum of impulse (A).

25
Second principle. Momentum of impulse and the performance of the machine are equal.

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 those 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 slope 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 .

3 A 2

Let

(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 1736, 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 10th 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*, 1747 and 1752.

Let $e - m$ be called the RELATIVE VELOCITY, and let it be expressed by v . And let it be supposed, that it has been discovered, by any means whatever, that the actual pressure varies in the proportion of v^q , or $e - m^q$. This supposition gives us $e^q : v^q = f : p$, and $\dot{p} = f \times \frac{v^q}{e^q}$. For the machine must be at rest, in order that the agent may be able to exert the force f on its impelled point. But when the machine is at rest, what we have named the relative velocity is e , the whole of the extinguishing velocity.

The momentum of impulse is $p m$, that is $\frac{v^q}{e^q} f m$, or $f \times \frac{v^q}{e^q} \times \overline{e - v}$ (because $m = e - v$). Therefore $f \times \frac{v^q}{e^q} \times \overline{e - v}$ must be made a maximum. But f and e^q are two quantities which suffer no change. Therefore the momentum of impulse 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 $q e v^{q-1} \dot{v} - (q+1) v^q \dot{v}$. This being supposed $= 0$, we have the equation

$$q e v^{q-1} \dot{v} = (q+1) v^q \dot{v}$$

$$\text{And } q e = (q+1) v$$

$$\text{Therefore } v = \frac{q e}{q+1}$$

And m , which is $= e - v$, becomes $\frac{e}{q+1}$. Therefore we must order matters so, 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 $= f \times \frac{q^q}{q+1^q}$. And $p m$,

$$= f \frac{q^q}{q+1^q} m, = f \frac{q^q}{q+1^q} \times \frac{e}{q+1}, = f \times \frac{q^q e}{q+1^{q+1}}, =$$

the momentum of impulse, and therefore $=$ the momentum of effect, or the performance of the machine, when in its best state.

Thus may the maxim of construction be said to be brought to a state of great simplicity, and of most easy recollection. A particular case 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 impulse of fluids must be as the square of the relative velocity. From which Mr Parent deduced, that the most advantageous velocity of the floats of an undershot wheel is one-third of that of the stream. This maxim is evidently included in our general proposition; for in this case, the index q of that function of the relative velocity v , which is proportional to the impulse, is $= 2$. Therefore we have the maximum when

$$v = \frac{2 e}{2+1}, = \frac{2}{3} e, \text{ and } m = \frac{1}{3} e. \quad e, \text{ the extinguishing}$$

velocity, is evidently the velocity of the stream. Our proposition also gives us the precise value of the performance. The impulse of the stream on the float at rest being supposed $= f$, its impulse on the float moving with

the velocity $\frac{2}{3} e$ must be $= \frac{4}{9} f$. This is the measure of

the actual pressure p . This being multiplied by m , or

by $\frac{1}{3} e$, gives $\frac{4}{27} f$. Now f is considered as equal to the

weight of a column of water, having the surface of the floatboard for its base, and the depth of the sluice under the surface of the reservoir (or, more accurately, the fall required for generating the velocity of the stream) for its height. Hence it has been concluded, that the utmost performance of an undershot wheel is

to raise $\frac{4}{27}$ of the water which impels it, to the height

from which it falls. But this is not found very agreeable to observation. Friction, and many imperfections of execution in the delivery of the water, the direction of its impulse, &c. may be expected to make a deduction from this theoretical performance. But the actual performance, even of mills of acknowledged imperfection, considerably exceeds this, and sometimes is found nearly double of this quantity. The truth is, that the particular fact from which Mr Parent first 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 selected, the least calculated for being the foundation of a general rule, being of a nature so abstruse, that the first mathematicians of Europe are to this day doubtful whether they have a just conception of its principles. Mr Smeaton's experiments shew very distinctly, that the maximum of performance of an undershot wheel corresponds to a velocity considerably greater than one-third of the stream, and approaches nearly to one-half; and he assigns some reasons for this which seem well founded. But, independent of this, the performance of Mr Smeaton's model was much greater than what corresponds with the velocity by the above mentioned estimation of f . The theory of the impulsion of fluids is extremely imperfect; and Daniel Bernoulli shews, from very unquestionable principles, that the impulse of a narrow vein of fluid on an extended surface is double of what was generally supposed; and his conclusions are abundantly confirmed by the experiments adduced by him.

It is by no means pretended, that the maxim of construction is reduced to the great simplicity enounced in the proposition now under consideration. We only supposed, that a case had been observed where the pressure exerted by some natural agent did follow the proportions of v^q . This being admitted, the proposition is strictly true. But we do not know any such case; yet is the proposition of considerable use: for we can affirm, on the authority of our own observations, that the action both of men and of draught horses does not deviate very far from the proportions of v^2 . The observations were made on men and horses tracking a lighter along a canal, and working several days together, without having any knowledge of the purpose of the observations. The force exerted was first measured by the curvature and weight of the track rope, and afterwards by a spring steelyard. This was multiplied by the number of yards per hour, and the product considered as the momentum. We found the action of men to be very nearly as $e - m^2$. The action of horses, loaded so as not to be able to trot, was nearly as $e - m^{1.7}$,

The practitioner can easily avail himself of the maxim, although the function q should never be reduced to any algebraic form. He has only to institute a train

28
Example in
undershot
mills by
Mr Pa-
rent

29
This sub-
stitute is
useful, even
where it
is not alto-
gether ex-
act.

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 maximum.

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 br , b being an abstract number. Let x 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 $br : p = m : n$,

$$\text{and } n = \frac{pm}{br} = \frac{\frac{q^l}{q+1} fm}{br} = m \frac{q^l f}{q+1 br}, \text{ or } m : n = q+1 \times br : q^l f.$$

2. On the other hand, when $m:n$ is already given, by the construction of the machine, but br 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 pm , that is, by $fe \times \frac{q^l}{q+1^{l+1}}$. 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.

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 farther 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 accele-

Recapitulation.

rations 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.

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 coming 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 formulæ contained in the first part of this article.

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,

31
Theory of machines still intricate, especially of such as reciprocate.

32
Working and returning strokes.

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.

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.

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.

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

33
Uniformity of motion throughout is of great advantage.

34
How to attain this.

35
Best forms for the teeth of wheels.
Plate XXXIII.
fig. 1.

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.

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 $\frac{1}{80}$ 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.

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 defaultory 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

Epicycloids
recom-
mended by
De la Hire.

36
A better
form.

37
Maxim for
the con-
struction
of stamp-
ers, &c.

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.

38
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 *toasted* 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 stroke, 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.

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

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Nature, operation, and use of a FLY.

(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.

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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

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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 Valoué'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.

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.

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A bad construction of a fly.

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 pen-

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A conical pendulum is the most perfect regulator.

dulums, the time of a revolution is determined. Thus, if the length of each pendulum be $39\frac{1}{2}$ 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.

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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 caught 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 Elbing-roda 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.

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.

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

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Simplicity of construction recommended.

Fig. 30
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Example of a very simple and powerful capstan.

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 friction, 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.

M A C

Mac-Intosh,
||
Macoketh.

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. $69^{\circ} 14'$, 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 *Mocoketh, River, Great*, empties into the Mississippi from the N. W. in N. lat. $42^{\circ} 23'$. *Little Macoketh* falls through the E. bank of the Missis-

M A C

siippi, 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;

Macopin,
||
Macpherson.

Macpher-
son. 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 tagging 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

Macpher-
son. 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 OSSIANS, *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 *Fiinne Maccuil* (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 *Stramazhie*; a man of native genius, and though not possessed of very extensive erudition, well acquainted with Gaelic poetry.

Macpher-
son.

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 ori-

ginal; 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.

Macpher-
son.

Macpher-
son.

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 favours 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.

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 Mahomed 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,

Macpher-
son,
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Mad.

Madame,
||
Magdalen.

MADAME, *Ile*, forms the N. E. side of the Gut of Canfo, 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 Strafford 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 *Iles*, 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
||
Magellania.

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,

Magel-
lania.

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.

M A G N E T I S M,

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.

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 philosophizing. 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 philosophizing 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 ferrugineous 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.

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.

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

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His treatise
contains
many discoveries.

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We can only
class the
phenomena.

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.

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.

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 basin 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 by.

The position thus affected by a rod of iron is called by Dr Gilbert the **MAGNETICAL POSITION OF DIRECTION**. It is not the same, nor parallel, in all parts of the earth, as will be more particularly noticed afterwards.

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.

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.

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

6
MAGNETICAL POSITION.

7
Second fact.
Iron attracts and repels iron.

8
This action mutual.

9
Not peculiar to magnets or loadstone; Gilbert

5
First leading fact.
Iron arranges itself in a particular position.

Plate XXXIV.

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.

IO
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.

II
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.

14
The law of attraction and repulsion is of difficult investigation.

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.

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.

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

$$p \times f, 15 = m \times f, 30$$

$$\text{And } p : m = f, 30 : f, 15; \text{ for the same reason}$$

$$p : m = f, 75 : f, 30$$

$$\text{Therefore } f, 15 : f, 30 = f, 30 : f, 75.$$

But it is well known that

$$\text{Sine } 15 : \text{Sine } 30 = \text{Sine } 30 : \text{Sine } 75.$$

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 d , and if a be a constant quantity, nearly equal to two-thirds of the length of the needle, we have f proportional to $\frac{d-a^2}{d}$.

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.

It is a matter of experience, that when two magnets are taken, each of which is as nearly equal as possible to 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, 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

16

Attempt to explain the phenomena without a precise knowledge of this law.

pears

15
Judicious
experiments by
Mr Lambert.

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^o 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 Oq take Om, Op, On, Oq, respectively equal to Ns, Nn, Ss, Sn; and let MPNQ be a curve line, having Oq for its axis and asymptote; and let the curve, in every part, be convex towards its axis. Then draw the ordinates mM, pP, nN, qQ, 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 mM represents the attraction of the north pole N of the magnet A for the south pole s of the magnet B; pP represents the repulsion of N for n; nN represents the repulsion of S for s; and qQ 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 mp, or nq, is equal to that of B. Mm, Pp, and Nn, Qq, 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 Mm and Qq will always exceed the sum of Pp and Nn; 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 PZQ'. For this curve, having Oq for its asymptote (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 asymptote in the remote parts. But there will be an arch MPZ between Z and O, which is concave toward the asymptote. In which case, it is possible that Mm + Qq shall be less than Pp + Nn; 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 asymptote 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 asymptotic axis.

It will greatly aid our conceptions of the combined actions of the four magnetic poles, if we notice some of the primary properties of a curve of this kind, limited by no other condition.

Draw the chords MQ, PN, MP, NQ. Bisect them in B, D, E, F, and join EF. Draw the ordinates Ee Ff, and BD b (cutting EF in C). Draw Pu parallel to the axis, cutting Ee in e. Draw also Qi parallel to the axis, cutting Ff in φ. Also draw FHL parallel

17
Unquestionable inferences from the phenomena.

to the axis, and $P o t$ parallel to $Q N$; and draw $PL l$, and $P e x$, cutting $M m$ in l and x .

Let each ordinate be represented by the letter at its intersection with the axis. Thus, the ordinates $M m$ and $Q q$ may be represented by m and q , &c.

Because MP is bisected in E , $M t$ is double of $E e$; $M l$ is double of EL ; $M x$ is double of $E e$. Also, because $P t$ is parallel to $Q N$, and $P u$ to $Q i$, we have $t u = N i$. From these premises, it is easy to perceive, that,

1. $B b = \frac{m + q}{2}$.
2. $D b = \frac{p + n}{2}$.
3. $BD = \frac{m + q - p + n}{2}$.
4. $M u = m - p$.
5. $u t = n - q$.
6. $M t = m - p - n - q$.
7. $E e = \frac{m + p}{2}$.
8. $F f = \frac{n + q}{2}$.
9. $M l = \frac{m + p - n + q}{2}$.
10. $EL = \frac{m + p - n + q}{2}$.
11. $CD = \frac{m + q - p + n}{4}$.
12. $CH = \frac{m + p - n + q}{4}$.

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 $m + q - n + p$; 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 $m - p - n - q$; 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.

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 $m - p - n - q$.

Now $m + q - p + n$ is evidently equal to $M t$, or to twice $E o$, 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 $m p$, $p n$, $n q$, remain as before. In this case it is plain, that $M u$, the difference of $M m$ and $P p$, will increase faster than $t u$ or $N i$, the difference between $N n$ and $Q q$. Therefore $M t$ will increase; that is, the attraction will increase.

3. By increasing the length of A , while the distance between them remains the same. For $O m$ remaining the same, as also $m p$ and $n q$, while $n q$ is only removed farther from $m p$, it is plain $M u$ remains the same, and that $N i$ and $t u$ are diminished; therefore $M t$ must increase, or the attraction must increase.

4. By increasing the length of B , the distance between them remaining the same. For this increases $m p$ and $n q$; and consequently increases $M u$ and $t u$. But $M u$ increases more than $t u$; and therefore $M t$ 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 asymptotic 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.

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

19
And of their repulsions.

20
Seeming exceptions obviated.

18
Explanation of the observed attraction of magnets,

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
DIREC-
TIVE POW-
ER explain-
ed.

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'*B*n'*, 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 mea-
sure.

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 *ns* 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'B's'*, 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 ex-

press 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.

The directive power of A, and the polarity of B, are increased,

23
How in-
creased and
diminished.

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.

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.

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Circum-
stances af-
fecting the
proportion
of the at-
tractive
and direc-
tive pow-
ers.

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.

25
The polari-
ty of a small
magnet
may be
great while
the attrac-
tion is in-
sensible.

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 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 tl , which is equal to twice oL . Now se is equal to Pp , or to p ; and sl is equal to $Pp - Ff$, or to $Pp - Qq - Ff$, or to $Pp - Qq - o$. Therefore $oL = Pp - Qq$, and $tl = 2(Pp - Qq) = 2(p - q)$.

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 ng is removed farther from the part mp . 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 Ee 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.

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 nb , while N repels n with a force no , somewhat smaller than nb . These two compose the force nd . In like manner, the two forces se and sf , exerted by N and S on the pole s , compose the force sq . 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 nb and se are equal, as also the forces nc

and sf . These must compose two forces nd and sq , which are equal, and equally inclined to ns ; 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 nc , while S attracts it with a force nb (smaller than nc , because the distance is greater). These two compose a force nd considerably different from the direction cn of its axis. In like manner, the south pole s of the small magnet is acted on by two forces se and sf , exerted by the two poles of A, which compose a force sq nearly equal and parallel to nd , 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 nd or sf . 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.

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, dc . 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 dg . 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.

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 this function by observation of the position of the needle.

Let NS (fig. 5. n^o 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 bd , as the sine of the angle HBS to the sine of KBN . Therefore, because BG and BN are equal, we have $Bb : Bc = GE : NF$.

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Means of acquiring a near measure of the law of action.

28
Law of action investigated—MAGNETIC CURVE.

26
Peculiarities of oblique positions of two magnets.

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 difficult 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 $m = \frac{\text{Log. SK} : \text{NK}}{\text{Log. SB} : \text{NB}} - 1$. 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 $SB = 5\frac{1}{3}$, $NB = \frac{2}{3}$, $SK = 11.49$, and $NK = 3.37$. This gives $m = 1.97$, which differs from 2 only $\frac{1}{50}$ th part. Finding it to 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 $\frac{1}{2}$, $\frac{2}{3}$, and $\frac{3}{4}$ 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 Gottingen, 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 magnetic 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^o 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.

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 same manner as the great magnets. Happening to set it off to a good distance on the table, as at F, he was surprised to see it immediately turn round on its pivot, and arrange itself nearly in the opposite direction. Bringing it back to D restored it to its former position. Carrying it gradually out along DF, perpendicular to NS, he observed it to become sensibly more feeble, vibrating more slowly; and when in a certain point E, it had no polarity whatever towards A and B, but retained any position that was given it. Carrying it farther out, it again acquired polarity to A and B, but in the opposite direction; for it now arranged itself in a position that was parallel to NS, but its north pole was next to N, and its south pole to S.

This singular appearance naturally excited his attention. The line on which the magnets A and B were placed had been marked on the table, as also 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 such things were no entertainment. Next day, wishing to repeat them to some 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 considerable verticity, turning its north pole toward the magnet B; and it required to be taken farther out, toward F, before it became neutral. While standing there, something chanced to joggle the magnets A and B, and they instantly rushed together. At the same instant, the little magnet or needle turned itself briskly, and arranged itself, as it had done the day before, at F, quivering very briskly, and thus shewing great verticity. This naturally surprised 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 position. It was very amusing to observe how the simply separating the magnets A and B, or bringing them together, made the needle assume such a variety of positions and degrees of vivacity in each.

The needle was now put in various situations, in respect to the two great magnets: namely, off at a side, and not in the perpendicular DF. In these situations, it took an inconceivable variety of positions, which could not be reduced to any rule; and in most of them, it required only a motion of one of the great magnets for an inch or two, to make the needle turn briskly round on its pivot, and assume a position nearly opposite to what it had before.

But all this was very puzzling, and it was not till after several 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 assistance, however, they are very clear, and very instructive.

Nothing hinders us from supposing the magnets A and B perfectly equal in every respect. Let NHM, NEL, be two magnetic curves belonging to A; that is, such that the needle arranges itself along the tangent of the curve. Then the magnet B has two curves SGK, SEI, perfectly equal, and similar to the other

two. Let the curves NHM and SGK intersect in C and F. Let the curves NEL and SEI touch each other in E.

The needle being placed at C, would arrange itself in the tangent of the curve KGS, by the action of B alone, having its north pole turned toward the south 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 these positions, but an intermediate one, nearly bisecting 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 position nearly bisecting 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. These actions being supposed equal and opposite, it will have no verticity, or will be neutral, and retain any position that is given to it.

The curve SEI intersects the curve NHM in P and Q. The same reasoning shews, that when the needle is placed at P, it will arrange itself with its north pole on the angle SPH: but, when taken to Q, it will stand with its north pole in the angle EQM.

From these facts and reasonings we must infer, that, for every distance of the magnets A and B, there will be a series of curves, to which the indefinitely short needle will always be a tangent. They will rise from the adjoining poles on both sides, crossing diagonally the lozenges formed by the PRIMARY OR SIMPLE curves, as in fig. 6. These may be called COMPOUND OR SECONDARY magnetic curves. Moreover, these secondary curves will be of two kinds, according as they pass through the first or second intersections of the primary curves, and the needle will have opposite positions when placed on them. These two sets of curves will be separated by a curve GEH, in the circumference of which the needle will be neutral. This curve passes through the points where the primary curves touch each other. We may call this the *line of neutrality* or inactivity.

We now see distinctly the effect of bringing the magnets A and B nearer together, or separating 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 *second* intersection (such as F) of two magnetic curves, and the needle will take a subcontrary position. By drawing them farther from each other, E may be in the *first* intersection of two magnetic curves, and the needle will take a position similar to that of C.

If the magnets A and B are not placed so as to form a straight line with their four poles, but have their axes making an angle with each other, the contacts and intersections of their attending curves may be very dif-

ferent from those now represented; and the positions of the needle will differ accordingly. But it is plain, from what has been said, that if we knew the law of action, and consequently the form of the primary curves, we should always be able to say what will be the position of the needle. Indeed, the consideration of the simple curves, although it was the mean of suggesting to the writer of this article the explanation of those more complicated phenomena, is by no means necessary for this purpose. Having the law of magnetic action, we must know each of the eight forces by which the needle is affected, both in respect of direction and intensity; and are therefore able to ascertain the single force arising from their composition.

Secondary curves of repulsion.

When the similar poles of A and B are opposed to each other, it is easy to see, that the position of the needle must be extremely different from what we have been describing. When placed anywhere in the line DF, between two magnets, whose 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 position of the magnets gives another set of secondary curves, which also cross the primary curves, passing diagonally through the lozenges formed by their intersection. But it is the other diagonal of each lozenge which is a chord to those secondary curves. They will, therefore, have a form totally different from the former species.

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Remarks on this investigation.

The consideration of this compounded magnetism is important in the science, both for explaining complex phenomena, and for advancing our knowledge of the great desideratum, the law of magnetic action. It serves this purpose remarkably. By employing a very small needle, the points of neutrality ascertain very nearly where the magnetic curves have a common tangent, and shew the position of this tangent. By placing the two magnets so as to form various angles with each other, we can, by means of these neutral points, know the position of the tangent in every point of the curve, and thus can ascertain the form of the curve, and the law of action, with considerable accuracy. The writer of this article took this method; and the result confirmed him in the opinion, that it was in the inverse duplicate ratio of the distances. The chief (perhaps the only) ground of error seemed to be the difficulty of procuring large magnets, having the action of each pole very much concentrated. Large magnets must be employed. He attempted to make such, consisting of two spherical balls, joined by a slender rod. But he could not give a strong magnetism to magnets of this form, and was forced to make use of common bars, the poles of which are considerably diffused. This diffusion of the pole renders it very difficult to select with propriety the points from which the distances are to be estimated, in the investigation of the relation between the forces and distances.

He tried another method for ascertaining this so much desired law, which had also the same result. Having made a needle consisting of two balls joined by a slender rod, and having touched it with great care, so that the whole strength of its poles seemed very little removed from the centres of the balls, he counted the number of horizontal vibrations which it made in a gi-

ven time by the force of terrestrial magnetism. 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 south. In this situation he counted the vibrations made in a given time. He then raised it up above the centre of the large magnet, till the distance of its poles from those of the great magnet were changed in a certain proportion. In this situation its vibrations were again counted. It was tried in the same way in a third situation, considerably more remote from the great magnet. Then, having made the proper reduction of the forces corresponding to the obliquity of their action, the force of the poles of the great magnet was computed from the number of vibrations. To state here the circumstances of the experiment, the necessary reductions, and the whole computations, would occupy several pages, and to an intelligent reader would answer little purpose. Mr Lambert's excellent dissertation in the 22d vol. of the *Mem. de l'Acad. de Berlin*, will shew the prolixity and intricacy of this investigation. Suffice it to say, that these experiments were the most consistent with each other of any made by the writer of this article, with the view of ascertaining the law of magnetic action; and it is chiefly from their result that he thinks himself authorized to say, with some confidence, that it is inversely as the square of the distance. These experiments were first made in a rough way in 1769 and 1770. In 1775, observing that Mr Æpinus seemed to think the action inversely as the distance (see his *Tentam. Theor. Electr. et Magn.* § 301. &c.), they were repeated with very great care; and to these were added another set of experiments, made with the same magnet and the same needle, placed not above the magnet, but at one side (but always in the line through the centre, perpendicular to the axis, so that the actions of the two poles might be equal). This disposition evidently simplifies the process exceedingly. The result of the whole was still more satisfactory. This conclusion is also confirmed by the experiments of Mr Coulomb in the *Memoirs of the Academy of Sciences at Paris* for 1786 and 1787. It would seem therefore to be pretty well established. Another method, which seems susceptible of considerable accuracy, still remains to be tried. It will be mentioned in due time.

Such then are the general laws observed in the mutual action of magnets. We think it scarcely necessary to enter into a farther detail of their consequences, corresponding to the innumerable varieties of positions in which they may be placed with respect to each other. We are confident, that the sensible actions will always be found agreeable to the legitimate consequences of the general propositions which we have established in the preceding paragraphs. We proceed therefore to consider some physical facts not yet taken notice of, which have great influence on the phenomena, and greatly assist us in our endeavours to understand something of their remote cause.

Magnetism, in all its modifications of attraction, repulsion, and direction, is, in general, of a temporary or perishing nature. The best loadstones and magnets, unless kept with care, and with attention to certain circumstances, are observed to diminish in their power. Natural loadstones, and magnets made of steel, tempered as hard as possible, retain their virtue with greatest obstinacy

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Magnetism is temporary and perishing.

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 found, 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 expe-

ditated by any of the other causes, particularly by heat or by knocking.

On the other hand, magnetism is acquired by the same means, when some other circumstances are attended to.

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Magnetism may be acquired,

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, attraherat ferrea ramento, 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.

1. By magnetical position,

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. Transf.* 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).

2. By hammering;

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

3. By heating;

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 appone versorio excito; stat versorium, nec ad tale ferrum convertitur: sed statim ut primum de candore aliquantum 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 by; 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.

THE whole may be comprehended in one proposition, which may be said to contain a complete theory of magnetism.

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Communi-
cation 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.

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.

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Attractive
power
communi-
cated.

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 show 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.

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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^o 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^o 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.

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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^o 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^o 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.

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

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Exception explained.

to

to C will also shew C to be a fourth 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^o 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 equatorial 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 magnetic 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 reactions; and we should expect, what really happens in the present case, namely, that red hot iron should not be rendered magnetical and attractable.

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 Ce, and let this be very carefully marked. Now bring a great bar of iron s Bz near to the other end of the magnet. We shall instantly perceive the wire Ce approach to the south pole of the magnet, taking a position Cf. Withdraw the bar of iron, and Cf will fall back into the position Ce. 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

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Magnetism
not impaired
by communica-
tion.

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Therefore
nothing is
transfer
red.

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.

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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.

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.

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

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Magnetism
of iron is
transitory
and indiffe-
rent; but
that of
magnets
is durable
and deter-
minate.

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MAGNE-
TISM OF
INDUC-
TION.

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Tempered
steel ac-
quires du-
rable mag-
netism.

some days, though the bar be kept with care; but the dissipation diminishes fast, and it retains at least one-third of its greatest power for any length of time, unless carelessly kept or injudiciously treated.

Steel tempered for strong cutting tools, such as chisels, punches, and drills for metal, acquires magnetism still more slowly by induction, and acquires less 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 possible, is much longer in acquiring all the magnetism which simple juxtaposition can give to it. It acquires less than the former; but it retains it with great firmness, and finally retains a much greater proportion.

Such ores of iron as are susceptible of magnetism, are nearly like hard steel in these respects; that is, in the time necessary for their *greatest* impregnation, and in the durability of the acquired magnetism. They differ exceedingly in respect to the degree of power which they can attain by mere juxtaposition, and the varieties seem to depend on heterogeneous mixture. We must observe, that few ores of iron are susceptible of magnetism in their natural state. The ordinary ores, consisting of the metal in the state of an oxyd, and combined with sulphur, are not magnetizable while remaining in that state. Most ores require roasting, and a sort of cementation, in contact with inflammable substances. This matter is not well understood; but it would seem that complete metallization is far from being the most favourable condition, and that a certain degree of oxydation, and perhaps some other composition, yet unknown, make the best loadstones. But all this is extremely obscure. The late Dr Gowin Knight made a composition which acquired a very strong and permanent magnetism, but the secret died with him. Dr Gilbert speaks of similar compositions, in which ferruginous clays were ingredients; but we know nothing of the state of the metal in them, nor their mode of acquiring magnetism.

It is of peculiar importance to remark that the acquisition of magnetism is gradual and progressive, and that the gradation is the more perceptible in proportion as the steel is of a harder temper. When a magnet is brought to one end of a bar of common iron, its remote extremity, unless exceedingly long, acquires its utmost magnetism immediately. But when the north pole of a magnet is applied to one end of a bar of hard steel, the part in contact immediately becomes a south pole, and the far end is not yet affected. We observe a north pole formed at some distance from the contact, and beyond this a faint south pole. These gradually advance along the bar. The remote extremity becomes first a faint south pole, and it is not till after a very long while (if ever) that it becomes a simple, vigorous, north pole. More frequently it remains a diffused and feeble north pole: nay, if the bar be very long, it often happens that we have a succession of north and south poles, which never make their way to the far end of the bar. This phenomenon was first observed (we think) by Dr Brook Taylor, who gives an account of his observations in the *Philosophical Transactions*, n^o 344.

From the account we have given of these phenomena of induced magnetism, it appears that the temporary magnetism is always so disposed that the sum of the

mutual attractions of the dissimilar poles exceeds the sum of the repulsions between the similar poles, and that therefore the two magnets tend to each other. This is evidently equivalent to saying, that a piece of unmagnetic iron is always attracted by a magnet. No exception has ever been observed to this fact; for Pliny's story of a Theamedes, or loadstone, which repels iron, is allowed by all to have been a fable.

We think ourselves authorized to say that this attraction of the loadstone for iron, or this tendency of iron to the loadstone, is a secondary phenomenon, and is the *consequence* of the proper disposition of the induced magnetism. The proofs already given of the compound nature of this phenomenon, namely, that it arises from the excess of two attractions above two repulsions, need (we imagine) no addition. But the following considerations place the matter beyond doubt:

1. The magnetism of the two poles is evidently of an opposite nature; the one repelling what the other attracts. If the one attracts iron, therefore, the other should repel it. But each pole, by inducing a magnetism opposite to its own, on the nearest end of the iron, and the same with its own on the remote end, and its action diminishing with an increase of distance, there must always be an excess of attraction, and the iron must be attracted.

2. Each of the magnets A and B, in either of the positions represented in fig. 12. would alone attract the piece of common iron C. But when placed together, the south 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 south pole. If their actions be nearly equal, the weight of C cannot be supported by the magnetism induced by any difference of action that may remain. While C is hanging by B alone, let A be gradually brought near; it gradually destroys the action of the north pole of B, so that C gradually loses its magnetism and polarity, and its weight prevails.

3. In all those cases where the induction of magnetism is slow, the attraction is weak in proportion. This is particularly remarked by Dr Gilbert. If we take pieces of common iron, and of steel of different tempers, but all of the same size and form, we shall find that the iron is much more strongly attracted than any of the rest, and that the attraction for each of them is weaker in proportion as they are harder. This diversity is so accurately observed, that when the piece is thoroughly susceptible of magnetism, we can tell, with considerable precision, what degree will be ultimately acquired, and how much will be finally retained. Also, the attraction of the magnet for any of those pieces of steel increases exactly in proportion as their acquired magnetism increases.

4. An ore of iron incapable of acquiring magnetism is not attracted by a magnet. But we know that, by cementation with charcoal dust, they may be rendered susceptible of magnetism. In this state they are attracted. It is an universal fact, that any substance that is attracted by a magnet may be rendered magnetical, and that none else can. We have already observed that red hot iron is not attracted; nor does it acquire any directive power while in that state. From all this we must conclude, that the previous induction of magnetism is the mean of the observed attraction of magnets for iron, and that this is not a primary fact in magnetism.

These

44
Induction
of magne-
tism is gra-
dual and
progressive.

45
Iron is at-
tracted on-
ly because
it becomes
magneti-
cal.

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.

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 out 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 float 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.

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

47
Remarks
on the the-
ories by im-
pulsion.

* See VA-
RIATION,
Encycl.
p. 621.

work. "Magnetica frustra (that is, substances susceptible of magnetism) bene et convenienter intra vires posita, mutuo cohærent. Ferramenta, presente magnetæ (etiam si magnetem non attingant), concurrunt, sollicitè se mutuo quærent, et amplexantur, et, conjuncta, quasi ferruminantur." Scobs ferrea, vel in pulverem redacta, filibus imposita chartaceis—supra lapidem meridionaliter locata, vel propius tantum admota, in unum coalescet corpus; et subito tam multæ partes concreverunt et combinantur; ferrumque aliud affectat conjuratorum turba et attrahit, ac si unum tantum et integrum esset ferri bacillum; dirigiturque supra lapidem in septentriones et meridiem. Sed cum longius a magnetæ removeantur (tanquam soluta rursus) separantur, et diffuunt 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 mechanicæ, i. e. per impulsum, producat. Mirum est, effluvia, quæ ferrum agitare valent, bractæas aureas *interpositas* ne vel minimum a loco movere. Lucretii et Cartesii theoriam, de fugato intermedio aëre, refutat experimentum infra aquam institutum. *Sulci in limatura ferri, magneti in plano cujusvis meridiani circumposita, non sunt ab effluviis secundum istos canales motis, sed ex inde, quod ipsa ramenta, magneticæ 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 frigescente, 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 permittantur, ut qui prius septentriones respiciebat nunc austrum respicit; quod ictu forti ad medium, virtutem illam prorsus 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 labra vasis aquam, cui innatet, continentis, posita, labrum vicinissimum continuo, et cum impetu petat (A)." *Nat. MS. in Prop. 23. ii. Prin.*

48
Filings are
weakly at-
tracted.

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, $m-p - n-q$, is therefore ex-

remely small in proportion to its directive power, $m+p - n+q$. 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.

If a paper be laid above the magnet, and the filings be sprinkled on it, we observe them to congregate 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 ns (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 ns nearer to the horizon than the position no , 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 equilibrium with the magnetic repulsion sd , 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 no , 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 ns , 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.

49
Curious
fact.

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 sounce, 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.

50
Filings ar-
range in
magnetic
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

51
Also in
secondary
curves.

(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 same way, by strewing iron filings round the magnets. Many representations have been given of these curves by different authors, particularly by Muschenbrock, in his *Essais de Physique*; and by Fufs in the *Comment Petropolit*. Great use has been made of these arrangements of filings by two magnets in the theories of magnetism proposed by those who insist on explaining all motion by impulse. When the dissimilar poles of two magnets A and B (fig. 14.) face each other, the curves formed by the filings considerably resemble those which surround a single magnet, and give the whole somewhat of the appearance of a magnet with very diffused poles. The arranging fluid, which streams from one pole of a magnet, is supposed to meet with no obstruction to its entry into the adjoining pole of the other magnet, but, on the contrary, to be impelled into it; and therefore (say the proposers) 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 similar poles front each other; for example, the poles from which the arranging fluid issues, then the two streams meet, obstruct each other, accumulate, and, by this accumulation, cause the magnets to recede from each other; which we call the repulsion of the magnets. This is the only explanation of this kind that can make any pretensions to probability, or indeed that can be conceived. For how the free circulation in the former case can bring the two magnets together, no person can form to himself any conception. We see nothing like this produced by any vortex that we are acquainted with. All such vortices cause bodies to separate. But even this explanation of magnetic repulsion is inadmissible. It will not apply to the repulsion of the receiving poles; and the phenomena of the filings are inconsistent with the notion of accumulation. The filings indeed accumulate, and they look not unlike two streams which oppose each other, and deflect to the sides (See fig. 15.): But, unfortunately, by tapping the paper gently, the filings do not move off from the magnets, but approach them much faster than in any other experiment. The phenomenon receives a complete and palpable explanation from the principles we have established. Both magnets concur in giving the same polarity to every particle of the filings. Thus, if the fronting poles are north poles, each particle has its nearest end made a vigorous south pole, and its remote end a north pole; and it is therefore strongly attracted towards both magnets while it is arranged in the tangent to the secondary curve of that class, which crosses the others nearly at right angles.

Since it is found, that the magnetism, even of natural loadstones and hard steel, and still more those of softer tempered steel, are continually tending to decay; and since we find that it may be induced by mere approach to a magnet; and since we know that magnets may oppose, each other in producing it—it is reasonable to suppose, that when a piece of iron has acquired a

slight, though permanent magnetism, by the vicinity of a magnet, a magnet applied in the opposite direction will destroy it, and afterwards produce the opposite magnetism.

Accordingly, we may change the poles of soft magnets at pleasure.

Farther; since we find that loadstones and hard tempered steel bars are distinguished from soft ones only by the degree of obstinacy with which they retain their present condition, we should also expect that hard magnets will even affect each other. It must therefore happen, that a powerful magnet applied to a weak one, so that their similar poles are in contact, shall weaken, destroy, and even change the the magnetism of the weaker. Dr Knight's famous magazine of magnets enabled him to change the poles of the greatest and the strongest natural loadstone, or artificial magnet, that could be given him, in the space of one minute.

We now see clearly the reason why magnetic repulsion is weaker than attraction at the same distance. When magnets are placed with their similar poles fronting each other, in order to make trials of their repulsion, they really do weaken each other and are not in the same magnetical condition as before. For similar reasons, we see how experiments with magnets attracting each other rather improve them, and make their attractive powers appear greater than they are. All these effects must be most remarkable in soft magnets, especially when long.

We also see, that the observed law of attraction and repulsion between two magnets must be different from the real law of magnetic action. For, in the experiments made on attraction at different distances, beginning with the greatest distance, the magnetism is continually increasing, and the attraction will appear to increase in a higher rate than the just one; the contrary may happen, if we begin with the smaller distances. The results of experiments on repulsion must be still more erroneous; because it is easier to diminish any accumulation which required an exertion to produce it, than to push it still farther.

We have now a complete explanation of the remarkable fact, that the induction of magnetism does not weaken the magnet employed; but, on the contrary, improves it. The magnetism induced on the iron causes it to act on the magnet employed in the very same manner that a permanent magnet of the same shape, size, and strength, would do. Nay, it will have even a greater effect; for as it improves the magnet, its own induced magnetism will improve; and will therefore still farther improve the magnet.

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 position; but it always puts common iron into a state which increases its own magnetism. This has been known as long as magnetism itself; and the ancients conceived the notion, that the magnet somehow fed upon the iron (B).

53
Attraction must appear to exceed repulsion.

54
The observed law differs from the true.

55
Magnetism improves by inducing it on iron.

56.

We

(B) So Claudian.—“ Nam ferro nurunt vitam, ferrique vigore
Vescitur, hoc dulces epulas, hoc pabula novit
Hinc proprias renovat vires, hinc suta per artus
Aspera secretum servavit alimenta vigorem
Hoc absente perit trilli morientia torpent
Membra fame, venatque sitis consumit apertas.”

Pliny says, “ Sola hæc materia (ferrum) vires ab eo lapide, accipit retinetque longo tempore, aliud apprehendens ferrum, ut annulorum catena spectetur interdum, quod imperitum vulgus ferium appellat vivum.”

52
Magnets must affect each other.

We think that these observations authorize 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, constricting 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 constricted. 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 found. 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 this operation was to leave the end at which we began the stroke possessed 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).

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.

59.
Method of
double
touch.

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 $\frac{1}{4}$ 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.

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.

This

This is in evident conformity to the general facts of induced magnetism, and affords the strongest proof that nothing is communicated in this operation, but that powers residing in the bars are excited, or brought into action. The manipulation merely *gives occasion* to this action, as a spark of fire kindles a city.

There still remain some circumstances of this method, as practised by Savery, Canton, and Antheaume, which are extremely curious and important.

Mr Savery had observed a small bit of steel acquire very sensible magnetism by lying long in contact with the lower end of a great window bar. Telling this to a friend, he was, for the first time, informed that this had been long observed, and that Dr Gilbert had made some curious inferences from it. Mr Savery wanted some magnets, and was at a distance from town. Reflecting, like a philosopher, on what he had heard and observed, he saw here a source of magnetism which he could increase, in the manner commonly practised in making magnets. He placed the bar AB (fig. 21.) to be magnetised 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 loadstone, on its ends; and with those ends he rubbed the bar AB, rubbing the upper half of it with the end F, and the lower with the end E. The result of this was a very brisk magnetism in a few minutes, which, by various well devised alternations, he brought to its highest degree. His numerous experiments published in the Philosophical Transactions in 1746, contain much curious information, highly deserving the attention of the philosophers. Mr Canton, proceeding on the same principle, that bars of iron, which have been long in a vertical position, acquire an efficient magnetism, begins his operations by placing his steel 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 strictly to the inferences from the principle of terrestrial magnetism, and repeats precisely the previous disposition of things practised by Mr Savery, placing his little steel bar AB (fig. 22.) between two great bars C and D of common iron, and arranging the whole in the magnetic direction. Then, proceeding most judiciously on the same principle, he greatly improves the process, 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 these five bars is a north pole, and the upper end a south pole. Therefore the poles F and G concur in giving the proper magnetism to the portion FG of the steel bar which is between them; and by rubbing it with these poles up and down, overpassing each extremity about half an inch, he must soon give to the bar AB a regular magnetism; weak, perhaps, but to be afterwards increased in the Cantonian method, on a horizontal table. In this manner did Mr Antheaume make magnets of very great strength in 1766. See his *Dissertation* already quoted.

These observations naturally bring us to the *PHYSIOLOGIA NOVA DE MAGNET ET CORPORIBUS MAGNETICIS* of Dr Gilbert; a discovery which the sagacious Kepler classes among the greatest in the annals of science.

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It could not be that a phenomenon so general, and so interesting and important as the natural polarity of magnetic bodies, would be long known without exciting curiosity about its cause. Accordingly the philosophers of the 16th century speculated much about it, and entertained a variety of opinion, if that can be called an opinion which can hardly be said to express a thought. We have in *Marigli Ficino* a short notice of many of these opinions. Some maintained that the needle was directed by a certain point in the heavens, as if that were saying more than that it always pointed one way. Others, with more appearance of reasoning, ascribed the direction to vast magnetic rocks. But all this was without giving themselves the trouble of trying to ascertain what situation of such rocks would produce the direction that is observed. Fracastori was, if we mistake not, the first who thought this trouble at all necessary; and he observes very sensibly, that if those rocks are supposed to be in any place yet visited by navigators, and if they act as loadstones do (a circumstance which he says must 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 inaccessible polar regions, but not in the very pole. Norman, the discoverer of the dip of the mariner's needle, or of the true magnetic direction, was naturally led by his discovery to conceive the directing cause as placed in the earth; because the north point of the needle, in every part of Europe, points very far below the horizon. But although he calls the treatise in which he announces his discovery the *New Attractive*, he does not express himself as supposing 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 Colchester that we owe the opinion now universally admitted, that magnetic polarity is a part of the constitution of this globe. Norman had, not long before, discovered, that if a steel needle be very exactly balanced on a horizontal axis, like the beam of a common balance, so that it would retain any position 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 equilibrium, but (at London) the north point of it will dip 72 or 73 degrees below the horizon. He did not, however, publish his discovery till he had obtained information how it stood in other parts of the world. The differences in the variation in different places naturally suggested the necessity of this to him. Being a maker of mariners compasses, and teacher of navigation in London, he had the fairest opportunities that could be desired, by furnishing dipping needles to such of the navigators, his scholars, as he knew most able to give him good information. And the accounts which he received made his discovery, when announced to the world, a very complete thing; for the commanders of ships 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 depressed, and that the south end dipped in like manner at the Cape of Good Hope, and in the Indian Ocean; that the needle gradually approached the horizontal position as the ship approached the equator, but

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 equatorial 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 magnetice*; 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 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.

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

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Daniel Bernoulli's dipping needle.

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 $1\frac{1}{2}$ 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.

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 contipated 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 Ber-*

lin, 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 Chuchman 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 series; but the reflecting reader will be very sensible of them, if he only supposes 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

See VARIATION, *Encyc.*

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Opinions concerning the great magnet contained in this globe.

known with the variations, they appear so irreconcilable 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 elevés, 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.

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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 Petersburg 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 short 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.

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^o 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

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Confirmations of Dr Gilbert's physiology.

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 authorized 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.

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^o 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 shew 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.

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

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Seeming
objection
deduced
from the
want of
sensible at-
traction.

69
This com-
pletely an-
swered.

content ourselves with supposing the action to be inversely as the distance.

Let $AN = AS = a$; $BN = b$; $Cn = c$, $AC = d$, $BC = s$; 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,

$$1. \text{ Action of AN on C } s = \frac{m}{d-a-c}.$$

$$2. \text{ ——— AN on C } n = -\frac{m}{d-a+c}.$$

$$3. \text{ ——— AS on C } s = -\frac{m}{d+a-c}.$$

$$4. \text{ ——— AS on C } n = \frac{m}{d+a+c}.$$

$$5. \text{ The whole action } = \frac{8 m a c d}{(d^2 - a + c)^2 \times (d^2 - a - c)^2}.$$

$$6. \text{ If } c \text{ be very small in comparison with } a \text{ or } b, \text{ the whole action of A is very nearly } = \frac{8 m a c d}{d^2 - a^2}.$$

$$7. \text{ And the tendency of C to B is, in like manner, } = \frac{8 b c s}{s^2 - b^2}.$$

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,

$$8. \text{ The directive power of A } = \frac{4 m a}{d^2 - a^2}.$$

$$9. \text{ The directive power of B } = \frac{4 b}{s^2 - b^2}.$$

When these directive powers are made equal, by placing C at the proper distances from A and B, we have,

$$10. 4 m a : 4 b, \text{ or } m a : b = d^2 - a^2 : s^2 - b^2$$

And $m a s^2 - m a b^2 = b d^2 - b a^2$
 $m a s^2 = b (d^2 - a^2) + m a b^2.$

$$11. s^2 = \frac{b}{m a} (d^2 - a^2) + b^2.$$

$$12. s = \sqrt{\frac{b}{m a} (d^2 - a^2) + b^2}.$$

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.

$$\alpha : \beta = \frac{8 m a c d}{(d^2 - a^2)^2} : \frac{8 b c s}{(s^2 - b^2)^2}, \text{ which, by n}^\circ 10. \text{ is}$$

$$= \frac{8 (d^2 - a^2) c d}{(d^2 - a^2)^2} : \frac{8 (s^2 - b^2) c s}{(s^2 - b^2)^2} = \frac{d}{d^2 - a^2} : \frac{s}{s^2 - b^2}$$

$$= b d : m a s; \text{ that is,}$$

$$13. \text{ Attr}^n \text{ of A : attr}^n \text{ of B } = b d : m a s.$$

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 attrⁿ of A : attrⁿ of B = 1 : 1000 very nearly; and there-

fore 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.

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.

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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 physicae 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 magnetizable 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 magnetic. 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 crystalline 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.

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.

73
Natural causes of the changes of the magnetic direction.

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 $13^\circ 30'$ west in 1724, while at the head of the island it was only 5° . The dip at the Lagoon was $63^\circ 30'$, 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 Sussari, 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 those 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 de-

metallization. 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 Bessledt 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 $2\frac{1}{2}$ 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.

But

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Speculations about
the origin
of magnetism. Hypothesis of
Æpinus.

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 *virtus 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

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 condensation 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 equalizing 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^o 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 unequal distribution; as is the case with induced electricity.

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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 nB 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^o 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 cbd (fig. 27), while the natural density is represented by the ordinates to the line CbD , parallel to sn . 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 cbd 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 Mm , Pp , Nn , Qq , of fig. 2.; of which the property (deduced from the single circumstance of its being convex toward the axis) is, that $Mm + Qq$ is greater than $Pp + Nn$. 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 $Pp - Qq$ 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 $Mm - Nn$ of the attraction of the redundant fluid in AN above the repulsion of the redundant iron in AS: and this excess is greater than the other; for $m + q$ is greater than $p + n$.

The piece of common iron nB 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 condensed 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 condensed 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*.

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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^o 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 af-

terwards; at present, the *hypothesis* is, that it does not escape.

If the key and wire have the position fig. 10. n^o 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 fourth pole of the magnet.

If they be presented as in n^o 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^o 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.

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.

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 nCs, 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 nCs 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.

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.

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

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Explanation of the directive power, and of polarity.

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Explanation of the curves formed by iron filings.

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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^o 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.

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 great-

est when $\frac{\text{Cof. } dpf}{dp}$ is a maximum, or (nearly) when

Sin. $dpf \times \text{Cof. } dpf$ is a maximum: but this depends

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.

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 ferruginous 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.*) &

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.

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 immoveable

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Farther
grounds
of belief.

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Probability
of the
existence
of a mag-
netical
fluid.

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.

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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. Elec. 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 $n^{\circ} 3$. there is still a force operating at n , tend-

ing 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 $n^{\circ} 4$. 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.

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 condensation 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 condensed 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

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Defects of this reasoning.

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 in-

terfection 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 decomposes 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.

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 constricted in another, and perceive the abstraction and constriction 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,

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Hypothesis
of Prevôt.

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Remarks
on hypo-
theses.

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 curvilinear 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.

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—

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The preceding theory is not a hypothesis.

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Analogy of magnetism and electricity.

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.

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.

Muschenbroek 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, 1753.

Æpini item Comment. Petrop. nov. tom. x.

Anton. Brugmanni tentam. Phil. de materia Magnetica, Francquæ, 1765.

There is a German translation of this work by Eifenbach, 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, Fufs, 1782.

Essai sur l'Origine des Forces Magnetiques par Mr Prevost.

Sur les Aimans artificielles par Rivoir, Paris 1752.

Dissertatio de Magnetismo par Sam. Klingentier 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 irreconcilable with the acknowledged laws of impulsion.

Si quid novisti rectius istis, candidus imperti—si non—his utere mecum.

A P P E N D I X.

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 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 = ϕ , and CBA = ψ ; then CAH = ϕ , and CBH = $-\psi$; also CL = $AC \times \phi$, and CK = $-BC \times \psi$. Now $HC : CL :: AC : AM = \frac{AC^2 \times \phi}{HC}$; and for the same reason $BC = -\frac{BC^2 \times \psi}{HC}$. Therefore since $AF : FB :: AM : BC$, $AF : FB :: \frac{AC^2 \times \phi}{HC} - \frac{BC^2 \times \psi}{HC}$, and $AF : AB :: \sin. \psi^2 \phi : -\sin. \psi^2 \phi - \sin. \phi^2 \psi$; wherefore if $AB = a$, $AF = \frac{-a \phi \sin. \psi^2}{\psi \sin. \phi^2 + \phi \sin. \psi^2}$.

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 $AF = \frac{AB \times AC^{m+1}}{B e^{m+1} - A e^{m+1}}$; and since

$$AC = \frac{a \sin. \psi}{\sin. (\phi + \psi)}, \text{ and } BC = \frac{a \sin. \phi}{\sin. (\phi + \psi)}, \text{ we}$$

$$\text{have by substitution } AF = \frac{a \sin. \psi^{m+1}}{\sin. \phi^{m+1} - \sin. \psi^{m+1}} =$$

$$\frac{a \phi \sin. \psi^2}{\psi \sin. \phi^2 + \phi \sin. \psi^2}. \text{ Hence, } \sin. \phi^2 \times \psi \sin. \psi^{m+1} +$$

$$\phi \sin. \psi^{m+3} = -\sin. \psi^2 \times \phi \sin. \phi^{m+1} + \phi \sin. \psi^{m+3},$$

$$\text{and therefore } \psi \sin. \psi^{m-1} = -\phi \sin. \phi^{m-1}; \text{ and also, } \int \psi \sin. \psi^{m-1} + \int \phi \sin. \phi^{m-1} = C.$$

5. These fluents are easily found when m is any whole positive number.

If $m = 1$, we have $\psi + \phi = o$.
 $m = 2$, $\psi \sin. \psi + \phi \sin. \phi = o$.
 $m = 3$, $\psi \sin. \psi^2 + \phi \sin. \phi^2 = o$.
 $m = 4$, $\psi \sin. \psi^3 + \phi \sin. \phi^3 = o$, &c.
 Therefore, &c.

Also if $m = 1$, $\phi + \psi = C$.
 $m = 2$, $\cos. \phi = \cos. \psi = C$.
 $m = 3$, $-\sin. 2 \phi + 2 \phi - \sin. 2 \psi + 2 \psi = C$.
 $m = 4$, $\cos. 3 \phi - 9 \cos. \phi + \cos. 3 \psi - 9 \cos. \psi = C$, &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 $m = 2$, $\cos. \phi + \cos. \psi$ 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 $\phi \times \psi$ 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 = Nb, 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 κ being applied above, and B g below, the intersection is in d. The curve has a branch extending below A; and if D e be made = DE, and B e be drawn, it will be an asymptote 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, n^o 65. Addition to a hypothesis of the celebrated astronomer Tobias Mayer n^o 65. 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 Bassin'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

th

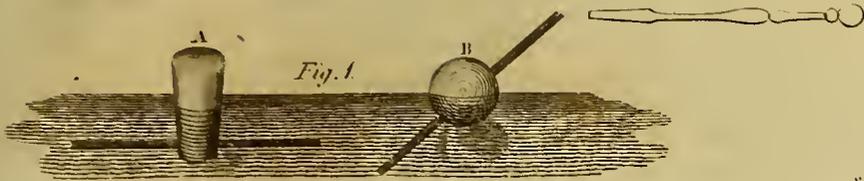


Fig. 1.

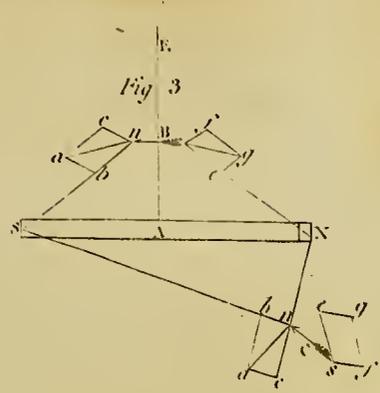


Fig. 3.

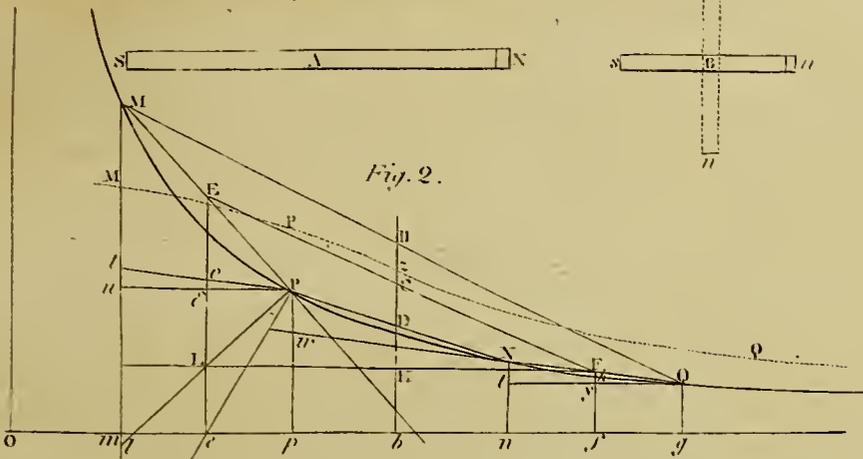


Fig. 2.

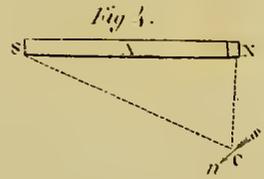


Fig. 4.



Fig. 2.

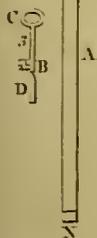


Fig. 2.

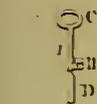


Fig. 2.

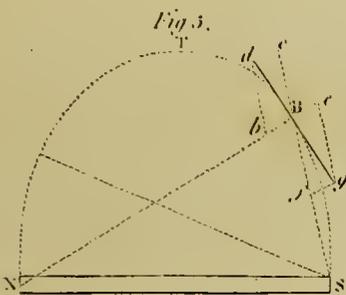


Fig. 5.

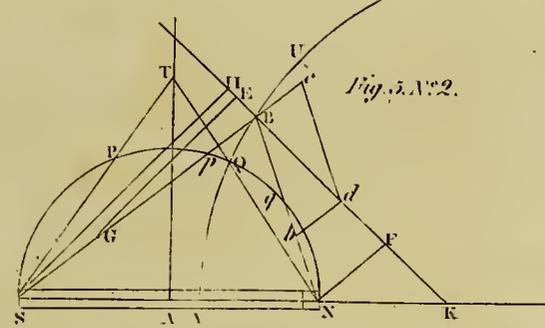


Fig. 5. A. 2.



Fig. 9.

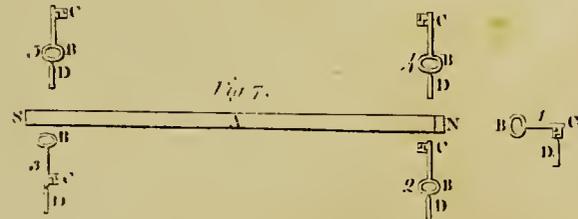
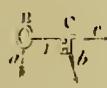


Fig. 7.

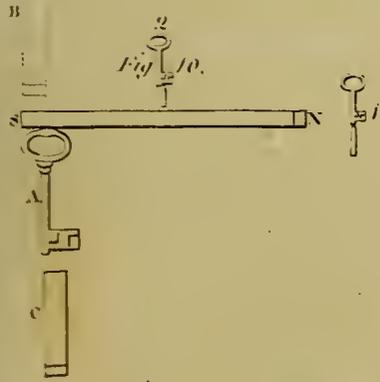


Fig. 10.

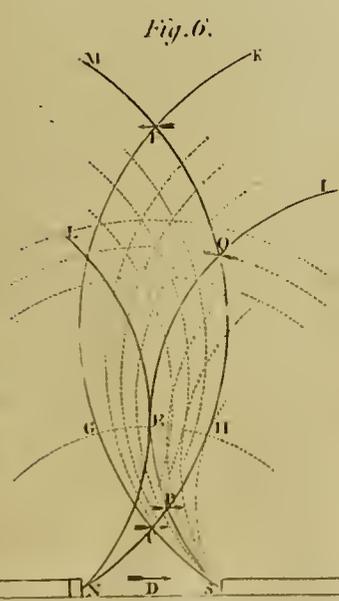


Fig. 6.

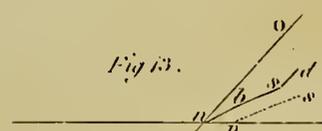


Fig. 11.

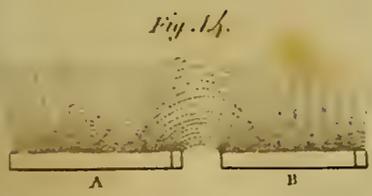


Fig. 14.

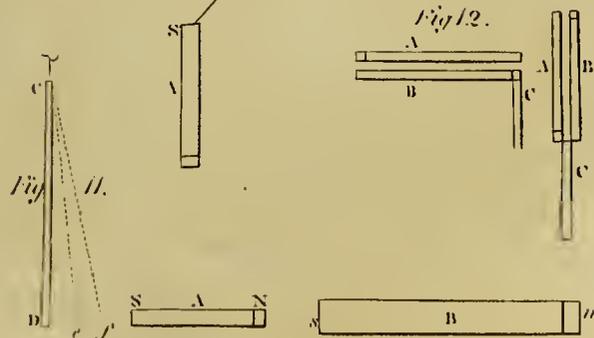
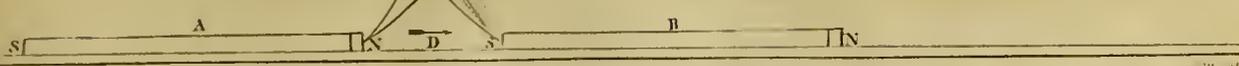


Fig. 12.

Fig. 11.



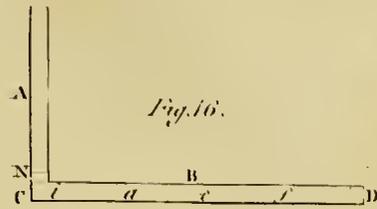
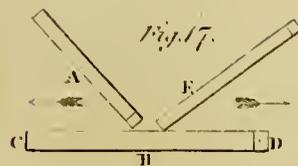
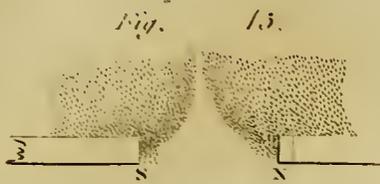


Fig. 18.

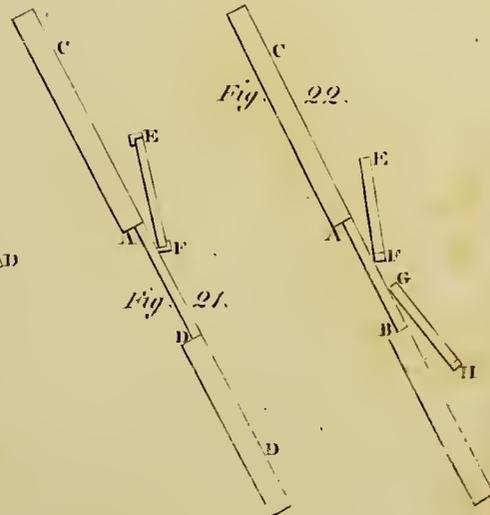
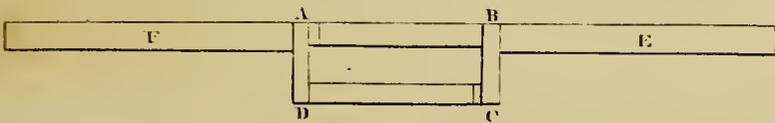


Fig. 19.

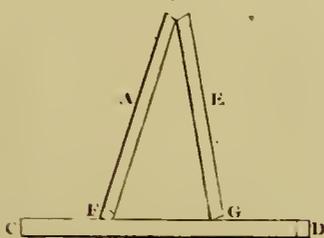


Fig. 20.

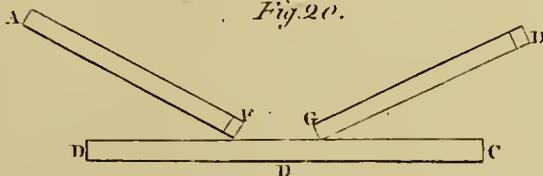


Fig. 21.

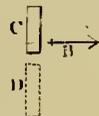
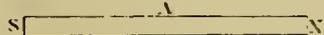


Fig. 23.

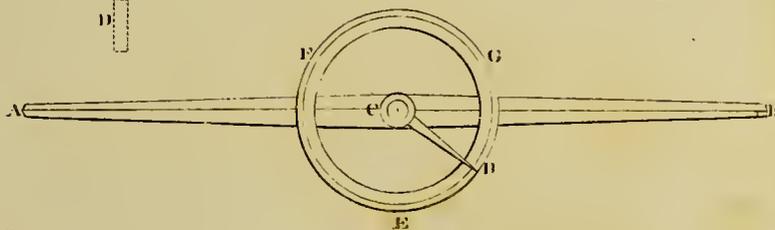


Fig. 25.

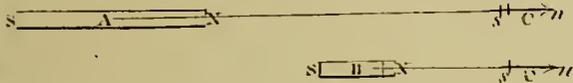


Fig. 26.

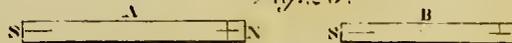


Fig. 28.

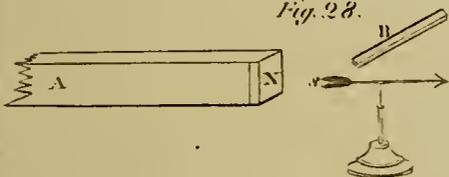


Fig. 29.

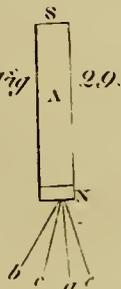


Fig. 27.

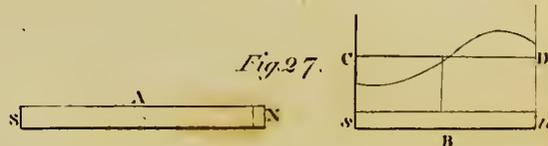


Fig. 32.

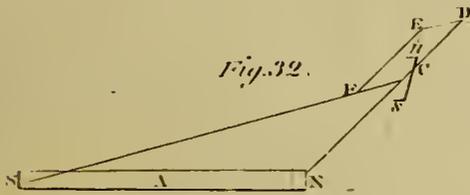


Fig. 31.

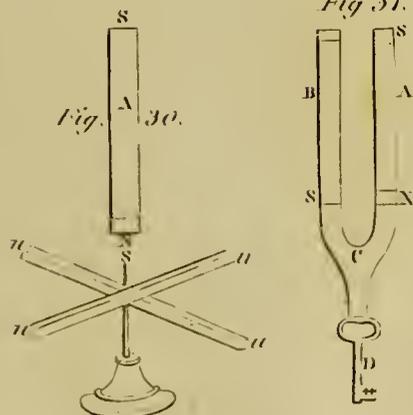


Fig. 30.

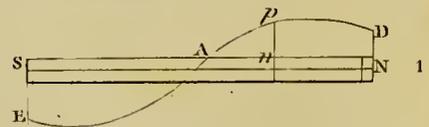
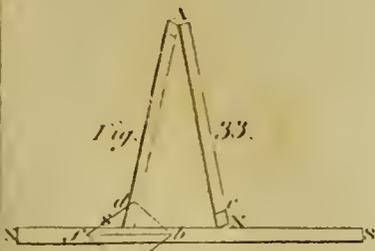


Fig. 33.



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 *Eukliben's Elem. of Nat. Phil.* published by Lichtenberg 1784, p. 645.

at liberty to settle in the true magnetic direction. The angle HON is the inclination or dip of the needle. Let ZnF 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 no , and its south point in the direction sp , both of which are parallel to NS. By the laws of mechanical equilibrium, it cannot rest, except in such a position that the forces no and sp are in a plane perpendicular to the plane ZnF . In any other position, there would be a force impelling the needle toward that side on which no makes an acute angle with the tangent nt of the vertical circle. Therefore the spherical triangle NnF is right angled in n , and $\text{Cof. } NFn : R = \text{Tan. } nF : \text{Tan. } NF, = \text{Tan. } HN : \text{Tan. } n'n$. Therefore

$$\text{Tan. } n'n = \frac{\text{Tan. } HN}{\text{Cof. } Hn'} = \text{Tan. } HN \times \text{Sec. } Hn'$$

Therefore, in any place, the real inclination of the magnetic 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 HCn' , 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.

Addition to n° 64.

Let HZOF (fig. 37.) be the plane of a magnetic meridian, $Hn'O$ the plane of the horizon, and NS the position of the magnetic needle in any place, when it is

Addition to n° 64.

M A I

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 Anacana. 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*.

MAHONNOY, 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*.

M A I

MAINE, DISTRICT OF, belonging to Massachusetts, is situated between lat. 43° and $48^{\circ} 15'$ north, and between long. $64^{\circ} 53'$ and $70^{\circ} 39'$ 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, Scodic, Sebacock, 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.

Maine.

Maguana, Maine.

Maine,
||
Malabar.

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 stocks 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 possesses 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 Carthage, in Terra Firma, about 60 miles easterly of Carthage, 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 Myrick 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, superintendent of the prés; 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 *objets 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

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Malesher-
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Male-
herbes.

Maleherbes 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 fable 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 coloured 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. Maleherbes 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 dismissal of Turgot; and Maleherbes, 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, Maleherbes 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. Maleherbes 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 Maleherbes, 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

Male-
herbes.

* Bertrand's
Memoirs,
vol. iii.
chap. 33.

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Male-
sherbes.

pleaded the cause of the monarch with a strength of argument that nothing could have resisted but the blood-thirsty 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*.

* Clery's
Journal, p.
158—196.

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 Rafambo, 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 guillotine. 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."†

Malguz-
zary,
Malphag-
hino.

† Bertrand's
Memoirs,
chap. 40.

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 infer, 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.

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 whirlpool, 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, penniless 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

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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,

3 I

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(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 vidcor,

Malphag-
hino.

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 Roffi, 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 neighbour-

ing 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 Vergerus, Leonardus Aretinus, Robert Roffi, James Angeli, Poggius, and Niclaus 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 à præceptore non eloquentia modo, quam ex ordine legerit, sed mores etiam, ac quædam bene honesteque vivendi ratio cum doctrina tum exemplis disciebatur.—*Sicco Polentonus*, Ap. Mehus, l. c. p. 139.

(c) *Blondi Flavii Forlivienfis Italia illustrata*. Bas. 1559. fol. p. 346.

Melphag-
hino,
Malt.

cus Philadelphus, 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 exiccation 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

Malt.
Mamma-
lukes.

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^o 466.); but from the disposition of the grains to become four, 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.

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.

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 Cherfonefas, 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 Melachfala, 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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*Antijacobin
Review*, n^o
12. and
*Brown's
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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. Melachfala 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 Clotho, 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.

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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 awfina*," "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 negotiate 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 *Waqil 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-
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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 Mamelouc. 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 Mamelouc, 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 chafnadars, 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 Mameloucs, 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 Mameloucs 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 Mamelouc 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 Yenktchery, 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 Desterdar, 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 go-

vernors 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.

“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

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Phil. Mag.
vol. iii.
p. 284.

Man. 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 meal-fed 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

Man. 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 Ycaque, 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 fortrefs 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 Sackashawan 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 Manfa, which usually signifies king; but the chief power of the state, in the last resort, is lodged in the assembly of these manfas

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Manding. manfas (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 *tornados*), 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 ankles, 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 sympathize 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 *Manfas*, 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 tranquillity 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 inform-

ed, 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.*

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 dith called *dega*, made of pounded corn and four 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 or consequence, in the last quarter. An eclipse, whether of the sun or moon, is supposed to be effected by witchcraft. The

stars are very little regarded; and the whole study of astronomy appears to them as a useless pursuit, and attended to by such persons only as deal in magic.

Their notions of geography are equally puerile. They imagine that the world is an extended plain, the termination of which no eye has discovered; it being, they say, overhung with clouds and darkness. They describe the sea as a large river of salt water, on the farther shore of which is situated a country called *Tobaubo doo*; "the land of the white people." At a distance from *Tobaubo doo*, they describe another country, which they allege is inhabited by cannibals of gigantic size, called *Koomi*.

Mr Park says he has conversed with all ranks and conditions of negroes on the subject of their faith, and that he can pronounce, without the smallest shadow of doubt, that the belief of one God, and of a future state of reward and punishment, is entire and universal 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 necessary to offer up prayers and supplications to the Almighty. They represent the Deity, indeed, as the creator and preserver of all things; but in general they consider him as a being so remote, and of so exalted a nature, that it is idle to imagine the feeble supplications of wretched mortals can reverse the decrees, and change the purposes, of unerring wisdom. The concerns of this world, they believe, are committed by the Almighty to the superintendance and direction of subordinate spirits, over whom they suppose that certain magical ceremonies have great influence. A white fowl, suspended to the branch of a particular tree, a snake's head, or a few handfuls of fruit, are offerings which ignorance and superstition frequently present, to deprecate the wrath, or to conciliate the favour, of these tutelary agents.

The Mandingoes seldom attain extreme old age. At forty, most of them become grey haired, and covered with wrinkles; and but few of them survive the age of fifty-five, or sixty. Yet their diseases appeared but few; fevers and fluxes being the most common, and the most fatal. For these they generally apply *saphies*, i. e. charms, to different parts of the body; though sometimes, on the first attack of a fever, the patient is, with great success, placed in a sort of vapour bath. The other diseases which prevail among the negroes, are the *yaws*, the *elephantiasis*, and a *leprosy* of the very worst kind, together with the *Guinea worm*, which they attribute to bad water.

When a person of consequence dies, the relations and neighbours meet together, and manifest their sorrow by loud and dismal howlings. A bullock or goat is killed for such persons as come to assist at the funeral; which generally takes place in the evening of the same day on which the party died. The negroes have no appropriate burial places, and frequently dig the grave in the floor of the deceased's hut, or in the shade of a favourite tree. The body is dressed in white cotton, and wrapped up in a mat. It is carried to the grave, in the dusk of the evening, by the relations. If the grave is without the walls of the town, a number of prickly bushes are laid upon it, to prevent the wolves from digging up the body; but our author never observed that any stone was placed over the grave as a monument or memorial.

With respect to employment, the men cultivate the ground, or catch fish in large rivers; while the women manufacture cotton cloth. It is only the spinning and the dying, however, that are performed by the women; for the web, which is seldom more than four inches broad, is wove by the men in a loom made exactly upon the same principle as that of Europe. As the arts of weaving, dyeing, sewing, &c. may easily be acquired, those who exercise them are not considered in Africa as following any particular profession; for almost every slave can weave, and every boy can sew. The only artists which are distinctly acknowledged as such by the negroes, and who value themselves on exercising appropriate and peculiar trades, are the manufacturers of leather and of iron. The first of these are called *Karrankeas* (or as the word is sometimes pronounced *Gaungay*). They are to be found in almost every town, and they frequently travel through the country in the exercise of their calling. They tan and dress leather with very great expedition, by steeping the hide first in a mixture of wood ashes and water, until it parts with the hair; and afterwards by using the pounded leaves of a tree, called *goo*, as an astringent.

The manufacturers in iron are not so numerous as the *Karrankeas*; but they appear to have studied their business with equal diligence. The negroes on the coast being cheaply supplied with iron from the European traders, never attempt the manufacturing of this article themselves; but in the inland parts, the natives smelt this useful metal in such quantities, as not only to supply themselves from it with all necessary weapons and instruments, but even to make it an article of commerce with some of the neighbouring states. During our author's stay at Kamalia, there was a smelting furnace at a short distance from the hut where he lodged, and the owner and his workmen made no secret about the manner of conducting the operation; and readily allowed him to examine the furnace, and assist them in breaking the iron-stone. The process it is needless to describe; though it be proper to observe, that the mass of metal obtained by it was rather steel than iron. Most of the African blacksmiths are acquainted also with the method of smelting gold, in which process they use an alkaline salt, obtained from a ley of burnt corn-stalks evaporated to dryness. They likewise draw the gold into wire, and form it into a variety of ornaments, some of which are executed with a great deal of taste and ingenuity.

The reader will observe, that in the extracts which we have made from Mr Park's interesting travels, the terms African and Negro are frequently used as if all Africans and Negroes were Mandingoes. The reason is, that the Mandingoes were not only the most numerous tribe which he visited, but were also spread over all that tract of country which he traversed.

MANGEEA, an island of the S. Seas, visited by Captain Cook in the beginning of his last voyage. The coast is guarded by a reef of coral rocks, against which a heavy surf is continually breaking. The island is about 15 miles in circumference. The inhabitants appear of a warlike disposition. S. lat. 21° 27', W. long. 158° 7'.—*Morse*.

MANHEIM, a town of Pennsylvania, in the county of Lancaster. It contains about 60 houses, and a

Maniana, Dutch church. Glafs 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, Pennsylvania.—*ib.*

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Mansfield.

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 mult 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 Tadoufac.—*Morse.*

MANIEL, or rather *Baboruco*, 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 Genesee 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 Suffex 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 inhabit. ants.—*ib.*

Mansfield.

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.*

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Manure.

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 *Encyclopaedia*; 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.*

Manure. 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 Eller 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 Alton, 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

Manure. 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 root 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

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fectly 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 develop 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 development, 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.

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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 those 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

Manure. 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 laboratory 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 soil 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,

Manure.

Manure. 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 attend to the principles of which those 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. excrementitious substances, by which they are dried and reduced to powder, cannot be praeserved 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 Lille 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 fertilizing 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,

3 L that

(A) We believe they are universally preferable.

Manure,
Maouana.

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 Prouse 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 Prouse 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, Prouse 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 those 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.

Maouana.

Mapleton,
||
Maracaibo.

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 Maine, 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 Weiserunfett, and thence over to St Lawrence; or turned and went down through Montseag 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 Venezuela, 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 inter-

cept 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 Tapouytapare, 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.*

Maranhao,
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Marbletown.

Marcellus,
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Mariagala-
lante.

MARCELLUS, a military township in Onondago county, New-York, situated on Skaneateles 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. $18^{\circ} 18'$.—*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 Amarisoggin river. Its mouth is 10 rods wide.—*ib.*

MARGARET'S Bay, St, a port on the fourth 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 Kamtschatka in 1780. Their latitude is $24^{\circ} 40'$ N. long. $141^{\circ} 12'$ 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. $35^{\circ} 28'$ 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 $19^{\circ} 48'$ 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. $7^{\circ} 43'$, W. long. $78^{\circ} 12'$.

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, $4\frac{1}{2}$ leagues from N. to S. and 3 from E. to W. It lies 5 or 6 leagues S. easterly of Guada-

loupe, 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. $15^{\circ} 55'$, W. long. $61^{\circ} 6'$.—*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 Nanmkeag, 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. $18^{\circ} 38'$, W. long. from Paris $76^{\circ} 51'$. The town of this name, situated on the cape, is on the north-westernmost part of the fourth 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. $39^{\circ} 34'$, long. $82^{\circ} 9'$.—*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. $30^{\circ} 12'$, W. long. $85^{\circ} 45'$.—*ib.*

MARK,

Marianna
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Mark's.

Mark,
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Marlboro-
rough.

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 pleasanterest in the island. Its commerce is considerable. It owes a great deal of its embellishments to the attention of M. de Marbois, 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 *Okonmakamefit* 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 Hatavist, 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. Federalburgh 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,

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Martha's.

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burgh.

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 feverely 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.*

Martins-
ville,
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Mary's.

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 southeasterly 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 Ekanfanoga 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,

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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 Alton 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 enrolled himself among the supporters of the *Bill of Rights*. The decision of the House, which pronounced Mr Luttrell 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 expediture of the public money, and a more equal representation

Mason.

Mafon.

of the people, Mr Mafon came forward, and took an active part in promoting thefe designs, as one who was convinced of their importance and neceffity. When the county of York affembled, on the 30th of December 1779, and refolved unanimoouly, "that a committee of correpondence fhould be appointed, for the effectually promoting the object of the petition then agreed to, and alfo to prepare a plan of *affociation* to fupport that laudable reform, and fuch other meafures as may conduce to reftore the *freedom of parliament*," he was chofen upon the committee, and was confulted with, or affifted in drawing up thofe various high-fpirited refolutions and addreffes to the public, for which the Yorkfhire committee was fo celebrated; and which was afterwards generally adopted by the other affociated bodies of reformers. This part of his conduct is furely entitled to no praife. Thinking as we do of the parliamentary reformers, we cannot but regret that a man of Mr Mafon's talents and virtues fhould have embarked in their dangerous purfuits; and though we perceived lefs hazard in thofe purfuits than we do, we fhould ftill confider them as unfuitable to the character of a clergyman. Our author, however, was of a different opinion. In reply to a censure paffed by a dignified clergyman on the political conduct of himfelf and fome of his reverend brethren, he publifhed, without his name indeed, a fpirited defence of their proceedings and designs in fome of the country papers. The York committee, too, at its next meeting, refolved, "that a Proteftant, by entering into holy orders, does not abandon his civil rights;" they alfo refolved, "that the thanks of the committee be given to thofe reverend gentlemen who, thus preferring the public good to their own private emoluments, have ftood forth the firm friends to the true interefts of their country."

Mr Mafon, however, fhewed, by his fubfequent conduct, that however earneftly he might wifh for what he doubtlefs confidered as an expedient reform in the commons-houfe of Parliament, he was firmly attached to the Britifh conftitution. He was indeed a whig; but he was a whig of the old fchool. In the beginning of 1794, when the reformers had betrayed the principles of French democrates, he deferted them, and ranged himfelf under the banners of the fervants of the crown; and for this conduct, which was certainly confiftent, he has been plentifully traduced by our Jacobin journalifts as an alarmift, who not only deferted his old friends, but afcribed to them a certain degree of guilt and political depravity.

The death of this great and good man, which happened in April 1797, was occafioned neither by age nor by inveterate difeafe. As he was stepping into his chariot, his foot flipped, and his fhin grazed againft the ftep. This accident had taken place feveral days before he paid the proper attention to it; and on April the 3d a mortification enfued, which, in the fpace of forty-eight hours, put a period to his life.

That he was a fcholar and a poet of high eminence is univerfally acknowledged; and we are affured, that his pofthumous works, when publifhed, will not detract from his living fame. In private life, though he affected perhaps too much the faftidious manners of Mr Gray, whofe genius he eftimated with a degree of enthufiafm amounting almoft to idolatry, his character was diftinguifhed by philanthropy and the moft fervid

friendfhips; and he may be confidered as a man who merits to be ranked with the ableft fupporters of Britifh liberty and Britifh morals.

MASON, a county of Kentucky, on the fouthern fide of Ohio river. It contains 2,267 inhabitants, of whom 208 are flaves.—*Morse*.

MASON, a townfhip in Hillsborough county, New-Hampfhire, on the Maffachufetts line, about 70 miles weft of Portfmouth, and 50 N. W. of Bofton. It was incorporated in 1768, and contains 922 inhabitants.—*ib*.

FREE-MASONRY, is a fubject which, after the copious detail given in the *Encyclopadia* of its lodges, and wardens, and grand mafters, we fhould not have refumed in this place, but to warn our countrymen againft the pernicious fuperftitutions which have been raifed by the French and Germans on the fimple fystem of Britifh mafonry.

Much falfehood is current refpecting the origin and antiquity of the mafonic affociations. That the Dionyfians of Afia Minor were a fociety of architects and engineers, who had the exclusive privilege of building temples, ftadia, and theatres, under the myfterious tutelage of Bacchus, feems to be unqueftionable. "We are alfo certain, that there was a fimilar trading affociation during the dark ages in Chriftian Europe, which monopolized the building of great churches and caftles, and enjoyed many privileges under the patronage of the various fovereigns. Circumftances (fays Dr Robifon), which it would be tedious to enumerate and difcufs, continued this affociation longer in Britain than on the continent;" but there is no good evidence, that, anterior to the year 1648, any man fought admiffion into it, who was not either a builder by profefion, or at leaft skilled in the fciences of architecture. At that period, indeed, Mr Afhmole, the famous antiquary (fee *ASHMOLE, Encycl.*), was admitted into a lodge at Warrington, together with his father-in-law Colonel Mainwaring; and thefe are the firft diftinct and unequivocal inftances that we have in Britain of men unconnected with the operative mafons being received into their myfterious fraternity. The fecrecy, however, of the lodges, made them fit places for the meetings of the royalifts; and accordingly many royalifts became free-mafons. "Nay, the ritual of the mafter's degree feems to have been formed, or perhaps twifted from its original inftitution, fo as to give an opportunity of founding the political principles of the candidate, and of the whole brethren prefent. For it bears fo eafy an adaption to the death of the king, to the overturning of the venerable conftitution of the Englifh government of three orders by a mean democracy, and its re-eftablifhment by the efforts of the loyalifts, that this would ftart into every perfon's mind during the ceremonial, and could hardly fail to fhew, by the countenances and behaviour of the brethren, how they were affected."

This fuppofition receives much countenance from the well known fact, that "Charles II. was made a mafon, and frequented the lodges. It is not unlikely, that beftides the amufement of a vacant hour, which was always agreeable to him, he had pleafure in meeting with his loyal friends, and in the occupations of the lodge, which recalled to his mind their attachment and fervices. His brother and fucceffor James II. was of a more ferious and manly caft of mind, and had little pleafure in the

Mafon,
||
Mafonry.

Masonry. 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 teasing, 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 in their lodges they introduced the impieties and seditious doctrines of Voltaire and the other philosophers. Indeed, if the account which the Abbe Barruel gives of masonry be just, it must be admitted, that even the secrets of the most ancient lodges,

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Masonry. 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*

Masonry. *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 traitorous 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 recognized. 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 free-masons 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 surpris'd. 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. officer 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 impicity, 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 Rosierncians, 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 *Rosa 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 our-

elves, 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, ma-

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Pacona,
||
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fonry appears, in every point in which it can be placed, an affociation which no good Christian will think himfelf at liberty to encourage.

MASQUE PACONA, a jurifdiction of Charcas, in Peru, extending above 30 leagues. Its air is hot, but not too great for vines. The city of the fame name, where the bifhop of Santa Cruz de la Sierra refides, is very thinly inhabited; but there are in other parts of the jurifdiction, feveral populous towns. It produces all kinds of grain and fruits; honey and wax constitute a principal part of its trade.—*Morfe.*

MASQUES, or *Chilques* and *Mafques*, a jurifdiction of Cafco, in Peru, which begins about 7 or 8 leagues from Cafco, extending about 30 in length.—*ib.*

MASSAC, a fort built by the French, on the north-western fide of the Ohio, about 11 miles below the mouth of Tennessee river. Its remains ftand on a high bank, in a healthy agreeable fituation.—*ib.*

MASSACHUSETTS, *Fort*, ftands on the north-western corner of the State of its name, in N. lat. $42^{\circ} 41' 30''$; 19 miles N. E. by N. of Pittsfield, and 20 due E. of Lanfingburgh city, in New-York State.—*ib.*

MASSACHUSETTS Sound, on the N. W. coaft of North-America, is fituated on the fouthern fide of the Quadras Ifles, and leads from the W. into Nootka Sound along the N. fide of Kendrick's Ifland, whofe eastern fide forms, with Point Breakfast, the mouth of Nootka Sound.—*ib.*

MASSACRE River paffes out of the Straits of Magellan S. W. into the fupposed channel of St Barbara, which cuts through the ifland of Terra del Fuego, through which, we are informed, Capt. Mareanille of Marfeilles paffed in 1713 into the South Pacific Ocean.—*ib.*

MASSACRE River, on the N. fide of the Ifland of St Domingo, falls into the bay of *Mancenilla*.—*ib.*

MASSACRE, a fmall ifland on the coaft of Weft-Florida, 2 miles to the eastward of Horn Ifland; 10 miles from the main land, all the way acrofs there is from 2 to 3 fathoms; except the fhool called La Grand Bature, which ftretches a league from the main land, with 2 or 3 feet water on it, and in fome places not fo much. Behind it is a large bay called L'Ance de la Grand Bature, 8 miles E. of Pascagoula bluff.—*ib.*

MASSAFUERO, an ifland in the S. Pacific Ocean, called by the Spaniards the Leffer 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 provifions. But Lord Anfon found this to be a political falftiy, afferted to prevent hostile veffels from touching there. There is anchorage on the N. fide in deep water, where a fingle fhip may be fheltered clofe under the fhore, but is expofed to all winds except the fouth. According to Capt. Magee of the fhip Jefferson, it is 38 leagues to the weftward of Juan Fernandes, and in about $33^{\circ} 30'$ S. lat. and 82° W. long. from Greenwich.—*ib.*

MASSANUTEN'S River, a weftern branch of the Shenandoah.—*ib.*

MASSEDAN Bay, on the N. Pacific Ocean, and W. coaft of Mexico, is fituated between Acapulco and Aquacara, a port near the cape of California, where Sir Thomas Cavendifh lay after he had paffed the Straits of Magellan.—*ib.*

MASEY'S-TOWN, in the N. W. Territory, ftands 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 Georgetown, and S. by W. of Saffafra-Town, a little more than 5 miles from each.—*ib.*

MAST Bay, on the north fide of the ifland of Jamaica, in the N. W. part. It is eastward of Montego Bay, and near the fhelf of rocks that lies from the fhore, called Catlin's Cliffs.—*ib.*

MASTICK Gut, on the S. W. fide of the ifland of St Christopher's in the Weft-Indies, is between Moline's Gut on the N. W. and Godwin's Gut on the fouth-east.—*ib.*

MASTIGON, a river which runs weftward 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 $15^{\circ} 35' 5''$ north, and in longitude $39^{\circ} 36' 30''$ east of Greenwich. On the 22d of September 1769 Mr Bruce found the variation of the needle at Mafuah to be $12^{\circ} 48'$ weft.

MATA Point, on the northern fide of the ifland of Cuba, and 9 leagues N. W. of Cape Maify.—*Morfe.*

MATACA, or *Mantaca*, is a commodious bay on the N. coaft of the ifland of Cuba, where the galleons ufually come to take in freff water on their return to Spain, about 12 leagues from the Havannah. It appears to be the fame as Matanze, in lat. $23^{\circ} 12'$ N. long. $81^{\circ} 16'$ W. Peter Heyn took a great part of a rich fleet of Spanifh galleons here in 1627.—*ib.*

MATAIA, a province of S. America, towards the river Amazon, between the mouth of Madeira and Tapaifa rivers.—*ib.*

MATANCA, or *Manances*, a fhort and broad river of E. Florida which falls into the ocean fouth of St Auguftine.—*ib.*

MATANCHEL, a fea-port on the weft coaft of New Mexico, about 20 leagues to the N. E. of the rocks of Ponteque, over which, in clear weather, may be feen a very high hill, with a break on the top, called the hill of Xalifco, and may be feen 8 or 9 leagues from the port.—*ib.*

MATANE, a river of Canada, in N. America, the mouth of which is capable of admitting veffels of 200 tons burden. All this coaft, efpecially near this river, for 20 leagues, abounds in cod, which might employ 500 fhallops or fifhing fmacks at a time. The fifh is very fine, and fit for exportation to the Straits, Spain, and the Levant. Great numbers of whales have been alfo feen floating upon the water, which may be ftruck with a harpoon, and prove a very valuable fifhery.—*ib.*

MATANZAS, or *Matance*, a large bay on the north fide of the ifland of Cuba, 14 leagues fouth-east of the Havannah, but fome accounts fay 20 leagues. From Cape Quibanico to this bay the coaft is weft-north-weft.—*ib.*

MATAVIA Bay, or *Port Royal Bay*, is fituated within Pitavina near the north part of the ifland of Otahete, but open to the north weft, and in the fouth Pacific Ocean. The east fide of the bay has good anchorage in 14 and 16 fathoms. S. lat. $17^{\circ} 29'$ W. long. $149^{\circ} 30'$, and the variation of the compafs $3^{\circ} 34'$ east.—*ib.*

MATCH-

Mafey's,
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Matavia.

Matchadock,
Matthews.

MATCHADOCK Bay, in the easternmost part of Lake Huron.—*ib.*

MATHANON Port, in the south-east part of the island of Cuba, is one of those ports on that coast which afford good anchorage for ships, but without any use for want of them. It is between Cape Cruz and Cape Maizi, at the east end of the island.—*ib.*

MATHEWS, Fort, stands on the eastern side of Oconee river, in the S. western part of Franklin county, Georgia.—*ib.*

MATHEWS, a county of Virginia, bounded W. by Gloucester, from which it was taken since 1790; lying on the W. shore of the bay of Chesapeake. It is about 18 miles in length and 6 in breadth.—*ib.*

MATICALOC River, on the W. coast of New Mexico, is 7 leagues from Catalta Strand, or the port of Sanfonate. It is much exposed to northerly winds, and is known by some small but high hills that are opposite to it. There is another large river to the westward of it, about 4 leagues, which has 2 fathoms upon the bar; and from thence to the bar of Estapa it is 15 leagues.—*ib.*

MATILDA, a village of Virginia situated on the south-west bank of Patowmac river, above Washington city, and near the Great Falls.—*ib.*

MATINICUS Islands, on the coast of Maine. When you pass to the west of these islands, the main passage from the sea to Penobscot Bay lies about north by west. Matinicus lies north lat. $43^{\circ} 56'$, west long. $68^{\circ} 20'$.—*ib.*

MATMAI, or **MATSUMAI**, is the largest of the Kurile islands; and if it be not independent, is tributary to Japan. The capital town of the same name, Matmai, is situated on the sea-shore, on the south-west side. It was built and is inhabited by the Japanese. It is a fortified place, furnished with artillery, and defended by a numerous garrison. The island of Matmai is the place of exile for persons of distinction at Japan: it is separated from that empire by only a narrow channel, but which is considered as dangerous, because the capes, which project on both sides, render the navigation difficult. The people are said to be sensible to friendship, hospitable, generous, and humane.

MATTA DE BRAZIL, a town in the captainship of Pernambuco, in Brazil; about 9 leagues from Olinda. It is very populous; and quantities of Brazil are sent from this country to Europe.—*Morse.*

MATTAPONY, a navigable river of Virginia, which rises in Spottsylvania county, and running a S. E. course, 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 east coast of South-America, in the south Atlantic Ocean, is in lat. $45^{\circ} 5'$ south, and long. $64^{\circ} 25'$ west.—*ib.*

MATTHEO Island, St. or *St. Matthew's Island*, in the S. Atlantic Ocean. S. lat. $1^{\circ} 24'$.—*ib.*

MATTHEW'S Bay, St. in the Gulf of Mexico, on the W. shore of Campeachy Gulf, is more than 100 leagues to the N. of Tumbuz.—*ib.*

MATTHEWS, St. or *Mattheo Bay*, on the coast 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 anchorage all the way, if ships keep at least in 6 fathoms water. It is all high land with hollow red crags, and several points run out, forming good retreats for ships driven in by hard squalls and flaws from the hills, and by the seas running high, which often happen.—*ib.*

MAUGERVILLE, a township in Sunbury county, province of New Brunswick, situated on St John's river, opposite St Annes, and 30 miles above Belisle.—*ib.*

MAUREPAS, an island on the north-east coast of Lake Superior, and north-east of Ponchartrain island.—*ib.*

MAUREPAS, a lake in W. Florida, which communicates westward with Mississippi river, through the Gut of Ibberville, and eastward 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 cypress, live-oak, myrtle, &c. Two creeks fall into this lake, one from the north side, called Nattabanie, the other from the peninsula 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 Mississippi at the W. side of the peninsula of Orleans, 21 miles. From the Ibberville across the lake, it is 7 miles to the passage leading to Ponchartrain. The length of this passage is 7 miles, and only 300 yards in width, which is divided into two branches by an island that extends from Maurepas to about the distance of a mile from Ponchartrain. The south channel is the deepest and shortest. The passage thence through Lake Ponchartrain, to the Gulf of Mexico, is above 50 miles.—*ib.*

MAUREPAS Island, on the coast of Cape Breton, the same as the *Isle Madame*.—*ib.*

MAURICE Bay, on the W. side of Cape Farewell Island, or S. extremity of E. Greenland, and the principal harbour of that sea.—*ib.*

MAURICE, Port, on the E. coast of Terra del Fuego Island, is on the W. shore of Le Maire Straits, between that island and Staten Land on the E. and N. of the bay of Good Success. It is a small cove, having anchorage before it in $12\frac{1}{2}$ fathoms, about half a mile from the shore, over coral rocks.—*ib.*

MAURICE River, the name of a place in Cumberland county, New-Jersey.—*ib.*

MAURICE River, in some maps called corruptly *Morris*, rises in Gloucester county, New-Jersey, and runs southwardly about 40 miles, and empties into Delaware Bay; is navigable for vessels of 100 tons 20 miles, and for small craft considerably further.—*ib.*

MAXANTALLA Island, is near the port of Matanchel on the W. coast of New-Mexico, and on the North Pacific ocean.—*ib.*

MAY, Cape, the most southerly point of land of the State of New-Jersey, and the N. point of the entrance into Delaware Bay and river, in lat. 39° , and long. $74^{\circ} 56'$ W. The time of high water on spring tide days, is a quarter before nine o'clock.—*ib.*

MAY POINT, on the S. side of New-Foundland Island, a point of the peninsula between Fortune and Placentia Bays.—*ib.*

MAYAGUANA, one of the Bahama islands in the West-Indies, and the same with Maranella, and in lat. $22^{\circ} 51'$ N. at the N. point, and long. $72^{\circ} 57'$ W.—*ib.*

MAYFIELD,

Maugerville,
Mayaguana.

Mayfield,
||
Mayow.

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 east to the governments of Quixos and Jaen de Bracamoros. 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

Mayow,
||
Mean.

portional between 1 and 9, is $\sqrt{1 \times 9} = \sqrt{9} = 3$; a mean between 2 and $4\frac{1}{2}$ is $\sqrt{2 \times 4\frac{1}{2}} = \sqrt{9} = 3$ also; 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 so divided that the less 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 described by the radius vector; that is, as the whole periodic time in one revolution of the planet, is to the time past the aphelion or perihelion, so is 360° to the mean anomaly. See *ANOMALY*, *Encycl.*

MEAN Conjunction or Opposition, is when the mean place of the sun is in conjunction, or opposition, with the mean place of the moon in the ecliptic.

MEAN Distance of a Planet from the Sun, is an arithmetical mean between the planet's greatest and least distances.

MEAN Motion, is that by which a planet is supposed to move equably in its orbit; and it is always proportional to the time.

MEAN Time, or *Equal Time*, is that which is measured by an equable motion, as a clock; as distinguished from apparent time, arising from the unequal motion of the earth or sun.

UNIVERSAL or PERPETUAL MEASURE, is a kind of measure unalterable by time or place, to which the measures of different ages and nations might be reduced, and by which they may be compared and estimated. Such a measure would be very useful if it could be attained; since, being used at all times, and in all places, a great deal of confusion and error would be avoided.

It has been attempted, at different times and in different countries, more especially by the French, who, since the commencement of their revolutionary government, have laboured hard to obtrude their innovations in arts and science, as well as in politics, upon all nations. Proposals, however, have been made by sober men for a standard both of weights and of measures for all nations: and some of the most rational of these shall be noticed under the word *WEIGHTS* in this *Supplement*.

MECATINA, *Great*, *Point of*, on the south coast of Labrador, and the north shore of the Gulf of St Lawrence, in N. America. N. lat. $50^\circ 42'$, W. long. $59^\circ 13'$.—*Morse*.

MECATINA *Island*, *Little*, on the same coast and shore, lies south-west of Great Mecatina. N. lat. $50^\circ 36'$.—*ib.*

MECHANICS.—Our readers will recollect that in the article *PHYSICS*, *Encycl.* we proposed to distinguish by the term *Mechanical Philosophy* that part of natural science which treats of the local motions of bodies and the causes of those phenomena. And, although all the changes which we observe in material nature are accompanied by local motion, and, when completely explained, are the effects (perhaps very remote) of those powers of matter which we call *moving forces*, and of

those alone, yet, in many cases, this local motion is not observed, and we only perceive certain ultimate results of those changes of place. This is the case (for example) in the solution of a grain of silver in a phial of aquafortis. In the beginning of the experiment, the particles of silver are contained in a small space at the bottom of the phial; but they are finally raised from the bottom, and uniformly disseminated over the whole fluid. If we fix our attention steadily on one particle, and trace it in its whole progress, we contemplate nothing but a particle of matter acted on by moving forces, and yielding to their action. Could we state, for every situation of the particle, the direction and intensity of the moving force by which it is impelled, we could construct a figure, or a formula, which would tell us the precise 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 vessel where it finally rests in perfect equilibrium. Newton having done all this in the case of bodies acted on by the moving force called gravity, has given us a complete system of mechanical astronomy. The philosopher who shall be as fortunate in ascertaining the paths and motions of the particles of silver, till the end of this experiment, will establish a system of the mechanical solution of silver in aquafortis; and the theorems and formulæ which characterise this particular moving force, or this modification of force, stating the laws of variation by a change of distance, will be the complete theory of this chemical fact. It is this modification of moving force which is usually (but most vaguely) called the *chemical affinity*, or the *elective attraction of silver and aquafortis*.

But alas! we are, as yet, far from having attained this perfection of chemical knowledge. All that we have yet discovered is, that the putting the bit of silver into the spirit of salt will not give occasion to the exertion of this moving force; and we express this observation, by calling that unknown force (unknown, because we are ignorant of the law of its action) an *affinity*, an *elective attraction*. And we have observed many such elections, and have been able to class them, and to tell on what occasions they will or will not be exerted; and this scrap of the complete theory becomes a most valuable acquisition, and the classification of those scraps a most curious, and extensive, and important science. The chemical philosopher has also the pleasure of seeing gradual approaches made by ingenious men to the complete mechanical explanation of these unseen motions and their causes, of which he has arranged the ultimate results.

The ordinary chemist, however, and even many most acute and penetrating enquirers, do not think of all these motions. Familiarly conversant with the results, they consider them as principles, and as topics to reason from. They think a chemical phenomenon sufficiently explained, when they have pointed out the affinity under which it is arranged. Thus they ascribe the propagation of heat to the expansive nature of fire, and imagine that they conceive clearly how the effect is produced. But if a mathematical philosopher should say, "What is this which you call an expansive fluid? Explain to me distinctly, in what manner this property which you call expansiveness operates in producing the propagation of heat."—We imagine that the chemist would

Mechanics.

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 comprehend 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

Mechanics.

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

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 joint, 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.

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 lbs, 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. It 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.

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, bound-

Mecklen- ed south by the State of N. Carolina. It contains
burg, 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, Mas-
sachusetts, 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 Myrick 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 in-
dustry.—*ib.*

MEDICAL JURISPRUDENCE. See *MEDICINA Fo-
rensis* in this *Suppl.*

MEDICI, is the name of an illustrious family in Flo-
rence, 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 bio-
graphical sketches of all the great men whom it produ-
ced, 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 con-
temporaries. 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 aristo-
cratic 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 ra-
ther a secure privacy than a dangerous popularity. E-
ven when raised to the office of gonfalonier, or genera-
lissimo 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 con-
duct, 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 priva-
cy and retirement, accepting any office in the state with
the utmost appearance of reluctance, and never attend-
ing 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 oppo-
nents, 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 plebei-
ans: and that a law should be ordained, by which per-
sonal 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 una-
nimity prevented any thing decisive from being carried
into execution. The people, alarmed for the safety of
their leader and patron, offered him the sovereignty,
but this his prudence forbade 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 affabili-
ty to all established his character for moderation. His
extensive knowledge and pleasantry made his company
eagerly sought. As all his actions were placid and se-
rene, 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 ad-
ministration 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 death-
bed, 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 fa-
vour 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 exten-
sive 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 agree-
able 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-
ness

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ness to the superior ranks of his fellow-citizens, and by a constant attention to the interests and the wants of the lower class, whom he relieved with unbounded generosity. By these means he acquired numerous and zealous partizans of every denomination; but he rather considered them as pledges for the continuance of the power which he possessed, than as instruments to be employed in extending it to the ruin and subjugation of the state. 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 circumstance of its being in the power of either of the parties at any time to have dissolved it.

But the prudence and moderation of Cosmo could not repress the ambitious designs of those rival families, who wished to possess or to share his authority. In the year 1433, Rinaldo de Albizi, at the head of a powerful party, carried the appointment of the magistracy. At that time Cosmo had withdrawn to his seat in the country, to avoid the disturbances which he saw likely to ensue; but at the request of his friends he returned to Florence, where he was led to expect such a union of parties, as might at least preserve the peace of the city. No sooner did he make his appearance in the palace, where his presence had been requested, on pretence of his being intended to share in the administration of the republic, than he was seized upon by his adversaries, and committed to prison.

The conspirators were divided in their opinions as to the disposal of their prisoner. Most of them inclined to follow the advice of Peruzzi, who recommended taking him off by poison. Cosmo, confined in the Alberzettino, a room in one of the turrets of the Palazzo, could hear this dreadful consultation, which was determining, not in what manner he should be tried, but in what manner he should be put to death; and finding that he was to die by an infusion of poison secretly administered to him, a small portion of bread was the only food which he thought proper to take.

Cosmo lived in this manner four days; and, shut up from all his kindred and friends, he soon expected to be numbered with the dead; but here, as it sometimes happens, he found relief where least expected, from the man who had been engaged to take him off. Malavolta, the keeper of the prison, either from compunction, dissatisfaction, or the youth and misfortunes of the illustrious sufferer, relented; and instead of pursuing any criminal intentions against the life of Cosmo, after upbraiding him with entertaining so unworthy an opinion of him, declared that his fears were entirely groundless. To convince him of this, he sat down, and partook of every thing the prisoner chose to eat of. The expressions of gratitude, together with his most engaging manners, and great promises, entirely won Malavolta, who, to ingratiate himself still farther in the good opinion of Cosmo, invited Fargaccio, the most celebrated wit in Florence, to dine with him the next day, from the idea that his sprightly mirth would contribute to lighten his misfortunes.

In the mean time, his brother Lorenzo, and his cousin Averardo, having raised a considerable body of men in Romagna and other neighbouring districts, and being joined by the commander of the troops of the republic, approached towards Florence to his relief. The

apprehension, however, that the life of Cosmo might be endangered, if they should proceed to open violence, induced them to abandon their enterprise. At length Rinaldo and his adherents obtained a decree of the magistracy, by which Cosmo was banished to Padua for ten years, his brother to Venice for five years; and several of their relations and adherents shared the same fate.

Cosmo received this determination of his judges with a composure that gained him the compassion and the admiration of many of his most inveterate enemies. He would gladly have left the city pursuant to his sentence; but he was detained by his enemies till their authority should be established: 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 sentence, was in the dominions of Venice; but before he could reach that place, he received a deputation from the senate, the purport of which was to condole with him for his misfortunes, and to promise him their protection and assistance in whatever he should desire. He experienced the treatment of a prince rather than that of an exile. Nor were that wise people without good reasons for such a conduct. Venice had long regarded Florence as her rival in commerce, and hoped, by conferring upon Cosmo the most flattering distinctions, to prevail upon him to reside there in future; prudently supposing, that the manufactories of Florence, and the great commerce the Medici had carried on throughout Italy, and extended far beyond it to the wealthiest kingdoms in Europe, would become their own by enrolling him amongst their subjects.

The readiness with which Cosmo had given way to the temporary clamour raised against him, and the reluctance which he had shewn to renew those rencounters which had so often deluged the streets of Florence with blood, gained him new friends, even during his exile. The utmost exertions of his antagonists could not long prevent the choice of such magistrates as were known to be attached to the cause of the Medici; and no sooner did they enter on their office, than Cosmo 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 banishment of Cosmo.

The subsequent 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 those of Sylla and Octavius to the partizans of Marius and Brutus; whilst Roscoe represents his conduct as in a high degree amiable and generous. It appears to us evident, from his own words, that he had exercised some 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, so far from her nest." When some other exiles acquainted him that "they were not asleep," he answered, "he could easily believe that, for he thought he had spoiled their sleeping." At another time, some of the citizens remonstrated with him upon the odiousness of his conduct in banishing so many persons; telling him, "the republic would be extremely weakened, and God offended, by the expulsion of so many good and pious men as he was

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sending 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 noster*."

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 Stagyrice 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:

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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 ascendancy 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 etics, 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 intrusted 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 safely 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 conquer, 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 Sec.

Pisa had been under the dominion of Florence from
the

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(A) This man had fled from Constantinople, when it was taken by the Turks, to Florence, where he was protected by Cosmo de Medici.

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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 Francesco 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 Giacompo Salviati, brother to the archbishop; Giacompo 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 Monteficco, 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

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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 treat 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 Salviati, 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 Salviati 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.

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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 boldnets 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 Hieronimo, 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 no-

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tions 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 surpris'd 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 brandish'd with one hand the spiritual weapon, which the Florentines treated with such contempt, in the other, he grasp'd 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 avow'd their firm resolution to suffer every extremity, rather than betray the man whom they considered as guardian of the republic. War therefore was commenc'd; 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 judg'd, perhaps, that any stipulations for his personal safety would be usefess with a prince who had sported with honour, justice, mercy, and the most solemn treaties. But, whilst all view'd 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 compos'd, 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 propos'd to accomplish. But before he engag'd in these momentous undertakings, he had further personal dangers to encounter. By the instigation of Cardinal Riario, and some Florentine exiles, one Battista Frascobaldi, 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 embroil'd 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

Medici.

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, idiotism, &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 jurymen. 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

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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, the capital of the kingdom of Woollin 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 vernices 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 scani 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

Medina,

Medusa.

Plate XXXVI.

Medway,
||
Melete-
cunk.

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 Peroufe 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 Chilca. 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 *Quanshipauge* 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

Memoron-
cok,
||
Mendoza.

Menich-
lick,
||
Meninski.

bridge of rocks, from the vaults of which hang several pieces of stone resembling salt, which congeal like icicles, as the water drops from the rock. This bridge is broad enough for 3 or 4 carts to pass abreast. 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 Dobcunt.—*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 splendidly republished at Vienna in 1780, with this title: "Francisci a Mesgnien Meninski Lexicon Arabico-Persico-Turcicum, adjecta ad singulas voces et Phrases interpretatione Latina, ad usitatiores, etiam Italicâ." 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 Persian 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.

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 settlement,

3 O 2

Meninski,
||
Menolo-
pen.

(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.

Mercer, 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.*

Merchetta.

MERCER, a county of Kentucky, adjoining Woodford, Shelby, and Madison counties. Harrodsburg 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 sextam 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 Wallingham 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 Winnipiseogee, 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.”

Magnetical MERIDIAN, is a great circle passing thro' or by the magnetical poles; to which meridians the magnetical needle conforms itself. See MAGNETISM, *Suppl.*

Mercy,
Meridian.

Plate
XXXVI.

MERIM,

Merrim,
|
Merrimack.

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 empties 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. $3^{\circ} 40' S$. 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. $43^{\circ} 26'$. 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 Mystic 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. $\frac{1}{2}$ N. and W. $\frac{1}{2}$ 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. $42^{\circ} 47' 40''$.—*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 clothed 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. $137^{\circ} 30'$.—*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 interfections. 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. $50^{\circ} 10'$, 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.

Merrimi-
chi,
||
Mefurata.

Metallic, Africa. It is 260 miles north of Mourzook. E. lon. 15. 5. N. lat. 31. 3.

Mexico.

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 felling 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 Crotoe, 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, Coatzacoalco, 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 Coiltlytlan and Chilapan, in the country of the Coahuixcas.

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, chestnuts, 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

Mexico.

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. $19^{\circ} 26'$, and $103^{\circ} 35'$ 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 salt-springs.—*Morse.*

MIAMI River, *Great*, or *Great Mincami*, called also *Affereniet*, 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, $32\frac{1}{2}$ 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 30 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 Ouia-tanon, 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. $17^{\circ} 52'$, W. long. $148^{\circ} 6'$.—*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

Mha,
||
Michael.

Michael, 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.*

Michilli-
makkinak.

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, where 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 Swanton, 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

Michilli-
makkinak.

Mick-
macks.

Micoya, Gulf of St Lawrence in Nova-Scotia, opposite to St John's Island. This nation convey their sentiments by hieroglyphics marked on the rind of the birch and on paper, which the Roman missionaries perfectly understand. Many of them reside at the heads of the rivers, in King's and Hants counties.—*ib.*

MICOYA Bay is situated on the S. W. coast of Mexico, or New-Spain, on the North Pacific Ocean. In some charts it is laid down in lat. $10^{\circ} 15'$ N. and having Cape Blanco and Chira Island for its south-east limit.—*ib.*

MICROCOUSTICS, or **MICROPHONES**, instruments contrived to magnify small sounds, as microscopes do small objects.

MICROCOSMIC SALT. See **CHEMISTRY-Index**, *Suppl.*

MIDDLE BANK, a fishing ground in the Atlantic Ocean, which lies from north-east to south-west, between St Peter's Bank and that of Sable Island; and opposite to, and S. E. of Cape Breton Island, laid down in some charts between lat. $44^{\circ} 32'$, and $45^{\circ} 34'$ N. and between long. $57^{\circ} 37'$, and $59^{\circ} 32'$.—*Morse.*

MIDDLEBOROUGH, the *Namasket* of the ancient Indians, a township in Plymouth county, Massachusetts, bounded west by Freetown and Taunton, east by Carver and Warham, and is 40 miles S. by E. of Boston; was incorporated in 1669, and contains 4,526 inhabitants. This town was formerly thickly inhabited by Indian natives, governed by the noted sachem *Tispacan*: there are now only 30 or 40 souls remaining, who, to supply their immediate necessities, make and sell brooms and baskets. The town is remarkable for a large range of ponds, which produce several sorts of fish, and large quantities of iron ore. The bottom of Affowamset Pond may be said to be an entire mine of iron ore. Men go out with boats, and use instruments like oyster dredges, to get up the ore from the bottom of the pond. It is now so much exhausted, 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 shoaler 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 first rolling and slitting mills were erected about 40 years ago, but were imperfect and unproductive, in comparison with those of the present time. The prints of naked hands and feet are to be seen on several rocks in this town, supposed to have been done by the Indians. These are probably similar to those observed in the States of Tennessee and Virginia.—*ib.*

MIDDLEBOURG Key, a small islet separated from St Martin's in the West-Indies on the N. E.—*ib.*

MIDDLEBURG, or *Eoa*, the most southerly of all the Friendly Islands, in the South Pacific Ocean; and is about 10 leagues in circuit.—*ib.*

MIDDLEBURY, a post-town of Vermont, and capital of Addison 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 scale. The township lies on the E. side of Otter Creek, and contains 395 inhabitants.—*ib.*

MIDDLE Cape is to the S. W. of Cape Anthony, **SUPPL. VOL. II.**

in Staten Land, on the strait Le Maire, and the most westerly point of that island; at the extremity of S. America.—*ib.*

MIDDLEFIELD, a township in Hampshire county, Massachusetts, 30 miles N. W. of Springfield, and 125 miles westerly of Boston. It was incorporated in 1783, and contains 608 inhabitants.—*ib.*

MIDDLEHOOK, a village in New-Jersey, 8 miles W. of Brunswick, on the cross post-road from Brunswick to Flemington, and on the N. bank of Rariton river.—*ib.*

MIDDLE Islands, or *Iblas de en Medio*, on the W. coast of New-Mexico, and are between the islands of Chira and St Luke. They are in the North Pacific ocean, in lat. $9^{\circ} 30'$ N. There is only from 6 to 7 fathoms from Chira to these islands, and all vessels should keep nearer to them than to the main.—*ib.*

MIDDLE LATITUDE, is half the sum of two given latitudes; or the arithmetical mean, or the middle between two parallels of latitude. Therefore,

If the latitudes be of the same name, either both north or both south, add the one number to the other, and divide the sum by 2; the quotient is the middle latitude, which is of the same name with the two given latitudes. But

If the latitudes be of different names, the one north and the other south; subtract the less from the greater, and divide the remainder by 2, so shall the quotient be the middle latitude, of the same name with the greater of the two.

MIDDLESEX, a county of Massachusetts, bounded north by the State of New-Hampshire, E. by Essex county, S. by Suffolk, and W. by Worcester county. Its figure is nearly equal to a square of 40 miles on a side; its greatest length being 52, and its greatest breadth 42 miles. It has 42 townships, which contain 42,737 inhabitants. The religious societies are 55 of Congregationalists, 6 of Baptists, and some Presbyterians. It was made a county in 1643. It is watered by five principal rivers, Merrimack, Charles, Concord, Nashua, and Mystick; besides smaller streams. The chief towns are Charlestown, Cambridge, and Concord. Charlestown is the only sea-port in the county; Concord is the most respectable inland town, and is near the centre of the county, being 20 miles N. W. of Boston. There are in the county 24 fulling-mills, about 70 tan-yards, 4 paper-mills, 2 snuff-mills, 6 distilleries, and about 20 pot and pearl ash houses. The southern and northern sides 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 summits. The air is generally serene, and the temperature mild. The extreme variation of Fahrenheit's thermometer, may be considered as 100° in a year; but it is in very few instances, that in the course of a year it reaches either extreme: 92° may be considered as the extreme summer heat, and 5 or 6° below 0, as that of the winter cold. In the winter of 1796—1797, it sunk to 11° below 0. The soil is various, in some parts of rich, black loam, and in others it is light and sandy. 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, **3 P** bounded

Middle-
field.
||
Middlesex.

Middlesex, 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.*

Middleton.

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 Chesapeake 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 Mystic 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 con-

tains 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 Susquehanna, 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 Fredericktown.—*ib.*

MIDDLE-

Middle-town.

Middle-
town,
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Milford.

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 Mispillion 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 sound, 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,
||
Mill.

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 embraced 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 Naukeag 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;

Mill,
||
Millstone.

Straits; N. N. W. of Nottingham Island, and S. by E. of Cape Comfort, but nearer to the latter. N. lat. $64^{\circ} 36'$. W. long. $80^{\circ} 30'$.—*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 Frelinghuyten, and formerly the county town of Somerset.—*ib.*

Millstone,
||
Minehead.

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 Susquehanna 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 incorporated 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. $3^{\circ} 20'$, W. long. $75^{\circ} 18'$.—*ib.*

MINE AU FER, or *Iron Mines*, on the E. side of Mississippi river, is $67\frac{1}{4}$ 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.*

MINERALOGY

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, *Ency. l.* 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 *Encyclopaedia*, 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.

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).

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*.

The *external properties* may be arranged under the following heads:

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|-----------------|---------------|-----------------|
| 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. | | |

4 Properties of minerals.

External Characters.

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 spheroid; *ovate*, like an egg; *chese-shaped*, a very flattened sphere; *almond-shaped*, like an almond; *centicular*, like a double convex lens, 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; *strubform*, branches not arising from a common stem; *coraloidal*, 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 Trewson 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 Leipzig in 1774; or the *French translation* published at Dijon in 1790. See also *Romé de Lisle. Des caractères extérieurs des minéraux*. And *Huy Jour. d'hist. Nat.* 11. 56.

External
Characters.

dric 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
Transpa-
rency.

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.

External
Characters.

Prussian blue. The purest blue.
Azure blue. A bright blue with scarce a tint of red.
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.

External Characters.

Peach blossom red. A very pale whitish red of the crimson kind.

Mordéré. A dark dirty crimson red; a mixture of crimson and a little brown.

Brownish red. A mixture of blood red and brown.

8. *Brocons.*

Reddish brown. A deep brown inclining to red.

Clove brown. A deep brown with a tint of carmine.

Yell with 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 greate; 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 asperi-

ties; *uneven*, having many small, sharp, abrupt, in regular 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 flatish 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 *flaty*, 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 *flaty structure* and *earthy texture*. The texture of pitcoal is compact, but its structure is often flaty.

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, Haüy, 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.

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

19
Artificial
classes.

Artificial System.

Artificial System.

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 alkalis.

* 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. Forns with potash 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. Calamin.

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.

SUPPL. VOL. II.

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. Tintone.

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. Shail.

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. Thumcristone.

Colour clove brown.

** Hardness 5 to 8.

GENUS VI. Melts into a transparent glass.

- 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 potaſh, 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 antiſmony.
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 bluith grey. Hardneſs 10.
When ſtruck, emits an arſenical ſmell. Luſtre ſcarceſy 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 ar-
fenical 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 sulphu-
reous 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 me-
tallic.

- 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.
Melts 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 clas-
ses, orders, and genera; because a more careful exami-
nation 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 those
bodies which in the following system are arranged un-
der the class of combustibles; because there can scarce-
ly 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 mi-
nerals into four classes; stones, salts, inflammable bodies,
and metals (D). This division has been, in some mea-
sure, followed by all succeeding writers. Linnæus, in-
deed, the first of the moderns who published a system of
mineralogy, being guided by the external characters
alone, divided minerals into three classes, *peira*, *minera*,
fossilia: but Avicenna's classes appear among his orders.
The same remark may be made with respect to the sy-
stems 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 ad. pt his classes, with a few slight excep-
tions; 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.

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 bo-
dies which are composed chiefly of metals.

20
Natural
classes.

CLASS I. EARTHS AND STONES.

WE shall divide this class into three orders. The
first order shall comprehend all chemical com-
binations 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 sim-
ple bodies. We shall therefore, for want of a better name,
call the first order *simple*; the second order we shall di-
stinguish by the epithet of *saline*; and the third we shall

3 Q 2

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 dusti-
bilia, et quædam non. *Avicenna de congelatione et conglutinatione lapidum*, Cap. 3. *Theatrum Chemicum*, t. iv.
p. 997.

Earths and
Stones.

call *aggregates*; because most of the minerals belonging to it consist of various *simple stones*, cemented, as it were, together.

ORDER I. SIMPLE STONES.

²¹
Cronstedt's
genera

CRONSTEDT divided this order into nine genera, corresponding to nine earths; one of which he thought composed the stones arranged under each genus. The names of his genera were, *calcareæ, siliceæ, granatina, argillacea, micacæ, fluores, asbestina, zeolithica, magnesia*. All his earths were afterwards found to be compounds, except the first, second, fourth, and ninth. Bergman, therefore, in his *Sciagraphia*, first published 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 discovered. Accordingly, in the latest systems of mineralogy, the genera belonging to this order amount to eight. Each genus is named from an earth; and they are arranged in the newest Wernerian system, which we have seen, as follows:

- | | |
|------------------------|----------------------|
| 1. Jargon genus. | 5. Magnesian 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 system of mineralogy, has adopted the same genera. Under each genus, those stones are placed, which are composed chiefly of the earth which gives a name to the genus, or which at least are supposed to possess the characters which distinguish that earth.

²³
Still deficient.

A little consideration will be sufficient to discover that there is no natural foundation for these genera. Most stones are composed of two, three, or even four ingredients; and, in many cases, the proportion of two or more of these is nearly equal. Now, under what genus soever such minerals are arranged, the earth which gives it a name must form the smallest part of their composition. Accordingly, it has not been so much the chemical composition, as the external character, which has guided the mineralogist in the distribution of his species. The genera cannot be said properly to have any character at all, nor the species to be connected by any thing else than an arbitrary title. This defect, which must be apparent in the most valuable systems of mineralogy, seems to have arisen chiefly from an attempt to combine together an artificial and natural system. As we have separated these two from each other, it becomes necessary for us to attend more accurately to the natural distribution 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 substances which enter into the minerals belonging to this order, in such quantity as to deserve attention, are the following:

- | | |
|-----------|------------------|
| Alumina, | Glucina, |
| Silica, | Zirconia, |
| Magnesia, | Oxyd of iron, |
| Lime, | Oxyd of chromum, |
| Barytes, | Potass. |

Simple
Stones.

All those minerals which are composed of the *same* ingredients we arrange under the *same* genus. According to this plan, there must be as many genera as there are varieties of combinations of the above substances existing in nature. The varieties in the *proportion* of the ingredients constitute species. We have not imposed names upon our genera, but, in imitation of Bergman,* have denoted each by a symbol. This symbol is composed of the first letter of every substance which enters in any considerable quantity into the composition of the minerals arranged under the genus denoted by it. Thus, suppose the minerals of a genus to be composed of *alumina, silica,* and *oxyd of iron*, we denote the genus by the symbol *asi*. The letters are arranged according to the proportion of the ingredients; that which enters in the greatest proportion being put first, and the others in their order. Thus the genus *asi* is composed of a considerable proportion of alumina, of a smaller proportion of silica, and contains least of all of iron. By this contrivance, the symbol of a genus contains, within the compass of a few letters, a pretty accurate description of its nature and character. Where the proportions of the ingredients vary in the same genus so much, that the letters which constitute its symbol change their place, we subdivide the genus into parts; and whenever the minerals belonging to any genus become too numerous, advantage may be taken of these subdivisions, and each of them may be formed into a separate genus. At present this seems unnecessary (E).

* *Opusc. iv.*
^{231.}

The following is a view of the different genera belonging to this order, denoted each by its symbol. Every genus is followed by the species included under it; and the whole are in the order which we mean to follow in describing them:

- | | | | |
|-----------|--|-------------|---|
| I. A. | Telefia,
Corundum,
Native alumina. | VI. I. ASI. | Micarell,
Shorl,
Granatite, |
| II. AMC. | Ruby. | 2. SA1. | Tourmaline, |
| III. AIM. | Ceylanite, | | Argentine felspar,
Mica, |
| IV. s. | Quartz,
Elastic quartz,
Flint,
Opal,
Pitchstone,
Chrysoprasium. | | Talc,
Bafaltine,
Hornblende,
Obsidian,
Petrilite,
Felsite. |
| V. I. AS. | Topaz,
Sommitte,
Shorlite. | VII. SAP. | Felspar,
Lepidolite,
Leucite. |
| | 2. SA. | VIII. SAG. | Emerald. |
| | Rubellite,
Hornstone,
Hornstone,
Chalcedony,
Jasper,
Tripoli. | IX. SAB. | Staurolite. |
| | | X. I. ASL. | Chrysoberyl. |
| | | 2. SAL. | Hyalite,
Ædelite. |
| | | 3. SAWL. | |

(E) We need hardly remark, that the last three genera of Werner belong to the second order of the first class of this treatise.

Earths and Stones.

3. SAWL.	Zeolite, Stibite, Analcime.
4. SLA.	Lazulite.
XI. SALI.	Garnet, Thunbergite, Fichtite, Thallite.
XII. 1. AMS.	Cyanite.
2. MSA.	Serpentine.
XIII. MSAL.	Potilone, Chlorite.
XIV. SLAM.	Stuccous spar.

XV. SAMLI.	Argillite.
XVI. SM.	Kiddekill, Steatites.
XVII. MSI.	Chrysolite, Jade.
XVIII. SML.	Asbestos, Asbestinites.
XIX. 1. SILM.	Pyroxen, Asbestoid.
2. SMIL.	Actinolite.
XX. SL.	Shikofe hornstone.
XXI. ZS.	Zireen.

are isosceles triangles, having the angle at their vertex $22^{\circ} 54'$, and each of those at the base $78^{\circ} 48'$ (c). The inclination of a side of one pyramid to a contiguous side of the other pyramid is $139^{\circ} 54'$.† 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 $122^{\circ} 18'$.‡ For figures of these crystals we refer the reader to Romé de Lisle and Haüy.*

Simple Stones.
† *Ibid.* and Romé de Lisle, ii. 515.
* Fig. 2.
‡ Haüy, *Ibid.*
* *Ibid.*

The texture of the telefia 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 telefia into the three following varieties.

Variety 1. Red telefia.
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 telefia.
Oriental topaz.

Colour golden yellow. Transp. 4. Hardness 15. Sp. gr. 4.0106.

Variety 3. Blue telefia.
Oriental sapphire.

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 sapphire of the ancients. Their sapphire was distinguished by gold-coloured spots, none of which are to be seen in the sapphire of the moderns.||

A specimen of this last variety, analysed by Mr Klapproth, was found to contain in 100 parts,

98.5 alumina,	‡ <i>Greville's</i> , <i>Niobolton's</i> <i>Four.</i> lii. 11.
1.0 oxyd of iron,	<i>Hill's</i> <i>Theophrastus</i> , πρρ τὰς λιβάν,
0.5 lime,	p. 100.

100.0*.

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 sapphire .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 telefia.

* *Beiträge*, i. 81.

† *Bergman's*, ii. 96.

GENUS I. A.

SPECIES 1. Telefia (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 Haüy, whose labours, distinguished equally by their ingenuity and accuracy, have contributed not a little to the progress of mineralogy, denominated it *telefia*, from the Greek word *τελειος*, which signifies *perfect*.

The telefia 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 Haüy, 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 telefia appears under the form of two very long slender six-sided pyramids, joined base to base.† The sides of these pyramids

25
G. L. A.
Telefia.

* *Ann. de Chim.* xvii. 313.
† *Plac.* XXXVI. fig. 1.

SPECIES.

(F) See Kirwan's *Mineralogy*, I. 250.—Gmelin's *Systema Naturæ of Linneus*, III. 170.—Romé de Lisle's *Crysallographie*, II. 212.—Bergmanni *Opuscula*. II. 72.

(c) In some instances, the angle at the vertex is 31° , those at the base $74^{\circ} 30'$, and the inclination of two triangles $122^{\circ} 36'$. See Haüy, *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 (1).

Corundum of Gmelin—*Adamantine spar* of Klaproth and Kirwan—*Corindon* of Haüy—*Corivindum* 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 Terree, one of the western islands of Scotland †.

The corundum is usually crystallized. Its primitive form, discovered by Mr Haüy ‡ and the Count de Bournon,* is a rhomboidal parallelepiped, 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 Haüy; 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 parallelepiped. Lustre, when in the direction of the laminae, 3; when broken across, 0. Opaque, 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 ‡.

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 analytes exhibit in the corundum, we have been induced to include it in the present genus, on account of the strong resemblance between it and the third variety of telefia. The striking resemblance between the crystals of telefia 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 telefia, and that the seeming difference in their ingredients is owing to the impurity of these 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.

SPECIES 3. Native alumina (κ).

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 †.

GENUS II. AMC.

SPECIES 1 Ruby (λ).

Spinel and balafs Ruby of Kirwan—*Ruby* of Haüy—*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 *balafs*; if pale rosy, *spinell*.

The

* Garroz 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 Haüy Jour. de Min. N° xxviii. 262.

† Klaproth. See also Mr Greville, Nicholson's Jour. iii. 11.

‡ Beiträge, i. 77.

Simple
Stones.

‡ Ibid. i. 73.

* Nicholson's Jour. iii. 9.

27
Native alumina.

† Schreber. 28
G. II. AMC.
Ruby.

‡ Fig. 9.

* Crystall. 226. Estner's Miner.

75.
† Klaproth.
‡ Halchette and Greville.

(1) 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 Haüy Jour. de Phys. XXX. 193. and Jour de Min. N° XXVIII. 262.

(κ) See Kirwan's Mineralogy, I. 175. and Schreber. 15. Stück, p. 209.

(λ) See Kirwan's Min. I. 253.—Romé de Lisle, II. 224.—Klaproth Beob. der Berlin, III. 336. and Beiträge, 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*
 The ancients seem to have classed this stone among their hyacinths †.

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 Lisse ‡; but was first described by La Metherie in the Journal de Phytique for January 1793.

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 †.

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

68 alumina,
 16 oxyd of iron,
 12 magnesia,
 2 silica.

98 ‡.

SPECIES 1. Quartz ‖.

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 parallelepiped; 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 law which they have followed in crystallizing, we refer the reader to Romé de Lisse † and Mr Hauy ‡.

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 va-

rious; a circumstance which has induced mineralogists to divide it into numerous varieties. Of these the following are the chief.

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 *compsoella hyacinth*, and by Hauy *quartz hematoid*. 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.*

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 *Smeiffers'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.

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.

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 †

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.*

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

Simple Stones.

* Jour. de Min. N° xxviii. 255.

Elastic quartz. 31

† Beitrage, ii. 116.

Flint. 32

* Gmelin's Systema Naturæ, iii. 183.

(N) Kirwan's Min. I. 316—Gerhard Mem. Berlin, 1783, 107.—Klaproth's Beitrage 2 Band. 113. See also Jour. de Phys. XL1. 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 crust. A specimen of flint analysed by Klaproth contained

98.00	silica,
.50	lime,
.25	alumina,
0.25	oxyd of iron,
1.00	water.

† *Beiträge*, i. 46. Another specimen analysed by Dolomieu was composed of

100.00†	
97	silica,
1	alumina and oxyd of iron,
2	water.

‡ *Jour. de Min.* N^o xxxiii. 702. The white crust with which flint is enveloped, consists of the same ingredients, and also a little carbonat of lime. Dolomieu discovered that water is essential to flint; for when it is separated by heat the stone loses its properties §.

§ *Ibid.* The manufacture of gun flints is chiefly confined to two or three departments in France. The operation is exceedingly simple: a good workman will make a 1000 flints in a day. The whole art consists in striking the stone repeatedly with a kind of mallet, and bringing off at each stroke a splinter, sharp at one end and thicker at the other. These splinters are afterwards shaped at pleasure, by laying the line at which it is wished they should break, upon a sharp iron instrument, and then giving it repeatedly small blows with a mallet. During the whole operation the workman holds the stone in his hand, or merely supports it on his knee ||.

33 Opal. SPECIES 4. Opal (p). This stone is found in many parts of Europe. It is usually amorphous. Its fracture is conchoidal, commonly somewhat transparent. Hardness from 6 to 10. Sp. gr. from 1.7 to 2.66. The lowness of its specific gravity, in some cases, is to be ascribed to accidental cavities which the stone contains. These are sometimes filled with drops of water. Some specimens 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 possess this property, are distinguished by lapidaries by the epithet *oriental*; and often by mineralogists by the epithet *nobilis*. This property rendered the stone much esteemed by the ancients.

Variety 1. Opal edler—*Opalus nobilis*.

Lustre glassy, 3. Transp. 3 to 2. Hardness, 6 to 8. Colour, usually light bluish white, sometimes yellow or green. When heated it becomes opaque, and sometimes is decomposed by the action of the atmosphere. Hence it seems to follow, that water enters essentially into its composition. A specimen of this variety, analysed by Klaproth, contained

90	silica,
10	water.

¶ *Beiträge*, ii. 153.

100¶¶ Variety 2. Semi-opal.

Fracture, imperfectly conchoidal. Lustre, glassy 2. Transp. 2 to 3. Hardness, 7 to 9. Its colours are

very various, greys, yellows, reds, browns, greens of different kinds.

Specimens of this variety sometimes occur with rifts: these readily imbibe water, and therefore adhere to the tongue. These specimens sometimes become transparent when soaked in water, by imbibing that fluid. They are then called *hydrophanes*.

Variety 3. Cat's eye*.

This variety comes from Ceylon, and is seldom seen by European mineralogists till it has been polished by the lapidary. Mr Klaproth has described a specimen which he received in its natural state from Mr Greville of London. Its figure was nearly square, with sharp edges, a rough surface, and a good deal of brilliancy.

Its texture is imperfectly foliated. Lustre greasy, 2. Transp. 3 to 2. Hardness 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 positions it reflects a splendid white, as does the eye of a cat; hence the name of this stone.

Two specimens, analysed by Klaproth, the first from Ceylon, the other from Malabar, were composed of

95.00	94.50	silica,
1.75	2.00	alumina,
1.50	1.50	lime,
0.25	0.25	oxyd of iron.
<hr/>		
98.5 *	98.25 †.	

SPECIES 5. Pitchstone §. *Menelites*.

This stone, which occurs in different parts of Germany, France, and other countries, has obtained its name from some resemblance which it has been supposed to have to pitch. It is most usually in amorphous pieces of different sizes; and it has been found also crystallized in six-sided prisms, terminated by three-sided pyramids.

Its texture is conchoidal and uneven, and sometimes approaches the splintery. Lustre greasy, from 3 to 1. Transp. 2 to 1, sometimes 0. Hardness 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, greyish black, bluish grey, green, red, yellow of different shades. Sometimes several of these colours appear together in the same stone. A specimen of pitchstone from Mefnil-montant near Paris*, analysed by Mr Klaproth, contained

85.5	silica,
11.0	air and water,
1.0	alumina,
.5	iron,
.5	lime and magnesia.

98.5 †

SPECIES 6. Chrysoprasium (Q).

This mineral, which is found in different parts of Germany, particularly near Kosmütz in Silesia, is always amorphous. Its fracture is either even or inclining to the splintery. Scarcely any lustre. Transp. 2 to 3. Hardness 10 to 12. Sp. gr. 2.479. Colour, green. In a heat of 130° Wedgewood it whitens and becomes opaque.

Simple Stones.

* Kirwan's Min. i. 301. Klaproth, Beitrage, i. 90.

* Beitrage, i. 94. † *Ibid.* p. 96.

34 Pitchstone. § Kir. Min. i. 292.—Daubanton, Mem. Par. 1787, p. 86.

* See *Jour. de Phys.* xxxi. 219.

† *Beitrage*, ii. 169.

35 Chrysoprasium.

(p) Kirwan's Min. I. 289.—Hauy, *Jour. d'Hist. Nat.* II. 9. Delius. *Nouv. Jour. de Phys.* I. 45. (Q) Kirwan's Min. I.—Lehmann. *Mem. Berlin.* 1755. p. 202.—Klaproth *Beitrage*, II. 127.

Order I.

Earth and Stones. A specimen of this stone, analysed by Mr Klaproth, contained

96.16 filica,	
1.00 oxyd of nickel,	
0.83 lime,	
0.08 alumina,	
0.08 oxyd of iron.	

98.15 †	

4. *Aigue marine*. It is of a bluish or pale green colour.

Simple Stones.

5. *Occidental sapphire*. It is of a blue colour; and sometimes white.

A specimen of white Saxon topaz, analysed by Vauquelin, contained

68 alumina,	
31 filica.	

99 ¶	

† *Jour. de Min.* N^o xxiv. 3.

GENUS V. 1. AS.

SPECIES 1. Topaz (R).

Occidental ruby, topaz, and sapphire.

The name *topaz* has been restricted by Mr Hauy to the stones called by mineralogists occidental ruby, topaz, and sapphire; 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 †.

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.

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 ††.
3. *Saxon topaz*. It is of a pale wine yellow colour, and sometimes greyish white.

SUPL. VOL. II.

SPECIES 2. Sommite.

This stone was called sommite by La Metheric, 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 filica,	
2 lime,	
1 oxyd of iron.	

98 *	

¶ *Jour. de Min.* N^o xxiv. 3.

SPECIES 3. Shorlite †.

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 filica.	

100	

* *Ibid.* N^o xxviii. 279.

GENUS V. 2. SA.
SPECIES 4. Rubellite (T).
Red shorl of Siberia.

† *Jour. de Min.* N^o xxviii. 286.

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 filica,	
35 alumina,	
5 oxyds of iron and manganese.	

97	

39
G. V. 2 SA.
Rubellite.

SPECIES 5. Hornslate (U).
Shistose porphyry.

This stone, which occurs in mountains, is generally amorphous; but sometimes also in columns. Structure

3 R	ture
-----	------

40
Hornslate.

(R) Kirwan's *Min.* I. 254.—Pott. *Mem. Berlin*, 1747, p. 46.—Margraf, *ibid.* 1776. p. 73. and 160.—Henkel. *Ab. Acad. Nat. Cur.* IV. 316.

(S) It got its name from *τοπαζα*, to seek; because the island was often surrounded with fog, and therefore difficult to find. See *Plinii lb.* 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 Reufs. *Samml. Natur. Hist. Aufsätze*, p. 207.

† *Beilage*, ii. 133. 36
G. V. I. AS.
Topaz.

* *Hauy*, *Jour. de Min.* N^o xviii. 287. † Fig. 8.

† Fig. 9.

† *Jour. de Min.* *ibid.*

§ *Hauy, ibid.*

¶ *Vauquelin, Jour. de Min.* N^o XL. 165.

Earths and
Stones.

ture flaty. Texture foliated. Fracture uneven and splintery; sometimes approaching the conchoidal. Lustre o. Transparency 1 or o. 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.†

41
Hornstone.

SPECIES 6. Hornstone (x).
Petrofibre—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 o. 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.†

Schneif-
fer's Min.
i. 103.

According to Kirwan, it is composed of

72	silica,
22	alumina,
6	carbonat of lime.

100‡

Ibid. p.
305.

SPECIES 7. Chalcedony.

42
Chalcedo-
ny.

This stone is found abundantly in many countries, particularly in Iceland and the Faro islands. It is most commonly amorphous, stalaftical, 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 (x).

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 o. 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.

This mineral is found sometimes in an earthy form, but more generally indurated. Its texture is earthy. Its fracture often somewhat conchoidal. Lustre o. 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.*

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,

45

G. VI. I.

ASI.

Micarell.

* 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. 46. A specimen analysed by Klaproth contained

63.00 alumina,
29.50 silica,
6.75 iron.

99.25

SPECIES 2. *Shorl*.†

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

41.25 alumina,
34.16 silica,
20.00 iron,
5.41 manganese.

100.82 †

SPECIES 5. *Granatite*.

Staurotide of Hauy—*Pierre de Croix* of De Lisle—*Staurotite* of Lametherie.

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 is found in Galicia in Spain, and Brittany 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 integument 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.

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 †

GENUS VI. 2. *SAL*.

SPECIES 4. *Tourmaline* (z).

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.

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.

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 ‡.

SPECIES 5. *Argentine felfpar*.§

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.

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

3 R 2

apt

Simple Stones. *Ann. de Chim. vi. 142.*

† *Ibid.* xxx. 106.

48 C. VI. 2.

SAL. *Tourmaline*.

* *Hauy*. *Jour. de Min.* N° xxviii. 265.

† *Æpinus*.

‡ *Ann. de Chim.* xxx. 105.

§ *Argentine felfpar*. *Kirwan*, i. 327.

46 *Shorl*.

• *Thal.* i. 166.

† *Cronst.* *Beiträge*, I. *Bardes*, 4. *Stau.*, p. 21.

‡ *Fig.* 10. *Rom.* de *Lisle*, ii. 45.

(z) *Kirw.* I. 271.—*Berg.* II. 118. and V 402.—*Gerhard.* *Mem.* Berlin, 1777, p. 14—*Hauy Mem.* Paris 1784, 270.—*Wilson Phil. Trans.* XLI. 308.—*Æpinus.* *Recueil sur la Tourmaline.* See also *La Porterie.* *Le Sapphir.* *L'Œil de Chat.* et *la Tourmaîne de Ceylon demasqués.*

(A) And when black only 1.

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Stones.

apt to decay: Its surface becomes iridescent, and at last changes to ochre yellow: Its specific gravity is 2.3 or 2.212; and when breathed upon, it gives out an earthy smell.

50

Mica.

|| Kirw. i.
210—Gmelin, Nov. Com. Petro-pol. xii. 549.

SPECIES 6. Mica ||.

This stone forms an essential part of many mountains, and has been long known under the names of *glacies maris* and *Muscovy glass*. It consists of a great number of thin laminæ adhering to each other sometimes of a very large size. Specimens have been found in Siberia nearly $2\frac{1}{2}$ yards square (B).

It is sometimes crystallized: Its primitive form is a rectangular prism, whose bases are rhombs, with angles of 120° and 60° †: Its integrant molecule has the same form. Sometimes it occurs in rectangular prisms, whose bases also are rectangles, and sometimes also in short six-sided prisms †; but it is much more frequently in plates or scales of no determinate figure or size.*

† Fig. II.

† Fig. 12.

* Haüy,
Jour. de Min. N°
xxviii. 296.

Its texture is foliated. Its fragments flat. The lamellæ flexible, and somewhat elastic. Lustre metallic, from 3 to 4. Transparency of the laminæ 3 or 4, sometimes only 2 (c). Hardness 6. Very tough. Often absorbs water. Sp. gr. from 2.6546 to 2.9342. Feels smooth, but not greasy. Powder feels greasy. Colour, when purest, silver white or grey; but it occurs also yellow, greenish, reddish, brown, and black. Mica is fusible by the blow-pipe into a white, grey, green, or black, enamel; and this last is attracted by the magnet (D). Spanish wax rubbed by it becomes negatively electric.*

Ibid.

A specimen of mica, analysed by Vauquelin, contained

50.00 silica,
35.00 alumina,
7.00 oxyd of iron,
1.35 magnesia,
1.33 lime,

Ibid. 302.

94.68 †.

Mica has long been employed as a substitute for glass. A great quantity of it is said to be used in the Russian marine for panes to the cabin windows of ships; it is preferred, because it is not so liable as glass to be broken by the agitation of the ship.

51

Talc.

Kirw. i.
150.—Pott.
Mem. Berl.
1746, p. 65.

SPECIES 7. Talc †.

This stone has a very strong resemblance to mica, and was long considered as a mere variety of that mineral. It occurs sometimes in small loose scales, and sometimes in an indurated form; but it has not hitherto been found crystallized.

Its texture is foliated. The lamellæ are flexible, but not elastic. Its lustre is from 2 to 4. Transparency from 2 to 4. Hardness 4 to 6. Sp. gr. when indurated, from 2.7 to 2.8. Feels greasy. Colour most commonly whitish or greenish. Spanish wax rubbed with it becomes positively electric §.

§ Haüy,
Jour. de Min. N°
xxviii. 291.

Variety I. Scaly talc.

Talcite of Kirwan.

This variety occurs under the form of small scales,

scarcely cohering. Lustre 3 to 4. Very light. Adheres to the fingers. When rubbed upon the skin, it gives it a gloss. Colour white, with a shade of red or green; sometimes leek green.

Variety 2. Common talc.

Venetian talc.

This variety often occurs in oblong nodules. Lustre, nearly metallic, 4. Transparency 2 to 3; when very thin 4. Hardness 4 to 5. Colour white, with a shade of green or red; or apple green, verging towards silver white. By transmitted light, green.

Variety 3. Shiftose talc.

Its structure is flaty. Fracture hackly and long splintery. Easily crumbles when rubbed in the fracture. External lustre 2 to 3; internal, 1; but sometimes, in certain positions, 3. Colour grey, with a shade of white, green or blue. Becomes white and scaly when exposed to the air.

A specimen of common talc, analysed by Mr Chenevix, contained

48.0 silica,
37.0 alumina,
6.0 oxyd of iron,
1.5 magnesia,
1.5 lime,
5.0 water,

99.0.*

SPECIES 8. Basaltine †.

Basaltic hornblende of Werner—*Astinote* of Haüy—*Zillerthite* of Lametherie—*Sborl prismatique hexagone* of Sauffure.

This stone is found commonly in basaltic rocks; hence its name, which we have borrowed from Mr Kirwan. It is crystallized, either in rhomboidal prisms, or six or eight-sided prisms, terminated by three-sided pyramids. Its texture is foliated. Its fracture uneven. Lustre 3. Transparency, when in very thin plates, 1. Hardness from 9 to 10. Sp. gr. 3.333. Colour black, dark green, or yellowish green. Streak white. Transmits a reddish yellow light. Before the blow-pipe, it melts into a greyish coloured enamel, with a tint of yellow †. A specimen, seemingly of this stone, analysed by Berg-

man, contained 58 silica,
27 alumina,
9 iron,
4 lime,
1 magnesia,

99 †.

SPECIES 9. Hornblende ¶.

Amphibole of Haüy (E).

This stone enters into the composition of various mountains. Its texture is very conspicuously foliated. Fracture conchoidal. Fragments often rhomboidal. Lustre 2. Opaque. Hardness 5 to 9. Tough. Sp. gr. 2.922 to 3.41. Colour black, blackish green, olive green,

Simple
Stones.* Ann. de
Chim.
xxviii. 200.52
Basaltine.
† Kirw. i.
219.† Le Lievre,
Jour. de
Min. N°
xxviii. 269.‡ Berg. iii.
207.53
Horn-
blende.
¶ Kirw. i.
213.

(B) *Hist. General de Voyages*, T. XVIII. 272, quoted by Haüy *Jour. de Min.* N° XXVIII. 299.

(C) Black mica is often nearly opaque.

(D) Haüy, *ibid.* p. 295. Bergman, however, found pure mica infusible *per se*; and this has been the case with all the specimens of Muscovy glass which we have tried.

(E) We suspect, that under this name Mr Haüy comprehends *Sborl* also.

Earths and stones. green, or leek green. Streak greenish. It neither becomes electric by friction nor heat.* Before the blow-pipe it melts into a black glass. A specimen of black hornblende, analysed by Mr Hermann, was composed of

37 silica,
27 alumina,
25 iron,
5 lime,
3 magnesia,

97 †

SPECIES 10. Resplendent Hornblende

† *Ess. der*
Berlin, 5.
Band, 317.
54
Resplendent hornblende.

There are two minerals which Werner considers as varieties of hornblende, and Mr Kirwan as constituting a distinct species. These, till future analyses decide the point, we shall place here under the name of resplendent hornblende, the name given them by Mr Kirwan; and we shall describe them separately.

Variety 1. Labrador hornblende.

Texture, curved foliated. Lustre, in some positions, 0; in others metallic, and from 3 to 4. Opaque. Hardness 8 to 9. Sp. gr. from 3.35 to 3.434. Colour, in most positions, greyish black; in others, it reflects a strong iron grey, sometimes mixed with copper red.

Variety 2. Shiller spar.*

Texture foliated. Lustre metallic, 4. Transparency, in thin pieces, 1. Hardness 8 to 9. Sp. gr. 2.882. Colour green, often with a shade of yellow; also golden yellow. In some positions it reflects white, grey, or yellow. At 141° Wedgewood, hardened into a porcelain mass. A specimen, analysed by Gmelin, was composed of

43.7 silica,
17.9 alumina,
23.7 iron,
11.2 magnesia.

96.5 †.

It has been found in the Hartz, stuck in a serpentine rock.

SPECIES 11. Obsidian ‖.

Iceland agate.

This stone is found either in detached masses, or forming a part of the rocks which compose many mountains. It is usually invested with a grey or opaque crust. Its fracture is conchoidal. Its internal lustre 3. Transparency 1. Hardness 10. Sp. gr. 2.348. Colour black or greyish black; when in very thin pieces, green. It melts into an opaque grey mass. According to Bergman, it is composed of

69 silica,
22 alumina,
9 iron.

100 †.

SPECIES 12. Petrillite.*

Cubic felspar.

This stone is found in the mass of mountains. It is amorphous. Texture foliated. Fracture splintery. Fragments cubic, or inclining to that form; their faces unpolished. Lustre 2. Transparency partly 2, partly 1. Hardness 9. Sp. gr. 3.081. Colour reddish brown. Does not melt at 160° Wedgewood.

SPECIES 13. Felsite †.

Compact felspar.

This stone also forms a part of many mountains, and

is amorphous. Texture somewhat foliated. Fracture uneven, approaching to the splintery. Lustre 1. Transparency scarce 1. Hardness 9. Colour azure blue, and sometimes brown and green. Streak white. Before the blow-pipe, whitens and becomes rifted; but is infusible *per se*.

Simple
Stones.

GENUS VII. SAP.

SPECIES 1. Felspar †.

This stone forms the principal part of many of the highest mountains. It is commonly crystallized. Its primitive form, according to De Lisle, is a rectangular prism, whose bases are rhombs, with angles of 65° and 115° †. Sometimes the edges of the prism are wanting, and faces in their place; and sometimes this is the case also with the acute angles of the rhomb. For a description and figure of these, and other varieties, we refer the reader to *Romé de Lisle*,* *Mr Haüy* †, and *Mr Pini* †.

Its texture is foliated. Its cross fracture uneven. Fragments rhomboidal, and commonly smooth and polished on four sides. Lustre of the polished faces often 3. Transparency from 3 to 1. Hardness 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. Fusible *per se* into a more or less transparent glass. When crystallized, it decrepitates before the blow-pipe.

Variety 1. Pure Felspar.

Moon stone—Adularia.

This is the purest felspar hitherto found. It occurs in Ceylon and Switzerland; and was first mentioned by Mr Sage. Lustre nearly 3. Transparency 2 to 3. Hardness 10. Sp. gr. 2.559. Colour white; sometimes with a shade of yellow, green, or red. Its surface is sometimes iridescent.

Variety 2. Common Felspar.

Lustre of the cross fracture 0; of the fracture, in the direction of the laminæ, from 3 to 1. Transparency 2 to 1. Colour most commonly flesh red; but often bluish grey, yellowish white, milk white, brownish yellow; and sometimes blue, olive green, and even black.

Variety 3. Labrador felspar.

This variety was discovered on the coast of Labrador by Mr Wolfe; and since that time it has been found in Europe. Lustre 2 to 3. Transparency from 1 to 3. Sp. gr. from 2.67 to 2.6925. Colour grey. In certain positions, spots of it reflect a blue, purple, red, or green colour.

Variety 4. Continuous felspar.

This variety most probably belongs to a different species; but as it has not hitherto been analysed, we did not think ourselves at liberty to alter its place.

It is found in large masses. Texture earthy. Fracture uneven, sometimes splintery. Lustre 0. Transparency 1. Hardness 10. Sp. gr. 2.609. Colour reddish grey, reddish yellow, flesh red.

A specimen of green felspar from Siberia, analysed by Vauquelin, contained

62.83 silica,
17.02 alumina,
16.00 potash,
3.00 lime,
1.00 oxyd of iron.

99.85 ‖.

58
G. VII. SAP.
Felspar.
† *Kirw.* i.
316. and
Jour. de
Phys. nat-
sim.
† *Fig.* 13.
and 14.

* *Crystall.*
ii. 461.
† *Mem.*
Par. 1784,
p. 273.
† *Sur de*
Nouvelle
Crystallisa-
tion, &c. 8.

* *Kirw.* i.
211.

† *Bergbau-*
kunde,
I *Band*, p.
92.

55
Obsidian.
| *Kirw.* i.
264.

§ *Berg.* iii.
204.

56
Petrillite.
• *Kirw.* i.
325.

57
Felsite.
† *Kirw.* i.
326.

|| *Ann. de*
Chim. xxx.

Earths and
Stones.

SPECIES 2. Lepidolite (F).

Lilalite.

This stone appears to have been first observed by the Abbé Poda, and to have been first described by De Born \S . 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 \dagger . Lustre, pearly 3. Transparency between 1 and 2. Hardness 4 to 5. Not easily pulverised \ddagger . Sp. gr. from 2.816 \parallel to 2.8549 \P . Colour of the mass, violet blue; of the thin plates, silvery white. Powder white, with a tint of red \S . Before the blow-pipe, 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 \dagger .

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 potafs,
5 fluat of lime,
3 oxyd of manganese,
1 oxyd of iron.
100 \ddagger

SPECIES 3. Leucite \parallel .*Vesuvian* of Kirwan—*White garnet* of Vesuvius.

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 \dagger ; 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 Haüy \parallel . The crystals vary from the size of a pin head to that of an inch.

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 cautes syrup of violets to assume a green colour*.

It is composed, as Klaproth has shewn, of

54 silica,
23 alumina,
22 potafs.

99 (1)

It was by analysing this stone that Klaproth discovered the presence of potafs in the mineral kingdom; which is not the least important of the numerous discoveries of that accurate and illustrious chemist.

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 \S .

GENUS VIII. SAG.

SPECIES I. Emerald (K).

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 \dagger , and small faces in their place \ddagger . The sides of the prism are generally channelled.

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 \dagger . At 150° Wedgewood it melts into an opaque coloured mass. According to Dolomieu, it is fusible *per se* by the blow-pipe \ddagger .

This mineral was formerly subdivided into two distinct species, the *emerald*, and *beryl* or *aqua marina*. Haüy 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 \parallel

The *beryl* is of a greyish green colour, and sometimes blue, yellow, and even white: sometimes different colours appear in the same stone \S . It is found in Ceylon, different parts of India, Brazil, and especially in Siberia and Tartary, where its crystals are sometimes a foot

long \P . \P *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 $\lambda\epsilon\pi\iota\varsigma$, the *scale of a fish*, and $\lambda\iota\theta\omicron\varsigma$, a *stone*.

(H) Hence the name leucite, from $\lambda\epsilon\upsilon\kappa\omicron\varsigma$, *white*.

(I) See *Four. de Min.* N° XXVII. 194. and 201. and *Klaproth's Beiträge*, II. 39.

(K) *Kir.* I. 247. and 248.—*Dolomieu. Magazin Encyclopedique*, II. 17. and 145.; and *Four. de Min.* N° XVIII. 19.—*Klaproth Beiträge*, II. 12.

Simple
Stones.

§ Four. de Min. N° xxxix. 177.

61
G. VIII.
SAG. Emerald.

* *Haüy, Four. de Min.* N° xix. 72.
 \ddagger *Fig. 16.*
 \dagger *Romé de Lisle*, ii. 245. and *Haüy, ibid.*

\dagger *Dolomieu, Four. de Min.* N° xviii. 19.
 \ddagger *Ibid.*

\parallel *Ann. de Chim.* lxxvi. 264.

\S *Dolomieu, ibid.*

\dagger *Vauquelin, Ann. de Chim.* xxx. 105.

60

Leucite.
 \parallel *Kirw.* i. 285.

\dagger *Fig. 15.*

\parallel *Four. de Min.* N° xxvii. 185.

* *Vauquelin, Four. de Min.* N° xxxix. 165.

MINERALOGY.

Order I.

Earth and long. A specimen of beryl, analysed by Vauquelin, contained
 69 silica,
 13 alumina,
 16 glucina,
 1.5 oxyd of iron.

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.

It was by analysing this stone that Vauquelin discovered the earth which he called glucina.

GENUS IX. SAB.

SPECIES I. Staurolite*.

Andréolite of Lametherie and Hauy—*Hyacinthe blanche cruciforme*, var. 9. of Romé de Lisle.

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.

† Hauy, *Jour. de Min. N^o* xxi. 5.
 † Werner, *Hauy*.

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.

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§

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 (n), 2 to 3. Transparency 2 to 3; sometimes, though seldom, it is opaque. Hardness 9. Sp. gr. 2.11†. Colour pure white. Infusible at 150° Wedgwood; but it yields to soda†. According to Mr Link, it is composed of

§ *Beiträge*, i. 102.
 64
 G. X. 2.
 SAL.
 Hyalite.
 * *Kirw. i.* 296.
 † *Kirwan*.
 † *Id.*

57 silica,
 18 alumina,
 15 lime.

90 and a very little iron||.

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 intumescs and forms a frothy mass. Acids convert it into a jelly§. A specimen from Mosseberg, analysed by Bergman, contained

|| *Crill's Annals*, 1790, 2 Band. 232.
 65
 Ædelite.
 * *Kirw. i.* 276.
 † *Opusc. vi.* 101.
 † See *Kirwan's Min.* i. 276.
 § *Berg. iii.* 227.

69 silica,
 20 alumina,
 8 lime,
 3 water.

100||

A specimen from Ædelfors yielded to the same chemist

62 silica,
 18 alumina,
 16 lime,
 4 water.

100§

|| *Opusc. vi.* 101.

¶ *Id.*

GENUS

100

Klaproth found the same ingredients, and nearly in the same proportions†.

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

GENUS X. 1. ASL.

SPECIES I. 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 Nertschink 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

63
 X. ASL.
 Chrysoberyl.
 † *Kirw. i.* 32.

(L) See *Gillet, Jour. de Phys.* 1793, p. 1 and 2.

(n) Hence probably the name *hyalite*, which was imposed by Werner from *υαλις*, glass, and *λιθος*, a stone.

Earths and
Stones.

66

G. X. 3.
SAWL.
Zeolite.* Haüy,
Four. de
Min. N°
xiv. 86.† Haüy, *ibid.*
N° xxviii.
276.‡ *Ibid.* N°
xliv. 576.
67
Stilbite.* Haüy,
Four. de
Min. N°
xiv. 86.† Haüy, *ibid.*
N° xxviii.
276.§ Vauquelin,
ibid. N°
xxxix. 161.

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.*

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.

A specimen of zeolite (P), analysed by Vauquelin, contained

53.00 silica,
27.00 alumina,
9.46 lime,
10.00 water.

99.46 ‡.

SPECIES 5. Stilbite.

This stone was first formed into a distinct species by Mr Haüy. 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.*

Its texture is foliated. The laminae 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. ‡

99.46 §.

According to the analysis of Vauquelin, it is composed of

52.0 silica,
17.5 alumina,
9.0 lime,
18.5 water.

97.0 ||

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 Haüy. 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.*

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 Haüy; an alteration which was certainly proper, and which therefore we have adopted.

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.

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 §

GENUS XI. SALI.

SPECIES 1. Garnet (T).

This stone is found abundantly in many mountains. It is usually crystallized. The primitive form of its crystals

Simple
Stones.|| *Ibid.* 164.
68
Analcime.* Haüy,
Four. de
Min. N°
xiv. 86.
and xxviii.
278.G. X. 4.
SLA. Lazulite.
† Kirw. I.
283.

‡ Briffon.

§ Beitrage,
i. 196.70
G. XI.
SALI. Garnet.

(N) Kirw. I. 278.—Guetard, 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 *ζωο*, to ferment, and *λίθος*, 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 Haüy, *stilbite*, from *στειλω*, to shine.

(R) Hence the name *analcime* given it by Haüy, from *ανηλις*, weak.

(S) Hence the name *lazulite*, from an Arabian word *azul*, which signifies blue.

(T) Kirw. I. 258.—Gerhard, Disquisitio physico-chymica Granatorum, &c.—Pafumot, Jour. de Phys. III. 442.—Wiegleb, Ann. de Chim. I. 231.

Earth and Stones. crystals is a dodecahedron whose sides are rhombs, with angles of $78^{\circ} 31' 44''$, and $120^{\circ} 28' 16''$. 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 parallelepipeds, 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 *Haüy*.‡

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.

Variety 1. Oriental garnet (v). 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.

* *Beiträge*, 26. A specimen of red garnet, analysed by Vauquelin, contained
 52.0 silica,
 20.0 alumina,
 17.0 oxyd of iron,
 7.7 lime.

† *Jour. de Min. N° 177*. A specimen of black garnet yielded the same chemist
 43 silica,
 16 alumina,
 20 lime,
 16 oxyd of iron,
 4 moisture.

‡ *Jour. de Min. N° 177*. 99 †.

§ *Jour. de Min. N° 177*. 99 †.

¶ *Jour. de Min. N° 177*. 99 †.

‡ *Jour. de Min. N° 177*. 99 †.

§ *Jour. de Min. N° 177*. 99 †.

¶ *Jour. de Min. N° 177*. 99 †.

‡ *Jour. de Min. N° 177*. 99 †.

§ *Jour. de Min. N° 177*. 99 †.

¶ *Jour. de Min. N° 177*. 99 †.

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 ¶

SPECIES 2. Thumerstone.*

Yanolite of Lamethetic—*Axinite* of Haüy. This stone was first described by Mr Schreber, who found it near Balme d'Auris in Dauphiné, and gave it the name of *skorl viole*.† It was afterwards found near Thum in Saxony, in consequence of which Werner called it *thumerstone*.

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 $101^{\circ} 32'$ and $78^{\circ} 28'$.‡ The most usual variety is a flat rhomboidal parallelepiped, with two of its opposite edges wanting, and a small face in place of each.§ The faces of the parallelepiped are generally streaked longitudinally.

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.¶

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 *
 A specimen, analysed by Vauquelin, contained
 44 silica,
 18 alumina,
 19 lime,
 14 oxyd of iron,
 4 oxyd of manganese.

99 †

SPECIES 3. Prehnite (v).

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.

3 S

Simple Stones.

* *Beiträge*, ii. 21.

71 Thumerstone.

† *Kirw. i. 273*—*Pelletier, Jour. de Phys. xxvi. 66.*

‡ *De Lisle*, ii. 353.

§ *Haüy, Jour. de Min. N° xxxviii. 264.*

¶ *De Lisle, ibid.*

|| *Haüy, ibid.*

¶ *Vauquelin, Jour. de Min. N° xxiii. 1.*

* *Beiträge*, ii. 126.

† *Jour. de Min. ibid.*

72 Prehnite.

† *Miner. i. 232.*

* *Crystallog.* ii. 275.

† *Ann. de Chim. i. 213.*

SUPPL. VOL. II.

(v) This seems to be the *carbuncle* (σβραζ) of Theophrastus, and the *carbunculus garamanicus* of other ancient writers. See *Hill's Theophrastus* πρὸς οὐρανὸν, 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.*

Earths and Stones.

† Haüy, *Four. de Min.* N° xxviii. 277.

It is both amorphous and crystallized. The crystals are in groups, and confused: they seem to be four-sided prisms with dihedral summits †. Sometimes they are irregular six-sided plates, and sometimes flat rhomboidal parallelepipeds.

Its texture is foliated. Fracture uneven. Internal lustre pearly, scarcely 2. Transparency 3 to 2. Hardness 9 to 10. Brittle. Sp. gr. 2.6969 ||. Colour apple green, or greenish grey. Before the blow-pipe it froths more violently than zeolite, and melts into a brown enamel. A specimen of prehnite, analysed by Klapproth, was composed of

43.83	silica,
30.33	alumina,
18.33	lime,
5.66	oxyd of iron,
1.16	air and water.

§ *Ann. de Chim.* i. 208.

Whereas Mr Hassenfratz found in another specimen

99.31	§
50.0	silica,
20.4	alumina,
23.3	lime,
4.9	iron,
.9	water,
.5	magnesia.

¶ *Ibid.* and *Four. de Phys.* N° xxxii. 81.

100.0 ¶

SPECIES 4. Thallite.

73 Thallite.

Green soorl of Dauphiné of De Lisle *—*Delphinite* of Saussure.

* *Crystallog.* ii. 401.

This stone is found in the fissures of mountains; and hitherto only in Dauphiné and on Chamouni in the Alps.

† Haüy, *Four. de Min.* N° xxviii. 277. § *Fig.* 22. † *Romé de Lisle, ibid.* and Haüy, *Four. de Min.* N° xxx. 415.

It is sometimes amorphous, and sometimes crystallized. The primitive form of its crystals is a rectangular prism, whose bases are rhombs with angles of 114° 37', and 65° 23' †. The most usual variety is an elongated four-sided prism (often flattened), terminated by four-sided incomplete pyramids †; sometimes it occurs in regular six-sided prisms †. The crystals are often very slender.

Its texture appears fibrous. Lustre inconsiderable. Transparency 2 to 3, sometimes 4; sometimes nearly opaque. Causes single refraction. Hardness 9 to 10. Brittle. Sp. gr. 3.4529 to 3.46. Colour dark green (z). Powder white or yellowish green, and feels dry. It does not become electric by heat. Before the blow-pipe, froths and melts into a black slag.

¶ Haüy, and Descotils, *ibid.*

With borax melts into a green bead ||.

A specimen of thallite, analysed by Mr Descotils, contained

37	silica,
27	alumina,
17	oxyd of iron,
14	lime,
1.5	oxyd of manganese.

§ *Ibid.* N° xxx. 420.

96.5 §

GENUS XII. I. AMS.

SPECIES 1. Cyanite.*

Sappare of Saussure.

This stone was first described by Mr Saussure, the son, who gave it the name of *Sappare* †. It is commonly found in granite rocks. The primitive form of its crystals is a four-sided oblique prism, whose sides are inclined at an angle of 103°. The base forms with one side of the prism an angle of 103°; with another, an angle of 77°. It is sometimes crystallized in six-sided prisms †.

Its texture is foliated. Laminæ long. Fragments long, splintery. Lustre pearly, 2 to 3. Transparency of the laminæ 3. Causes single refraction ||. Hardness 6 to 9. Brittle. Sp. gr. from 3.092 to 3.622 §. Feels somewhat greasy. Colour milk white, with shades of sky or prussian blue (A); sometimes bluish grey; sometimes partly bluish grey, partly yellowish or greenish grey.

Before the blow pipe it becomes almost perfectly white; but does not melt. According to the analysis of Saussure, it is composed of

66.92	alumina,
13.25	magnesia,
12.81	silica,
5.48	iron,
1.71	lime.

100.17 ¶

Cyanite has also been analysed by Struvius and Hermann, who agree with Saussure 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 magnesia,
51.5	- - - 23 silica,
5.0	- - - 2 iron,
4.0	- - - 3 lime.
96.5*	97†

GENUS XII. 2. MSA.

SPECIES 2. Serpentine (B).

This stone is found in amorphous masses. Its fracture is splintery. Lustre 0. Opaque. Hardness 6 to 7. Sp. gr. 2.2645 to 2.709. Feels rather soft, almost greasy. Generally emits an earthy smell when breathed upon. Its colours are various shades of green, yellow, red, grey, brown, blue: commonly one or two colours form the ground, and one or more appear in spots or veins (c).

Before the blow-pipe it hardens and does not melt.

A specimen of serpentine, analysed by Mr Chenevix, contained

34.5	magnesia,
28.0	silica,
23.0	alumina,
4.5	oxyd of iron,
0.5	lime,
10.5	water.

101.0*

GENUS * *Ann. de Chim.* xxviii 199.

(z) Hence the name *thallite* given it by Lametherie, from θαλλος, a green leaf.

(A) Hence the name *cyanite*, imposed by Werner.

(B) *Kirw.* I. 156.—*Margraf, Mem. Berlin*, 1759, p. 3.—*Bayen, Four. de Phys.* XIII. 46.—*Mayer, Crell's Annals*, 1789, II. 416.

(c) Hence the name *serpentine*, given to the stone from a supposed resemblance in colours to the skin of a serpent.

Simple Stones.

74 G. XII. AMS. Cyanite. * *Kirw.* i. 209.—*Sage, Four. de Phys.* xxxiv. 39. † *Four. de Phys.* xxxiv. 213. ‡ Haüy, *Four. de Min.* N° xxviii. 282. || Haüy, *ibid.* § *Kirwan.*

¶ *Four. de Phys.* *ibid.*

* *Crell's Annals*, 1790. † *Ibid.*

75 G. XII. 2. MSA Serpentine.

Earths and
Stones.76
G. XIII.
MSAL.
Pottstone.
† Kirw. i.
155.

GENUS XIII. MSAL.

SPECIES 1. Pottstone †.

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.

Pottstone is not much affected by fire; and has therefore been made into utensils for boiling water; hence its name.

According to Wiegleb, the pottstone of Como contains

38	magnesia,
38	silica,
7	alumina,
5	iron,
1	carbonat of lime,
1	fluoric acid.
<hr/>	
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*.

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 potash,
4.0	water.
<hr/>	
98.8†	

† Ann. de
Chim. LXXI.
126.

A specimen of the same variety yielded Mr Hæpner

12.92	oxyd of iron,
37.50	silica,
4.17	alumina,
43.75	magnesia,
1.66	lime.
<hr/>	
100.0‡	

Simple
Stones.

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.
<hr/>	
99.9 §	

§ Sauffure's
Voyages, ii.
133.

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.

§ Crell's An-
nals, 1790,
p. 56.

GENUS XIV. SLAM.

SPECIES 8. Siliceous spar (D).

78
G. XIV.
SLAM.

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.
<hr/>	
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

3 S 2 the

(D) Is this the tremolite of Lowitz from the lake Baikal in Siberia? If so, the name of the genus ought to be SLAM; 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,
<hr/>	
96	

Earths and Stones.

the lime is wanting. Several varieties contain a considerable quantity of carbonaceous matter.

a tint of other colours; the foliated commonly green. Does not melt *per se* before the blow-pipe.

Simple Stones.

80
G. XVI.
SLACMI.
Smaragdite.

GENUS XVI. SLACMI.
SPECIES I. Smaragdite.

This stone was called *smaragdite* by Mr Saussure, from some resemblance which it has to the emerald. Its texture is foliated. The laminae 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.†

Variety I. 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.*

† Haüy,
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.

‡ Ann. de
Chim. xxx.
106.

94.5 ‡

81
G. XVII.
SM.

GENUS XVII. SM.
SPECIES I. Kiffekil.*
Myrten—Seafroth.

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.

A specimen of steatites, analysed by Klaproth, contained

59.5 silica,
30.5 magnesia,
2.5 iron,
5.5 water,

† Reingegg,
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.

A specimen of white steatites, analysed by Mr Che-
nevis, contained

98.0 †.
60.00 silica,
28.50 magnesia,
3.00 alumina,
2.50 lime,
2.25 iron.

§ 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.

GENUS XVIII. MSI.
SPECIES I. 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*.§

Chrysolite is found sometimes in unequal fragments, and sometimes crystallized.† The primitive form of its crystals is a right angled parallelepiped,‡ whose length, breadth, and thickness, are as 5, √8, √5.*

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

* Briffon.

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

† Plinii, lib.
37. c. 8.
‡ Fig. 23.
§ Fig. 24.
* Haüy,
Jour. de
Min. N°
xxviii. 282.

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.

Earths and Stones.

Kirw. Min. 263.

Vauquelin, Ann. de Chim. xxi.

Kirw. Min. 263.

Cochard, Ann. de Chim. xxi.

Kirwan's Min. i. 63.

Leveque, Ann. de Chim. xxx.

97.

Klaproth's Beitrage, i. 93.

Ann. de Chim. ibid.

Beitrage, 112.

84

Jade.

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. §

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.

Variety 2. Olive chrysolite—Olivine. ¶

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 †
According to that of Vauquelin, it is composed of 51.5 magnesia, 38.0 silica, 9.5 oxyd of iron.

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 §.

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 Hæpfner, 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. SML.

SPECIES 1. Asbestos (1).

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 Asbestos.

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 asbestos.

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.

Variety 3. Elastic asbestos.

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 *

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 †

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 ||

Twelve || Ibid. p. 170.

Simple Stones. 85 G. XIX. SML. Asbestos.

† Briffon.

* Opusc. iv.

† Ibid. p.

(H) Kirw. I. 171.—Bartolin, De Lapide Nephritico.—Lehmann, Nov. Comm. Petropol. X. 381.—Hæpfner, Hist. Nat. de la Suisse, I. 251.

(1) Kirw. I. 159.—Bergman, IV. 160.—Plot, Phil. Transf. XV. 1051.—Nebel, Jour. de Phys. II. 62.—Ibid. III. 367.

Earths and
Stones.
† *Opusc. iv.*
175.

Twelve different specimens of asbestus, analysed by Bergman, yielded the same ingredients, differing a little in their proportions†.

86
Asbesti-
nite.

SPECIES 2. Asbestinite (κ).

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° Wedgwood it melts into a green glass.

GENUS XX. I. SILM.

SPECIES 1. Pyroxen.

87
G. XX. I.
SILM.
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,*
Four. 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.

|| *Four. de*
Min. N°
xxxix. 172.
88

95.19||

SPECIES 2. Asbestoid*.

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 blow-pipe 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.

‡ *Ibid.*

95‡

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.

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.

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.

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*

GENUS XXI. SL.

SPECIES 1. Shistose hornstone†.

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

Simple
Stones.
89
G. XX. 2.
SMIL.
Shorlace-
ous actino-
lite.

90
Lamellar
actinolite.

91
Glassy acti-
nolite.

* *Opusc. iv.*
171.

92
G. XXI.
SL. Shistose
hornstone.
† *Kirwan,*
i. 305.

(κ) *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 synonyms 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 the colour of the metallic streak. On this account they called it *βαρανος, the trier*. They called it also *Ly-dian stone*, because, as Theophrastus informs us, it was found most abundantly in the river Tmolus in Lydia†.

† Hill's *Theophrastus*, πειρασιων, p. 190. A specimen of the first variety, analysed by Wieg-
 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.
 25
 Zircon.

GENUS XXII. ZS.
 SPECIES I. Zircon*.
Jargon—Hyacinth.

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 Haüy*‡.

‡ *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.

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 Vauque-
 lin, 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‡

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§

Saline
 Stones.

‡ *Beiträge*, i. 231.

§ *Ibid.* i. 219.

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.

GENUS I. CALCAREOUS SALTS.

This genus comprehends all the combinations of lime and acids which form a part of the mineral kingdom.

95
 G. I. Calcareous salts.

SPECIES I. 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.

96
 Carbonat of lime.

It is often amorphous, often stalactitical, and often crystallized. The primitive form of its crystals is a parallelepiped, 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 *Haüy* (o).

‡ Fig. 28.

When crystallized, its texture is foliated; when amorphous, its structure is sometimes foliated, sometimes striated, sometimes granular, and sometimes earthy. Its lustre

* *Cryстал.* i. 497.

(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 Théorie*, &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.

lustre varies from 0 to 3. Transparency from 0 to 4. It causes double refraction; and it is the only mineral which causes double refraction through two parallel faces of the crystal. Hardness from 3 to 9. Sp. gr. from 2.315 to 2.78. Colour, when pure, white. Effervesces violently with muriatic acid, and dissolves completely, or leaves but a small residuum. The solution is colourless.

This species occurs in a great variety of forms; and therefore has been subdivided into numerous varieties. All these may be conveniently arranged under two general divisions.

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 state of powder; of a white colour, sometimes with a shade of yellow; and so light, that it almost floats on water.

Variety 2. Chalk.

The colour of chalk is white, sometimes with a shade of yellow. Lustre 0. Opaque. Hardness 3 to 4. Sp. gr. from 2.315 to 2.657. Texture earthy. Adheres slightly to the tongue. Feels dry. Stains the fingers, and marks. Falls to powder in water. It generally contains about $\frac{1}{100}$ of alumina, and $\frac{3}{100}$ of water; the rest is carbonat of lime.

Variety 3. Arenaceous limestone.

Colour yellowish white. Lustre 1. Transparency 1. So brittle, that small pieces crumble to powder between the fingers. Sp. gr. 2.742. Phosphoresces in the dark when scraped with a knife, but not when heated. It consists almost entirely of pure carbonat of lime.

Variety 4. Testaceous tufa.

The colour of this variety is yellowish or greyish white. It is exceedingly porous and brittle; and is either composed of broken shells, or resembles mortar containing shells; or it consists of fistulous concretions variously ramified, and resembling moss.

II. Indurated carbonat of lime.

Variety 1. Compact limestone.

The texture of this variety is compact. It has little lustre; and is most commonly opaque. Hardness 5 to 8. Sp. gr. 1.3864 to 2.72. Colour grey, with various shades of other colours. It most commonly contains about $\frac{1}{100}$ th of alumina, oxyd of iron, &c.; the rest is carbonat of lime. This variety is usually burnt as lime.

Variety 2. Granularly foliated limestone.

Structure sometimes slaty. Texture foliated and granular. Lustre 2 to 1. Transparency 2 to 1. Hardness 7 to 8. Sp. gr. 2.71 to 2.8376. Colour white, of various shades from other colours.

Variety 3. Sparry limestone.

Structure sparry. Texture foliated. Fragments rhomboidal. Lustre 2 to 3. Transparency from 2 to 4; sometimes 1. Hardness 5 to 6. Sp. gr. from 2.693 to 2.718. Colour white; often with various shades of other colours. To this variety belong all the crystals of carbonat of lime.

Variety 4. Striated limestone.

Texture striated or fibrous. Lustre 1 to 0. Transparency 2 to 1. Hardness 5 to 7. Sp. gr. commonly from 2.6 to 2.77. Colours various.

Variety 5. Swine stone.

Texture often earthy. Fracture often splintery. Lustre 1 to 0. Transparency 0 to 1. Hardness 6 to 7. Sp. gr. 2.701 to 2.7121. Colour dark grey, of various shades. When scraped or pounded, it emits an urinous or garlic smell.

Variety 6. Ovoid form.

This variety consists of a number of small round bodies, closely compacted together. Lustre 0. Transparency 0 or 1. Hardness 6 to 7.

SPECIES. 2. Sulphat of lime.

Gypsum—Selenite.

This mineral is found abundantly in Germany, France, England, Italy, &c.

It is found sometimes in amorphous masses, sometimes in powder, and sometimes crystallized. The primitive form of its crystals, according to Romé de Lisle, is a decahedron †, which may be conceived as two four-sided pyramids, applied base to base, and which, instead of terminating in pointed summits, are truncated near their bases; so that the sides of the pyramids are trapeziums, and they terminate each in a rhomb. These rhombs are the largest faces of the crystal. The angles of the rhombs are 52° and 158°. The inclination of two opposite faces of one pyramid to the two similar faces of the other pyramid is 145°, that of the other faces 110.* Sometimes some of the faces are elongated: sometimes it crystallizes in six-sided prisms, terminated by three or four-sided summits, or by an indeterminate number of curvilinear faces. For a description and figure of these varieties, we refer to *Romé de Lisle* †.

The texture of sulphat of lime is most commonly foliated. Lustre from 0 to 4. Transparency from 0 to 4. It causes double refraction. Its hardness does not exceed 4. Its sp. 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 laminae. When the flame is directed against its faces, the mineral falls into powder †.

It does not effervesce with muriatic acid, except it be impure; and it does not dissolve in it.

The following varieties of this mineral are deserving of attention.

Variety 1. Broad foliated sulphat.

Texture broad foliated. Lustre glassy, from 4 to 2. Transparency from 4 to 3. Hardness 4. Sp. gr. 2.311. Colour grey, often with a shade of yellow.

Variety 2. Grano-foliated sulphat.

Texture foliated, and at the same time granular; so that it easily crumbles into powder. Lustre 2 to 3. Transparency 2 to 3. Hardness 4 to 3. Sp. gr. from 2.274 to 2.310. Feels soft. Colour white or grey, often with a tinge of yellow, blue, or green; sometimes flesh red brown, or olive green.

Variety 3. Fibrous sulphat.

Texture fibrous. Fragments long splintery. Lustre 2 to 3. Transparency 2 to 1; sometimes 3. Hardness 4. Brittle. Sp. gr. 2.300. Colour white, often with a shade of grey, yellow, or red; sometimes flesh red, and sometimes honey yellow; sometimes several of these colours meet in stripes.

Variety 4. Compact sulphat.

Texture compact. Lustre 1 or 0. Transparency 2 to

Saline
Stones.97
Sulphat of
lime.

† Fig. 29.

* *Crystal.*
i. 144.† *Ibid.*† *Le Lievre,*
Four. de
Min. N°
xxviii. 315.

Earths and 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.

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.*

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.

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 Haüy* †.

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 blow-pipe it melts into a transparent glass †.

It admits of a polish, and is often formed into vases and other ornaments.

SPECIES 5. Borat of lime.

Boracite.

This mineral has been found at Kalkberg near Lu-
STAPL. VOL. II.

neburg, seated in a bed of sulphat of lime. It is crystallized. The primitive form of its crystals is the eube §. 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.

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 †.

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 †.

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 §

SPECIES 6. Nitrat of lime.

Found abundantly mixed with native nitre. For a description see the article CHEMISTRY in this Supplement, n^o 672.

GENUS II. BARYTIC SALTS.

This genus comprehends the combinations of barytes with acids.

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.*

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 †

SPECIES 2. Sulphat of barytes.

Boroselenite.

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,
3 1
whose

Saline
Stones.

§ *Haüy*,
Jour. de
Min. N^o
xxviii. p.

325.
* *Haüy*, and
Westrum.

† *Haüy*, *ibid.*
and *Ann. de*
Chim. ix.

59.

‡ *Le Lievre*,
Jour. de
Min. *ibid.*

§ *Ann. de*
Chim. ii.

116.

101
Nitrat of
lime.

102
G. II. Ba-
rytic salts.

103
Carbonat
of barytes.

† *Jour. de*
Min. N^o
xxi p. 46.

104

Sulphat of
barytes.

98
Phosphat of
lime.

† Fig. 30.
§ *Haüy*,
Jour. de
Min. N^o
xxviii. p.
310.

† Fig. 31.
* *Haüy*, *ibid.*

99
Fluat of
lime.

* *Haüy*, *ibid.*
p. 325.

† Fig. 32.

† Fig. 33.
† *Ibid.*

† *Ibid.*

100
Borat of
lime.

Earth's and 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.

Stones. 78° 30'.
 † *Hauy, Essai d'une Théorie, &c. p. 119.*
 || *Crystal. i. 588.*
 * *Ibid. and Ann. de Chim. xii. 3.*

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.

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.

GENUS III. STRONTITIC SALTS.

This genus comprehends all the combinations of strontites and acids which form a part of the mineral kingdom.

105
 G. III.
 Strontitic salts.

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.

106
 Carbonat of strontites.

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 effervesces, and melts into a transparent colourless glass. Effervesces with muriatic acid, and is totally dissolved. The solution tinges flame purple.

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.

107
 Sulphat of strontites.

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.* Klapproth found a specimen of this mineral from Pennsylvania composed of 58 strontites, 42 sulphuric acid.

Aggregates.
 * *Clayfield, Nicholson's Jour. iii. 36.*

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. †

† *Beiträge, ii. 97.*

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.

† *Ibid. Nicholson's Journal.*

99 §

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,

§ *Jour. de Min. N° xxxvii. 6.*

SPECIES 1. Sulphat of magnesia.

It is found in Spain, Bohemia, Britain, &c.; and enters into the composition of many mineral waters.

108
 G. IV.
 Magnesian Salts.

For a description of it, we refer to CHEMISTRY, n° 633. in this *Suppl.*

109
 Sulphat of magnesia.

SPECIES 2. Nitrat of Magnesia.

Found sometimes associated with nitre. For a description see CHEMISTRY, n° 674.

110
 Nitrat of magnesia.

GENUS V. ALUMINOUS SALTS.

This genus comprehends those combinations of alumina and acids which occur in the mineral kingdom.

111
 G. V. Aluminous salts.

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.

112
 Alum.

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

Order III.

MINERALOGY.

Earths and 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 :

SPECIES 1. Porcelain clay.

115
Porcelain
clay.

Its texture is earthy. Its lustre o. 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 *

A specimen, analysed by Mr Wedgewood, contained

- 60 alumina,
- 20 silica,
- 12 air of water.

92

SPECIES 2. Common clay.

116
Common
clay.

Its texture is earthy. Lustre o. 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. Shitose clay.
Structure flaty. 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.

Aggre-
gates.

SPECIES 3. Lithomarga.

Texture earthy. Fracture conchoidal. Lustre from o 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.

117
Lithomar-
ga.

Variety 1. Friable lithomarga.

Formed of scaly particles slightly cohering. Lustre 1 to o. 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.*

SPECIES 4. Bole.

Texture earthy. Fracture conchoidal. Lustre o. 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.

118
Bole.

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.

SPECIES 5. Fullers earth.

Texture earthy. Structure sometimes flaty. Fracture imperfectly conchoidal. Lustre o. 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 §

3 T 2

§ *Ibid. 156.*

This

Earths and
Stones.

This earth is used by fullers to take the greafe out of their cloth before they apply soap. It is essential to fullers earth that the particles of filica be very fine, otherwise they would cut the cloth. Any clay, possessed of this last property, may be considered as *fullers earth*; for it is the alumina alone which acts upon the cloth, on account of its strong affinity for greasy substances.

120
G. H. Co-
lorific
earths.

GENUS II. COLORIFIC EARTHS.

The minerals belonging to this genus consist of clay, mixed with so large a quantity of some colouring ingredient as to render them useful as paints. The colouring matter is commonly oxyd of iron, and sometimes charcoal.

121
Red chalk.

SPECIES I. Red chalk.

Reddle.

Texture earthy. Fracture conchoidal. Lustre o. Opaque. Hardness 4. Sp. gr. inconsiderable. 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 greenish yellow frothy enamel. Composed of clay and oxyd of iron.

122
Yellow
chalk.

SPECIES 2. Yellow chalk.

Texture earthy. Fracture conchoidal. Hardness 3. Sp. gr. inconsiderable. Colour ochre yellow.

Feels smooth or greasy. 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 some sulphuric acid.

Mem.
Par. 1779,
313.

100*

123
Black
Chalk.

SPECIES 3. Black chalk.

Structure flaty. Texture earthy. Fragments splintery. Lustre o. Opaque. Hardness 5. Sp. gr. 2.144 to 2.277. Colour black. Streak black.

Feels smooth. Adheres slightly to the tongue. Does not moulder in water. When heated to redness it becomes reddish grey.

According to Wiegleb, it is composed of

64.50 filica,
11.25 alumina,
11.00 charcoal,
2.75 oxyd of iron,
7.50 water.

† Ann. de
Chim. xxx.
13.

97.00 †

124
Green
earth.

SPECIES 4. Green earth.

Texture earthy. Lustre o. Opaque. Hardness 6 to 7. Sp. gr. 2.637. Colour green.

Commonly feels smooth. Does not stain the fingers. Often falls to powder in water. When heated it becomes reddish brown; and at 147° Wedgewood melts into a black compact glass.

Composed 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 considerably exceeds the other ingredient, is called *marl*.

Its texture is earthy. Lustre o. Opaque. Hardness from 4 to 8; sometimes in powder. Sp. gr. from 1.6 to 2.877. Colour usually grey, often tinged with other colours. Effervesces with acids.

Some marls crumble into powder when exposed to the air; others retain their hardness for many years.

Marls may be divided into two species: 1. Those which contain more filica than alumina; 2. Those which contain more alumina than filica. Mr Kirwan has called the first of these *siliceous*, the second *argillaceous*, marls. Attention should be paid to this distinction when marls are used as a manure.

Aggre-
gates.

GENUS IV. MOULD.

By *mould* is meant the soil on which vegetables grow.

It contains the following ingredients: filica, alumina, lime, magnesia (sometimes), iron, carbon derived from decayed vegetable and animal substances, carbonic acid, and water. And the good or bad qualities of *soils* depends upon a proper mixture of these ingredients. The filica is seldom in the state of an impalpable powder, but in grains of a greater or smaller size: Its chief use seems to be to keep the soil open and pervious to moisture. If we pass over the carbon, the iron, and the carbonic acid, the goodness of a soil depends upon its being able to retain the quantity of moisture which is proper for the nourishment of vegetables, and no more. Now the retentive power of a soil increases with the proportion of its alumina, lime, or magnesia, and diminishes as the proportion of its filica increases. Hence it follows, that in a dry country, a fertile soil should contain less filica, and more of the other earths, than in a wet country.

Giobert found a fertile soil 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 soil to contain

Coarse sand 25
Fine sand 21
— 46.0 filica,
16.5 alumina,
37.5 lime.

100.0 †

The varieties of mould are too numerous to admit an accurate description: we shall content ourselves, therefore, with mentioning the most remarkable.

† Kirwan
on Manures.

127
Sand.

SPECIES I. Sand.

This consists of small grains of siliceous stones not cohering together, nor softened by water. When the grains are of a large size, the soil is called *gravel*.

128
Clay.

SPECIES 2. Clay.

This consists of common clay mixed with decayed vegetable and animal substances.

SPECIES 3. Loam.

Any soil which does not cohere so strongly as clay, but more strongly than chalk, is called *loam*. There are many varieties of it. The following are the most common.

129
Loam.

Variety

Earths and
Stones.

Aggre-
gates.

Variety 1. Clayey loam; called also *strong, stiff, cold,*
and *heavy,* loam.

Sometimes stones occur, consisting of grains of lime
cemented together with silica. These stones are also de-
nominated siliceous sandstones.

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 amount-
ing to .8 or .9 of the whole.

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.

GENUS I. SANDSTONE.

Small grains of sand, consisting of quartz, flint, horn-
stone, siliceous shistus, 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.

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 dis-
tinguish carbonat of lime. Thus the calcareous sand-
stone of Fountainbleau is crystallized in rhomboidal
tables. It contains, according to the analysis of Laf-
sone

62.5 siliceous sand,
37.5 carbonat of lime.

100

Calcareous sandstones have commonly an earthy tex-
ture. 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.

SPECIES 2. Aluminous sandstones.

The basis of argillaceous sandstones is alumina, or
rather clay. Their structure is often slaty. Their tex-
ture is compact, and either fine or coarse grained, ac-
cording to the size of the sand of which they are chief-
ly 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.

SPECIES 3. Siliceous sandstones.

Siliceous sandstones consist of grains of sand cement-
ed together by silica, or some substance which consists
chiefly of silica or flint. They are much harder than
any of the other species.

125
Ferrugi-
nous.

SPECIES 4. Ferruginous sandstones.

The iron which acts as a cement in ferruginous sand-
stones 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 sand-
stones, 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 com-
pose them are often pretty large. Their hardness is
commonly inconsiderable.

GENUS II. PUDDINGSTONE.

Pebbles of quartz, flint, or other similar stones of a
round or elliptical form, from the size of rape seed to
that of an egg, cemented together by a siliceous ce-
ment, often mixed with iron, have been denominated
pudding stones.

Pudding stones, of course, are not inferior in hard-
ness to quartz, flint, chalcedony, &c. of which the peb-
bles 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.

GENUS III. AMYGDALOID.

Rounded or elliptical masses of chalcedony, zeolite,
limestone, lithomarga, steatites, green earth, garnets,
hornblend, or opal, cemented together by a basis of in-
durated clay, trap, mullen, walken or kragg, consti-
tute 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.

GENUS IV. BRECCIA.

Angular fragments of the same *species* of stone agglu-
tinated together, constitute a *breccia.* Thus *calcareous*
breccia consists of fragments of marble cemented to-
gether by means of lime.

SECT. III. *Aggregates of Crystals.*

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.

GENUS I. GRANITE.

An aggregate of feldspath, quartz, and mica, what-
ever be the size or the figure of the ingredients, is de-
nominated *granite.* This aggregate may be divided
into two species, namely, *common granite,* and *fibristose*
granite or *gneiss.*

SPECIES 1. Common granite.

Its structure is always granular. The feldspar is often
amor-

136
G. II. Pud-
ding stone.

137
G. III.
Amygda-
loid.

138
G. IV.
Breccia.

139
G. I. Gra-
nite.

140
Common.

130
Till.

131
G. I. Sand-
stone.

132
Calcareous.

133
Alumi-
nous.

134
Siliceous.

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 slaty, 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.

GENUS II. Sienite.

142 G. 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 slaty structure: it might, therefore, like granite, be divided into two species. In sienite the quartz is commonly in by far the smallest proportion.

GENUS III. GRANATINE.

143 G. 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*.

GENUS IV. GRANITELL.

144 G. IV. Granitell.

Mr Kirwan gives the name of *granitell* to all aggregates composed of any two of the following ingredients: quartz, feldspath, 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 slaty, is called by Werner *shistose mica*: by the Swedes, it is denominated *stelssten*, whatever be its structure.

The aggregate of hornblende and mica is called *grunstein*, from the dark green colour which it usually has.

GENUS V. GRANILITE.

145 G. 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.

GENUS VI. TRAP. (P).

146 G. VI. Trap.

Under this genus we class not only what has commonly been called *trap*, but also *wacken*, and *mullen*, and *kragstone* of Kirwan.

SPECIES I. Common trap.

147 Common.

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 o. Opaque. Hardness 8 to 9. Not brittle. Sp. gr. from 2.78 to 3.021.* * Kirwan. 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.

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 basalt, 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. A. Transf. v. 89.

(P) Kirw. I. 231 and 431.—Faujas de St Fond. *Essai sur l'Hist. Nat. des Roches de Trap.*—Phil. Transf. passim. See also a very ingenious set of experiments on the fusion of trap, by Sir James Hall in *Transf. Edin.* V. 43.

Earths and
Stones.

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 †

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.

SPECIES 2. Wacken.*

This stone often forms considerable parts of hills, and, like trap, is amorphous. Its texture is earthy. Its fracture usually even. Lustre o. 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.

It melts into a grey porous slag.

SPECIES 3. Mullen †

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 o, 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.

SPECIES 4. Kragstone.*

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 o. 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.

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.

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. Argillitic porphyry.
12. Potstone porphyry.
13. Serpentine porphyry.
14. Sandstone porphyry.

Aggre-
gates.

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 Haüy, 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 Haüy into the following genera:

- | | |
|---------------------|--------------------------|
| 1. Felspathic rock. | 7. Hornblendean rock. |
| 2. Quartzous rock. | 8. Petro-siliceous rock. |
| 3. Micaceous rock. | 9. Garnetic rock. |
| 4. Chloritous rock. | 10. Calcareous rock. |
| 5. Serpentine rock. | 11. Argillaceous rock. |
| 6. Trappean 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.

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.

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.

This species is full of cells. Surface rough and full of cavities. Texture earthy. Lustre o. 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.

This species is the most common of all; it runs into the

152
G. I. Lava.

153
Vitreous.

154
Cellular.

155
Compact.

† Edin.
Transf. v.
90.

148
Wacken.
* Kirw. i.
225.

† Kirwan.

149
Mullen.
† Kirw. i.
225.

150
Kragstone.
Kirw. i.
226.

151
G. VII.
Porphyry.

the second by insensible degrees; and indeed is seldom found of any considerable size without some pores. It bears in general a very strong resemblance to trap.

A specimen of the lava of Catania in Sicily, analysed by Dr Kennedy, contained

- 51.0 silica,
- 19.0 alumina,
- 14.5 oxyd of iron,
- 9.5 lime,
- 4.0 soda,
- 1.0 muriatic acid.

† *Transf. Edin. v. 93.*

A specimen of the lava of Sta. Venere in Sicily he found to contain

- 99.0†
- 50.75 silica,
- 17.50 alumina,
- 14.25 oxyd of iron,
- 10.00 lime,
- 4.00 soda,
- 1.00 muriatic acid.

‡ *Ibid. 94.*

Thus we see; that the resemblance between trap and lava holds not only in their external appearance, but also in their component parts.

GENUS II. PUZZOLANA. Found in small pieces. Surface rough. Texture earthy and porous. Fracture uneven. Lustre o. Opaque. Hardness 3. Very brittle. Sp. gr. from 2.57 to 2.8. Colour brown or dark grey. Magnetic. Easily melts into a black slag.

Combustibles. 156 G. II. Puzzolana.

When mixed with lime into a mortar, it possesses the property of hardening even under water. This property it owes most probably, as Mr Kirwan supposes, to the iron which it contains. The iron decomposes the water of the mortar, and by this means it becomes too hard to be acted upon by water in a very short time.

GENUS III. PUMICE.

This is a very light substance ejected from volcanoes. It is porous. Hardness 3. Brittle. Sp. gr. below 1. Colour grey or brown.

157 G. III. Pumice.

In some varieties the lustre and transparency are 0: in others, the lustre is glassy, 2. Transparency from 1 to 2.

GENUS IV. VOLCANIC ASHES.

These are analogous to the ashes of common pit coal. Loose and smooth, very light, and fine. Slowly diffusible in water, and when wet somewhat ductile.

158 G. IV. Volcanic ashes.

CLASS II. SALTS.

UNDER this class we comprehend all the combinations of alkalies with acids which exist in the mineral kingdom. As they have been already described in the article CHEMISTRY, *Suppl.* we shall here only give a list of their names.

GENUS I. POTASS.

- Sp. 1. Sulphat of potafs.
- 2. Nitrat of potafs.

† 159 Genera.

GENUS II. SODA.

- Sp. 1. Carbonat of soda.
- 2. Sulphat of soda.
- 3. Muriat of soda.
- 4. Borax.

GENUS III. AMMONIA.

- Sp. 1. Sulphat of ammonia.
- 2. Muriat of ammonia.

CLASS III. COMBUSTIBLES.

THE combustible substances 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.

160 Genera.

GENUS I. SULPHUR.

SPECIES I. Native sulphur.

This substance is found abundantly in many parts of the world, especially near volcanoes, as Hecla, Ætna, Vesuvius, the Lipari islands, &c. It is either in the state of powder, or massive, or crystallized. The primitive form of its crystals is an octohedron, composed of two four-sided pyramids, joined base to base†. The sides of these pyramids are scalene triangles, and so inclined that the plane where the bases of the pyramids join is a rhomb, whose long diagonal is to its short as 5 to 4*. Sometimes the apices of the pyramids, to use the language of De Lisle, are truncated; sometimes they are separated from each other by a prism;

161 G. I. Sulphur.

† Fig. 34.

* *Romé de Lisle, i. 292. Haüy and Lefroy, Jour. de Min. N° xxix. 337.*

sometimes they are truncated near their bases, and a low four-sided pyramid rises from the truncature: this pyramid is also sometimes truncated near its apex†. Finally, one of the edges of the pyramids is sometimes truncated. For figures of these varieties, and for the laws of their formation, we refer to *Mr Lefroy*†.

† Fig. 35.

Colour yellow, with a shade of green; sometimes reddish (Q). Lustre greasy, 2. Transparency varies from 0 to 4. Causes double refraction†. Texture compact. Hardness 4 to 5. Brittle—For its other properties, we refer to CHEMISTRY in this *Suppl.*

† *Jour. de Min. N° xxix. 337.*

† *Haüy.*

Sometimes sulphur is mixed with different proportions of earths. These combinations are hardly susceptible of accurate description.

Sulphur combines also with metals. These combinations shall be described in the fourth class.

GENUS II. CARBON.

This genus comprehends all minerals composed of pure carbon, or of carbon combined with a little earth.

162 G. II. Carbon.

SPECIES I. Diamond.

This mineral, which was well known to the ancients, is

163 Diamond.

(Q) It then contains arsenic.

Combus- is found in different parts of Asia, particularly in the
tibles. 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.† *Four. de Min.* N^o
xxix. 343.
‡ *Hauy, ibid.*‡ *Id. ibid.*
§ *Morveau, Ann. de Chim.* xxxi.
72.164
Mineral
charcoal.

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§.

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 nested 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 flaty. 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†

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‡.

† *Four. de Min.* N^o
xxix. 338.‡ *Morveau, ibid.*166
G. III. Bi-
tumen.

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

* *Niobolton's Journal*, ii.
201, 248.

SUPPL. VOL. II.

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.

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**.

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 foot, and leaves a small quantity of coally residuum.

By exposure to the air it becomes like tar, and is then called *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**.

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*.

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*. Feels 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.

SPECIES 6. Elastic bitumen.

Mineral caoutchouc.

This substance was found about the year 1786 in the

3 U

lead

Combus-
tibles.
167
Naphtha.* *Muscoben-
brook.*
† *Boulduc.*
‡ *Briffon.** *Hatchett.*
168
Petroleum.* *Briffon.*† *Hatchett,*
*ibid.*169
Mineral
tar.* *Hatchett,*
*ibid.*170
Mineral
pitch and
maltha.171
Asphalt.172
Elastic bi-
tumen.

Combustibles.

lead mine of Odin, near Castletown, Derbyshire. It was first mentioned by Mr De Born.

Colour yellowish or reddish brown, sometimes blackish brown. In its appearance it has a strong resemblance to caoutchouc or Indian rubber; hence its name. Consistency various: sometimes so soft as to adhere to the fingers; sometimes nearly as hard as asphalt. When soft it is elastic; when hard brittle. Sp. gr. 0.9053 to

† Hatchett, 1.0233 †.

ibid. Insoluble in alcohol, ether, and oil of turpentine, but soluble in oil of olives. Not affected by nitric acid. When distilled, it yields a bituminous oil insoluble in alcohol; the residuum is carbonaceous.*

* Lametherie, Four. de Phys. xxxi. 312. There is a variety of this substance found in a rivulet near the mine of Odin, which, when fresh cut, exactly resembles fine cork in colour and texture; but in a few days after being exposed to the air, becomes of a pale reddish brown. This substance contains within it a nucleus of elastic bitumen. It seems to be the elastic bitumen altered in its texture by the water †.

† Hatchett, ibid.

173
G. IV.
Coal.

GENUS IV. COAL.

The substances belonging to this genus are composed of carbon or rather charcoal, and bitumen.

174
Jet.

SPECIES I. Jet (s).

This substance is found in France, Spain, Germany, Britain, and other countries. It is found in detached kidneyform masses, of various sizes, from an inch to seven or eight feet in length.

Colour full black. Lustre 3 to 4; internal glassy. Opaque. Hardness 7 to 8. Not near so brittle as asphalt. Texture striated. Fracture conchoidal. Sp. gr. 1.259.* It has no odour except when heated, and then it resembles the odour of asphaltum. Melts in a strong heat, burns with a greenish flame, and leaves an earthy residuum †

* Brisson.

† Hatchett.
‡ Kirwan.
§ Vauquelin.

Becomes somewhat electric by friction †. When distilled yields a peculiar acid ‡.

This mineral is formed into buttons, beads, and other trinkets. The manufacture has been almost confined to France ‖.

‖ Four. de Min. N^o iv. 41.
175
Cannel coal.

SPECIES 2. Cannel coal.

This mineral is found in Lancashire, and in different parts of Scotland, where it is known by the name of *parrot coal*.

Colour black. Lustre common, 2. Opaque. Structure sometimes slaty. Texture compact. Fracture conchoidal. Hardness 5 to 8. Brittle. Sp. gr. 1.232 to 1.426. Does not stain the fingers.

Kindles easily, and burns with a bright white flame like a candle (τ), which lasts but a short time. It does not cake. It leaves a stony or sooty residuum.

A specimen of Lancashire cannel coal, analysed by Mr Kirwan, contained

75.20 charcoal,
21.68 maltha,
3.10 alumina and silica.

† Mineral. ii. 523.

99.98 †

A specimen of the slaty kind from Airshire, called *split coal*, was composed of

47.62 charcoal,
32.52 maltha,
20.00 earths.

100.14 †

Cannel coal is fusible of polish, and, like jet, is often wrought into trinkets.

† Ibid. 524.

SPECIES 3. Common coal.

This very useful combustible is never found in the primitive mountains, but only in the secondary mountains, or in plains formed of the same materials with them. It is always in strata, and generally alternates with clay, sandstone, or limestone.

Colour black, more or less perfect. Lustre usually greasy or metallic, 2 to 4. Opaque. Structure generally slaty. Texture often foliated. Fracture various. Hardness 4 to 6. Sp. gr. 1.25 to 1.37. Usually stains the fingers. Takes fire more slowly, and burns longer; than the last species. Cakes more or less during combustion.

Of this species there are many varieties, distinguished in Britain by the names of caking coal, rock coal, &c. These are too well known to require any description.

Mr Kirwan analysed a variety of different kinds of coal: The result of his experiments may be seen by the following table.

Whitehaven coal.	Wigan.	Swansey.	Leeirim.	
57.0	61.73	73.53	71.43	charcoal.
41.3	36.7	23.14	23.37	maltha & asph.
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 amidst strata of genuine coal. It is also called *parrot coal* in Scotland.

Colour greyish black. Lustre 0 to 1. Structure usually slaty. Texture earthy. Hardness 7 to 8. Sp. gr. 1.5 to 1.6. Generally explodes, and bursts when heated.

Composed of charcoal, maltha, and asphalt, and above .20 of stony matter.

GENUS V. AMBER.

SPECIES I. Common amber.

This substance, called *electron* by the ancients, is found in different countries; but most abundantly in Prussia, either on the sea shore, or under ground at the depth of about 100 feet, reposing on *wood coal*.* It is in lumps of different sizes.

Colour yellow. Lustre 3 to 2. Transparency 2 to 4. Fracture conchoidal. Hardness 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 †.

By distillation it yields succinic acid.

178
G. V. Amber.

* Kirwan. Min. ii. 66.

† Haüy.

CLASS

(s) It was called *gagathes* by the ancients, from the river Gages in Licia, near which it was found; *jayet* in French, *ozabache* in Spanish, *gagath* in German.

(τ) Hence it has been called *cannel coal*. *Candle*, in the Lancashire and Scotch dialect, is pronounced *cannel*.

CLASS IV. METALLIC ORES.

THIS class comprehends all the mineral bodies, composed either entirely of metals, or of which metals constitute the most considerable and important part. It is from the minerals belonging to this class that all metals are extracted; for this reason they have obtained the name of *ores*.

179
Orders.

The metals hitherto discovered amount to 21; we shall therefore divide this class into 21 orders, allotting a distinct order for the ores of every particular metal.

Metals exist in ores in one or other of the four following states. 1. In a metallic state, and either solitary or combined with each other. 2. Combined with sulphur. 3. In the state of oxyds. 4. Combined with acids. Each order therefore may be divided into the four following genera.

180
Genera.

- | | |
|----------------|-----------|
| 1. Alloys. | 3. Oxyds. |
| 2. Sulphurets. | 4. Salts. |

It must be observed, however, that every metal has not hitherto been found in all these four states, and that some of them are hardly susceptible of them all. Some of the orders therefore want one or more genera, as may be seen 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. *Bismuth ores.*

1. Alloys.
2. Sulphurets.
3. Oxyds.

ORDER XII. *Arsenic 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. *Manganese ores.*

1. Oxyds.
2. Salts.

ORDER XVI. *Tungsten 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.*

- I. Oxyds.
ORDER XX. *Ores of tellurium.*
I. Alloys.

- ORDER XXI. *Ores of chromium.*
I. Oxyds.

ORDER I. GOLD ORES.

No metal perhaps, if we except iron, is more widely scattered through the mineral kingdom than gold. Hitherto it has been found only in a metallic state; most commonly in grains, ramifications, leaves, or rhomboidal, octohedral, or pyramidal crystals. It is generally mixed with quartz, though there are instances of its having occurred in calcareous rocks. It is not uncommon also to find it disseminated through the ores of other metals: especially iron, mercury, copper, and zinc. The greatest quantity of gold is found in the warmer regions of the earth. It abounds in the sands of many African rivers, and is very common in South America and India. Europe, however, is not destitute of this metal. Spain was famous in ancient times for its gold mines, and several of the rivers in France contain it in their sands. But the principal gold mines in Europe are those of Hungary, and next to them those of Salzburgh. Gold also has been discovered in Sweden and Norway, and more lately in the county of Wicklow in Ireland.

181
Where found.
* Bergman.

GENUS I. Alloys of gold.

SPECIES I. Native gold.

Native gold is never completely pure; it is alloyed with some silver or copper, and sometimes with iron. In the native gold found in Ireland, indeed, the quantity of alloy appears to have been exceedingly small. Its colour is yellow. Lustre metallic. Fracture hackly. Hardness 5. Sp. gr. from 12 to 19.

† Reaumur, *Mem. Par.* 1718, p. 68.
† Løyd, *Phil. Trans.* 1796, p. 36. *Mills, ibid.* p. 38.—*Niobolsson's Journ.* ii. 224.
182
G. I. Native gold.

ORDER II. SILVER ORES.

SILVER is found most commonly in quartz, limestone, hornstone; or combined with the ores of other metals, most commonly with copper, antimony, zinc, cobalt, and lead. This last metal indeed is seldom totally destitute of silver.

183
Where found.

GENUS I. Alloys of silver.

SPECIES I. Native silver.*

Native silver, so called because the silver is nearly in a state of purity, forms the principal part of some of the richest silver mines in the world. It is sometimes in small lumps; sometimes crystallized in cubes, hexahedrons, octohedrons, or dodecahedrons; sometimes in leaves, or threads, often so connected with each other as to resemble branches of trees, and therefore called *dendrites*. The silver in the famous mines of Potosi has this last form. When newly extracted, it is not unlike small branches of fir.

184
G. I. Native silver.
* Kirw. ii. 108.—*Cal-ling. Ati. Liter. Swe-dia*, 1738, p. 420.

The colour of native silver is white; often tarnished. Lustre metallic. Fracture hackly. Hardness 6. Malleable. Sp. gr. from 10 to 10.338.

† Bergman's *Phys. Geogr. Jour. de Min.* N^o xvi. p. 26.

This silver in this species is almost constantly alloyed with from .03 to .05 of some other metal, frequently gold or arsenic.

Silver.
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. Transf.*
1776, p. 532.

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†

† *Beiträge,*
ii. 301.

187
G. II. Sulphurets.
Common
sulphuret of
silver.
† *Kirwan,*
ii. 115.

¶ *Crystall.*
iii. 441.

* *Briffon.*
† *Gellert.*

† *Beiträge,*
i. 162.

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‡

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‡

SPECIES 3. Sulphuret of silver and copper*.

Cupriferous sulphurated silver ore.

This ore, which is found in the Korbolokinik 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

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

SPECIES 2. Red silver ore (v).

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

Metallic
ores.

188

Antimoni-
ated silver
ore.
* *Kirwan,*
ii. 118.

† *Gellert.*

‡ *Beiträge,*
i. 166.

189

Sulphuret
of silver
and copper.
* *Kirwan,*
ii. 121.

190

G. III.

Oxyds.
Calciform
silver ore.
† *Kirwan,*
ii. 112.

191

Red silver
ore.

‡ Fig. 38.

con-

(v) *Kirw.* II. 122.—*Scopoli de Mineris 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, Beitrage,* I. 141.

Metallic ores.

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‡.

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‡.

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, 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*.

GENUS IV. SALTS OF SILVER. SPECIES I. 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.

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 67.75 oxyd of silver, 6.00 oxyd of iron, 21.00 muriatic acid, .25 sulphuric acid, 1.75 alumina.

96.75¶ The alumina can only be considered as mixed with the ore. Sometimes its quantity amounts to .67 of the whole§.

ORDER III. ORES OF PLATINUM (γ).

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.

GENUS I. ALLOYS OF PLATINUM.

SPECIES I. 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 silvring of looking glasses, gilding, &c. are performed by means of it; and its sulphuret forms a beautiful paint.

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) * Carreri's 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 Guanaca Velica in Peru (C).

Mercury has never been found in Britain, nor has any mine worth working been discovered in France. It occurs most commonly in argillaceous shists, limestone, and sandstones.

GENUS I. ALLOYS OF MERCURY.

SPECIES I. 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

193 Mines.

194 G. I. Alloys. Native platinum.

195 Mines.

* Carreri's Voyage. † Scopoli, Four. de Min. N° xxxvi. p. 915. ‡ Four. de Min. N° vi. and vii.

196 G. I. Alloys. Native mercury.

(x) Kirw. II. 113 —Laxmann. Nov. Comm. Petropol. XIX. 482.—Monnet. Mem. Scav. 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, Four. 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.—Willis, Manchester Memoirs, III. 467.—Mussin Puschkin, Ann. de Chim. XXIV. 205.—Morveau, ibid. XXV. 3. (z) See Entrecolle's Lettres Edificantes. (A) See Molina's Natural History of Chili. (B) See Boule's Natural History of Spain, and Four. de Min. N° xxxi. p. 555. (C) See Ulloa's Memoirs concerning America.

Metallic
Ores.

200

Mercurial
Salts.Muriat of
mercury.* Kirwan,
ii. 226.† Romé de
Lisfe, iii.

161.

† Phil.
Transf. lxxi.

618.

§ Suckow.

201

Mines.

202

G. I. Al-
loys.Native
copper.* Kirwan,
ii. 127.—

Carthoufer.

† Haüy,
Four. de
Min. N^oxxxi. p.
509.‡ Kirwan's
Min. ii.

128.

§ Haüy,
ibid. p. 509.

203

White cop-
per ore.

§ Kir. Min.

ii. 152.

* Widenman.

204

G. II. Sul-
phurets of
copper.Common
sulphuret of
copper.† Kirwan,
ii. 144.

‡ Kirwan.

§ Gellert.

* Kirwan.

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.

GENUS II. SULPHURETS OF MERCURY.

SPECIES I. 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 ‡.

GENUS III. OXYDS OF MERCURY.

SPECIES I. 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 †.

GENUS IV. MERCURIAL SALTS.

SPECIES I. 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 §.

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.

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.

GENUS I. ALLOYS OF COPPER.

SPECIES I. 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 ¶.

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.*

GENUS II. SULPHURETS OF COPPER.

SPECIES I. Common sulphuret of copper †.

Vitricous copper ore.

This ore, which is found in Cornwall, 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

Ores of
Mercury.

197

Amalgam
of silver.* Kirwan,
ii. 223.† Cronstedt's
Min.

‡ Heyer.

Crell's An-
nals, 1790.§ Beiträge,
i. 183.

198

G. II. Sul-
phurets.Common
sulphuret.* Kirwan,
ii. 228.† Romé de
Lisfe, iii.
154.‡ Haüy,
Four. de
Min. N^o
xxxii. p.
518.

§ Brisson.

¶ Muschen-
brock.

† Brisson.

‡ Gellert.

199

G. III.
Oxyds.Hepatic
mercurial
ore.* Kirwan,
ii. 224.

† Brisson.

‡ Kirwan.

¶ Sage,
Four. de
Phys. xxiv.
61.§ Scopoli,
Four. de
Min. N^oxxxvi. p.
919.† Kirwan,
ii. 226.

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.

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 ||.

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.

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 †.

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 ‡

SPECIES 4. Grey copper ore §.

This ore is found in Cornwall, 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 ||.

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 or 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.

A specimen of this ore from Cremlitz, 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 †. Savorelli, 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.

GENUS III. OXYDS OF COPPER.

SPECIES 1. Red oxyd of copper §.

Florid red copper ore—Red copper glass.

This ore is found in Cornwall, and many other countries. It occurs in masses, disseminated, in scales, and crystallized. The figure of its crystals is most commonly the regular octohedron.*

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.

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.

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 accidentally mixed with the sand ‡.

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, Cornwall, &c. is either amorphous or crystallized. The crystals are small, and difficult to examine. According to Romé de Lisse, 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.*

Its colour is azure or smalt blue. Streak blue. Hardness

Metallic Ores.

† Mem. Turin, v. 173.

‡ Catal. ii. 498.

208 G. III. Oxyds.

Red oxyd of copper. § Kirwan, ii. 135.

* Haüy, Jour. de Min. N° xxxi. 517.

† Ibid.

209 Green oxyd of copper.

§ Kirwan, ii. 149.

* Berthollet, Mem. Par. 1786, 462.

‡ Jour. de Min. N° xxxi. 519.

210 G. IV. Salts.

Blue carbonat of copper.

§ Crystal. iii. 343.

* Ibid. p. 345.

Copper Ores. *Briffon.* nefs 4 to 6. Brittle. Sp. gr. 3.608 †. It effervesces with nitric acid, and gives it a blue colour. Before the blow-pipe it blackens, but does not melt. Tinges borax green with effervescences.

The crystals, according to Pelletier, are composed of
66 to 70 copper,
18 — 20 carbonic acid,
8 — 10 oxygen,
2 — 2 water.

Fontana first discovered 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 crystallized; and sometimes is almost in the state of powder. Lustre 0. Texture earthy.

Variety 2. Striated blue carbonat of copper.

Lustre glassy. Transparency, when crystallized, 2; when amorphous, 1. Texture striated; sometimes 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 sometimes it is crystallized in four-sided prisms, terminated by four-sided pyramids.

Colour green. Lustre silky. Hardness 5 to 7. Brittle. Sp. gr. 3.571* to 3.653 †. Effervesces with nitric acid, and gives a blue colour to ammonia. Before the blow-pipe it decrepitates and blackens, but does not melt. Tinges borax yellowish green. It is composed of carbonic acid and green oxyd of iron.

Variety 1. Fibrous malachite.

Texture fibrous. Opaque when amorphous; when crystallized its transparency is 2. Colour generally grass green.

Variety 2. Compact malachite.

Texture compact. Opaque. Colour varies from the dark emerald green to blackish green.

A specimen of malachite from Siberia, analysed by Klaproth, contained
58.0 copper,
18.0 carbonic acid,
12.5 oxygen,
11.5 water.

100*

* Beiträge, ii. 290.

This species is sometimes mixed with clay, chalk, and gypsum, in various proportions; it is then known by the name of

Common mountain green.

Its colour is verdigris green. Lustre 0. Transparency 0 to 1. Hardness 3 to 4. Brittle. Texture earthy. Effervesces feebly with acids. Before the blow-pipe it exhibits the same phenomena with malachite.

212
Sulphat of copper.

SPECIES 3. Sulphat of copper.

For a description of this salt, see CHEMISTRY, n° 648. in this Supplement.

SPECIES 4. Arseniat of copper †.
Olive copper ore.

213
Arseniat of copper.
† Kirwan, ii. 151.

This ore is found at Carrarach in Cornwall. It is generally crystallized in six-sided compressed prisms. Its colour is olive green. Streak sometimes straw coloured,

sometimes olive green. Lustre glassy. Transparency from 4 to 2. Fracture conchoidal. Hardness 4 to 7. Before the blow-pipe deflagrates with an arsenical smoke, and melts into a grey coloured bead. This bead, fused with borax, leaves a button of pure copper †.

Klaproth discovered that it was composed of oxyd of copper and arsenic acid.

Sometimes this ore is combined with iron. It then crystallizes in cubes. These cubes are of a dark green colour; before the blow-pipe they froth, give out an arsenical smoke, and do not so quickly form a grey bead as the arseniat of copper.*

Metallic Ore.

‡ Klaproth's Observations on Cornwall, p. 29.

* Ibid. p. 29.

ORDER VI. IRON ORES.

To describe the uses of iron, would be to write the history of every art and manufacture, since there is not one which is not more or less dependent upon this useful metal. Nor is its abundance inferior to its utility. It exists almost everywhere, and seems, as it were, the bond which connects the mineral kingdom together.

GENUS I. ALLOYS OF IRON.

SPECIES 1. Native iron (F).

Native iron has been found in Siberia and in Peru in immense masses, which seemed as if they had been fused. These masses evidently did not originate in the place where they were found. See FIRE-Balls, Suppl.

Colour bluish white. Fracture hackly. Lustre metallic. Malleable. Magnetic. Hardness 8 to 9. Sp. gr. 7.8. Proust has discovered, that the native iron found in Peru is alloyed with nickel †.

GENUS II. SULPHURETS OF IRON.

SPECIES 1. Common sulphuret of iron.*
Pyrites.

This mineral occurs very frequently both in ores and mixed with other bodies, for instance in slates. It is often amorphous, and often also crystallized. The primitive form of its crystals is either a regular cube or an octohedron. The varieties of its form hitherto described amount to 30; for a description of which we refer the reader to *Romé de Lisle* †.

Its colour is yellow. Its lustre metallic. Hardness 8 to 10. Brittle. Sp. gr. 3.44 to 4.6. Soluble in nitric acid with effervescence. Scarce soluble in sulphuric acid. Before the blow-pipe burns with a blue flame and a sulphureous smell, and leaves a brownish bead, which tinges borax of a smutty green.

Variety 1. Common pyrites.

Fracture uneven. Hardness 10. Decrepitates when heated. Emits a sulphureous smell when rubbed. Not magnetic. It occurs often in coal mines and in slates.

Variety 2. Striated pyrites.

Texture striated. Hardness 10. Not magnetic.

Variety 3. Capillary.

Colour often steel grey. Found in needle-form crystals. Uncommon. Not magnetic.

Variety 4. Magnetic pyrites.

Found in masses. Texture compact. Hardness 8, 9. Slightly magnetic. Seems to contain less sulphur than the other varieties.

In pyrites the proportion of the sulphur to the iron is variable, and this explains the variety of its crystalline forms.

GENUS

(E) Kirw. II. 131.—Fontana, *Jour. de Phys.* XI. 509.—Klaproth, *Beiträge*, II. 287.

(F) Pallas, *Phil. Transf.* LXVI. 523.—Rubin de Celis, *ibid.* LXXVIII. 37.—See also Schreiber, *Jour. de Phys.* XLI. 3.; and Stelin, *Phil. Transf.* LXIV. 461.

MINERALOGY.

Order VI.

Iron Ores.
217
G. III.
Plumbago.
* Kirwan,
ii. 58.

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 flaty. 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.

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 Plufier, in France, analysed by Vauquelin, contained
23 carbon,
2 iron,
38 silica,
37 alumina.

100 †

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.

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.

According to Wiegleb it contains
95.6 silica,
4.3 iron.

99.9

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.

SPECIES I. Black oxyd of iron †.

Common magnetic iron stone—Blackish octohedral iron ore.

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 †.

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

SUPPL. VOL. II.

this species belongs the magnet. Before the blow-pipe it becomes browner, but does not melt. Tinges borax dark green.

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.

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 potash, and into a green glass with microcosmic salt, both opaque †. It probably contains some silica, as Kirwan has supposed †.

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 parallelepiped; 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 *Haüy* †.

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.

This ore, according to Mr Muschet, is composed of

66.1 iron,
21.2 oxygen,
10.7 water and carbonic acid,
2.0 lime.

100.0 †

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 Muschet 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 laminae. 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.

3 X

* Kirwan's Min. ii. 159.

* Kirwan, ii.—Dupuy-got, *Jour. de Min.* N^o xxi. p. 75.

† Fourcroy, *Ann. de Chim.* ii. 127. † *Min.* ii. 161.

221
Specular iron ore. † *Kirw.* ii. 162.—*Coudrai, Jour. de Phys.* iv. 52.

* Haüy, *Jour. de Min.* N^o xxxiii. 660a. † *Fig.* 39.

† *Cryst.* iii. 189. † *Ibid.* 660a.

† Haüy, † *Briffon.*

† *Philos. Mag.* iii. 354.

† *Jour. de Min.* N^o xii. p. 16. 218
G. IV.
Emery.
* Kirwan, ii. 193.

† *Briffon.*

219
G. V.
Oxyds.

220
Black oxyd of iron.
† Kirwan, ii. 158.

* *Romé de Lisle*, iii. 1-8.

† *Ibid.*
* Haüy, *Jour. de Min.* N^o xxxiii. 659.

† Kirwan's *Min.* ii. 159.
† Haüy, *Jour. de Min.* N^o xxxi. 527.

Iron Ores. magnetic. Infusible by the blow-pipe. Tinges borax greenish brown.

222
Laminated specular iron ore.

SPECIES 3. Laminated specular iron ore.

Fer pyrocete of Haüy.

This ore, which is found at Mont d'or in Auvergne, was usually arranged under the last species; but has been separated from it, we think properly, by Mr Haüy, because the form of its crystals is incompatible with the supposition that their primitive nucleus is a cube, as we have seen is the case with common specular iron ore. Its crystals are thin octagonal plates, bounded by six linear trapeziums, alternately inclined different ways †.

† De Lisle, iii. 188.

Colour steel grey. Powder reddish black. Lustre metallic; surface polished. Fracture glassy. Very brittle †. Haüy supposes that this ore has been produced by fire, and accordingly has given it a name which denotes its origin.

† Haüy, *Jour. de Min.* N^o xxxi. 33.

223
Brown iron ore.

SPECIES 4. Brown iron ore †.

† Kirw. ii. 163.

This species of ore is found abundantly in Britain, particularly in Cumberland and Lancashire; and it is also very common in other counties. It consists of the brown oxyd of iron, more or less contaminated with other ingredients.

Its colour is brown. Its streak reddish brown. Sp. gr. from 3.4771 to 3.951. Before the blow-pipe blackens, but does not melt. Tinges borax greenish yellow.

Variety 1. Brown hæmatites.

The name hæmatites (bloodstone) was probably applied by the ancients only to those ores which are of a red colour, and have some resemblance to clotted blood; but by the moderns it is applied to all the ores of iron which give a reddish coloured powder, provided they be of a fibrous texture.

Brown hæmatites occurs in masses of various shapes, and it is said also to have been found crystallized in five or six-sided acute angled pyramids. Colour of the surface brown or black, sometimes iridescent; internally nut brown. Powder red. Texture fibrous. Hardness 8 to 10. Brittle. Sp. gr. 3.789 † to 3.951 †. Not magnetic.

† Gellert, Kirwan.

This variety has not been analysed, but it seems to consist of brown oxyd of iron, oxyd of manganese, and alumina †.

† Kirwan's *Min.* ii. 164.

Variety 2. Compact brown iron stone.

This variety occurs in masses of very various and often fantastical shapes.

Colour brown. Internal lustre metallic. Texture compact. Hardness 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. Lustre metallic. Stains the fingers, marks strongly. Feels unctuous. Texture foliated. Hardness 3 to 5. Brittle. So light as often to float on water.

Variety 4. Brown iron ochre.

This variety occurs both massive and disseminated. Colour from nut brown to orange. Lustre o. Strongly stains the fingers. Texture earthy. Hardness 3 to 4. When slightly heated reddens.

224
Red iron ore.
† Kirw. ii. 168.

SPECIES 5. Red iron ore †.

Colour red. Streak blood red. Sp. gr. from 3.423

to 5.005. Before the blow-pipe blackens, but does not melt. Tinges borax yellowish olive green. When digested in ammonia, it becomes black and often magnetic.

Metall. Ores.

Variety 1. Red hæmatites.

Found in masses, and all the variety of forms of stalactites. Colour between brownish red and steel grey. Powder red. Internal lustre metallic. Texture fibrous. Hardness 9 to 10. Brittle. Sp. gr. 4.74 † to 5.005 †.

† Gellert, † Kirwan.

When pure it consists of red oxyd of iron, but it often contains manganese and alumina †.

Variety 2. Compact red iron ore.

Found massive and stalactitic; sometimes in crystals of various forms, but they seem to be only secondary; sometimes in columns like basalt.

§ Kirwan's *Min.* ii. 169.

Colour between brown red and steel grey. Stains the fingers. Lustre 1 to 0; often semimetallic. Texture compact. Hardness 7 to 9. Brittle. Sp. gr. 3.423 to 3.76 †. Sometimes invested with a rosy red ochre.

† Kirwan.

Variety 3. Red ochre.

Found sometimes in powder, sometimes indurated. Colour blood red. Stains the fingers. Lustre o. Texture earthy. Hardness 3 to 5. Brittle.

Variety 4. Red scaly iron ore.

This variety is generally found incumbent upon other iron ores. Colour between cherry red and steel grey. Stains the fingers. Lustre silky, inclining to metallic. Texture foliated. Feels unctuous. Hardness 3 to 4. Brittle. Heavy.

SPECIES 6. Argillaceous iron ore †.

225
Argillaceous iron ore.

Oxyd of iron combined or mixed with clay.

This ore is exceedingly common; and though it contains less iron than the species already described, it is, in this country at least, preferred to them, because the method of extracting pure iron from it is easier, or rather because it is better understood.

† Kirw. ii. 173.

Colour most commonly dark brown. Streak red or yellowish brown. Sp. gr. from 2.673 to 3.471 †. Before the blow-pipe blackens, and tinges borax olive green and blackish. It is composed of oxyd of iron, alumina, lime, silica 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 considerably from each other in their external characters. They are found in masses of various shapes, and often form large strata.

Colour various shades of grey, brown, yellow, and red. Streak reddish yellow or dark red. Lustre o. Hardness from 3 to 8. Smell earthy when breathed upon.

Variety 2. Columnar or scapiform iron ore.

This variety is found in columns, adhering to each other, but easily separable: They are commonly incurvated, and their surface is rough. Colour brownish red. Streak dark red. Slightly stains the fingers. Lustre o. Adheres strongly to the tongue. Sound hollow. Feel dry. Texture earthy.

Variety 3. Acinose iron ore.

This variety is found in masses, and is commonly lenticular. Colour generally brownish red. Lustre metallic, nearly. Texture granular. Hardness 5 to 9. Brittle.

Variety

Iron Ores. Variety 4. Nodular, or kidney-form iron ore.
Ætiter 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. Pilitiform 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

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*.

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.

GENUS VI. SALTS OF IRON.

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, manganese, lime, and carbonic acid.

One specimen, according to his analysis, contained

38 iron,
24 manganese,
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 parallelepipeds; 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 Haüy have supposed, this ore is merely carbonat of lime, contaminated with a quantity of the oxyds of iron and manganese.

SPECIES 2. 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 †.

SPECIES 3. Sulphat of iron.

For a description of this salt, see CHEMISTRY, n^o 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* (1). 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.

3 X 2

Almost

228
Arseniat of iron.

† *Ann. de Chim.* i. 195.

229
Sulphat of iron.

230
Mines.

(G) *Kirw.* II. 190.—*Bergman*, II. 184.—*Bayen. Jour. de Phys.* VII. 213.—*Razowowski*, *Mem. Lauenw.* 1783, p. 149.

(H) *Geoffroy*, *Mem. Par.* 1738, p. 103.—*Morveau*, *Ann. de Chim.* XXIV. 127.

(1) 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 proper

226
lowland
iron ore.
Kirw. ii.
79.

227
G. VI.
Salts.
sparry iron
ore.

Tin Ores.

Almost the only tin mines known to Europeans are those of Cornwall, Devonshire, Saxony, Bohemia, Silesia, Hungary, Galicia; those of the island of Banca and the peninsula of Malacca in India; and those of Chili and Mexico in America.

tinstone, we refer the reader to *Romé de Lisle* and *Mr Day*.^{*} 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 †

Variety 2. Woodtin.

† *Beiträge*, ii. 256.

This variety has hitherto been found only in Cornwall. 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 blow-pipe 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.

GENUS I. SULPHURETS OF LEAD.

SPECIES I. 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 unequiform, and sometimes their solid angles are wanting †.

Its colour is commonly bluish grey, like lead. Streak bluish grey and metallic. Lustre metallic. Sometimes flints

233 G. I. Sulphurets. Galena, or pure sulphuret of lead. † *Kirw.* ii. 216.

|| *Romé de Lisle*, iii. 364.

231 G. I. Sulphurets. Sulphuret of tin and copper. * *Kirw.* ii. 200. † *Klaproth's Cornwall*, p. 21. ‡ *Klaproth*.

GENUS I. SULPHURETS OF TIN. SPECIES I. Sulphuret of tin and copper.* *Tin pyrites.*

Hitherto this ore has only been found in Cornwall. 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.

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 §

GENUS II. OXYDS OF TIN. SPECIES I. 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

§ *Id.* 58. 232 G. II. Oxyds. Brown oxyd of tin. * *Kirw.* ii. 197. † *Jour. de Min.* N^o. xxxii. 576. ‡ *Cryсталlog.* iii. 413. || *Philos. Mag.* iv. 152. § *Romé de Lisle*, *ibid.*

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. Gneifs, | 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.
§ Watson.

stains the fingers. Texture foliated. Fragments cubical. Hardness 5 to 7; sometimes even 9. Brittle. Sp. gr. 6.884 to 7.786 ρ . Effervesces with nitric and muriatic acids. Before the blow-pipe decrepitates, and melts with a sulphureous smell; part sinks into the charcoal.

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.

SPECIES 2. Sulphuret of lead, with silver and antimony.*

Plumbiferous antimoniated silver ore.

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 †

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 †

SPECIES 3. Blue lead ore.*

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.

SPECIES 4. Black lead ore †.

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 generally truncated and confused.

Colour black, often with some streaks of red. Streak 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.

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.

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 Seib, and afterwards described by Weidenmann and Einerling.

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 †

GENUS II. OXYDS OF LEAD.

SPECIES I. Lead ochre †.

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 ρ . 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.

GENUS III. SALTS OF LEAD.

SPECIES I. Carbonat of lead †.

White lead spar.

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 (κ).

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 ρ . 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.

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

Metallic Ores.

|| Briffon.
* Gellert.

237
Sulphuret of lead, bismuth, and silver.

† Beiträge, ii. 297.

238
G. II. Ox- yds. Lead ochre.
† Kirw. ii. 205.

§ Kirwan.

239
G. III. Salts. Carbonat of lead.
† Kirw. ii. 203.

|| Kirwan.
§ Gellert.
* Pelletier, Ann. de Chim. ix. 56.
† Ribben-trapp, Ann. de Chim. xxv. 189.

234
Sulphuret of lead, with silver and antimony.
* Kirw. ii. 119.

† Beiträge, i. 172.

* Ibid. 175.
235
Blue lead ore.
* Kirw. ii. 220.

† Gellert.

236
Black lead ore.
† Kirw. ii. 221.

Ores of Lead.
240
Phosphat of lead.
† Kirw. ii. 207.

SPECIES 2. Phosphat of lead †.

This ore, which is found in Siberia, Scotland, England, Germany, Carinthia, Brittany, &c. is sometimes amorphous, and sometimes crystallized. The primitive form of its crystals according to Romé de Lisle, is a dodecahedron, consisting of a six-sided rectangular prism, terminated by six-sided pyramids, the sides of which are isosceles triangles (L). Sometimes the pyramids are truncated and even altogether wanting. The crystals of this ore are often acicular.

* Briffon.
† Klaproth.
‡ Fourcroy, Ann. de Chim. ii. 207.

Its colour is commonly green; sometimes yellowish or brownish, or greyish white. Streak commonly greenish white. Powder yellowish. External lustre, waxy, 2 to 3. Somewhat transparent, except when its colour is greyish white. Hardness 5 to 6. Brittle. Sp. gr. from 5.86.* to 6.27 †. Insoluble in water and sulphuric acid, and nearly insoluble in nitric acid; soluble in hot muriatic acid, with a slight effervescence ‡. Before the blow-pipe it easily melts on charcoal, and crystallizes on cooling: with soda the lead is in some measure reduced.

The composition of this ore was first discovered by Gahn.

According to Fourcroy's analysis, a specimen from Erlench in Alsace, consists of

96 phosphat of lead,
2 phosphat of iron.
2 water.

Or it contains
79 oxyd of lead,
1 oxyd of iron,
18 phosphoric acid,
2 water.

100

100 ¶

¶ Ibid.

241
Arseniat of lead.
§ Kirw. ii. 209.

SPECIES 3. Arseniat of lead §.

This ore, which has hitherto been found only in Andalusia in Spain, and always in quartz or feldspar, is in small masses. Colour meadow green, often passing into wax yellow. Lustre waxy, 2. Transparency 2. Before the blow-pipe it melts, and retains its colour, and does not crystallize on cooling. When heated to whiteness, the arsenic acid escapes, and the lead is reduced.*

* Proust, Four. de Phys. xxx. 394.

242
Phosphat and arseniat of lead.
† Kirw. ii. 210.

SPECIES 4. Phosphat and arseniat of lead.

Arsenio phosphat of lead. †

This ore, which has been found in Auvergne in France, is either in masses, or crystallized in small six-sided prisms, with curvilinear faces.

Colour yellowish green, or shews alternate layers of pale and light green. Powder yellowish. The crystals are somewhat transparent; but when massive, this ore is opaque. Hardness 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 easily, effervesces, emits a white smoke, with an arsenical smell. Some particles of lead are reduced, a brown fluid remains, which crystallizes on cooling like phosphat of lead.

‡ Briffon.

According to Fourcroy, from whom the whole of this description has been taken, it is composed of

65 arseniat of lead,
27 phosphat of lead,
5 phosphat of iron,
3 water.

100 %

Metallic Ores.

* Ann. de Chim. ii. 23.

243
Molybdat of lead.

SPECIES 5. Molybdat of lead (M).

This ore, which is found in Carinthia and at Lead-hills in Scotland, was first mentioned in 1781 by Mr Jacquin (N). It occurs either in masses, or crystallized in cubic, or rhomboidal, or octohedral plates.

Its colour is yellow. Streak white. Lustre waxy. Generally somewhat transparent. Texture foliated. Fracture conchoidal. Hardness 5 to 6. Sp. gr. 5.486 †; ‡ Macquart. when purified from its gangue by nitric acid, 5.706 ‡. † Hatchett.

Soluble in fixed alkalies and in nitric acid. Communicates a blue colour to hot sulphuric acid. Soluble in muriatic acid, and decomposed by it. Before the blow-pipe decrepitates, melts into a yellowish grey mass, and globules of lead are reduced ¶.

Klaproth first proved that this ore was molybdat of lead.

A very pure specimen, analysed by him, contained
64.42 oxyd of lead,
34.25 molybdic acid.

98.67 ¶

According to the analysis of Mr Hatchett, it is composed of

58.40 oxyd of lead,
38.00 molybdic acid,
2.10 oxyd of iron,
.28 filica.

¶ Beiträge, ii. 275.

98.78 *

Macquart found a specimen to contain

58.74 lead,
4.76 oxygen,
28.00 molybdic acid,
4.50 carbonat of lime,
4.00 filica.

* Phil. Transf. lxxxvi. 323.

100.00 †

Its gangue is carbonat of lime.

SPECIES 6. Sulphat of lead ‡.

This ore, which is found in Anglesey and in Andalusia, is generally crystallized. The crystals are regular octohedrons §, and very minute.

Colour white. Lustre 4. Transparency 4. Before the blow-pipe it is immediately reduced.

The composition of this ore was first ascertained by Dr Withering.

244
Sulphat of lead.

‡ Kirw. Min. ii.

211.
§ Haüy,

Four. de Min. N° xxxi. 508.

ORDER IX. ORES OF ZINC.

HITHERTO zinc has not been applied to a great variety of uses. It enters into the composition of brass; it is used in medicine; and Morveau has shewn that its oxyd

(L) Crystal. III. 391. See also Haüy's remarks on the same subject in the Four. de Min. N° XXXI, 506.

(M) Kirw. II. 212.—Klaproth, Ann. de Chim. VIII. 103.—Hatchett, Phil. Transf. 1796, p. 285.

(N) In his Miscellanea Austriaca, Vol. II. p. 139.

Ores of Zinc. 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.
* Kirw. ii. 238.--Berg. ii. 329.

GENUS I. SULPHURETS OF ZINC.
SPECIES I. 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 parallelepipeds, 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.*

* Haüy, *Four. de Min.* N^o xxxiii. 669.
† Fig. 40.
† Fig. 41.
† See Haüy, *ibid.* and *Romé de Lisle*, iii. 65.
† Gellert, *Brisson*.

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 †.

† Haüy, *Four. de Min.* *ibid.*

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 ||.

* Bergman, ii. 345.

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.*

† *Ibid.* 347.

According to Bergman, it is composed of
64 zinc,
20 sulphur,
5 iron,
4 fluor acid,
1 filica,
6 water.

† *Ibid.* 353.

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 filica,
5 iron,
5 alumina,
5 water.

100 †
Variety 3. Black blende.
Colour black, or brownish black; surface often tar-

nished 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 filica,
4 water.

100 †

GENUS II. OXYDS OF ZINC.
SPECIES I. 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 Haüy, 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, filica, lime, and other foreign ingredients. In one specimen Bergman found the following ingredients: 84 oxyd of zinc,

3 oxyd of iron,
12 filica,
1 alumina.

100 ¶

In another specimen, which gelatinized with acids, like zeolite, Klaproth found 66 oxyd of zinc, 33 filica.

99
In another specimen, analysed by Pelletier, the contents were
52 filica,
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 *wohan* or ore of *Tutenago*.

Variety

Metallic Ores.

† Bergman, ii. 335.

246
G. II. Oxyds. White oxyd of zinc. † Kirw. ii. 233--Berg. ii. 321.

† Four. de Min. N^o xxxii. 596.

† Kirwan

† Haüy, *Four. de Min.* *ibid.*

¶ Bergman, ii. 323.

* Four. de Phys. xx. 428.

Ores of
Antimony.

Variety 2. Compact calamine.
Colour different shades of grey; sometimes yellow or brownish red. Lustre o. 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.

GENUS III. SALTS OF ZINC.

SPECIES I. Sulphat of zinc.

For a description of this salt, we refer to CHEMISTRY, n^o 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.

GENUS I. ALLOYS OF ANTIMONY.

SPECIES I. Native antimony*.

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.

GENUS II. SULPHURETS OF ANTIMONY.

SPECIES I. Grey ore of antimony*.

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‡.

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

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†.

Sulphurets of antimony and arsenic.

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†.

Hydrosulphuret of antimony.

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.

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 vein. The gangue of the copper ore at Airthry is sulphat of barytes.

247
G. III.
Salts.
Sulphat of
zinc.

248
G. I. Alloys
Native an-
timony.
* Kirw. ii.
245.

249
G. II. Sul-
phurets.
Grey ore
of anti-
mony.
* Kirw. ii.
247.

† Romé de
Lisse, iii.
49.
‡ Ibid.—See
also Haüy,
Four. de
Min. N^o
xxxii. 606.
¶ Briffon.

* Ann. de
Chim. xxv.
259.

252
G. III.
Oxyds of
antimony.

250
Plumose
antimonial
ore.
† Kirw. ii.
250.

251
Red anti-
monial ore.
† Kirw. ii.
250.

Ores of Bismuth.

GENUS IV. SALTS OF ANTIMONY.
SPECIES I. Muriat of antimony*.

253
G. IV. Salts.
Muriat of antimony.
* Kirw. ii.
251.

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.

† Huy, Jour. de Min. N^o xxxii. 609.

* Pott, Obsev. Chym. I 34—Geoffroy, Mem. Par. 1753, p. 296.

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.

GENUS I. ALLOYS OF BISMUTH.
SPECIES I. Native bismuth*.

254
G. I. Alloys. Native bismuth.
* Kirw. ii.
264.

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.

† Briffon.
‡ Kirwan.

It is generally accompanied by cobalt, and sometimes contains arsenic.

GENUS II. SULPHURETS OF BISMUTH.
SPECIES I. Common sulphuret of bismuth*.

255
G. II. Sulphurets. Common sulphuret of bismuth.
* Kirw. ii.
266—Sage, Mem. Par. 1782, 307.

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 6.467‡. 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*.

† Kirwan.
‡ Briffon.

* Gillst, Jour. de Min. N^o xxiii. 585.

This ore, according to Sage, contains 60 bismuth, and, according to La Perouse, it holds 36 sulphur.

99

SUPPL. VOL. II.

A specimen, analysed by Klaproth, contained
95 bismuth,
5 sulphur.

100†

It is commonly accompanied by quartz, asbestos, or sparry iron ore.

GENUS III. OXYDS OF BISMUTH.
SPECIES I. 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.

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.

GENUS I. ALLOYS OF ARSENIC.
SPECIES I. Native arsenic†.

257
G. I. Alloys Native arsenic.
† Kirw. ii.
255.

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.

† Kirwan.
‡ Briffon.

It is always alloyed with some iron, and often contains silver, and sometimes gold.

GENUS II. SULPHURETS OF ARSENIC.
SPECIES I. Orpiment (P).
Auripigmentum.

§ De Born. Catal. of M. Raab, ii. 194.
258
G. II. Sulphurets. Orpiment.

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 3.048* to 3.521†. Effervesces with hot nitric acid. Burns with

* Kirwan.
† Gellert.

3 Y

Ores of Arsenic. a bluish white flame. Before the blow-pipe melts, smokes, and evaporates, leaving only a little earth and some traces of iron.

Composed of 80 sulphur,
20 arsenic.

100

259.
Realgar.
* Kirw. ii.
261—Berg.
ii. 297.

SPECIES 2. Realgar.*

This mineral is found in Sicily, about Mount Vesuvius, in Hungary, Transylvania, and various parts of Germany. It is either massive or crystallized. The primitive form of the crystals is, according to Romé de Lisle, a four-sided rhomboidal prism, terminated by four-sided pyramids, the sides of which are rhombs †. It commonly appears in 4, 6, 8, 10, or 12-sided prisms, terminated by four-sided summits ‡.

† Crystall.
iii. 34.
‡ Ibid.

Colour red. Streak yellowish red. Powder scarlet. Lustre 3 to 2. Transparency from 2 to 3; sometimes 0. Hardness 5 to 6. Sp. gr. 3.3384 §. It is an electric *per se*, and becomes negatively electric by friction ||. Nitric acid deprives it of its colour. Before the blow-pipe it melts easily, burns with a blue flame and garlic smell, and soon evaporates.

§ Briffon.

|| Haüy,
Four. de
Min. N^o
xxxii. 612.

Composed of 20 sulphur,
80 arsenic.

100

GENUS III. OXYDS OF ARSENIC.

SPECIES I. White oxyd of arsenic.*

Native calx of arsenic.

260
G. III.
Oxyds.
White oxyd of arsenic.
* Kirw. ii.
258—Berg.
ii. 285.

This ore is found in various parts of Germany, Hungary, &c. either in powder, or massive, or crystallized in prismatic needles.

Colour white or grey, often with a tint of red, yellow, green, or black. Lustre common, 1 to 2. Transparency 1 to 0; when crystallized, 2. Texture earthy. Hardness 6. Brittle. Sp. gr. 3.7 †. Soluble in hot diluted nitric acid without effervescence. Soluble at 60° Fahrenheit in 80 times its weight of water. Before the blow-pipe sublimes, but does not inflame. Tinges borax yellow.

Kirwan.

ORDER XIII. COBALT ORES.

COBALT is employed to tinge glass of a blue colour, and is useful in painting upon porcelain.

Cobalt ores are found almost exclusively in the stratified mountains, except one species, sulphuret of cobalt, which affects the primitive mountains. They are not very abundant; and for that reason cobalt is more valuable than many of the other metals which have been already treated of. They are commonly accompanied by nickel, bismuth, or iron. They are most abundant in Germany, Sweden, Norway, and Hungary; they have been found also in Britain and France, but not in any great quantity.

261
G. I. Alloys.
Cobalt alloyed with arsenic.

GENUS I. ALLOYS OF COBALT.

SPECIES I. Cobalt alloyed with arsenic †.

Dull grey cobalt ore.

This ore, which occurs in different parts of Germany, is either amorphous or crystallized. The forms of its crystals are the cube; sometimes the cube with its angles, or edges, or both wanting; and the octohedron ‡.

† Romé de Lisle, iii.
323.

Its colour, when fresh broken, is whitish or bluish grey, sometimes with a shade of red; when exposed to the air it soon becomes tarnished. Streak bluish grey and metallic. Lustre scarcely metallic, 0 to 1. Texture compact. Hardness 10. Difficultly frangible. Sp. gr. when amorphous, 5.309 to 5.571 §; when crystallized 7.7207 †. When struck it gives out an arsenical smell. Before the blow-pipe it gives out an arsenical vapour, becomes magnetic, and melts easily, unless it contains a great quantity of iron. Tinges borax dark blue, and a small metallic bead is obtained.

Metallic Ores.

§ Kirw. ii.
270.
† Haüy,
Four. de
Min. N^o
xxxii. 588.

A specimen of this ore from Cornwall, examined by Mr Klaproth, contained 20 cobalt,
24 iron,
33 arsenic,

77

with some bismuth and stony matter.*

Another specimen from Tunaberg, according to the analysis of the same chemist, contained

55.5 arsenic,
44.0 cobalt,
.5 sulphur.

* Klaproth's
Cornwall,
p. 61.

† Beitrüge
ii. 307.

100 †

GENUS II. SULPHURETS OF COBALT.

SPECIES I. White cobalt ore †.

Sulphuret of cobalt, arsenic, and iron.

The descriptions which different mineralogists have given of this ore are so various, that it is impossible not to suppose that distinct substances have been confounded together.

It occurs either in masses, or crystallized in cubes, dodecahedrons, octohedrons, and icosaedrons.

Colour tin white, sometimes tarnished reddish or yellowish. Powder steel grey. Lustre partly metallic, and from 2 to 4; partly 0 or 1. Texture foliated. Hardness 8 to 9. Sp. gr. from 6.284 † to 6.4509 ‡. Before the blow-pipe generally gives out an arsenical vapour, and does not melt.

262
G. II. Sulphurets.
White cobalt ore.
† Kirw. ii.
273.—Sage
Four. de
Phys. xxxii.
53.

The analyses that have been given of this ore are very various. Sometimes it has been found to contain no arsenic nor iron, and sometimes, to contain both. A specimen from Tunaberg in Sweden, which ought to belong to this species, was analysed by Tassaert, and found to consist of

49 arsenic,
36.6 cobalt,
5.6 iron,
6.5 sulphur.

97.8 †

Klaproth found a specimen of the same ore to contain

55.5 arsenic,
44.0 cobalt,
0.5 sulphur.

† Ann. de
Chim.
xxviii. 100.

‡ Beitrüge,
ii. 307.

100.0 ‡

GENUS III. OXYDS OF COBALT.

SPECIES I. 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 shade of blue, grey, brown, or green. Lustre 0 to 1. Streak brighter. Hardness (of the indurated) from 4 to 8. Sp. gr. 3 to 4. Soluble in muriatic acid. Tinges borax blue.

263
G. III.
Oxyds.
Black cobalt ore or ochre.
§ Kirw. ii.
275.

Metallic
Ores.

269
G. III.
Salts.

Arseniat of
nickel.
† *Kirw. ii.*
285.

SPECIES 2. Brown cobalt ore.*

Colour greyish or dark leather brown. Streak bright-
er, unctuous. Communicates a pale blue tinge in fu-
sion.

SPECIES 3. Yellow cobalt ore †.

Colour yellow. Dull and earthy. Hardness 4 to 5.
Texture earthy. Streak brighter, unctuous. Gives a
weak blue tinge.

GENUS IV. SALTS OF COBALT.

SPECIES 1. Arseniat of cobalt †.

Red cobalt ore.

This species, like most other ores of cobalt, has nei-
ther been accurately described nor analysed.

It is found in masses of various shapes, and crystalli-
zed in quadrangular tables or acicular prisms.

Colour red. Lustre from 2 to 3, sometimes 0.
Transparency 0 to 2. Hardness 5 to 7. Brittle. Be-
fore 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 quan-
tities to be applied to any use; of course there are, pro-
perly 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.

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, oc-
curs either massive or disseminated, but never crystal-
lized.

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.

It is composed of various proportions of nickel, ar-
senic, iron, cobalt, sulphur; often contains bismuth,
and sometimes silver and copper.

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 crystal-
lized in acicular form crystals. The powder is general-
ly found on the surface of other nickel ores.

Colour different shades of green. Lustre 1 to 0.
Texture earthy. Sp. gr. considerable. Slowly dis-
solves 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 alkalis precipi-
tate a greyish green oxyd. This oxyd is soluble by

acids and by ammonia. The acid solution is green;
the alkaline blue.

GENUS III. SALTS OF NICKEL.

SPECIES 1. Arseniat of nickel †.

This ore, which was lately discovered at Regendorff
by Mr Gmelin, is found in shapeless masses, and is of-
ten 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. consider-
able. 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 scarce-
ly been put to any use; but under the form of an oxyd
it has become of great importance. The oxyd of man-
ganese has the property of rendering colourless a varie-
ty of bodies which injure the transparency of glass; and
it has been long used in glass manufactories for this pur-
pose 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, how-
ever, we believe, in those mountains which are consider-
ed 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.

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.

This species, which exists in great abundance in Ro-
manche near the river Soane in France, is found mas-
sive, forming a stratum in some places more than 12
feet thick.

Colour greyish black or brownish black, of great in-
tensity. 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. Ab-
sorbs 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 †.
Insoluble 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.

3 Y 2

From

270
G. I. Ox-
yds.

271
Oxyd of
manganese
combined
with ba-
rytes.

(Q) *Pitt. Miscelan. Berolens.* VI. 40—*Margraff, Mem. Berlin*, 1773, p. 3.—*La Perouse, Jour. de Physf.*
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.

¶ Dolomieu,
Four. de Min. N^o
 xix. 42.

100.0 ¶

SPECIES 2. Grey ore of manganese.*

272
 Grey ore of manganese.

This ore occurs both massive and disseminated; it is also sometimes crystallized in slender four-sided prisms or needles.

* Kirwan,
 ii. 291.

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,
 ‡ Briffon.

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 §

Sometimes it contains a little barytes and iron.

§ *Four. de Min.* N^o
 xvii. 13.

SPECIES 3. Black or brown ore of manganese.*

273
 Black or brown ore of manganese.

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.

* Kirwan,
 ii. 292—
 Wedgerwood,
Phil. Transf.
 lxxiii. 284.

A specimen of this ore, analysed by Westrum, contained

45.00 manganese,
 14.00 oxyd of iron,
 11.00 silica,
 7 25 alumina,
 3.00 lime,
 1.50 oxyd of copper,
 18.00 air and water.

98.75

GENUS II. SALTS OF MANGANESE.

SPECIES 1. Carbonat of manganese †.

White ore of manganese.

274
 G. II. Salts.
 Carbonat 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.

† Kirwan,
 ii. 297.

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, lacks. Tinges borax violet.

SPECIES 2. Red ore of manganese †.
Carbonat of manganese and iron.

Metallic Ores.

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.

275
 Red ore of manganese.
 † Kirwan,
 ii. 297—
 Nafion,
Mem. Turin, iv. 303.

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 §

§ *Four. de Pbyf.* 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.

SPECIES 1. Wolfram (R).

Oxyds of tungsten, iron, and manganese—Tungstat of iron and manganese.

276
 G. I. Ox-
 yds. Wolf-
 ram.

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.
 * *Four. de Min.* N^o
 xix. 8.
 ‡ Fig. 43-

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 ¶.

† *Four. de Min.* N^o
 xix. 8.

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

¶ Vauquelin,
Four. de Min. N^o
 xix. 11.

Another

(R) Kirw. II. 316.—*De Luyart, Mem. Thoulouse*, II. 141.—*Gmelin, Crell's Four.* English transf. III. 127, 205, and 293.—*La Perouse Four. de Min.* N^o 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.

§ Vauquelin, *Jour. de Min.* N^o xix. II.

100.00 §
 GENUS II. SALTS OF TUNGSTEN.
 SPECIES I. Tungstat of lime (s).
Tungsten.

277 C. II. Salts. Tungstat of therto been found only in Sweden and Germany. It is either massive or crystallized; and, according to Haüy, the primitive form of its crystals is the octobedron †. 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 microcosmic salt it forms a blue glass, which loses its colour by the yellow flame, but recovers it in the blue flame †. It is composed of about 70 oxyd of tungsten, 30 lime,

† Scheele and Bergman.

100

with a little silica and iron §.
 SPECIES 2. Brown tungstat.
 This ore is found in Cornwall, and is either massive or composed of small crystalline grains.

§ Scheele.

278 Brown tungstat. 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.

279 G. I. Sulphuret. Common sulphuret.

GENUS I. SULPHURET OF MOLYBDENUM.
 SPECIES I. Common sulphuret (τ).
Molybdena.

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

* Karsten, † Briffon.

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.

Metallic Ores. † Haüy, *Jour. de Min.* N^o 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 I. Sulphuret of uranium †.
Pechblende.

280 G. I. Oxyds. Sulphuret of uranium. † Kirwan, ii. 305.

This ore, which has been found at Johanngeorgenstadt in Saxony, and Joachimsthal in Bohemia, is either massive or stratified with other minerals.

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.

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 *

* Beitrüge, ii. 221.

SPECIES 2. Yellow oxyd of uranium †.
Uranitic ochre.

This ore is generally found on the surface of the last species at Johanngeorgenstadt, and is either massive or in powder.

Colour yellow, red, or brown. Streak of the yellow forts yellow; of the red, orange yellow. Lustre o. 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.

281 Yellow oxyd of uranium. † Kirwan, ii. 303.

Composed of oxyd of uranium and oxyd of iron.

§ Haüy, *Jour. de Min.* *ibid.*

GENUS

(s) Kirw. II. 314.—Scheele's Works (French translation), II. 81.—Bergman, *ibid.* p. 94.—Crell, *Chem. Annalen.* 1784. 2 Band 195.
 (τ) Kirw. II. 322.—Scheele's Works (French translation), I. 236.—Pelletier, *Jour. de Phys.* XXVII. 434.—Ulfemann, *ibid.* XXXIII. 292.—Sage, *ibid.* 389.—Klaproth and Modeer, *Ann. de Chim.* III. 120.

Ores of
Titanium.

~282

G. II. Salts. Carbonat of uranium. *Kirwan*, ii. 304. *Gmelin*.

GENUS II. SALTS OF URANIUM.

SPECIES I. Carbonat of uranium.

This substance is also found at Johanngeorgenstadt, and near Eibenstein 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.

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 Cornwall.

* *Four. de Min.* N° xv. 27.
† *Ibid.* N° xii. 51.

‡ *Four. de Min.* N° xxxii. 614.
|| *Ibid.*

GENUS I. OXYDS OF TITANIUM.

SPECIES I. Red oxyd of Titanium.

Red short—Sagenite.

283
G. I. Oxyds. Red oxyd of titanium.

This ore has been found in Hungary, the Pyrenees, 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‡.

¶ *Four. de Min.* N° xv. 28. and xxxii. 615.
‡ *Fig.* 44.

* *Klaproth*, † *Vauquelin* and *Hecht*.

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 potash, 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.

SPECIES 2. Menachanite (x).

Oxyd of titanium combined with iron.

This substance has been found abundantly in the valley of Menachan in Cornwall; and hence was called me-

284
Menachanite.

nachanite 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 manganese. According to Mr Klaproth's analysis, it is composed of

51.00 oxyd of iron,	† <i>M. Gregor</i>
45.25 oxyd of titanium,	<i>Four. de</i>
3.50 silica,	<i>Phys.</i> xxxix,
.25 oxyd of manganese.	72. 152.

100.00‡

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§

SPECIES 3. Calcereo siliceous ore of titanium.

Oxyd of titanium combined with lime and silica—Titanite†.

This ore has hitherto been found only near Passau. 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.

According to the analysis of Klaproth, it is composed of

33 oxyd of titanium,
35 silica,
33 lime.

101

ORDER

(v) *Dolomieu*, *Four. de Min.* N° XLII. 431. and *Saussure*, *Voyages*, N° 1894.

(x) *Kirw.* II. 326.—*Gregor*, *Four. de Phys.* XXXIX. 72. and 152.—*Schmeisser*, *Crell's Annals* (English translation), III. 252.

Metallic
Ores.

† *M. Gregor*
Four. de
Phys. xxxix,
72. 152.

‡ *Beiträge*,
ii. 231.

§ *Four. de*
Min. N°
xix. 57.

285
Calcereo
siliceous ore
of titanium.
† *Kirwan*,
ii. 331.

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.

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†

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, it is composed of

60 tellurium,
30 gold,
10 silver.

100§

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*.

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§

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.

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.

According to the analysis of Vauquelin, it is composed of

65.12 oxyd of lead,
34.88 chromic acid.

100.00||.

SPECIES 2. Chromat of iron.

This mineral, which has been found only near Gafsin in the department of Var in France, is in irregular masses.

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 potash, 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†

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.

The first person who undertook the analysis of minerals was Margraff of Berlin. His attempts were indeed rude; but their importance was soon perceived by other chemists, particularly by Bergman and Scheele, whose

Metallic Ores.

239
G. I. Salts.
Chromat of lead.

† Briffon.
‡ Bindheim.

|| Four. de Min. N^o xxxiv. 760.

290
Chromat of iron.

† Tassaert, Ann. de Chim. xxxi. 220.

291
Analysis of minerals.

292
Begun by Margraff.

286
G. I. Alloys. White gold ore of Fatzbay.

* Ann. de Chim. xxv. 327.

† Ibid. 280.

287
Graphic golden ore of Offenbanya.

‡ Ann. de Chim. xxv. 328.

§ De Born, Kirwan's Min. ii. 101.

§ Ann. de Chim. xxv. 280.

* Ibid.

288
Grey foliated gold ore of Nagyag.

† Klaproth, Ann. de Chim. xxv. 329.

‡ De Born, Kirwan's Min. ii. 99.

§ Ann. de Chim. ibid. 280.

Analysis of Minerals.

whose industry and address brought the art of analysing minerals to a considerable degree of perfection.

293
Improved by Klaproth.

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 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 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.

294
And other chemists.

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; hydrofulphuret of potash and sulphurated hydrogen gas dissolved in water; prussic alkali, and a few neutral salts.

1. Potash and soda may be obtained pure, either by means of alcohol, or by the method described in the article CHEMISTRY, n^o 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 muriatic acid with two parts of quicklime, and receiving the gas in a dish containing a quantity of pure water, equal in weight to the muriatic acid employed. Its purity is known by the same tests which ascertain the purity of fixed alkalies.

3. The carbonates of potash and soda may be formed by dissolving the potash 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. Carbonate of ammonia is obtained by distilling together one part of muriatic acid and ammonia and two parts of carbonate of lime.

4. The sulphuric acid of commerce often contains nitric acid, potash, lead, &c. It may be purified by distillation in a low cucurbit. The first portion, when

it comes over, must be set aside; it contains the nitric acid. The other impurities remain behind in the cucurbit. Sulphuric acid, when pure, dissolves indigo without altering its colour, does not attack mercury while cold, and causes no precipitate in pure alkaline solutions.

Analysis of Minerals.

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 muriatic 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. Hydrofulphuret of potash is made by saturating a solution of pure potash with sulphurated hydrogen gas; and water may be saturated with sulphurated hydrogen gas in the same manner. See CHEMISTRY, n^o 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.

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^o 32, of this article.

296
How to reduce the mineral to powder.

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. 297
 Chemical dishes. 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.

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, chromium, 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 potash 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 potash 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 chromium.

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

Analysis of Minerals. which kept it in solution. Then an effervescence takes place, owing to the decomposition of some carbonat of potash 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 chromium.

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 potash 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 potash, and boiled in a porcelain capsule. If any

SUPPL. VOL. II.

3 Z

alumina

(P) 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 *fluorolite*; 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.
301
And the
alumina,

alumina or glucina be present, they will be dissolved in the potash; while the other substances remain untouched in the form of a powder, which we shall call B.

Into the solution of potash as much acid must be poured as will not only saturate the potash, 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 potash; 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 potash 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
Manga-
nese,

Into the solution let a solution of hydrosulphuret of potash 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 may then be precipitated by pure potash, washed, exposed to a red heat, and then weighed.

305
Magnesia,

Let the residuum C be boiled repeatedly with nitric acid, then mixed with pure potash; and after being 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 potash. 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.

306
Chromium,

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.

307
Iron,

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.

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 potash, 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.

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 potash be present, crystals of alum will be formed; and the quantity of potash 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 potash 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 potash and a little carbonat of potash. The potash may be dissolved in a little water. This solution, evaporated to dryness, gives us the potash pure; which may be examined and weighed.

If no crystals of alum can be obtained, we must look for some other substance than potash. 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.

If sulphuric acid does not attack the stone, as is often the case, it must be decomposed by fusion with soda,

Analysis of
Minerals.

309
Method of
detecting
volatile bo-
dies.

310
Method of
ascertain-
ing whe-
ther stones
contain
potash

311
Or soda.

Analysis of Minerals.

da, in the same manner as formerly directed with potas. 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 potas and alumina, crystals of alum will be deposited.

The presence of potas 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 potas be present, a very red precipitate will be formed. This precipitate is a triple salt, composed of potas, 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 potas 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 potas. 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 Beiträge, 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 potas. 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 potas, 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†.

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.

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.

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.

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.*

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.

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

Analysis of Minerals.

† Four. de Min. N^o xxxvii. p. 1.

315 Phosphats,

316 Fluats,

317 And borats.

318 Earths of coal how examined.

319 Method of detecting the relative proportions of charcoal and bitumen.

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.

* Mem. Sav. Etrang. xi. 626.

† Macquer's Dictionary, 2d edit. p. 481.

‡ Mineralogy, ii. 522.

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.

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

Analysis of Minerals. 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.

321 No general method of analysing 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.

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.

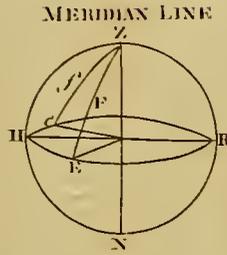
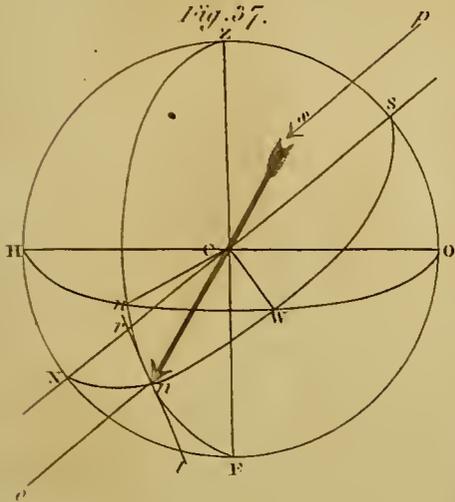
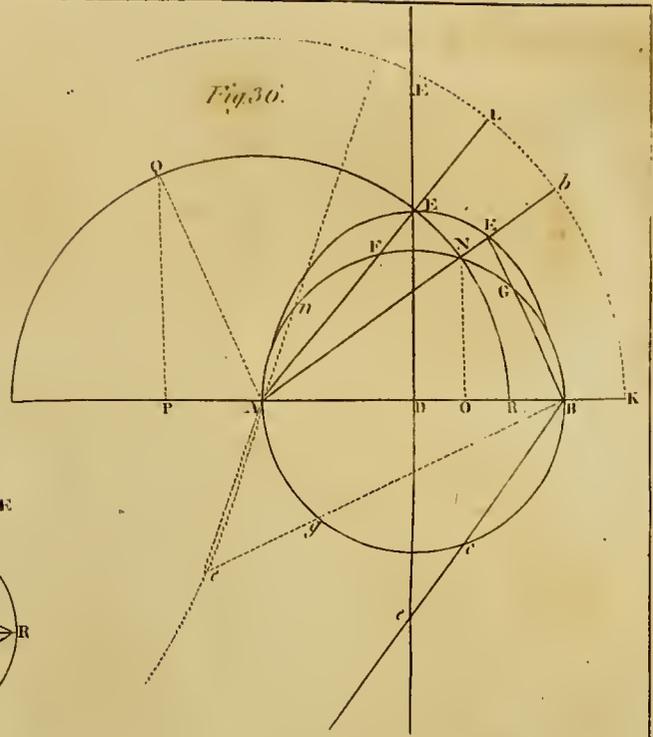
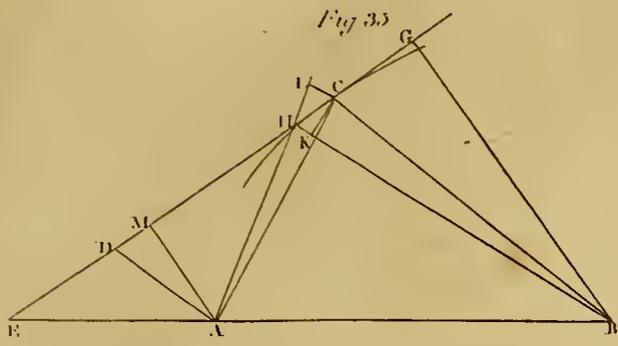
When the nitric acid, even though boiled gently, did not appear to be capable of dissolving any more of the powder, it was decanted off, and the residuum, after being carefully washed, weighed 42.06.

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



MINERALOGY

Fig. 1.



Fig. 2.



Fig. 3.

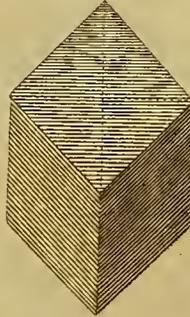


Fig. 4.

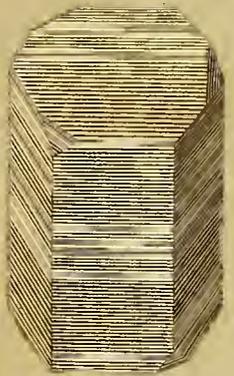


Fig. 6.



Fig. 5.

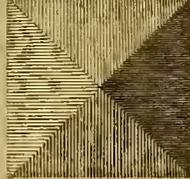


Fig. 7.



Fig. 10.

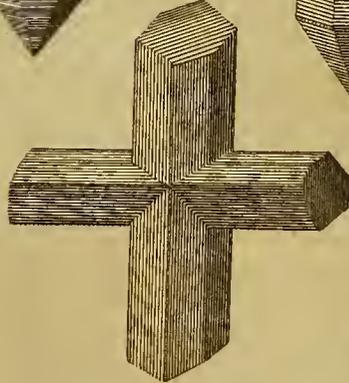


Fig. 8.

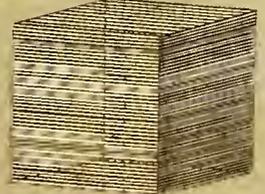


Fig. 12.

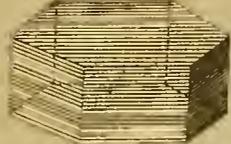


Fig. 9.

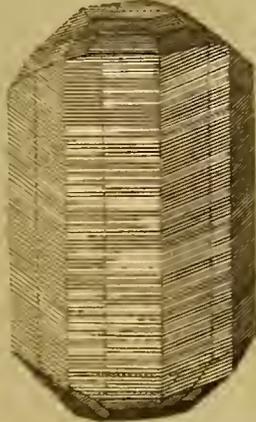


Fig. 11.



Fig. 13.

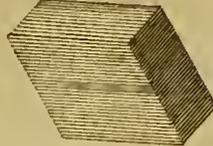


Fig. 14.

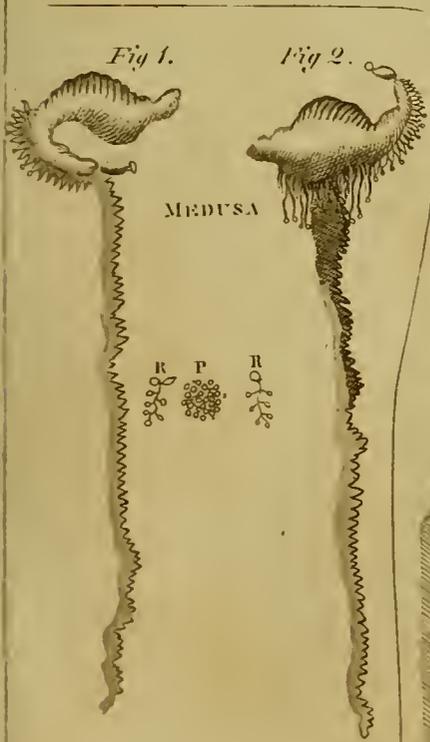
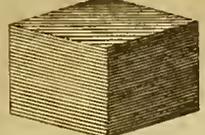




Fig. 20.



Fig. 16.

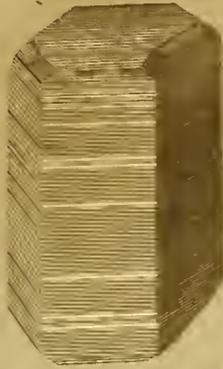


Fig. 18.

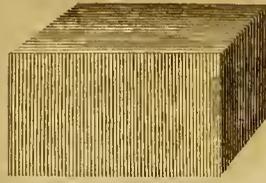


Fig. 17.



Fig. 15.

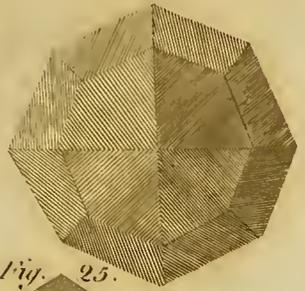


Fig. 21.



Fig. 23.



Fig. 19.

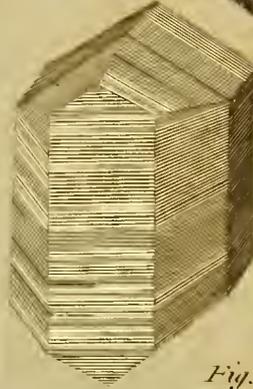


Fig. 25.

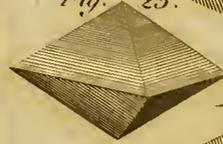


Fig. 26.

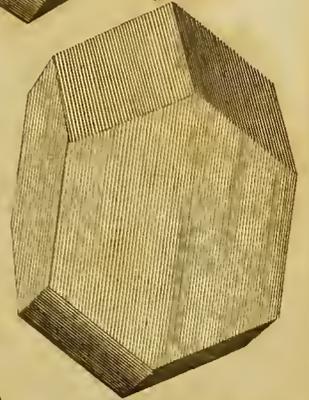


Fig. 27.

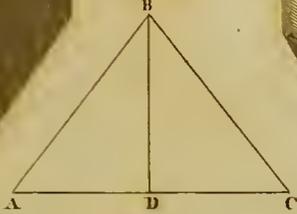


Fig. 22.



Fig. 28.

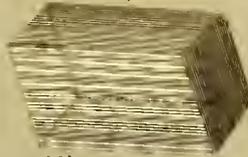


Fig. 24.



Fig. 31.



Fig. 32.

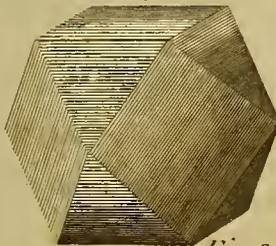


Fig. 29.



Fig. 34.



Fig. 30.



Fig. 33.

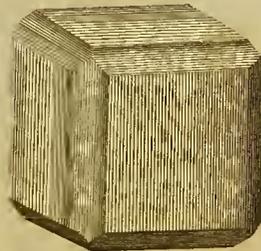


Fig. 36.

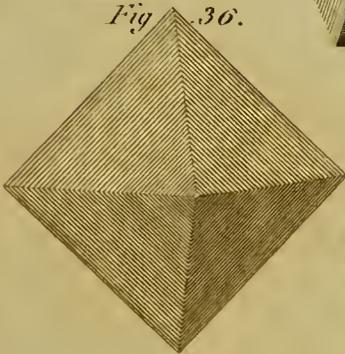


Fig. 37.

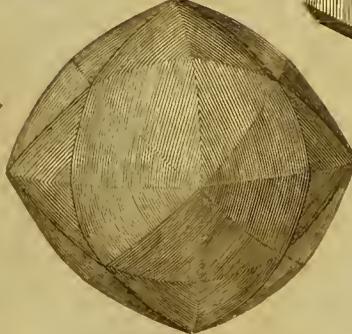


Fig. 38.



Fig. 39.

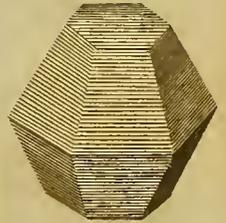


Fig. 35.



Fig. 44.

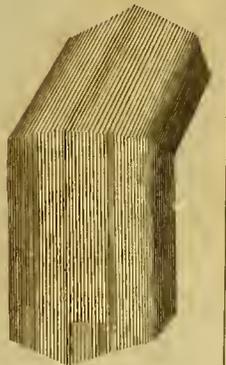


Fig. 40.



Fig. 41.

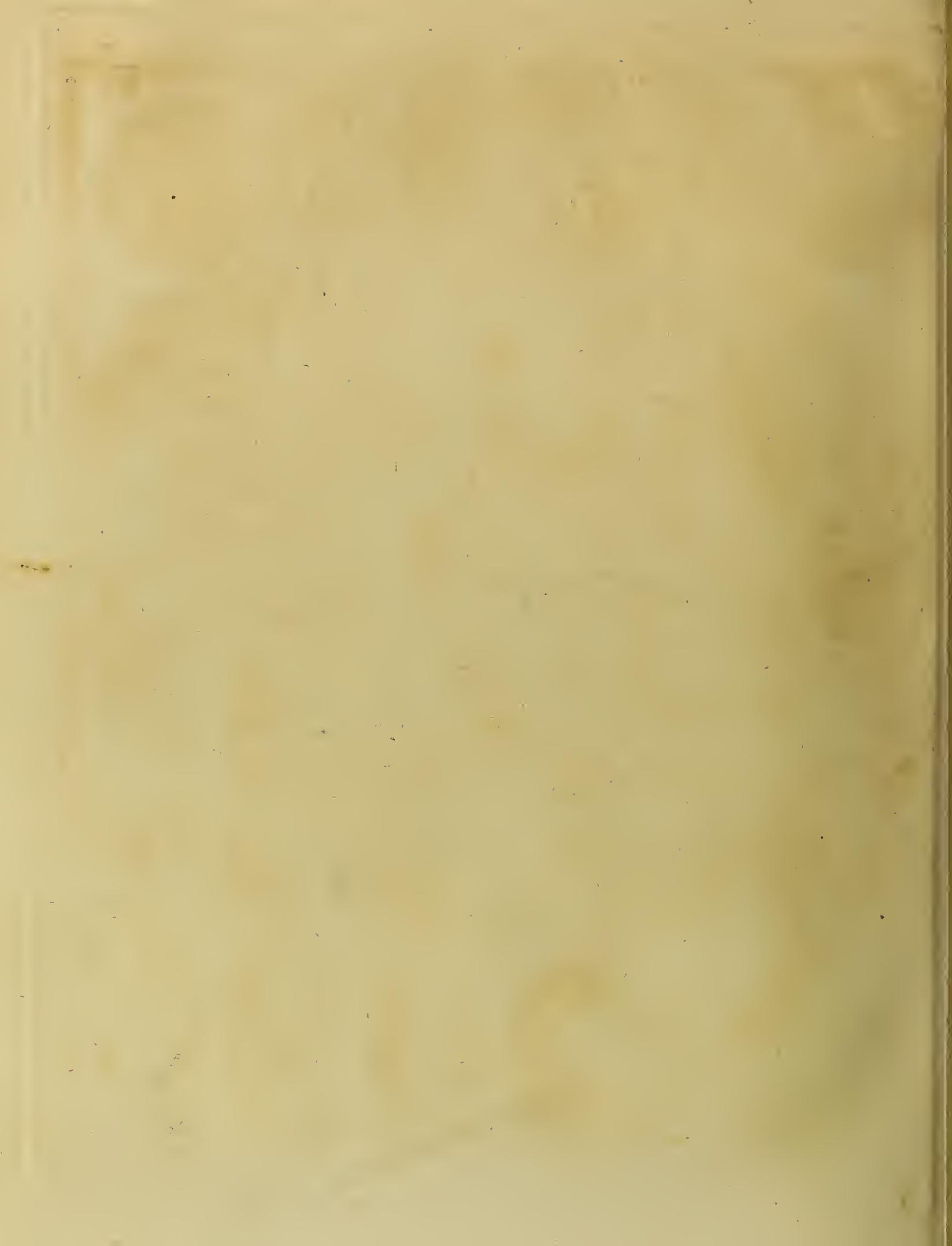


Fig. 42.



Fig. 43.





Analysis of Minerals.

The loss, which amounts to 3.52 parts, is to be ascribed to unavoidable errors which attend such experiments.

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.

Analysis of Minerals.

II. Antimoniated Silver Ore.

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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.

These 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

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 $\frac{1}{4}$ 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 $9\frac{1}{2}$ 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.

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.

325
Analysis of sulphuret of tin.

Analysis of Minerals.

The nitro-muriatic solution was completely precipitated by potash. 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 deposit 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 160½ 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 eva-

poration; 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 †:

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 potash 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.* lxxvi. 310.
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Analysis of molybdat of lead.

Analysis of Minerals. peated. By this method the oxyd of molybdenum was converted into a yellow powder, which was yellow acid of molybdenum. It weighed 95 grains.

A white powder remained, which weighed three grains, and which possessed the properties of silica.

Analysis of Minerals.

VII. Grey Ore of Manganese.

^{1 Year. de Min. N^o xvii. p. 12.} Mr Vauquelin analysed this ore as follows †. 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.

The excess of acid of the solution was saturated with carbonat of potash; the liquor became brown, but nothing precipitated. When boiled, a red powder precipitated, and the brown colour disappeared. The addition of more carbonat of potash 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 potash. 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.

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.

The acetous solution contained the oxyd of manganese: It was precipitated by an alkali, and, when dried, weighed 12.5 grains.

Carbonat of potash 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.

IX. Oxyd of Titanium and Iron.

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.

Vauquelin analysed this ore as follows: A hundred parts of the ore, reduced to a fine powder, and mixed with 400 parts of potash, 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.

³³⁰ Analysis of oxyd of titanium and iron.

Into the water with which the black oxyd of manganese had been washed, carbonat of potash was poured; a white powder precipitated, which, when dried, weighed 149 grains, and which possessed the properties of carbonat of lime.

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 potash precipitated two parts, which had the properties of oxyd of manganese.

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.

The 124 parts of residuum were boiled in a solution of pure potash for an hour. The solution was saturated with an acid, filtered, and carbonat of potash added, which precipitated three parts. These had the properties of oxyd of titanium.

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.

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 potash; and of a white colour by carbonat of potash 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.

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.

The muriatic solution, from which these 46 parts were deposited, formed, with prussiat of potash, a prussian blue; and ammonia precipitated from it 50 parts, which had the properties of yellow oxyd of iron.

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M I Q

M I R

Mingun, 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 Walkkill, 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;
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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 *Misguelon*.—*ib*.
 MIRABEAU (Honoré 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,
 4 A

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 epochs 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 Brabantons. It is entitled, *Doutes sur la Liberté de l'Escaut*, 8vo. 5. *Lettre à l'Empereur Joseph II. sur son Règlement 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 sacrifice 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 Biesler, 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 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 desert 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 illuminate 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 à 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 à M. de Grettele, 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 appelé 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 Frédéric 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 Constituans*, 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, 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 Nipisquit 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

Mirago-
ane,
||
Mississippi.

Missouri,
||
Mistral.

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 trouble-

some. 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 landwinds 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.

Mistral,
||
Mist.

Mixt,

Moder.

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 fourth point of which is in about lat. $31^{\circ} 26'$ N. and long. $87^{\circ} 55'$ W. Thence pursuing a fourth course into West-Florida, the confluent stream enters the Gulf of Mexico, at Mobile Point in lat. $30^{\circ} 17'$ 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 Chesapeake 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 Oronoko*, 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*.

MÆRIS, 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-kerum*, 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 *Mubulbuckitum*, 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 Curafs, 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 3000 men upon the place of battle, besides what were drown-

Mæris,

Mohacz.

Mohawk. ed in passing the river, which could never be known. After which victory, General Dunewalt, September 30th, found Esbeck totally deserted by the Turks, and took possession of it.

MOHAWK River, in New-York, rises to the northward of Fort Stanwix, about 8 miles from Black, or Sable river, a water of Lake Ontario, and runs southwardly 20 miles to the fort, then eastward 110 miles, and after receiving many tributary streams, falls into Hudson river, by three mouths opposite to the cities of Lansinburgh 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, sandy, shrub plain to Albany. It is in contemplation either to cut a canal from Schenectady to the navigable waters of Hudson river, or to establish a turnpike road between Schenectady and Albany. This fine river is now navigable for boats, from Schenectady, nearly or quite to its source, the locks and canals round the Little Falls, 56 miles above Albany, having been completed in the Autumn of 1795; so that boats full loaded now pass them. The canal round them is nearly $\frac{1}{4}$ of a mile, cut almost the whole distance through an uncommonly hard rock. The opening of this navigation is of great advantage to the commerce of the State. A shore of at least 1000 miles in length, is, in consequence of it, washed by boatable waters, exclusive of all the great lakes, and many millions of acres of excellent tillage land, rapidly settling, are accommodated with water communication for conveying their produce to market. The intervalles on both sides 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 some of the richest and best lands in the world. The fine farms which embrace these intervalles, are owned and cultivated principally by Dutch people, whose mode of managing them would admit of great improvement. The manure of their barns they consider as a nuisance, and instead of spreading 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 access to them becomes difficult, or else throw it into the river, or the gullies and streams which communicate with it. The banks of this river were formerly thickly settled with Indians. At the period when Albany was first settled, it has been said by respectable authority, that there were 800 warriors in Schenectady; and that 300 warriors lived within a space which is now occupied as one farm. The Cohoez in this river are a great curiosity. They are 3 miles from its entrance into the Hudson. 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. almost in a line from one side of the river to the other, and is about 40 feet perpendicular height, and including the descent above, the fall is as much as 60 or 70 feet. About a mile below the falls, is a handsome bridge, finished in July, 1795. It is 1100 feet in length, 24 in breadth, and 15 feet above the bed of the river, which for the most part is rock, and is supported by thirteen solid stone pillars. It is a free bridge, and including the expence of cutting through a ledge on the N. E. side of the river, cost 12,000 dollars. The river immediately below the bridge, divides into three

branches, which form several large islands. 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.—*Morse.*

MOHAWK, a branch of Delaware river. Its course from its source in Lake Uttayantha is S. W. 45 miles, thence S. E. 12 miles, when it mingles with the Popachton branch; thence the confluent stream 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 strongly attached to the Johnson family, on account of Sir William Johnson, a part of them emigrated to Canada with Sir John Johnson, as early as the year 1776. About 300 of this nation now reside in Upper Canada.—*ib.*

MOHEGAN, situated between Norwich and New-London, in Connecticut. This is the residence of the remains of the Mohegan tribe of Indians. A considerable 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 shillings.

MOHERIR, a writer of accounts.

MOHICCONS, a tribe of Indians who inhabit on a branch of the Susquehannah, 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. Also an Indian tribe, in the N. W. Territory, who inhabit near Sandusky, and between the Sciota and Muskingum; warriors, 60.—*Morse.*

MOINEAU, a flat bastion raised before a curtain when it is too long, and the bastions of the angles too remote to be able to defend one another. Sometimes the moineau is joined to the curtain, and sometimes it is divided from it by a moat. Here musquetry are placed to fire each way.

MOINS, a river of Louisiana, which empties from the N. W. into the Mississippi, in lat. 40 20 N. The Sioux Indians descend by this river.—*Morse.*

MOISIE River, on the N. shore of the St Lawrence, is about 3 leagues W. S. W. of Little Saguenay river, from which to the W. N. W. within the Seven Islands, is a bay so called from these islands.—*ib.*

MOLE (See **TALPA**, *Encycl.*), is an animal exceedingly troublesome, both to gardeners and farmers; and there are persons who contrive to make a livelihood by the trade of *mole-catching*. These men, it is well known, are generally quacks and cheats; and the secrets which they sell for extirpating those destructive animals are of very little avail. Even poison seldom produces any considerable effect; because the mole, while it does not drink, lives only on roots and worms. Under the word **MOLE** (*Encycl.*), some directions will be found for clearing fields of this destructive animal; but the following are perhaps preferable, as they seem to have been the result of much experience;

Immediately at day-break, it will be necessary to make a tour round the garden or meadow, from which it is wished to extirpate the moles; for at that time they will be all found at work, as may be seen by the hills newly thrown up. If the person is then close to the

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the hill, he must proceed as the gardeners do, and turn up with a 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^o 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 265,615 lb. coffee—26,861 lb. cotton—2,823 lb. 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 17½ 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, 11½ leagues S. W. of Point l'Epee, which is the south-westernmost point of the island of St Domingo, and 14½ 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

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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 Canada, 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, *Mongear* 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 oldest, 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 Mongear 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 passed 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 surprize 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 Mongear 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 Mongear 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 negroes 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 the

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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

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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 authorized 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 sabres 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 desert, 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.

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

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Moneton, 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.*

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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, Vermont, 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 basin 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 Navesink 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

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Monnier. serving to rectify the large mural quadrant of eight feet, which is immoveably made fast to a wall towards the south.

With these quadrants Le Monnier observed, for the long period of forty years, the moon with unwearied perseverance at all hours of the night. It is requisite, to be a diligent astronomer, to be able to conceive to what numberless inconveniences the philosopher is exposed during an uninterrupted series of lunar observations. As the moon during a revolution may pass through the meridian at all hours of the day or night; the astronomer who, day after day, prosecutes such observations, must be prepared at all, even the most inconvenient, hours, and sacrifice to them his sleep and all his enjoyments. How secluded from all the pleasures of social intercourse, and how fatiguing such a mode of life is, those astronomers, indeed, know not who then only set their pendulum clocks in motion, when some of the eclipses of the sun, moon, or of the satellites of Jupiter, are to be viewed. At this time, and in the present state of the science, these are just the most insignificant observations; and an able astronomer, well supplied with accurate instruments, may every day, if he take into his view the whole of his profession, make more important and more necessary observations.

Le Monnier was Lalande's preceptor, and worthy of such a scholar; and he promoted his studies by his advice, and by every other means in his power. Le Monnier's penetrating mind, indeed, presaged in young Lalande, then only sixteen years old, what in the sequel has been so splendidly confirmed. In his twentieth year, he became, on the recommendation of his preceptor, a member of the Royal Academy: and in 1752 he was proposed by him as the fittest person to be sent to Berlin, to make with La Caille's, who had been sent to the Cape of Good Hope, correspondent observations, for the purpose 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 astronomy knew no bounds. For this reason Lalande, in his *Notice des Travaux du C. Le Monnier*, says of himself: "*Je suis moi-meme le principal resultat de son zele pour l'astronomie.*"

Le Monnier was naturally of a very irritable temper: as ardently as he loved his friends, as easily could he be offended; and his hatred was then implacable. Lalande, as he himself expresses it, had the misfortune to incur the displeasure of his beloved preceptor; and he never after could regain his favour. But Lalande's gratitude and respect for him always continued undiminished, and were on every occasion with unremitting constancy publicly declared: patiently he endured from him undeserved ill treatment; so much did he love and esteem his instructor and master to the day of his death. "I have not ceased to exclaim (writes Lalande), as Dio-

genes exclaimed to his master Antisthenes, You cannot find a stick strong enough to drive me away from you!"

What a noble trait in the character of Lalande, who in 1797 wrote likewise an eulogium on Le Monnier in the style of a grateful pupil, penetrated with sentiments of profound veneration and esteem for his beloved master; but Le Monnier would not read it. This is not the place to give a circumstantial account of this intricate quarrel; we shall only further remark, that Lalande was the warm friend and admirer of the no less eminent astronomer La Caille, whom Le Monnier mortally hated. An intimate friendship likewise subsisted between Le Monnier and D'Alembert; but Lalande had no friendly intercourse with the latter.

Among the scholars of Le Monnier may likewise be reckoned Henwart, the celebrated geometrician and professor of mathematics at Utrecht; who, in a letter to Von Zach, astronomer to the Duke of Saxe Gotha, dated the 26th of May 1797, says, "Le Monnier is a penetrating and philosophical astronomer: I learned much from him in Paris; though I lodged with the late De l'Isle, where I frequently made observations in company with Messier. Le Monnier was the friend of D'Alembert; and consequently an opposer of Lalande."

This great man, who had, for some years, ceased to exist either for the science of astronomy, or for the comfort of his friends, died at Lizeaux, in the province of Normandy, in 1799, aged 84 years. He left behind him some valuable manuscripts, and a number of good observations; with respect to which he had always been very whimsical, and of which in his latter years he never would publish any thing. He had by him a series of lunar observations, and a multitude of observations of the stars, for a catalogue of the stars, which he had announced so early as the year 1741; among which was twice to be found the new planet Uranus: (See *Lalande's Astronomie, Tables*, p. 188, (A)). The more he was requested to communicate his observations, the more obstinate he became; he even threatened to destroy them. At the breaking out of the revolution, Lalande was greatly alarmed for the safety of these papers; he wished to preserve them from destruction, and made an attempt to get them into his possession; but all his endeavours were in vain. He was only able to learn, that Le Monnier had hidden them under the roof of his house. Le Monnier having been first seized with a fit of the apoplexy so early as the 10th of November 1791, Lalande apprehended, lest, if no one except himself should know where he had hidden his papers, the infirm old man might perhaps have himself forgot it. He hopes, however, that La Grange, who married his second daughter, may have some information concerning them. Le Monnier left behind him no son.

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(A) Such is the French and German account of his discovery 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 plagiarism of our neighbours on the Continent, from the celebrated philosophers and divines of England. As it is extremely probable that, half a century hence, a claim may be put in for Le Monnier's discovery of the Georgium Sidus (*Uranus*), similar to that which in 1757 the editor of Abbé St Real's works put in for that Abbé being the author of Leslie's *Short Method with the Devils* (see 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 discovery was then universally allowed to have been made by Herschel.

Monocacy, MONOCACY, a river which after a S. S. W. course, empties into the Patowmac, about 50 miles above Georgetown.—*Morse.*

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MONOMIAL, in algebra, is a simple or single nominal, consisting of only one term; as a or ax , 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 Pittsburg. It is deep, gentle and navigable with bateaux and barges beyond Red Stone Creek, and still further with lighter craft. It rises at the foot of the Laurel Mountain in Virginia, thence meandering in a N. by E. direction, passes into Pennsylvania, and receives Cheat river from the S. S. E. thence winding in a N. by W. course, separates Fayette and Westmoreland from Washington county, and passing into Alleghany county, joins the Alleghany river at Pittsburgh and forms the Ohio. It is 300 yards wide 12 or 15 miles from its mouth, where it receives the Youghiogany from the south-east, which is navigable with bateaux 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 western fork 50 miles higher, and the navigation frequently interrupted by rapids; which, however, with a swell of 2 or 3 feet, become very passable for boats. It then admits light boats, except in dry seasons, 65 miles further, to the head of Tygart's Valley, presenting only some small rapids and falls of one or 2 feet perpendicular, and lessening in its width to 20 yards. The western fork is navigable in the winter, towards the northern branch of the Little Kanaway, and will admit a good waggon road to it. From the navigable waters of the south-easternmost branch of the Monongahela, there is a portage of 10 miles to the south branch of Patowmac river. The hills opposite Pittsburg on the banks of this river, which are at least 300 feet high, appear to be one solid 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 slaves.—*ib.*

MONOTRIGLYPH, a term in architecture, denoting the space of one triglyph between two pilasters, or two columns.

MONPOX, a city of Terra Firma, about 75 miles S. E. by E. of Toln.—*Morse.*

MONSEAG Bay, in Lincoln county, District of Maine, is separated from Sheepcut river, by the island of Jeremysquam.—*ib.*

MONSELEMINES, are a people which inhabit that part of BILEDULGERID (see *Encycl.*) that borders on the territories of the Emperor of Morocco. They are a mixed race, being descended from the ancient Arabs and fugitive Moors; and they occupy a space of land, of which the limits are indicated by lofty columns placed at intervals towards the desert. Their territory extends from about 30 leagues beyond Cape Non, to the distance of 20 leagues from St Croix or Agader. Though of different qualities, it is, for the most part, very fertile, and produces the necessaries of life with little cultivation. The plains are watered by an infi-

nite number of streams, 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.

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More industrious and more laborious than their neighbours, the Monselemine nation cultivates the earth. The chiefs of families choose the ground most fit for cultivation. Its surface is turned slightly over with a kind of hoe, and then the seed is sown upon it: the field is surrounded with bushes, to mark the spot, and to preserve it from the cattle of the wandering Arabs. When the crop is ripe, which is generally at the end of August, three months after the sowing of the seed, it is cut about six inches from the ear, and formed into little bundles; during which time every one labours without intermission from morning to night. The corn is brought before the tent, thrashed, winnowed, and placed in the magazines. When the harvest is over, they set fire to the long stubble, and abandon the field for two or three years. Their magazines are large holes in the earth, formed like the frustum of a cone, the insides of which are hardened by burning wood in them, before the half winnowed corn be deposited. When filled with corn, they are covered with planks placed close to each other; over which a layer of earth is laid level with the soil, to prevent it from being discovered by enemies. In these magazines every one shares in proportion to the number of men he employed in the common labour.

The inhabitants of the plains remain by the cultivated fields in seed time, and return at the time of harvest. During the intervals they wander in all directions with their cattle, taking only necessaries along with them, and having recourse to the magazines when they require a supply. The more opulent people, and the artisans who are engaged in sedentary occupations, dwell in towns, which are all situated upon the declivity of hills. Their houses are built of stone and earth, according to the Moorish construction, low and covered with sloping terraces; yet they are so much injured by the heavy rains which prevail for three months of the year, as to be rendered uninhabitable in 15 or 20 years. Those who reside in towns are generally weavers, shoemakers, goldsmiths, potters, &c. and have no cattle; but the more opulent persons have flocks and herds of cows, horses, camels, sheep, goats, besides poultry, which are kept by their slaves at a distance from the towns. In the towns they take two meals a day; one at ten o'clock, and the other at the setting of the sun, though the inhabitants of the country only eat in the evening. In the towns they sleep in mats upon the floors of their apartments, and make use of linen; but the inhabitants of the country sleep upon terraces in the open air. The pastoral families of the country practise hospitality like those of the desert, and make the traveller pay nothing for his entertainment. In the towns this practice is impossible, as the concourse of strangers, especially on market-days, would soon impoverish the inhabitants. In this manner hospitality is always extinguished among a trading and commercial people. It is only where the superfluity of commodities runs necessarily to waste, that it is ever practised in a great extent; but where every commodity can find a market, every

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every kind of property acquires a definite value, and will be preserved with the same care as money.

By M. Saignier the government of the Monfelemine is said to be republican; but he writes inconsistently about it. In one place, he says that they choose their chiefs annually; in another, that in the time of war they choose from the natives or fugitive Moors indiscriminately, chiefs, whose authority lasts no longer than the campaign, during which it is absolute; and he afterwards represents their government as a kind of theocracy, during war as well as peace. But we must follow him in his detail, as it has been well arranged in a late anonymous publication, entitled, *An Historical Sketch of Discoveries in Africa*.

At the end of each campaign, he says the chief gives an account of his actions to the assembled aged men, and is rewarded or punished according to his conduct; after which his successor is appointed, and he serves in the army he commanded as an undistinguished individual. The country is populous, and would be still more so, were it not for the continual wars which its inhabitants are obliged to support against the Emperor of Morocco. The liberty they enjoy imparts energy and courage to their character, and renders their arms invincible to the Moors. They consider it as the most invaluable possession, and defend it to the last extremity. The nature of the country, surrounded on every side by steep and arid mountains, contributes to frustrate the efforts of their enemies. The Monfelemine, richer than the subject 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 requisite for the charges of the state, 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 reside in the country, resort to the markets, attend the assemblies of the nation, or pay visits.

As the Monfelemine territory is the retreat of the rich Moors, who wish to fly from the tyranny of the Emperor of Morocco, they are too well acquainted with the Moorish customs to be surprised by that prince. No sooner does a Moorish army take the field, than the inhabitants of the country cantons mount their horses, and occupy the passes of the mountains; while the women and slaves, escorted by a sufficient number of warriors, retire to the interior parts of the country, or, if they be hard pressed, to the desert. Among the pastoral tribes there are many that addict themselves entirely to arms, and serve as cavalry in the time of war. During peace they escort caravans, or exercise themselves in military evolutions, and the management of their horses. Being almost always on horseback, and wearing no boots, they have a callous lump on that part of the leg that comes in contact with the iron of the stirrup. Their horses, which they break in an admirable manner, are the best in the world: as they are treated with great care by their masters, they know them, and are obedient to their voice, and will admit no stranger to mount them.

The Monfelemine derive their origin and name from Moseilama, a contemporary of Mahomet; and, in their love of liberty, as well as in many of their customs, resemble the Arabs of remoter times. They respect the

prophet like other Mahometans; but neither believe that he was infallible, nor that his descendants are all inspired by God, nor that their will should be a law, nor that such faith is necessary in order to be a good Mahometan. Their priests are respected, and in old age generally become the civil judges of the nation; but the influence of the high priest is almost despotic. 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 disposal: he requires nothing from any one, and yet all are inclined to give. He administers justice according to the opinion of his counsel, without pretending to be inspired by the prophet.

On Friday the Monfelemine assemble in their mosques to pray: this is likewise the day of their principal market, when their merchandize is exposed to sale in the public squares, where the old men judge without appeal, when disputes arise. Different from their neighbours of Morocco and Sahara, the Monfelemine never attempt to make proselytes. Their Christian slaves are treated with humanity; but they owe this to the avarice of their masters. These detest Christians, but they love money, and are afraid lest sickness or death should deprive them of the ransom of the slave, or of the advantage of his labour. Among the inhabitants of the desert, a Christian, that adopts the religion of Mahomet, is admitted as a citizen and member of the family, and is presented with cattle to form an establishment. The Monfelemine pay more attention to the value of their property than the situation of the infidel. A Christian who enters a mosque at Morocco is put to death, or forced to assume the turban. The Monfelemine would turn him civilly out, and content themselves with imposing the highest possible fine. Among the Moors, a Christian discovered in an intrigue with a woman of that nation suffers death, or submits to conversion; but the Monfelemine prefer money to religion. From them the Christian has nothing to fear: the woman alone is punished, being put into a sack, and thrown into the sea. If a Christian slave among the neighbouring nations defends himself against his master, he is punished with death; but money saves him among the Monfelemine; he would at most receive a slight correction.

The Jews are allowed the free exercise of their religion among the Monfelemine, but are treated with the same indignity as among other Mahometan tribes. A Jew is not permitted to carry arms; and if he should make use of them against an Arab, he would be punished 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 situation of the women is more respectable, and they are not so much secluded as among the Moors. They mingle more in society, walk at large, and visit their friends; neither are their apartments so inviolable. Among the Monfelemine, that degrading picture of humanity is never seen which sometimes occurs in Morocco, a woman drawing the plough with an ass, a mule, or some other beast of burden. More happy than the women of the Sahara, and treated with
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greater attention by their husbands, they are more humane in their difpofitions. Like other Arab women, they ftain 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 confidered as men, as is the cuftom in the defart. Avarice is the principal defect in the character of the Monfelemine. They hoard their money with the utmoft care, bury it in the earth, and in many cafes die without difcovering their fecret even to their children. Mifers, fays M. Saugnier, fhould go to that country, where they would learn means of economy; which would fhew them, that, in comparifon with the Monfelemine, they are themfelves perfect prodigals.

The medicinal applications of the Monfelemine, which differ not from thofe of the MONGEARTS and other inhabitants of the defart, are extremely fimple, but appear fufficiently complex from the mummerly of the priefts, who are the depositories of their medical fcience. Flefh wounds are cauterifed with a hot iron, and then covered with herbs dipped in turtles oil and tar. In headachs, a comprefs is applied with fuch violence that the blood ftarts from the forehead. In internal difeafes, the general remedies are regimen, reft, and a few maxims of the Koran myfterioufly applied to the affected parts.

MONSON, a townfhip in Hampshire county, Maffachufetts, E. of Brimfield, and 80 miles fouth-weft by weft of Bolton. 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 townfhip in Hampshire co. Maffachufetts, on the E. bank of Connecticut river, between Sunderland and Wendel, about 18 miles north of Northampton, and 97 miles weft by north of Bolton. 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 northernmoft townfhip in New-Jerfey, is fituated in Suffex co. on the eaft fide of Delaware river, about 5 miles N. E. of Minifink, and 17 north of Newtown. It contains 543 inhabitants, including 25 flaves.—*ib.*

MONTAGUE, the largeft of the fmall iflands in Prince William's Sound, on the N. W. coaft of North-America.—*ib.*

MOTAUK *Point*, the eaftern extremity of Long-Ifland, New-York. A tract here, called *Turtle Hill*, has been ceded to the U. States for the purpofe of building a light-houfe thereon.—*ib.*

MONTE *Chrift*, a cape, bay, town, and river, on the north fide of the ifland 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 fituated in lat. 19 54 30 N. and in long. 74 9 30 W. of Paris. A ftrip of level land joins it to the territory of Monte Chrift, and it is owing to this that the cape has been taken for an ifland. It is 14 leagues N. E. by E. of Cape Francois, where it may be feen in a clear day, with the naked eye. After doubling this cape, we find the bay of Monte Chrift running nearly S. W. It is formed by Cape la Grange, on one fide, and

Pointe des Dunes (Down Point) on the other; about 6,500 fathoms afunder. The bay is about 1,400 fathoms deep, and its winding is nearly 4 leagues. About 900 fathoms from the cape, defcending the bay, we find the little ifland of Monte Chrift, 350 fathoms from the fhore. 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 oppofite the town of Monte Chrift. The town of Monte Chrift, ftanding at 800 fathoms from the fea fide, rife in an amphitheatre on the fide of the coaft, which is very high all round this bay. The town is 200 fathoms fquare, which fpace is divided into 9 parts, cut by two ftreets 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, deftitute of every refource but that of cattle raifed in its territory, and fold to the French. The town and territory contain about 3,000 fouls. There is a trifling garrifon at Monte Chrift. About a league from the battery, following the winding of the bay, is the river of Monte Chrift, or more properly, the river Yaqui. The land round the town is barren and fandy; and the river contains great numbers of crocodiles. Monte Chrift is a port well known to American fmugglers, 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 fituated between Port Dauphin and Mancenille Bay, is fhipped here, and in a war between France and Britain, it ufed to be a grand market, to which all the French in the north part of the ifland fent their produce, and where purchafers were always ready.—*ib.*

MONTE *Chrift*, a chain of mountains which extend parallel to the north coaft of the ifland of St Domingo, from the bay of Monte Chrift, to the bay of Samana on the E. Two large rivers run in oppofite direftions along the fouthern fide of this chain. The river Monte Chrift or Yaqui in a W. by S. direftion, and Yuna river in an E. by S. courfe to the bay of Samana. They both rife near La Vega, and have numerous branches.—*ib.*

MONTEGO *Bay* is on the N. fide of the ifland of Jamaica, 20 miles E. by N. of Lucea harbour, and 21 W. of Martha Brae. This was formerly a flourifhing and opulent town: it confifted of 225 houfes, 33 of which were capital ftores, and contained about 600 white inhabitants. The number of topfail veffels which cleared annually at this port were about 150, of which 70 were capital fhips; but in this account are included part of thofe which entered at Kingfton. This fine town was almoft totally deftroyed by an accidental fire, in July, 1795; the damage was eftimated at £200,000 fterling.—*ib.*

MONTEREY BAY, in North California, was vifited in 1786 by La Peroufe, 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 fouth; has an opening of eight leagues in this direftion, and nearly fix of depth to the eaftward, where the land is fandy and low. The fea breaks there as far as the foot of the fandy downs with which the coaft is furrounded, with a roaring which may be heard more than a league off. The lands north and

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Monterey.

Monterey. south of this bay are high, and covered with trees. Those ships which are desirous of touching there ought to follow the south coast, and after having doubled the Point of Pines, which stretches to the northward, they get sight of the presidency, and may come to an anchor in ten fathoms within it, and a little within the land of this point, which shelters from the winds from the offing. The Spanish ships, which propose to make a long stay at Monterey, are accustomed to bring up within one or two cables lengths of the land, in six fathoms, and make fast to an anchor, which they bury in the sand of the beach; they have then nothing to fear from the southerly winds, which are sometimes very strong; but, as they blow from the coast, do not expose 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, soft muddy ground; but there is a very heavy sea, 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 past one o'clock: the tide rises seven feet; and as this bay is very open, the current in it is nearly imperceptible. It abounds with whales; a genus of fishes, of which our *scientific* voyagers knew so little, that they were surprised at their spouting water!

The coasts of Monterey Bay are almost continually enveloped in fogs, which cause great difficulty in the approach to them. But, for this circumstance, there would be few more easy to land upon; there is not any rock concealed under water that extends a cable's length from the shore; and if the fog be too thick, there is the resource of coming to an anchor, and there waiting for a clear, which will enable you to get a good sight of the Spanish settlement, situated in the angle formed by the south and east coast. The sea was covered with pelicans. These birds, it seems, never go farther than five or six leagues from the land; and navigators, who shall hereafter meet with them during a fog, may rest assured that they are within that distance of it.

A lieutenant-colonel, whose residence is at Monterey, is governor of the Californias: the extent of his government is more than 800 leagues in circumference, but his real subjects consist only of 282 cavalry, whose duty it is to garrison five small forts, and to furnish detachments of four or five men to each of the 25 missions, or parishes, established in old and new California. So small are the means which are adequate to the restraining about 50,000 wandering Indians in this vast part of America, among whom, nearly 10,000 have embraced Christianity. These Indians are, in general, small and weak (A), and discover none of that love of liberty and independence which characterises the northern nations, of whose arts and industry they are also destitute. Their colour very nearly approaches that of the negroes whose hair is not woolly; the hair of these people is strong, and of great length; they cut it four or five inches from the roots. Several among them have a beard; others, according to the missionary fathers, have never had any; and this is a question which is even undecided in the country. The governor, who had travelled a great way into the interior of these lands, and

who had passed 15 years of his life among the savages, Monterey. assured our author, that those who had no beards had plucked them up with bivalve shells, that served them as pincers: the president of the missions, who had resided an equal length of time in California, maintained the contrary;—it was difficult, therefore, for travellers to decide between them." The difficulty, surely, was not great. By their own account, the governor had travelled much farther into the country than the missionary; and his report being confirmed by the evidence of their own senses, was intitled to unlimited credit.

These Indians are extremely skilful in drawing the bow; they killed, in the presence of the French, the smallest birds: it is true, they display an inexpressible patience in approaching them; they conceal themselves, and, as it were, glide along near to the game, seldom shooting till within 15 paces. Their industry in hunting the larger animals is still more admirable. Perouse saw an Indian, with a stag's head fixed upon his own, walk on all-fours, as if he were browsing the grass; and he played this pantomime to such 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 stags within a very small distance, and kill them with a flight of arrows.

Before the Spanish settlements, the Indians of California cultivated nothing but maize, and almost entirely lived by fishing and hunting. There is not any country in the world which more abounds in fish and game of every description: hares, rabbits, and stags are very common there; seals and otters are also 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 small grey tufted partridges, which, like those in Europe, live in society, but in large companies of three or four hundred; they are fat, and extremely well flavoured. The trees serve as habitations to the most delightful birds; and the ornithologists of the voyage stuffed a great variety of sparrows, titmice, speckled wood-peckers, and tropic birds. Among the birds of prey are found the white-headed eagle, the great and small falcon, the goshawk, the sparrow hawk, the black vulture, the large owl, and the raven. On the ponds and sea-shore are seen the wild duck, the grey and white pelican with yellow tufts, different species of gulls, cormorants, curlews, ring-plovers, small sea water hens, and herons; together with the bee-eater, which, according to most ornithologists, is peculiar to the old continent.

The country about Monterey Bay is inexpressibly fertile. The crops of maize, barley, corn, and pease, cannot be equalled but by those of Chili; the European cultivators can have no conception of a similar fertility; the medium produce of corn is from seventy to eighty for one; the extremes sixty and a hundred. Fruit trees are still very rare there, but the climate is extremely suitable to them: it differs a little from that of the southern French provinces. The forest trees are, the stone-pine, cyprus, evergreen oak, and occidental plane tree. There is no underwood; and a verdant carpet,

(A) The chief surgeon of the expedition says they are *strong*, but stupid.

Monterey. 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 sollicitudes 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 rocks.

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

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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. *Monterey.*

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 Laugle, 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 *pouffole*. 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

Monterey. 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 chase. 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 argusses, 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 bodice, 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 Newburgh, 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, opposite 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, Massachusetts, 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, and

Montevideo,
||
Montgomery.

Montgomery, and 40 from Salisbury. It is on the post-road from Richmond to Kentucky. A post-office is kept here.—*ib.*

Montreal. 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-west-erly of Baltimore.—*ib.*

MONTGOMERY, a new county in Tennessee State, Mero district. This and Robertson county, are the territory formerly called *Tennessee 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 Rivières 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.*

MONTRUIS, 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 $\frac{2}{3}$ ds 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 hhd. 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 Sheepcut 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

Montrouis,
Moorea.

Moorfields, royalists, were defeated (after a retreat of 80 miles, and a desperate engagement) by Gen. Moore, at the head of 800 continentals. Gen. McDonald 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 fourth branch of Patowmac river. It contains, a courthouse, 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 Desert, 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 *Bafing*, 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 Mifinabe 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 fourth 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

Moose,
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Moosehillock.

Moose,
||
Morgan-
town.

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 2,693 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 Boonborough.—*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 2s. sterling per pound; when others fetch only 12d or 15d. 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 *Encyclopedia*, though it is of much importance in oriental commerce. It is cultivated to a great extent in the province of *Malava* 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* (feminal) 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,

Morgans,
||
Morinda.

Morion,
||
Morotoi.

flower. *Calyx*, common receptacle roundish, collecting the feſſile flowers into an irregular head. *Perianth*, moſt entire, ſcarce obſervable above. *Coral*, one petal- led funnel-form. *Tube*, cylindrical: *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-cel- led, 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 ber- ries, pyramidal, compreſſed on all ſides by the adjacent ones, and concreted with them; lopped; containing to- wards the baſe a fleſhy pulp. *Seeds*, in each berry four; towards the point oblong, externally convex, internal- ly angular.”

The ſpecies here deſcribed is the *morinda arborea pe- dunculis 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 wa- ter 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 co- lour; 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 me- moir.

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 *pram- nion*. 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 tri- angle, 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 ap- proach.—*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 Car- thagena, on the coaſt of the Spaniſh Main, and in the bight of the caſt 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 moun- tainous, 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 43 grift-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 Preſ- byterian and Baptiſt church, a court-houſe, an acad- emy, 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 revo- lution war, was frequently in and about this town.—*ib.*

MORRISVILLE, a village in Pennsylvania, ſitu- ated in Bucks county on the W. bank of Delaware ri- ver, 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 recom- mended 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 at- tempt 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 In- dians: 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 Newfound- land 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 corſe, 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, ac- cording to the diſtance from ſhore.—*ib.*

MORUES *Bay*, on the ſouthern ſhore of the river St Lawrence, ſouthward of Gaſpee Bay, and weſt of Bo- naventura and Miſcan iſlands.—*ib.*

MORUGO, a ſmall river to the weſt and north- weſt of the gulf of Eſſequibo, on the coaſt of Surri- nam, in S. America.—*ib.*

MOSE, or *Villa del Moſe*, a town on the bank of the river

Morris.
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Moſe.

Mofes,
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Mofs.

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 floops and small vessels to the coast.—*ib.*

MOSES *Point*, a head or cape of land, on the E. side of the entrance into Bonavilla 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 Bonavilla.—*ib.*

MOSHAIIRA, 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 *moor*, a *fen*, or a *bog*. On the formation of these mosses some conjectures have been hazarded in the *Encyclopaedia*, 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 *teering* 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 chalders 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

Mofs.

Mofs. tum of mofs from the intermediate trenches, which is followed by another covering from the trenches when the potatoe plants make their first appearance; the covering in whole four or five inches. In this state they remain without any hoeing till the crop is taken up. The produce on Mr Smith's mofs has never been less than from forty to fifty bolls of excellent potatoes, eight Winchester bushels to the boll, and the bushel a little heaped.

"When the potatoe crop is removed, the ridges are again formed as before described, and the division furrow cleared out. In performing this part of the work, it will naturally occur, that a great part of the manured surface will be buried in filling up the trenches between the potatoe beds: but that is not the case; the workman makes two cuts with the spade, at eighteen inches distance, upon the side of the trench; another, one foot from the edge of it, as deep as the trench; which, instead of turning over, he presses a foot forward into the trench, which is continued the length of it; and when he comes to the other side he does the same, making both meet, and so proceeds; so that no part of the manured surface is thrown down, and the ridge is left in the same form as before the lazy-beds* were made.

* This is a vulgar Scottish phrase for beds of a particular kind of potatoe.
"When the potatoe crop is taken off, and the ridges formed as before described, they remain in that state till spring, when oats are sown (a wet or dry season has from experience been found a matter of indifference), and harrowed in with a small harrow drawn by two men. Four men with ease harrow at least one acre one rood per day, two and two by turns with the harrow, and the other two in the interim with spades, smoothing the inequalities, breaking and dividing the mould, and clearing out the division furrows; which last in all operations upon mofs are essentially necessary. The early or hot seed oats are always preferred for seed. The late or cold seed runs too much to straw, falls down, and becomes stoomy, consequently the grain is of mean quality, and unproductive in meal.

"The produce of the first crop of oats after potatoes is seldom less than ten bolls per acre, the Linlithgow boll of six Winchester bushels, and considerably more has been known; as good grain in quality, and meals as well as any in the country. It has been sold when growing, what is called upon the foot, including the straw, from eight to ten pounds per acre. To prepare for a second crop of oats, the ridges must be dug across, and turned over in the manner before described, and the division furrows cleared out as soon as convenient after the first crop is removed.

"Such is the effect of lime in consolidating mofs, aided by the draining, that often after the second, and always after the third year, it can be ploughed by horses within two bouts or stiches of the division furrow; and also harrowed by horses, and the crops taken off by carts.

"Five and often six consecutive crops of oats are taken, without any other manure than what it received the first year for potatoes, without any apparent signs of it being exhausted. The produce of the first two crops of oats has been mentioned to be ten bolls, and the third, fourth, fifth, and sixth, produce from six to ten bolls per acre. The mofs is now turned into a seeming rich dark brown mould; and what renders it less productive of corn crops the fourth, fifth, and

sixth years is, its naturally running into sweet and luxuriant grasses. The soft meadow grass, the daisy, some plaitain, but principally the white clover, are the most prevalent grasses; or more probably it may be ascribed to these crops being ploughed, in place of being dug with the spade, as the former years were. Along with the fifth or sixth crop of oats, rye-grass is sown, which, with the natural grasses in general, produce an abundant crop of hay.

"If the mofs in the original state has been wet and spongy, it will be found to have subsided some feet after the third or fourth year's operation has been performed; but care must always be taken to deepen, clear out, and keep clear the main drains and the division furrows, to prevent a superabundance of moisture, which would infallibly be the case were they neglected in consequence of the subsidence of the mofs. Indeed mofs of all sorts will subside less or more, in proportion as it has been dry or wet in its original state; at the same time, as stated before, care must be taken not to lay it too dry, but to keep in a proper degree of temperature between these two extremes."

By having recourse to the pamphlet from which this extract has been made, the reader may satisfy himself of the real advantages of this species of agriculture. The author calculates, with much apparent fairness, the expence of improvement, and the value of each crop, and concludes that no waste can be improved with equal advantage as mofs. It must not, however, be concealed, that we have heard practical farmers, who seemed to be acquainted with the subject, give it as their opinion that this mode of cultivation answers only in moses of no great depth; though our author affirms that it has with great success been practised by Mr Smith in moses 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 struck with the importance given, in some of the journals, to *The Experimental Researches of Venturi concerning the Principle of the lateral communication of Motion in Fluids applied to the Explanation of various Hydraulic Phenomena*. Of these researches we intended to lay an abridged account before our readers under the present title; but having examined the work with some attention, we find in it hardly any thing of consequence which the mechanical philosopher may not learn from our articles *RESISTANCE of Fluids* and *RIVER* in the *Encyclopædia*. That our readers, however, may find something under a title to which we rashly referred them, we shall, in the words of Nicholson's *Journal of Natural Philosophy*, &c. inform them what Venturi's work contains.

"This author, who is professor of experimental philosophy at Modena, has introduced an horizontal current of water into a vessel filled with the same fluid at rest. This stream entering the vessel with a certain velocity, passes through a portion of the fluid, and is then received in an inclined channel, the bottom of which gradually rises until it passes over the border or rim of the vessel itself. The effect is found to be, not only that the stream itself passes out of the vessel through the channel, but carries along with it the fluid contained in the vessel; so that after a short time no more of the fluid remains than was originally below the aperture at which the stream 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 cylindrical 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 cylindrical 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.

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The author proves, that the velocity or total expenditure of fluid through an aperture of given dimensions, 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

Motion,
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Moulton-
borough.

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 Phénomènes 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—Théophile Barrois, Rue Haute-feuille, N° 22. Ann. VI. 1797*—or to the 2d and 3d vols of the valuable Journal from which this abstract is taken.

MOTTE *Ile*, 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.

Mount.

Mount,
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Moufc.

Moufoirt,
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Mozart.

grove of different flowering forest trees. Parallel with them, on the land side, are two spacious gardens, into which one is led by two serpentine gravel walks, planted with weeping willows and shady shrubs. The mansion house itself appears venerable and convenient. The superb banqueting-room has been finished since the General returned home from the army. A lofty portico, 96 feet in length, supported by 8 pillars, has a pleasing effect when viewed from the water; the whole assemblage of the green-house, school-house, offices, and servants' halls, when seen from the land side, bears a resemblance to a rural village; especially as the lands on that side are laid out somewhat in the form of English gardens, in meadows and grass-grounds, ornamented with little copses, circular clumps, and single trees. A small park on the margin of the river, where the English fallow deer and the American wild deer are seen through the thickets, alternately with the vessels as they are sailing along, add a romantic and picturesque appearance to the whole scenery. On the opposite side of a small creek to the northward, an extensive plain, exhibiting corn-fields and cattle grazing, affords in summer a luxuriant landscape; while the blended verdure of wood-lands and cultivated declivities, on the Maryland shore, variegates the prospect in a charming manner. Such are the philosophic shades to which the Commander in chief of the American army retired in 1783, at the close of a victorious war; which he again left in 1789, to dignify with his unequalled talents, the highest 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 spend the remainder of his days as a private citizen, in peace and tranquillity.—*ib.*

MOUNT VERNON, a plantation in Lincoln county, District of Maine, in the neighbourhood of Sidney and Winflow.—*ib.*

MOUNT WASHINGTON, in the upper part of the island of New-York.—*ib.*

MOUNT WASHINGTON, one of the highest peaks of the White Mountains, in New-Hampshire.—*ib.*

MOUNT WASHINGTON, the south-westernmost township of Massachusetts, in Berkshire county, 150 miles W. by S. of Boston. It was incorporated in 1779, and contains 67 inhabitants.—*ib.*

MOURZOUK, the capital of Fezzan in Africa, is situated on a small river, and supplied with water from a multitude of springs and wells. Being formerly built of stone, it still retains the appellation of a Christian town; and the medley which it presents to the eye, of the vast ruins of ancient buildings, and the humble cottages of earth and sand that form the dwelling of its present Arab inhabitants, is singularly grotesque and strange. It is surrounded 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 (provisions excepted) that are brought for the supply of its people. A caravan sets out annually from Mesurata to this place; and hence the Fezzaners themselves dispatch every year a caravan to Cashna and another to Bornou. For the latitude of Mourzouk, see FEZZAN in this *Suppl.* Dr Brookes, in his *Gazetteer*, places it in 15° 5' E. Long.

MOUSE Harbour, at the E. side of the island of St John's, and at the S. W. angle of the gulf of St Law-

rence, is between East Point and Three rivers, and goes in with a small creek that is moderately spacious within.—*Morse.*

MOUSOM, a small river of York county, District of Maine, which falls into the ocean between Wells and Arundel.—*ib.*

MOWAZZEF, in Bengal, fixed revenue.

MOWEE, one of the Sandwich Isles, next in size to, and N. W. of, Owhyhee. A large bay of a semi-circular form; opposite to which are the islands Tahorowa and Morokinnee. It is about 162 miles in circumference, and is thought to contain nearly 70,000 inhabitants.—*Morse.*

MOYAMENSING, a township in Philadelphia county, Pennsylvania.—*ib.*

MOZART, the celebrated German musician, was born at Salzburg in the year 1756. His father was also a musician of some eminence, but not to be compared with the son; of whom we have the following account in one of the monthly miscellanies, taken by Mr Buhby from some biographical sketches by two eminent German professors.

At the age of three years, young Mozart, attending to the lessons which his sister, then seven years old, was receiving at the harpsichord, he became captivated with harmony; and when she had left the instrument, he would instantly place himself at it, find the thirds, sound them with the liveliest joy, and employ whole hours at the exercise. His father, urged by such early and striking indications of genius, immediately began to teach him some little airs; and soon perceived that his pupil improved even beyond the hopes he had formed of him. Half an hour was generally sufficient for his acquiring a minuet or a little song, which, when once learned, he would of himself perform with taste and expression.

At the age of six years he had made such a progress as to be able to compose short pieces for the harpsichord, which his father was obliged to commit to paper for him. From that time nothing made any impression upon him but harmony; and infantine amusements lost all their attractions unless music had a share in them. He advanced from day to day, not by ordinary and insensible degrees, but with a rapidity which hourly excited new surprise in his parents—the happy witnesses of his progress.

His father returning home one day with a stranger, found little Mozart with a pen in his hand. "What are you writing," said he? "A concerto for the harpsichord," replied the child. "Let us see it (rejoined the father); it is a marvellous concerto without doubt." He then took the paper, and saw nothing at first but a mass of notes mingled with blots of ink by the mal-address of the young composer, who, unskilled in the management of the pen, had dipped it too freely in the ink; and having blotted and smeared his paper, had endeavoured to make out his ideas with his fingers; but on a closer examination, his father was lost in wonder; and his eyes delighted and flowing with tears, became rivetted to the notes. "See (exclaimed he to the stranger) how just and regular it all is! but it is impossible to play it; it is too difficult." "It is a concerto (said the child), and must be practised till one can play it. Hear how this part goes." He then sat down to perform it; but was not able to execute the passages with sufficient fluency to do justice to his own

Mozart. ideas. Extraordinary as his manual facility was universally allowed to be for his age, it did not keep pace with the progress of his knowledge and invention. Such an instance of intellectual advancement, in a child only six years of age, is so far out of the common road of nature, that we can only contemplate the fact with astonishment, and acknowledge, that the possible rapidity of mental maturation is not to be calculated.

In the year 1762, his father took him and his sister to Munich, where he performed a concerto before the elector, which excited the admiration of the whole court; nor was he less applauded at Vienna, where the emperor called him the *little forcerer*.

His father gave him lessons only on the harpsichord; but he privately taught himself the violin; and his command of the instrument afforded the elder Mozart the utmost surprise, when he one day at a concert took a second violin, and acquitted himself with more than passable address. True genius sees no obstacles. It will not therefore excite our wonder, if his constant success in whatever he attempted begot an unbounded confidence in his own powers; he had even the *laudable* hardihood to undertake to qualify himself for the *first* violin, and did not long remain short of the necessary proficiency.

He had an ear so correct, that he felt the most minute discordancy; and such a fondness for study, that it was frequently necessary to take him by force from the instrument. This love of application never diminished. He every day passed a considerable time at his harpsichord, and generally practised till a late hour at night. Another characteristic trait of real genius; always full of its object, and lost as it were in itself.

In the year 1763 he made, with his father and sister, his first grand musical journey. He visited Paris; and was heard by the French court in the chapel-royal at Versailles, where his talent on the organ was admired even more than on the harpsichord. At Paris the musical travellers gave two concerts, which procured them the highest reputation, and the distinction of public portraits. It was here that a set of sonatas for the harpsichord, some of his earliest compositions, were engraved and published.

From Paris they went to London, where they also gave two concerts, consisting of symphonies composed by young Mozart, who even at that early age sang also with much expression, and practised publicly with his sister. Mozart played already at sight, and in a concert, at which the king was one of his auditors, a bass being placed before him as a *ground*, immediately applied to it a most beautiful melody. Those who are best acquainted with the extent of such a task, will be the most astonished at such mature familiarity with the intricacies of the science, and such prompt and ready invention in so juvenile a mind.

From London, where Mozart also published six sonatas for the harpsichord, the musical 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 repose; devoting the whole of his time to the study of composition, the principles of which he scrutinized with the depth and penetration of confirmed manhood. Emmanuel Bach, Haffa, and Handel, were his chief guides and models; though he by no means neglected the old Italian masters.

In 1768 he again visited Vienna, where Joseph II. engaged him to set to music a comic opera, entitled, *La Finta Semplice*, which obtained the approbation of Haffa and Metastasio. At the house of the prince of Kaunitz, it often happened that the first Italian air which came to hand would be given him, that in the presence of the company he might add to it accompaniments for numerous instruments; which he would write in the first style of excellence, and without the least premeditation. This is at once a proof with what acuteness of observation he had listened to the music of the best masters; how intimate he had already rendered himself with the characters, capacities, and effects of the different instruments; and what skill he had acquired in that abstruse art of mixed combination which, while it calculates the conjoint effect of sounds, as they regard the established laws of harmony, accommodates the different parts to the scales, tones, and powers of the respective instruments by which they are to be executed. It was at this time also that, although but twelve years of age, he composed the music for the consecration of the church of orphans, at the performance of which he himself presided.

In 1769 Mozart again returned to Salzburg, where he became *maitre de concert*. Not having yet seen Italy, in December of the same year he set out for that seat of the fine arts. Those talents which had already excited the admiration of Germany, France, and England, now awakened in that land of musical taste the most lively enthusiasm.

In 1771 he had no sooner given personal proofs of his genius, than *la scrittura* for the following carnival was conferred upon him. He visited Bologna, then as famous for harmonic excellence as Naples, where the celebrated theorist Martini was amazed to see a German boy work and execute the theme of a fugue which he presented to him, in the extraordinary style in which Mozart acquitted himself. He next went to Florence. Florence even enhanced the eulogiums which Bologna had lavished upon him.

During the holy week he arrived at Rome, and assisted at the *Miserere* in the Sixtine chapel; which performance is justly considered as the *ne plus ultra* of vocal music. This circumstance claims particular notice, as inducing a proof of another faculty of his mind, only to be equalled by those wonderful powers which he had already demonstrated. He was prohibited from taking a copy of this *Miserere*, and therefore piqued himself on retaining it in his memory. Having heard it with attention, he went home, made out a manuscript from recollection, returned the next day to the chapel, heard the piece a second time, corrected the rough draught, and produced a transcript which surprised all Rome. This *Miserere* formed a *scorer* numerous in its parts, and extremely difficult of execution. His mind had embraced and retained the whole!

He soon after received from the Pope the order of the gilt spur; and at Bologna was complimented, by an unanimous decision, with the title of *Member and Master 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 style, was required of him, and he was shut up alone in his chamber. He completed it in half an hour, and received his diploma. This evinced that he possessed an imagination constantly

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 *Mitridates*. This piece procured him *la scrittura* for the grand opera of the carnival of 1773, which was his *Lucio Sullu*. 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'enlèvement du Sérail*; 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 applause 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 achieved by this great master, to afford a basis for so glowing a picture of the merit and success of *L'enlèvement du Sérail*. 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 1787 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 Flutte Enchantée* 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 operabill; 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 refounded in the most distant provinces, favoured the idea that Mozart had actually the design to enchant all Germany with his *Flutte Enchantée*.

Mozart.

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 im-

ply 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 *phenomena 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."

Mozart.

Mucaros,
||
Mumbo-
Jumbo.

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 *MANDING*, *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 clumsy 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 drefs 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 drefs 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 **SAPOONES**, three Indian tribes, who inhabit at Diago, and other villages up the N. branch of Susquehannah river. About 20 years ago, the two first could furnish 150 warriors each, and the Sapoones 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 Princcton, 12 from Winton, 50 N. by W. of Edenton, and 422 S. W. of Philadelphia.—*Morse*.

MURGA MORG *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 of Lincoln's Inn, though he still continued to reside much 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,

Muncy,
||
Murray.

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 practitioners. 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 elocution, of which he has a never-failing stream."

In the outset of Lord Mansfield's life, it will be 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 surpris'd 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 doggerel 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.

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 expressed 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

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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.

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

Murray.

* Lord Melcombe's Diary, p. 220-

Murray. 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 suspense."

The anxiety of suspense, 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 confessions, 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."

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 these 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

Murray. the king's supreme court of justice, under his 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,

—“*Ipsa si cupiat salus
“ Servare, profus 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 views. I 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

(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 theology.

(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.

Murray. he falls 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 Woodfall 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

Murray. 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 passers. For a fuller account of those dreadful riots, see BRITAIN, n^o 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

Murray.

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 insatiation 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

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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 Holliday 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,
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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 *Messillon*, 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.*

"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 Mafinissa'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 basilisk 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

* *Inventions*,
vol. ii.
P. 44.

(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 petrifications, 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,
Muskitto.

MUSHROOM, a fungus, of which some of the principal species have been described in the *Encyclopaedia* 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,
||
Myerstown.

MUSQUITO *River and Bay* lie at a small distance north of Cape Canaveral, 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 Tulpehocken 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.*

Mynomanies,
||
Myrtle.

N.

Naanran's,
||
Nancowry.

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 Ekimaux is its southern point or entrance.—*Morse.*

NACO, a town of New-Spain, in the province of Honduras, 50 miles north-west of Valladolid.—*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 projections arise; or which serves as a ground to the projections.

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 *melôri*, 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

Nancowry.

(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 ascent is by a ladder. In thofe bays or inlets which are sheltered from the furf, they erect them fometimes fo near the margin of the water as to admit the tide to flow under, and wash 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 shave the hair of their heads, or keep it clofe cropt, which gives them an uncouth appearance, in the eyes of ftangers 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 anniversary 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 afsemble, drefed 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 corpf, is pulled up. The woman who is neareft of kin to the deceafed, fteps out from the crowd, digs up the fkuil, 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 fleft, 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 deposited 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 difgultful 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 befmeare themfelves with the blood of the flaughtered hog; and fome, more voracious than others, eat the fleft raw. They have various ways, however, of drefling their meat, but always eat it without falt. A

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kind of pafte made of the *melôri*, ferves them for bread; and they finifh their repaft with copious potations of *taury*, an inebriating liquor.”

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 feaft, 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 the 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 exhausted. 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 waficoats 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.

Nausse-
mond.
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Nantucket.

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 Chesapeake 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 Utshanago, 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 $3\frac{1}{2}$ 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 $7\frac{1}{2}$ 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 110000l. 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 sulphurous 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

Nantucket,
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Naples.

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*. Foucheroux 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

* *Litboge-
ognosic*, v. ii.
p. 15.

† *Mém. of
the Acad.
of Sciences*,
1766.

‡ *In Nuova
raccolta
d'opuscoli
scientifici*,
t. iv.

diphoretic antimony† (white oxyd of antimony by nitre). But before Foucheroux, 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 seccia*, and the same quantity of common salt." I am inclined (says M. Beckmann) to think that this receipt was not unknown to Foucheroux, and that he considered *alume di seccia* 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 seccia* 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 seccia*, but only *seccia*; 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 seccia*.

After Foucheroux'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 fur-

nace, 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.

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, *Játámansí*. After a pretty long interval, I

(A) In the Memoirs of the Academy of Sciences for 1767, Foucheroux 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, shewed them the spikes (as they are called) of *Játámani*, 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 *Játámani** evidently belongs to the natural order which Linnæus calls *aggregate*; with the following characters:

Calyx, scarce any; *margin*, hardly discernible. *Corolla*, one petal; *tube* somewhat gibbous; *border* five cleft. *Stamina*, three *Antbers*. *Pistula*, *Germ* beneath; one *Style* erect. *Seed*, solitary, crowned with a pappus. *Root*, fibrous. *Leaves*, hearted, fourfold; *radical* leaves petioled.

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 Játámaní floribus triandris, foëis 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 *Játámaní* is a native of the most remote and hilly parts of India, such as NEPAL, 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 Windfor; 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.

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 Crofdill, 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;

* Plate XXX.

Biog. Dict. new edit.

Nares.

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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 Glee; 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 embraces 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 Goldborough 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 in-

habited 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 Goldborough, 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 *Nawshawn*, 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

Narra-
guagus,
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Nassau.

Nassau,
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Nata.

mity of S. America. It is to the E. of False Cape Horn, which forms the western limit of the bay; Cape Horn being the S. point of the southernmost of the Hermit's Islands, a groupe of islands which lie off the coast opposite to this bay. This bay is large and open, well sheltered from the tempests of the ocean. It is capable of holding a fleet of ships, and though there are small islands near its entrance, all the dangers are visible, and ships may sail freely between them, or on each side of them.—*ib.*

NASSAU *Cape*, on the coast of Surinam, or N. E. coast of S. America, is to the N. N. W. of Essequibo gulf, and the E. point of the entrance into the river Pamaron. It is in about lat. 7. 40 N. and long. 59 30 W.—*ib.*

NASSAU *Cape*, on the N. shore of Terra Firma, S. America.—*ib.*

NASSAU, a small town in Dauphin county, Pennsylvania. It contains a German church, and about 35 houses. It is also called *Kempstown*.—*ib.*

NASSAU *Island*, at the mouth of Byram river, in Long-Island Sound.—*ib.*

NASSAU *Road*, on the coast of West-Florida, lies W. of Mobile Bay, 5 leagues to the northward of Ship Island, and within the north end of the Chandeleurs or Myrtle Islands. It is one of the best roads for large vessels on the whole coast of Florida. It affords good shelter from winds that blow on shore, has no bar, and is easy of access. Vessels, however, must not go within $\frac{3}{4}$ of a mile of the inside of the island, it being shoal near that distance from the shore. Vessels may go round the north end of it from the sea in $5\frac{1}{2}$ and 6 fathoms, at $\frac{1}{2}$ a mile from the shore, and afterwards must keep in $4\frac{1}{2}$ and 5 fathoms till the north point bears N. N. E. about 2 miles, where they can anchor in 4 fathoms good holding ground, sheltered from easterly and southerly winds: this is necessary for all vessels frequenting the coast of Florida, as easterly winds are very frequent. There is fresh 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 shore. Nassau Road was first discovered by Dr Daniel Cox, of New-Jersey, who named it so in honour of the reigning prince, William III. He also gave the name of Myrtle Islands to those afterwards call Chandeleurs, by the French, from the candles made of the Myrtle wax, with which these islands abound.—*ib.*

NASSAU *River*, on the coast of East-Florida, has a bar generally about 8 feet water, but is subject to shifting. The tides are about 7 feet at low spring tides. An E. S. E. moon makes high water here, as also in most places along the coast.—*ib.*

NASSAU, the chief town of Providence Island, one of the Bahamas, and the seat of government. N. lat. 25 3. It is the only port of entry except at Turk's Island.—*ib.*

NATA, a town and bay in the province of Terra Firma, S. America. The bay of Nata lies on the S. coast of the Isthmus of Darien, and on the North Pacific Ocean. From hence and the adjacent parts, provisions are sent for the supply of the inhabitants of Panama, which city is 67 miles N. E. of Nata. The

bay is spacious and deep, but is not used by ships, but in cases of necessity, as they are liable to be embayed by the winds that blow frequently at E. upon the shore. The bay extends to the island 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 coast trends W. to Haguera Point 7 leagues. All ships bound to the N. W. and to Acapulco make this point. It is also called the S. point of the bay, which lies within on the W. side of this great Gulf of Panama.—*ib.*

NATACHQUOIN *River*, a large river of the coast of Labrador, in N. America, to the westward of Nasquirou river, under Mount Joli, where it forms a fourthly cape in lat. 50 25 N. and long. 60 45 W. The little Natachquin is to the W. S. W. of this.—*ib.*

NATAL, a cape and town, on the S. shore of the Rio Grande, on the N. E. coast of Brazil in S. America, is to the S. W. of the 4 square shoal, at the mouth of the entrance of that river, which contains some dangerous rocks. On this point is the Castle of the Three Kings, or Fortaleza des Tres Magos. The town of Natal is 3 leagues from the castle, before which is good anchorage for ships, in from 4 to 5 fathoms, and well secured from winds.—*ib.*

NATCHEZ, a powerful nation of Indians who formerly inhabited the country on the E. side of the Mississippi. Fort Rosalie is situated in the country which they possessed, in lat. 31 40. Nothing now remains of this nation but the name, by which the country continues to be called. The Creeks or Muscogulges rose upon the ruins of this nation. The French completed their destruction in 1730. The French or Sun Set Indians, are a part of the Creek confederacy which they joined after they left Louisiana.—*ib.*

NATCHITOCHEs. A tract of country in Louisiana, on the river Rouge, or Red river, bears this name. The French had a very considerable post on this river called Natchitoches. It was a frontier on the Spanish settlements, being 20 miles from the fort of Adayes, and 70 leagues from the confluence of the Rouge with the Mississippi.—*ib.*

NATICK, an ancient township in Middlesex county, Massachusetts, situated upon Charles river, 18 miles S. W. of Boston, and 10 N. W. of Dedham. Its name in the Indian language signifies "The place of hills." The famous Mr Eliot formed a religious society 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 descendants, however, now remain. It was incorporated into an English district in 1761, and into a township in 1781; and now contains 615 inhabitants.—*ib.*

NATEENAT, an Indian village on Nootka Sound, on the N. W. coast 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-eastern branch of Housatonic

Nata Point,
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Nauga-
tuck.

Navi-
tors.

Houatonic 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, Fansoué, MAOUANA, Oyolava, Calinassé, Pola, Shika, Offamo, 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 overfet, 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,

Navi-
tors.

"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 seaweeds 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 basalt 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;

Navigators.

(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.

Navarre,
||
Nazareth.

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. $\frac{1}{2}$ 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 2 $\frac{1}{2}$ 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,

Nazareth,
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Necessity.

Neckar, 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 $23^{\circ} 34'$ north, and its longitude to be $166^{\circ} 52'$ 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 shore 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 sitting 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. $21^{\circ} 50'$ N. and long. $160^{\circ} 15'$ W. Sometimes it is called *Nebeewow*, or *Onébeowow*.—*ib.*

NEGADA, or *Anegada*, one of the Caribbee islands in the West-Indies. It is low and desert, encompassed with shoals and sand banks. It is called Negada, from its being mostly overflowed by high tides. It is 50 miles north-west of Anguilla, and abounds with crabs. N. lat. $18^{\circ} 6'$ W. long. $63^{\circ} 5'$.—*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. $18^{\circ} 45'$ 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. $57^{\circ} 12'$ north, and long. $92^{\circ} 42'$ west. The shoals so called are said to be in lat. $57^{\circ} 35'$ north, and long. $92^{\circ} 12'$ 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.*

NENAWEWHICK *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 Orientes is 20 leagues to the N. W. The river and island are in lat. about $4^{\circ} 30'$ 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

Neckar,
||
Negro.

Negro,
||
Nepal.

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 these 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 *Baryesu*; 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 Mahomedans, their religion also abounds with many prejudices, and is

Nepal.

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.

Nepal.

To the westward also of the great city of Lelit Patan, 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 mattrafs also of the same kind of stone, and the idol and the mattrafs 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 villainies: 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 north-west 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 site 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.

Nepan,
||
Neus.

Neutra,
||
New-Andalusia.

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 Manfel 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 hogheads of sugar. The island, finally 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 Passaic 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 Passaic 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

New-Andover,
||
New-Bedford.

Newbern. 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. *Accusnutt* 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 Sconticut 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 arch-

es, 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 Petersburg 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, Petitcodiac, 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

New-Biscay,
New-Brunswick.

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 Coos. 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 culti-

Newbury-
Port.

vation, 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 Byfield 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, 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 Belle, 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 breadth, and contains 19,686 inhabitants, including 2,562 slaves. Here are two snuff-mills, a flitting-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 Assaquin 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, 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 Ammonoosuck 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 Winnepissoga 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.

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.

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.

At this period New England was thickly inhabited by

New-Chester,
||
New-England.

Situation and Extent.

Boundaries.

Discovery.

New-Eng-land. Depopulation of New-Eng-land by a mortal pestilence.

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.

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. Ducey, 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

New-Eng-land.

before, had lived in Holland for the sake of enjoying liberty of conscience. They came over to America in the year 1620.

Disingenuous conduct of the Dutch.

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 under-written, 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."

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.

John Carver first Governor.

Afterwards by an unanimous vote, they chose JOHN CARVER their governor for one year. 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

Difficulties encountered by the colonists.

New-Eng-land.

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 *forefather'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.

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.

Fortunate discovery of seed corn.

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 found, 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.

First child born.

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.

Situation and prospects of the colonists.

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 indispensable to the support of the infant colony, was preserved.

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 Gorres, with thirty-four others and their successors, styling them, "The council established at Plymouth, in the county of Devon, for the planting, ruling, ordering, and governing, of New England in America."

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."

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.

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,

New-Eng-land.

The council of Plymouth established and New-England granted them.

Minot's Hist. Mass.

Treaty with Masassoit.

War with the Narraganset Indians.

New-Eng- ally, and terminated the dispute to the terror of their
land. enemies. Even Canonicus himself, the terrific sachem
of the Narragansets, sued for peace.

Death of In April of this year George Carver, while engaged
Gov. Car- in labour, with the rest of the settlers, was seized with
ver. 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 pru-
dence, 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 fore-
most 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 particu-
larly remarked that in the time of general sickness,
which beset the colony, and with which he was affect-
ed, after he had himself recovered, he was assiduous
in attending the sick, and performing the most humili-
ating services for them, without any distinction of
persons or characters."

Belknap. 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 ac-
counts much respected and beloved by the people. Isaac
Allerton was chosen his assistant in the admini-
stration of government. One of the first official acts
of Gov. Bradford was to send an embassy to Ma-
fassoit. 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 friend-
ly intercourse, and to procure seed corn for the next
season.

Embassy to Edward Winslow and Stephen Hopkins, with Squan-
to 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 accom-
plished 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 Mafassoit, nine of
the petty sachems in his neighbourhood, who were jeal-
ous 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 under-
written, do acknowledge ourselves to be the loyal sub-
jects of King James, king of Great Britain, France and
Ireland, defender of the faith, &c. In witness where-
of, and as a testimonial of the same, we have subscrib-
ed our names or marks as followeth:

Ohquamehud, Nattawahunt, Quadequina,
Cawnaname, Caubatant, Huttamoiden,
Obbatinua, Chickatabak, Apannow."

Hobbamack, another of these subordinate chiefs, came
and took up his residence at Plymouth, where he con-
tinued 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 New-Eng-
Vineyard, also sent messengers of peace." These trans- land.
actions are so many proofs of the peaceful and benevo-
lent disposition of the Plymouth settlers.

In September (1621) governor Bradford sent ten Masachu-
men, with Squanto, in a shallop to explore the bay, setts Bay
now called Massachusetts; they found that the islands explored.
in this bay had been cleared of wood, that they had
been planted, but were now almost without inhabi-
tants.

An acces- In November, a ship with thirty-five passengers ar- sion to the
rived from England. Unfortunately for the little col- colony.
ony, 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, threat-
ened the peace of the colony by a message sent in "the
emblematical style of the ancient Scythians, viz. a bun-
dle 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 Narra-
gansets, 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 alter-
nately 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- The practice of *duelling*, which has never prevailed England.
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 remit-
ted.

Death of Squanto. 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 re-
quested the governor to pray for him, that he might
"go to the Englishman's God in heaven." This In-
dian 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 conti-
nued till his death, rendering them in various ways,
most essential services.

Governor Bradford was treated with great respect
4 H 2 by

New-Eng-
land.
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 lhd. 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 Ham-
den visit
Masaffoit
who is sick.

In the spring of 1623, Masaffoit 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 disco-
vers a con-
spiracy of
the Indians.

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 wife plans were executed by the brave Capt. Standish, the colony was once more saved from destruction.

Belknap.

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.

In the year 1624, the charter of the Plymouth Coun-

cil 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. 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.

New-Eng-
land.
Charter at-
tacked.

Patentees
divide the
country
among
themselves.

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 *lull* 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.

Neat cattle
first im-
ported into
New Eng-
land.

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.

Situation of
the colony.

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.

Death of
Rev. Mr.
Robinson.

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 Masaffoit, 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. 1. p.
298.

Mr Brad-
ford surren-
dered this
patent to
the general
court, at
their re-
quest, in
1640.

Extent of
the patents.
Title.

† Hazard i.
401.

In

(A) In 1639, after the termination of the Piquod war, Masaffoit, who had then changed his name to Woomamequen, brought his son Moomanam 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-Eng- In the same patent was granted, a large tract border- land. ing on the river Kennebeck, where they had carried on a traffic with the natives for furs, as they did also at Grant on Kennebeck River. 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.

† 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.

Systems of sports established.

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."

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."

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 Haslegrig, 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 fortunate 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.

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,

New-Eng- land.

Minot's continuation of Hist. of Massa. p. 13.

O. Cromwell and others contemplate a removal to New-Eng- land. Prevented by Apb. Laud.

Minot.

Character of the first settlers of New England.

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 Woofamequen, 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-Eng-land.

New Eng-land.

Purchased of the Plymouth council.

March 4, 1628. Charter obtained.

Its contents.

H. Adams's Hist. N. Eng. p. 27. Cradock appointed Governor.

Hutchinson.

First church formed in Salem.

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 Merimac 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 authorized 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. 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. 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.

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.

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."

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

Charter to be transferred to Massachusetts.

Chalmers, p. 151.

John Winthrop governor.

Fifteen hundred colonists embark for New England.

Prince's Chronology, p. 211.

Indian conspiracy.

Scarcity.

Mortality among the colonists.

New-Eng-
land. ety and wisdom," and one of the assistants, and Mr Roslter 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 talked 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 Chris-
tians gathered in
Charlestown and
Boston. 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.

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, Roslter, 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 give or taker," and Mr Bradstreet was chosen Secretary.

ibid. 246,
247. 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 *bilbours*, 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*.

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.

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.

As the winter approached, provisions became extremely scarce; the people were compelled to subsist on clams, muskles, 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.

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.

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

New-Eng-
land. Prince, p. 248.

Water-
town, Bos-
ton, and
Roxbury
settled.

Plan of a
fortified
town,
formed but
relinquish-
ed.

Hutchin-
son, vol. I.
p. 28.

Alarming
Scarcity.

Mr. Ab-
bot's M. S.
notes.

Third
court hold-
en.

Chalmers,
p. 153.

Good ef-
fects of the
scarcity.

was

New-England was now valued at twenty-five to thirty pounds sterling.

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.

Union between the colonies of Massachusetts and Plymouth.

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.

New-England.

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

Representative government established, and the rights of the people asserted.

Hutchinson.

New-Eng-
land.Code of
laws enact-
ed.New-Eng-
land.

house of representatives that ever assembled in America. A house of burgesses met for the first time in Virginia, May 1620, fourteen years before.

Having thus established their form of government, the enactment 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 gained

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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-Eng-land.

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.

* John Adams, late President of the U. States.

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 achieved, 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."

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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."

New-England.

New-England.

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 south-westward 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 dissensions 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.

Eckknay,

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.

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.

Settlement of Connecticut.

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,

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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 refounded, 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. Conn.

The Indians on, and near, the river were numerous. Three Sachemdoms were in the vicinity. The seat of one was near the mouth of Podanck 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 Weathersfield, 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, New-Eng-
Vol. I. of this Work.)

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.

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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 A-
dams' Hist.
New-Eng-
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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 Osamaquin, two Narraganset sachems, for a tract of land within their territories, provided he should be under the necessity of settling among them. These circum-

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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 Seekhonck, 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 distresses," 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 Narragansett 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

Rhode-
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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.

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 Narragansett 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.

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

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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 Narragansett 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.

Charles II. proclaimed, and a patent obtained.

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 na-

Its contents.

ture 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 authorized 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 Narragansett bay, and the countries and parts adjacent: To be holden of the manor of East Greenwich, in common soccage." 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.

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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.

Chalmers.

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

Roman Catholics barred from the privileges of freemen.

New-Eng-land. Articles of charge exhibited against the governor and company, and a writ of *quo warranto* issued.

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, though 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.

Chalmers.

Charter surrendered to Sir Edward Andros.

Earthquake.

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.

Harvard College founded.

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.

New-Eng-land.

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-Eng-
land.
Hutchin-
son.

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
christian-
ized.

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
persecu-
tion.

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.* 1st "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 surpris'd 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 befall 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 colo-
nists.

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.

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. 1st, "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.

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."

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-Eng-
land.

Another
Synod con-
vened.

Loss of the
charter.

State of
New-Eng-
land at this
period.

New-Eng-land. Dudley appointed president. 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.

Hutchinson. 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.

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 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. Left 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 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.

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 Swain, 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. Swain 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.

New-Eng-land. Its disgraceful termination.

William and Mary proclaimed in Boston.

Indian war.

New-Eng-
land.

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 exertions were made for an expedition against Canada.

Expedition
against Ca-
nada.

The command was given to Sir William Phips, who sailed 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 ob-
tained.

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, there were 36 churches in New England; in 1650, there were 40, which contained 7750 communicants; and though the philosopher 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

Dr Stiles'
M. S.

where is knowledge more generally diffused, no where are morals more correct, religion more pure, or the inhabitants more independent and happy.

New-Eng-
land.

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 waiting 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

1692.
Sir William
Phips go-
vernor.
The witch-
craft infa-
tuation.

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."

Calef.

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 Keyser, aged about forty-five years faith, 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

same.

New-Eng-
land.

same room, said Capt. Daniel King asked me whether I would not go up and see Mr Burroughs, and discourse with him, he being then in one of the chambers of said house. I told him it did not belong to me, and I was unwilling to make or meddle with it; then said King said, are you not a christian? If you are a christian, go and see him, and discourse with him. But I told him I did believe it did not belong to such as I was to discourse him, he being a learned man. The said King said, 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 persons accused for witchcraft, or the ring-leader of them all; and told him also, that I believed if he was such a one, his master (meaning the devil) had told him before now, what I said of him. And said King seeming to me to be in a passion, I did afterwards forbear. The same afternoon, I having occasion to be at said Beadle's house, in the chamber where Mr George Burroughs kept, I observed that the said Burroughs did steadfastly fix his eyes upon me. The same evening, being in my own house, in a room without any light, I did see very strange things appear in the chimney, I suppose a dozen of them, which seemed to me to be something like jelly that used to be in the water, and quivered with a strange motion, and then quickly disappeared. Soon after which I did see a light up in the chimney, about the bigness of my hand, something above the bar, which quivered and shaked, and seemed to have a motion upward; upon which I called the maid, and she looking up the chimney, saw the same; and my wife looking up, could not see any thing. So I did, and do conclude it was some diabolical operation"!!!

Original
depositions.

On the margin of this deposition is written, M^r Elizur Keyfar declared to the jury of inquest, that the evidence in the paper is the truth upon oath, August 31, 1692.

Nine persons received sentence of death, September 17th, eight of whom were executed September 22d, one woman being reprieved, pleading pregnancy.—Giles Cory had been pressed to death, September 16th, because he would not (seeing all were convicted) put himself on trial by the jury. Previous to this, numbers had confessed themselves guilty of witchcraft, it being the only way of saving their lives, none who confessed being executed. But the supposed sufferers becoming more daring, accused some of the best people in the country. Suspicion roused from its lethargy; condemnation ceased; the accusers were silent; those under sentence were reprieved, and afterwards pardoned.

If we can be convinced by the the uniform protestations of those executed, or the confessions of numbers who had been accusers, or the deliberate recantations of others who had confessed themselves witches, or the universal conviction of error in the minds of those who had been leading actors in these awful scenes, or the entire change of public opinion, we shall be satisfied that these are facts. All those executed, the first excepted, protested their innocence with their dying breath, when a confession would have saved their lives. Several years after, persons who had been accusers, when admitted to the church confessed their delusion in such conduct, and asked "pardon for having brought the

guilt of innocent blood on the land." The following is an extract from the confession of six persons belonging to Andover, who had owned themselves witches;—"We were all seized as prisoners; knowing ourselves altogether innocent, we were all exceedingly astonished, and amazed, and affrighted out of our reason; and our dearest relations seeing us in this dreadful condition, and knowing our great danger, apprehending there was no other way to save our lives, persuaded us to confess: we said any thing and every thing which they desired."

On the day of a public fast, in the south meeting-house of Boston, one of the judges, who was concerned in the condemnation of these unhappy victims at Salem, delivered in a paper, and while it was reading stood up: it was to desire prayers, &c. "being apprehensive he might have fallen into some errors at Salem."

The following is from the declaration of twelve men, who had been jurymen at some of these trials:—"We do therefore signify our deep sense of, and sorrow for, our errors in acting on such evidence—we pray that we may be considered candidly and aright, by the living sufferers, as being then under the power of a wrong and general delusion." Mr Paris, who was active in the prosecution, and evidently a serious and conscientious man, in his public confession, November 26th, 1694, says, "I do acknowledge, upon after consideration, that were the same troubles again to happen, which the Lord of his mercy forever prevent, I should not agree with my former apprehensions in all points; as for instance," &c.

Mr Paris
public confession

Martha Cory, a member of the church in Salem village, admitted April 27th, 1690, was, after examination upon suspicion of witchcraft, March 21, 1692, committed to prison, and condemned to the gallows yesterday. This day in public, by general consent, she was voted to be excommunicated out of the church. The following will show, in a most affecting manner, the light in which the church viewed this vote, ten years after. "In December, 1702, the pastor spoke 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 sensible of the errors that prevailed in that day, some of her friends have moved me several times to propose to this church, whether it be not our duty to recal that sentence, that so it may not stand against her to all generations. And I myself being a stranger to her, and being ignorant of what was alleged against her, I shall now only leave it to your consideration, and shall determine the matter by a vote, the next convenient opportunity.—February 14th, The pastor moved the church to revoke Martha Cory's excommunication: a majority voted for revoking it." So deep was the people's sense of the errors of those transactions, that a great part of Mr Paris's congregation could not persuade themselves to sit under his ministry. Accordingly, after great difficulty, after a respectable council had laboured in vain for their reconciliation, after an arbitration respecting the business, Mr Paris was dismissed July 24, 1697, as the aggrieved state to the arbitrators, "for being an instrument to their miseries."

Ibid.

If any reader point the finger of scorn at the people of Essex, or the judiciary of Massachusetts, for their credulity

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 forcery.

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 Norridgewag, 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 Kennebec. 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.

New-England.

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.

Earl Bellamont governor.

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.

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.

Dudley governor.

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 sentinels 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.

War with the French and Indians.

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.

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.

Death of governor Winthrop.

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

Hutchinson.

New-England. 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.

Effects of French and Indian wars. Hutchinson.

Acadia taken, and annexed to New-England.

Unsuccessful expedition against Canada.

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.

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.

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 Arrosocic 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.

Shute governor;

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.

New-England.

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.

Small pox first inoculation in America.

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 Winipisiokepond.

Indian wars.

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.

Hutchinson.

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,

Burnet governor.

His death.

than

New-Eng-land.
Belcher go-vernor.

that a propofal was made of reducing the colony to ab-
folute 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 mer-
chant in London, was appointed governor of Maffa-
chufetts and New Hampshire.

While thefe provinces were in a constant 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 separated the two coun-
tries.

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 desperate, and obtained leave from the
British court, to receive fuch fums as fhould be granted
him. So terminated the long, the tedious conteft re-
fpecting the governor's falary.

Belknap.

The divifional line in 1740, was finally determined by
the lords of the council, between New Hampshire and
Maffachufetts. New Hampshire obtained 14 miles in
breadth, and about 50 in length, more than they had
claimed. A party the following year oppofed Mr Bel-
cher, and by their incessant applications to the miniftry,
by falfehood and forgery, they finally prevailed. He
was fucceeded in New Hampshire, by Benning Went-
worth; in Maffachufetts by William Shirley. Mr Bel-
cher repaired to court; demonftrated his own integrity
and the bafenefs of his enemies, was appointed gover-
nor of New Jerfey, paffed a quiet life, and his memory
has been treated with merited refpect.

Shirley go-vernor.

In 1744, news of war with France and Spain being
received, forces were raifed to attack Nova Scotia. Go-
vernor 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 Chapeaugogue Bay. The transports had been dif-
covered 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, spiked 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 for-
bade 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 har-
bour, fhips of the enemy, to the value of £600,000 fter-
ling. 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

Capture of
Louif-
bourg.

of New England were deeply affected by this evident
interpofition of divine providence.

New-Eng-land.
Threaten-
ed invafion
of New-
England by
the French.

The next year, 1746, a French fleet failed to pour
deftroction on New England. Twenty men of war, an
hundred transports, 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 fattered them; the com-
mander, difappointed and mortified, poifoned himfelf,
his fucceffor fell on his fword. Never was the hand of
divine providence more vifible; never was a difappoint-
ment 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 epi-
focpacy; but the defign was not executed. This year,
Benning Wentworth made a grant of Bennington.

In 1754 a congreff met in Albany, confifting of de-
legates from New Hampshire, Maffachufetts, Rhode
Ifland, Connecticut, New York, Pennsylvania, and
Maryland; but the plan of government they propofed
was rejected, both in England and America. Had
this intrument been accepted the mind is loft in con-
jecturing what might have been the confequences. Per-
haps the revolution of 1776, had been postponed a long
period; perhaps the millions and millions of the human
race lately deftroyed in Europe, and Asia, by the de-
mon of revolutionary madnefs, might have long fur-
vived, to fwell the tide of human felicity.

A congreff
convene at
Albany.

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
British crown, but were accused of furnifhing fupport
and intelligence to Indians and French in annoying
the colonies, fome of them were in arms. It was de-
termined to remove them; about two thoufand fouls
were accordingly transported to New England. The
cloud of their sorrows was never difpelled; in a land
of ftrangers they pined away and died. They were re-
markable for the fimplicity of their manners, the ardor
of their piety, and the purity of their morals.

Nova Sco-
tia taken
from the
French.

General Braddock, with 2200 regular and provincial
troops, marched this year for fort du Quesne, but fell into
an ambufcade, and was fatally wounded, panic feized
his regular troops, but colonel Washington, his aid-de-
camp, with his militia, covered their retreat, and faved
the fhattered army.

Braddock's
defeat.

In 1758, Louifbourg, Frontenac, and Fort du Quesne,
fubmitted to the Englifh, a fmall compenfation for the
more than 2000 men killed and wounded in the rafh
and unfucceffful attack upon Ticonderoga. Splendid
were the victories of the year 1759. Niagara, Ticon-
deroga, Crown Point, and Quebec, fubmitted to the
Englifh. At the taking of Quebec, Wolfe, the Bri-
tish commander, after being wounded in the wrift, re-
ceived a fatal ball in his breaft. Leaning on the fhoul-
der of a lieutenant; finking in the agonies of death, he
heard a cry "they run." For a moment reviving, he
asked who ran. It was answered "the French." He re-
plied "I thank God I die happy," and expired. Montcalm,
the French commander, alfo the fecond in command,
was

Succefs of
the Englifh
arms.

Hun-
phreys.

was

New-Eng-land. was killed. Quebec surrendered, and the whole province was soon annexed to the British empire.

In 1762, Martinico, Grenada, St Vincents, and Havana submitted: English valour was triumphant in every quarter of the globe; peace followed.

Com- mence- ment of the American Revolution. Stamp act. 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.

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 com- menced. Battle at Lexington. An army raised. 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.

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

New-Eng-land.

Bunker hill battle.

See note in Rev. Mr. Parish's sermon on the death of general Washington.

Warren,

New-Eng-
land.

Warren, a volunteer in the action; 278 were wounded and missing. The British lost one thousand and fifty-four killed; of whom 19 were commissioned officers.— A greater number than they lost at the battle of Quebec, which gave them the province of Canada; a proof that Putnam's orders were not disregarded.

Falmouth
burnt.

The people of Falmouth, now Portland, violently opposing the loading of a mast ship, captain Mowat received orders to burn the town. Privateers at this time were successful. Captain Manley brought in a vessel loaded with military stores, valued at £50,000. This summer a detachment was sent from Cambridge to Quebec, under the command of colonel Arnold; they ascended the Kennebec, and had a dismal march thence into Canada. Many of the men became sickly; one third were discouraged and returned; those who bravely persevered were compelled to eat their dogs, their shoes, and even their cartouch boxes. In thirty one days they again found inhabitants. They joined general Montgomery, and with him scaled the walls of Quebec. American valor was unsuccessful. The brave Montgomery fell; Arnold was wounded; one hundred men were killed or wounded, three hundred taken prisoners. These general Carlton treated with the most delicate humanity, as he always did his prisoners.

Boston eva-
cuated.

On the night of March 4th, 1776, works were raised on the hills of Dorchester, twelve hundred men were employed, and two hundred teams. So prodigious were their labours that in the morning, the whole seemed to the British "like enchantment and invisible agency." General Howe was seized with consternation. In vast confusion and hurry Boston was evacuated.

Of affairs
in the
north.

In 1777, astonishment and terror spread through New England by the flight of St Clair from Ticonderoga. The rear of his army was attacked at Hubbardton, a few miles from Lake George. The brave col. Francis of Beverly fell, with a number of his men. General St Clair was at Castleton within hearing of the musquetry, but though his officers entreated with tears, that they might return to succour 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 Eastern States. It was the first step to the capture of Bourgoyne, which procured us succour in Europe, and insured the independence of the country. This year Vermont declared itself a sovereign state.

Sullivan's
unsuccess-
ful expedi-
tion against
Rhode-
Island.

Five hundred British and Hessian troops burned the meeting house in Warren (Rhode-Island,) the church in Bristol, and a number of houses in each town in 1778. Newport was soon threatened by land and sea. General Sullivan passed to the island with ten thousand troops in high spirits, and nothing forbid the conquest of the British, who took possession of this island in 1776, but a failure of aid from the French fleet. This brought on them many execrations in New England. General Pigot, the British commander, had so placed himself, that a fleet was necessary to attack them with hope of success. After an action, supported with spirit, Sullivan left the island with the loss of 2 or 300 men.

Tryon's
expedition
into Con-
necticut.

In the summer of 1779, governor Tryon landed at New-Haven and plundered the town, proceeding by water burned Fairfield; continuing the work of de-

struction he burned part of Greens Farms, and the pleasant town of Norwalk.

New-Eng-
land
American
Academy
incorpor-
ated.

On the 4th of May 1780, the American Academy of Arts and Sciences, now one of the most respectable literary societies in America, was incorporated by the general court of Massachusetts.

New Lon-
don 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 set fire to the town, and immediately 60 houses and 84 stores were destroyed, without opposition. But the party at Groton found more bloody work. The men in Fort Griswold, who had hastened there in the morning, from the neighbourhood, defended themselves to the last extremity. The British finally entered the fort, sword in hand, and killed every man they found. Col. Ledyard resigning his sword, the officer plunged it into his heart. One man escaped by concealing himself in the magazine, another by climbing up a chimney in the barrack; one or two, who fell wounded among the slain; recovered. Awful was this day to Groton. The compact part of the town was in ashes; seventy of her valuable citizens, who in the morning rushed to arms, lay dead in the fort; they were conveyed to their families for interment. Peace between the belligerent powers, put an end to these bloody scenes in 1783.

In 1784, New Hampshire established a constitution of civil government, as Massachusetts had done in 1780. Connecticut, and Rhode Island, continued their ancient constitutions, and experienced no sensible change by the revolution.

Owing to their embarrassed circumstances, from the decay of trade, the loss of public credit, the weight of public and private debts, in the fall of 1786, the three eastern counties of Massachusetts obstructed the judicial courts; but were soon brought to submission, and are now very generally among the zealous friends of good government.

Insurrec-
tion in
Massachu-
setts.

The next year the federal constitution was formed, and afterwards adopted by all the states of New England; who with the other parts of the union, have liberally shared the blessings of that event, in the revival of commerce, and public credit, the increase of wealth, the promotion of the liberal arts, and all that exalts or adorns civil society; long may these enterprising States remain solid pillars in the federal edifice; and long maintain the pure morals, the serious religion and wise institutions of their pious forefathers.

Federal
constitu-
tion.

New-England is a country which presents to the traveller all the varieties of surface which can be found. There is a plain of great extent in the southeastern part of Massachusetts. Extensive plains are also spread through a considerable part of the counties of York and Cumberland, and along the Merrimack through the interior of New Hampshire. Many others not inconsiderable exist in other places. Vallies of every size, from the great Connecticut valley to the little basin, constitute of course no inconsiderable part of a country which is so generally undulating, and whose hills are a proverbial description of its surface. 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 diversified by the intrusion of nume-

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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 north-west 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 south-western 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. Watchett is a lofty hill in Princeton, in the county of Worcester. Ascutney is a noble single hill in Windsor, in the state of Vermont. Monadnock is a very圆锥ical 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.

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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 Mooshillock, 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 north-west; though these last may be considered as a continuation of the range of Mount Tom.

New England abounds in cataraets and cascades, alternately of great beauty and grandeur; of the first of these, the Connecticut, Housatonic, or Hoosstonuc, 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 south-western 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 unelustic 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 Fahrenheit'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 commences, 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 parts not quite so long. There-

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have

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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	Quinsey	
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 else-

where, 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.

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.

The principal rivers of New-England are the Scho-duc, Penobscot, Kennebec, Amarisoggin, 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.

The principal lakes are Champlaine and Memphremagog, lying partly in Vermont and partly in New-York; Winnipiseogee and Umbagog, in New-Hampshire; Sebago, Moosehead, Willeguanguagun, and Chilmacook or Grand Lake, in Maine. Small lakes, commonly

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Soil.

Rivers.

Lakes. Ponds and Harbours.

(A) Dr Foolke, in a discourse read before the American Philosophical Society.

New-England. commonly called ponds, of every size, are scattered throughout the country. Springs and small brooks water almost every farm.

Harbours abound in Maine and Massachusetts. The most useful ones at present, are those of Machias, Frenchman's Bay, Wiscasset, Portland, and Wells, in Maine; Piscataqua, in New-Hampshire; Newburyport, Salem, Marblehead, Boston, Province Town, and New Bedford, in Massachusetts proper; Newport, Bristol, and Providence, in Rhode-Island; and New London, New-Haven, and Black Rock in Fairfield, in Connecticut. Burlington Bay is the most considerable harbour in Lake Champlaine, on the Vermont shore.

Productions. The produce of the fields in New-England is of every kind suited to the climate. In the western half, and in various parts of the eastern, wheat, before the ravages of the Hessian fly, grew abundantly; but that insect has not a little discouraged the culture of this grain. Indian corn is a most abundant and useful grain, furnishing a very healthful and pleasing food to the inhabitants, and yielding also the best means of fattening their numerous herds of cattle and swine. The kind, frequently called sweet-corn, is perhaps the most delicious of all culinary vegetables, if eaten young, and one of the most salubrious. The juice of the corn-stalk yields a rich molasses, and a spirit not inferior to that of the sugar cane. No cultivated vegetable makes so noble an appearance in the field.—Fruits of every kind, which suit a temperate climate, abound, or may be easily made to abound here. The heat of the summer brings to high perfection the peach, apricot, and nectarine. The orchards of apple-trees cover a considerable part of the whole country, except the new settlements. Cider is the common drink of the inhabitants of every class, 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, gooseberries, whortleberries, blackberries, bilberries, &c. abound. Perry is made in some parts of the country, but not in great quantities. Butternuts, shagbarks, and various other fruits of the different species of the hickory and hazle-nuts, are plentifully furnished by the southern half of New-England. Madeira nuts and black walnuts are rarely cultivated, although the last grow very easily and rapidly. Hortuline productions are also abundant, of every kind found in this climate, and grow with very little care or culture. Gardening is much improved, and still advancing; many good gardens are seen in almost every quarter of New-England. But the most important production of New-England is grass. This not only adorns the face of the country, with a beauty unrivalled in the new world, but also furnishes more wealth and property to its inhabitants than any other kind of vegetation. A farm of two hundred acres of the best grazing land, is worth, to the occupier, as much as a farm of three hundred acres of the best tillage land. The reason is obvious. Far less labour is necessary 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 also exquisite, when well fed, and of the proper age; but it must be confessed, that, except in a part of the eastern half of this country, it is very often brought to market too young and indif-

ferently fed, to the injury of both the farmer and the consumer. The lamb is universally fine, but is most excellent in the states of New-Hampshire and Vermont; and particularly in the parts of these states which border on Connecticut river. A great discouragement to the raising of sheep, exists in a kind of enclosure which is extensive, the stone wall: over this wall sheep pass with great ease, 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 use. This evil, which is not a small one, will, however, be probably removed by increasing the new breed of sheep, called the *Otter breed*. These sheep, which, it is said, began in an extraordinary manner, at Mendon, in Massachusetts (of which a sufficiently correct account to be inserted here has not been received), have legs somewhat resembling those of a hare; and while they are not inferior to the common breed, in flesh or wool, are unable to climb any fence; a circumstance which, in New-England, confers on them a peculiar value.—The wool of the New-England sheep is of a good staple, and may be improved (as it often has been by attentive farmers) to a high, but indefinite degree. The best wool, and the best mutton also are furnished by short and sweet pastures, and in dry seasons.

The veal of New-England is extremely rich and fine when well fed, as it is to a great extent.

Butter and cheese, in this country, are made in vast quantities, and of various goodness. The butter is very generally excellent, but is still very commonly rendered sensibly worse in the firkin, by the imperfect manner in which it is prepared. A great quantity of ordinary cheese is shipped yearly, to the disadvantage of both the maker and the merchant. There is also a great quantity of cheese of a superior quality made throughout the country. The dairies in Pomfret and Brooklyn, and a few of the neighbouring towns in the eastern part of Connecticut, are probably more generally of the first class, than in any other quarter.

Of the forests of New-England, and not improbably of the world, the white pine is the first ornament: The greatest diameter of this extraordinary tree does not exceed six feet, but its height, in some instances, exceeds two hundred and sixty. This vast stem is often exactly straight, 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 exquisite; and the whole crown is noble beyond any thing of this kind, and perfectly suited to the stem which it adorns. The murmur of the wind in a grove of white pines, is one of the first poetical objects in the field of nature. This tree is of vast importance for building. The white oak of New-England is a noble and most useful tree. It is less enduring than the live, or the English oak; but the early decay of ships, built of the white oak, so generally complained of, is less owing to the nature of the tree, than to the haste and carelessness of the builders.—When the timber has been well selected and seasoned, ships formed of this material, have come near to the age of those built of the English oak. The chestnut is also of incalculable importance as a material in the construction of buildings, and for fencing. A fence composed of good rails of this tree, will endure seventy or eighty years. The chestnut is very common throughout the southern half of New-England, and is of no

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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 charac-
ter.

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.

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.

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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 BENEFACITOR 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 sen-

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sible 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 *respectable* 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, football, quoits, wrestling, jumping, hopping, foot races, and prison balls 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-

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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 Guilford 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 Bolton. 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, 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 hypotenuse. 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

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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, Ossipy, and Kyarfarge, 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 Moolhelock mountain. The ridge is then continued northerly, dividing the waters of the river Connecticut from those of Saco, and Amarisfoggin. 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. Ossipy 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, Androskoggin, 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,

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sons, and 925 slaves; and in 1790, 30,397 free persons, and 433 slaves.—*ib.*

NEW HAVEN, (*City*) the seat of justice in the above county, and the semi-metropolis of the State. This city lies round the head of a bay which makes up about 4 miles north from Long Island Sound. It covers part of a large plain which is circumscribed on three sides by high hills or mountains. Two small rivers bound the city east and west. It was originally laid out in squares of 60 rods; many of these squares have been divided by cross streets. Four streets run north-west and south-east, and are crossed by others at right angles. Near the centre of the city is the public square, on and around which are the public buildings, which are a state house, two college edifices, and a chapel, three churches for Congregationalists, and one for Episcopalians; all which are handsome and commodious buildings. The college edifices, chapel, state-house, and one of the churches are of brick. The public square is encircled with rows of trees, which render it both convenient and delightful. Its beauty, however, is greatly diminished by the burial-ground, and several of the public buildings which occupy a considerable part of it. Many of the streets are ornamented with rows of trees on each side, which give the city a rural appearance. The prospect from the steeples is greatly variegated and extremely beautiful. There are between 3 and 400 neat dwelling-houses in the city, principally of wood. The streets are sandy but clean. Within the limits of the city, are 4000 souls. About one in 70 die annually. Indeed as to pleasantness of situation and salubrity of air, New Haven is hardly exceeded by any city in America. It carries on a considerable trade with New York and the West India islands. 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 established 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 present six college *domicils*, two of which, each 100 feet long and 40 wide, are inhabited by the students, containing 32 chambers each, sufficient for lodging 120 students; a chapel 40 by 50 feet, with a steeple 130 feet high; a dining-hall 60 by 40 feet; a house for the president, and another for the professor of divinity. In the chapel is lodged the public library, consisting of about 3000 volumes, and the philosophical apparatus, as complete as most others in the United States, and contains the machines necessary for exhibiting experiments in the whole course of experimental philosophy and astronomy. The museum, to which additions are constantly making, contains many natural curiosities. From the year 1700 to 1793, there have been educated and graduated at this university about 2,303. The number of students 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 seats of the legislature alternately. It is 40 miles S. W. by S. of Hartford, 54 from New London, 88 from New-York, 152 from Boston, and 183 north-east of Philadelphia. N. lat. 41 18, W. long. 72 56.—*ib.*

NEW HAVEN, a township in Addison county, Vermont, on Otter Creek or River, containing 723 inhabitants.—*ib.*

NEW HEBRIDES, a cluster of islands in the Pacific Ocean, so called by Capt. Cook in 1794—the same as the *Archipelago of the Great Cyclades* of Bougainville, or the *Terra Austral* of Quiros.—*ib.*

NEW HAMPSTEAD, a township in Orange county, New York, bounded easterly by Clarkstown, and southerly by the state of New Jersey. It was taken from Haverstraw, and incorporated in 1791. By the state census of 1796, there were 245 of its inhabitants qualified electors.—*ib.*

NEW HOLDERNESS, a township in Grafton county, New Hampshire, situated on the E. side of Pemigewasset river, about 3 miles E. by S. of Plymouth. It was incorporated in 1761, and contains 329 inhabitants.—*ib.*

NEW HOLLAND, a town of Pennsylvania, Lancaster county, in the midst of a fertile country. It contains a German church and about 70 houses. It is 12 miles E. N. E. of Lancaster, and 54 W. N. W. of Philadelphia.—*ib.*

NEW HUNTINGTON, a mountainous township in Chittenden county, Vermont, on the S. W. side of Onion river, containing 136 inhabitants.—*ib.*

NEWINGTON, a township; formerly part of Portsmouth and Dover, in Rockingham county, New Hampshire. It contains 542 inhabitants.—*ib.*

NEW INVERNESS, in Georgia, is situated near Darien on Alatamaha river. It was built by the Scotch Highlanders, 160 of whom landed here in 1735.—*ib.*

NEW IPSWICH, a township in Hillsborough county, New Hampshire, on the W. side of Souhegan river, upon the southern 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 students. It is about 24 miles S. E. of Keene, and 75 W. S. W. of Portsmouth.—*ib.*

NEW JERSEY, one of the United States of America, is situated between 39 and 41 24 N. latitude, and between 74 44 and 75 33 W. longitude from London; bounded E. by Hudson's river and the Ocean; W. by Delaware Bay and river, which divide it from the States of Delaware and Pennsylvania; N. by the line drawn from the mouth of Mahakkamak river, in lat. 41 24 to a point on Hudson's river, in lat. 41. It is about 160 miles long and 52 broad, containing about 8,320 square miles, equal to 5,324,800 acres. It is divided into 13 counties, *viz.* Cape May, Cumberland, Salem, Gloucester, Burlington, Hunterdon, and Sussex; these 7 lie from S. to N. on Delaware river; Cape May and Gloucester extend across to the sea; Bergen, Essex, Middlesex, and Monmouth, lie from N. to S. on the eastern side of the State; Somerset and Morris are inland counties. The number of inhabitants is 184,139, of whom 11,423 are slaves. The most remarkable bay is Arthur Kull, or Newark Bay, formed by the union of Passaic and Hackinsac rivers. The rivers in this State though not large, are numerous. A traveller in passing the common road from New York to Philadelphia, crosses 3 considerable rivers, *viz.* the Hackinsac and Passaic, between Bergen and Newark, and the Rariton by Brunswick.

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Brunswick. Passaic 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 basin, 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 Passaic, Hackensack 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, chestnuts, &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,

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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, Hackensack, 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 Jerseys, 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.*

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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 *Towarvog*, and from being the feat of the Pequot tribe, was called *Pequot*. It was the feat of *Saffacus*, 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

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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 Bolton.—*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 Calco 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 Housatonic 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,

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wport. 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 sixty 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, 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 Kan-haway.—*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 $\frac{1}{4}$ 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 Rofs in Herefordshire, in the place of Mr John Toombes, ejected for nonconformity. He held this living till his death, which happened at Rofs on Christmas-day 1678. Mr Wood gives him the character of a capricious and humourous person: however that may be, his writings are sufficient monuments of his genius and skill in the mathematics. These are,

Newton, 1. *Astronomia Britannica*, &c. in three parts, 1656, in 4to. 2. *Help to Calculation*; with Tables of Declination, Ascension, &c. 1657, 4to. 3. *Trigonometria Britannica*, in two books, 1658, folio; one composed by our author, and the other translated 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. *Description of the Use of the Carpenter's Rule*, 1667. 9. *Ephemerides*, shewing the Interest and rate of Money at 6 per cent, &c. 1667. 10. *Chiliades centum Logarithmorum, et Tabula Partium proportionalium*. 1667. 11. *The Rule of Interest, or the Case of Decimal Fractions*, &c. Part II. 1668, 8vo. 12. *School-Pastime 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 English Academy*, 1677, 8vo. 17. *Cosmography*. 18. *Introduction to Astronomy*. 19. *Introduction to Geography*, 1678, 8vo.*

* *Biog. Diz.*
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NEWTON, a pleasant township in Middlesex county, Massachusetts, situated on Charles river, and is 9 miles west of Boston. It was incorporated in 1691, and contains 1360 inhabitants.—*Morse*.

NEWTON, a small town in Chester county, Pennsylvania, 22 miles south of Philadelphia.—*ib*.

NEWTON, a township in Rockingham county, New Hampshire, on Powow river, adjoining Amesbury, in Massachusetts, 10 or 12 miles southerly of Exeter. It was incorporated in 1749, and contains 530 inhabitants.—*ib*.

NEWTOWN, a post-town in Fairfield county, Connecticut, 9 miles east-north-east of Danbury, 26 west-north-west of New-Haven, 61 south-west of Hartford, and 80 north-east of New-York. The town stands pleasantly on an elevated spot, and was settled in 1708.—*ib*.

NEWTOWN, on Staten-Island, New-York, is 3 miles N. E. of Old-Town, as far east of Richmond, and 9 south-westerly of New-York.—*ib*.

NEWTOWN, a township in Queen's county, New-York, includes all the islands in the Sound opposite the same. It is about 8 miles east of New-York, and contains 2,111 inhabitants, including 533 slaves.—*ib*.

NEWTOWN, a township in West Chester county, New-York; of whose inhabitants 276 are electors.—*ib*.

NEWTOWN, a township in Tioga county, New-York, lies between the south end of Seneca lake and Tioga river; having Chemung township east, from which it was taken and incorporated in 1792. In 1796, 169 of its inhabitants were electors.—*ib*.

NEWTOWN, a township in Gloucester county, New Jersey.—*ib*.

NEWTOWN, the seat of justice in Suffex county, New Jersey, is about 70 miles S. E. of Sandyston.—*ib*.

NEWTOWN, the capital of Bucks county, Pennsylvania. It contains a presbyterian church, a stone jail, a court-house, an academy, and about 50 houses. It was settled in 1725, and is 10 miles W. of Trenton, in New Jersey, and 30 N. E. by N. of Philadelphia.— There are two other townships of this name, the one in Delaware county, the other in that of Cumberland.—*ib*.

NEWTOWN, a small town of Virginia, situated in Frederick county, between the north and south branches

of Shenandoah river; 7 miles south of Winchester, and 173 north-north-west of Richmond.—*ib*.

NEW-UTRECHT, a small maritime town of New-York, situated in King's county, Long-Island, opposite the Narrows, and 7 miles south of New-York city. The whole township contains 562 inhabitants; of whom 76 are qualified electors, and 206 slaves.—*ib*.

NEW-WINDSOR, a township of Ulster county, New-York, pleasantly situated on the W. bank of Hudson river, just above the high lands, 3 miles south of Newburgh, and 6 north of West Point. It contains 1819 inhabitants; of whom 261 are qualified electors, and 117 slaves. A valuable set of works in this town for manufacturing scythes were destroyed by fire. In 1795, the legislature granted the unfortunate proprietor, Mr. Boyd, £1500 to enable him to re-establish them. The compact part of the town contains about 40 houses and a presbyterian church, 64 miles north of New-York. The summer residence of governor Clinton was formerly at a rural seat, on the margin of the river, at this place.—*ib*.

NEW-WRENTHAM, district of Maine, a township 6 miles E. of Penobscot river, adjoining Orrington, and 15 miles from Buckston.—*ib*.

NEW-YEAR'S Harbour, on the north coast of Staten Land Island, at the south extremity of South America, affords wood and good water; was discovered Jan. 1, 1775; hence its name. S. lat. 54 49, west long. 64 11.—*ib*.

NEW-YEAR'S Islands, near the above harbour, within which is anchorage at north half west from the harbour, at the distance of two leagues from it.—*ib*.

NEW-YORK, one of the United States of America, is situated between lat. 40 40 and 45 north, and between long. 73 10 and 80 west; is about 350 miles in length, and 300 in breadth; bounded south-easterly by the Atlantic ocean; east by Connecticut, Massachusetts, and Vermont; north by Upper Canada; south-west and west by Pennsylvania, New Jersey, and Lake Erie. It is subdivided into 21 counties as follows, viz. New-York, Richmond, Suffolk, West Chester, Queen's, King's, Orange, Ulster, Dutchess, Columbia, Rensselaer, Washington, Clinton, Saratoga, Albany, Montgomery, Herkemer, Onondago, Otsego, Ontario, and Tioga. In 1790, this state contained 340,120 inhabitants; of whom 21,324 were slaves. Since that period the counties of Rensselaer, Saratoga, Herkemer, Onondago, Otsego, and Tioga have been taken from the other counties. In 1796, according to the state census, there were 195 townships, and 64,017 qualified electors. Electors in this state are divided into the following classes:

Freeholders to the value of £1000	36,338
Do. to the value of £20 and under £100	4,838
Do. who rent tenements of 40s. per annum	22,598
Other freeholders	243
	<hr/>
	64,017

It is difficult to ascertain accurately the proportion the number of electors bears to the whole number of inhabitants in the state. 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 state. In 1790, the number of inhabitants in the state was, as already mentioned, 340,120, of whom 41,785 were electors. In 1795, the number

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New York. 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 Chautauque. 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 enterprising 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 Mississippi. 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 chestnut 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 Kaar'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, grafs, 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 discover-

New York. ed 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, magnez, 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, singlats 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

New York. plied 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 : 10 $\frac{3}{4}$ 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

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 worship

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 privileges, 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 stair-cases, 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 officio*) 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 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, 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 hogheads of 130 gallons each. In some hot summer days 216 hogheads 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 hoghead 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 basin 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 Henriquelle. 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 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 Toronto, 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

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(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."

Niagara,
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Nicaragua.

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 $7\frac{1}{2}$ 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 Rica. 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 Rica 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 rectilinear 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

Nicaragua,
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Nicole.

Nicola, 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 surpris'd 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 Aeneas 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

Nieuwland. 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 Séjour, 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 un-

dertook 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 intrusted 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 (*Nieuw 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

Nieuwland, 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 13th 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 so 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 shewed 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, Edrifi 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*.

Nigua,
||
Nile.

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 *Babr-el-abiad*, and *Dar-Fur* or *Soudan*. See SOUDAN in this Supplement.

Nile.

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 *Babr-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 expressly 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 Edrifi, 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 *Babr-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.

Nimiquas.

Nimiquas.

ters. Major Rennel places the mountains of the moon between $5^{\circ} 40'$ and $8^{\circ} 10'$ N. Lat. and between $24^{\circ} 30'$ and $30^{\circ} 25'$ E. Long. Their latitude and longitude, as laid down by Mr Browne, are somewhat, tho' very little, different; whilst Gcesb, 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.

NIMIQUEAS, 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 $15^{\circ} 25'$ to $18^{\circ} 25'$ east from London, and in latitude from $28^{\circ} 12'$ to $29^{\circ} 36'$ 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 ascendancy, 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 crosses 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 mortar. 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 *nuyp-kror*, 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 pipefuls 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 they

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 greafe. 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 tortoisés, 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, 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.*

NIPEGON, 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

Ninety-Six,
Nizolius.

Nobleborough, a town in the county of Devon, is famous for the barbarism of their terms, but for many ridiculous opinions which they held. Leibnitz was so struck with its solidity and elegance, that, to expose the obstinacy of those who were zealously attached to Aristotle, he gave a new edition of it, with critical notes of his own, 1670, in 4to. Nizolius published also, *Theaurus Ciceronianus, sive Apparatus Linguae Latinae e Scriptis Tullii Ciceronis collectus*, in folio. This is a good Latin dictionary, composed of the words and expressions of Cicero; to which, it seems, Nizolius shewed as much bigotry as the schoolmen to their notions; and fell under the character of those pedants whom Erasmus has ridiculed in his *Ciceronianus*. We do not find the year either of his birth or death.

NOBLEBOROUGH, a township in Lincoln county, District of Maine, incorporated in 1788, and contains 516 inhabitants. It is 10 miles S. E. of New-Castle, and 192 N. E. of Boston.—*Morse*.

NOBLEBOROUGH, a township in the north-eastern part of Herkemer county, New York, situated on the north-western side of Canada Creek.—*ib.*

NOCKAMIXON, a township in Buck's county, Pennsylvania.—*ib.*

NOCTURNAL ARCH, is the arch of a circle described by the sun, or a star, in the night.

NODDLE'S Island, a small pleasant and fertile island in Boston harbour, Massachusetts. It is about 2 miles east north-east of the town, on the Chelsea shore. 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 Louisiana, runs southward, and joins Rouge or Red River.—*ib.*

NOIR, Cape, on the S. W. coast of the island of Terra del Fuego, at the entrance of the Straits of Magellan. S. lat. 54 30, W. long. 73 13.—*ib.*

NOIX, Isle au, or Nut Isle, a small isle of 50 acres, near the north end of Lake Champlain, and within the province of Lower Canada. Here the British have a garrison containing 100 men. It is about 5 miles N. N. E. of the mouth of La Cole river, 20 north of Isle La Motte, and 12 or 15 southward of St John's.—*ib.*

NOLACHUCKY, a river in the eastern part of the State of Tennessee, which runs W. S. W. into French Broad river, about 26 miles from Holston river. Near the banks of this river Grenville college is established.—*ib.*

NOLIN Creek, a branch of Green river in Kentucky. The land here is of an inferior quality.—*ib.*

NOMAN'S Land Island, lies a little S. W. of Martha's Vineyard, and is about 3 miles long and two broad. It belongs to Duke's county, Massachusetts. N. lat. 41 15, W. long. 71 5.—*ib.*

NOMBRE DE DIOS, a port to the S. S. E. of the cape to the eastward of Porto Bello, on the Spanish Main, or N. coast of S. America, at the distance of about 7 leagues. It is at the bottom of a large deep bay, being wide to the east side in lat. 9 43 N. and long 78 35 W. The islands called Bastimentos are in this bay. Large vessels seldom 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, such is the fury with which the sea pours

into the bay. Those vessels that now visit it, if their business require any stay, prefer riding at the Bastimentos, or at Porto Bello.—*ib.*

NOMBRE DE DIOS, on the W. coast of Mexico, situated 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 also the *Mid heaven*, is the highest point, or 90th degree of the ecliptic, reckoned from its intersection with the horizon at any time; and its altitude is equal to the angle that the ecliptic makes with the horizon at their intersection, or equal to the distance of the zenith from the pole of the ecliptic. It is much used in the calculation of solar eclipses.

NONAGON, a figure having nine sides and angles. In a regular nonagon, or that whose angles and sides are all equal, if each side be 1, its area will be $6.1818242 = \frac{9}{2}$ of the tangent of 70° , to the radius 1.

NONESUCH, a river of Cumberland county, District of Maine. It passes to the sea through the town of Scarborough; and receives its name from its extraordinary freshets.—*Morse*.

NONESUCH, a harbour at the E. end of the island 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 Islands, said to be the parent of them all, situated about 10 leagues S. W. of Ooahoona. Capt. Roberts named it *Adams*; it is the same which Ingraham called *Federal Island*. The lat. of the body of the island is 8 58 S. and nearly in the same meridian with Wooapo, between 140 and 140 10 W. long. from Greenwich. All accounts of the natives concurred, says Capt. Roberts, in representing it as populous and fruitful, and to have a large bay with good anchorage.—*ib.*

NOORT Point, on the coast 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 Massachusetts, lately taken from the southern part of Suffolk county, and lies to the southward around the town and harbour of Boston. And contains 20 townships, of which Dedham is the seat of justice. 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 slaves.—*ib.*

NORFOLK, a port of entry and post town and seat of justice in the above county, on the east side of Elizabeth river, immediately below the confluence of the eastern branch. It is the most considerable 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 safe and commodious, and large enough to contain 300 ships. It was burnt on the 1st of January, 1776, by the Liverpool man of war, by order of the British governor Lord Dunmore; and the loss amounted to £300,000 sterling. It now contains about 500 dwelling houses, a court house, gaol, an episcopal and methodist church, a theatre, and an academy. In 1790, it contained 2,959 inhabitants,

Nobleborough,
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Norfolk, tants, 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 Bucks 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 Chesapeake 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 100,572 were

Northampton,
North Carolina.

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 slaves. The swamps abound with cypress and bay trees. The

latter is an evergreen, and is food for the cattle in winter. The mistletoe 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 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

North
Carolina,
||
North
Castle.

North-East,
||
North Kingstown.

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 Rhyneck 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 Bolton. 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 Alleghany 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 Ammonoosuck. 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

North Mountain,
||
Northumberland.

Northum-
berland,
||
Norway.

the junction of the E. and W. branches of the Susquehanna. 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 Chesapeake 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 Kinfales, 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. Cusken'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 Windfor 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, chaifes, 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.*

Norway,
||
Nottaway.

Nottaway,
||
Noxan.

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 *Noxanton*, 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 1 1/2 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.*

Nublada,
||
Nucvo.

O.

Oachate,
||
Oakmulgee

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.*

OAHANA, 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 Alatomaha, 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 desert. In the SAHARA, or Great Desert of Africa, there are many *Oasis* 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, flattened 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

Oasis,
||
Oblique.

Oblique,
||
Occequan.

noſtial 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 contradiftinction from the *oblate ſpheroid*, or that which is flattened at its poles, being generated by the revolution of the ellipse about its conjugate or ſhorter axis.

OBSERVATORY, PORTABLE. See *ASTRONOMY*, n^o 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 Alatomaha 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 7¼ leagues ſouth-weſt ½ 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. Benediſt Prevot 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 ſtratium 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

Ocrecock,
||
Odour.

Odour.

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 fusée 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 gas. 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 dis-

solving 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 basin 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

Odour.

Odour,
||
Economists.

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."

ÆCONOMISTS, 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 *æconomists*, because the æconomy 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 schools, 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 Voltairian adepts, soon perceived the advantages they could reap from these establishments. In union with the æconomists, 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

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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 æconomists 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 protesting 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

Æconomists.

Oenemack, 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!

Oglethorpe.

"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. Left our object should be surmised, we called ourselves economists. 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 dismissal 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 bookfellers 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 Oflabaw 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 Alatomaha river, west of Liberty county. Fort

Telfair is in the S. E. corner of this county on the Alatomaha.—*ib.*

OHAMANENO, a small but good harbour, on the W. side of Ulitea, 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 $\frac{1}{4}$ 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 Ulitea, 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 Kanaway; 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 $\frac{1}{2}$
Yellow Creek	11 $\frac{3}{4}$	Big Bones	32 $\frac{1}{2}$
Two Creeks	21 $\frac{1}{2}$	Kentucky	44 $\frac{1}{2}$
Long Reach	53 $\frac{3}{4}$	Rapids	77 $\frac{1}{4}$
End Long Reach	16 $\frac{1}{2}$	Low Country	155 $\frac{1}{4}$
Muskingum	26 $\frac{1}{2}$	Buffalo river	64 $\frac{1}{2}$
Little Kanaway	12 $\frac{1}{4}$	Wabash	97 $\frac{1}{4}$
Hockhocking	16	Big Cave	42 $\frac{3}{4}$
Great Kanaway	82 $\frac{1}{2}$	Shawnee river	52 $\frac{1}{2}$
Guiandot	43 $\frac{1}{2}$	Cherokee river	13
Sandy Creek	14 $\frac{1}{2}$	Massac	11
Sioto, or Scioto	48 $\frac{3}{4}$	Mississippi	46

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In common winter and spring floods, it affords 30 or 40 feet water to Louisville; 25 or 30 feet to L. Tarte's Rapids; 40 above the mouth of the Great Kanaway; 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

Ohama-
reno,
||
Ohio.

Ohio,
Oil.

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 steeage. 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 Pittsburgh to the sea, than those now in use; and that this matter only requires one man of capacity and enterprise to ascertain it. A vessel intended to be rigged as a brigantine, sloop, 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 Alamaha river, in Oglethorpe county, Georgia.—*ib.*

OHIOPINGO, 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 Youhiogeny 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.

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 lintseed, 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^o 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^o 12.

4. The tails of the *lists*, 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^o 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 millstones.

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^o 4 fig. B.

19. Small cog wheel on the end of the wallower for giving motion to the millstones. 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 millstones.

1. *Upright shaft*, carrying the great cog wheel above, and the *runner millstones* below in their frame.

2. Cog-wheel of 76 cogs, driven by N^o 19. of fig. C.

3. The frame of the *runners*. This will be more distinctly understood in N^o 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 millstone, and the rest of the *legger* or *nether millstone* 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 millstone, 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 millstone on which they roll. The holes in these millstones 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 millstones, 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 millstone.

11. and 12. The nether millstone 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^o 4. of fig. C.

2. The little wheels at each end, for giving motion to the two spatulæ, marked n^o 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, b, c, e, g, ab, d, f, b, c, e, g, ab, d, f, b, 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 millstones.

1. The nether millstones and the masonry supporting the whole.

2. The runner.

3. A sort of case which encloses the two wings of the millstone at a very small distance from it, in order

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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 millstone. These rods are joined by a cross piece C. which almost touches the millstone. A piece of leather is put between, which rubs upon the millstone, and clears it of the grain which chances to stick to it. N^o 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^o 5.

Fig. K. Plan of the runner millstones, and the frame which carries them round.

- 1, 1. Are the two millstones.
- 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 millstone seen from above.

1. The wooden gutter, which surrounds the nether millstone.
 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^o 14. and having a hole in it at 9, through which the spindle passes, turning freely. The spindle has in this place a shoulder

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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^o 3. in fig. C.
14. The rail, marked n^o 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^o 10. fig. C.
20. Great wooden, and sometimes stone, *block*, in which the mortars are formed, marked n^o 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. Bucket 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 bucket. 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 buckets 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 millstone, 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 millstone, and even with its surface, but rising a

Oil-mill. 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 prefs-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 prefs.
6. Ditto, for the second pressing.
7. Wedge for freeing the prefs.
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. Prefs-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 prefs-box, under the drawing and discharging wedges.

Fig. R. Another view of the prefs-irons.

1. The side-irons laid flat.
2. The same seen edgewise.
3. The pierced iron plate, upon which the two irons, n^o 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 prefs. 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 prefs-irons.

Fig. S. The principal pieces of the prefs.

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 with mill-work.

Oil-mill. 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 $\frac{2}{3}$ ds 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.

Oil-mill. 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 v. y 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 chatellanie 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 per-

son 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 unhop'd-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 Ecoffoise 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 north.—*ib*.

Oistins,
||
Old Road.

Old Road,
||
Ombah.

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 Patowinac 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 *Oncatoyo*, 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 *Neeheehcoru*, 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 Ulitea,

Omphalop-
ter,
||
O-Nima-
mou.

Onion, 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 fourth-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, Lyfander, 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 vil-

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lage 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. I. 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 corset; two others, much larger, in the form of a crescent, are on the *elytrae*; 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.

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 its trunk, smooth, and about half a line long; at the base of the third pair are two points, of a horny 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.

Onflow, 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 1,748 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 Genessee 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 Genessee country, and bounded N. by the lake of its name. It is well watered by Genessee river, its tributaries, and a number of small lakes. Here are 8 townships, viz. Genessee, Erwine, Jerusalem, Williamsburg, Toulon, Seneca, Bloomfield, and Canandaqua, 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 Bahia 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 sort of block-house, in the shape of an English glass-house, in the centre of each, with rows of palisades 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 similitude 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 tattooed; 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.

Opaque,
Opera-

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 *rs*, 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, b a, 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 LM, 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 spiralis, 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, 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 fine), either in small drills, three in each bed, in the manner fallads 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

Ophiucus

||
Optic.

Optic,
||
Optica.

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.

"To screen the image from the light (which will be often found to be advantageous), there is a pyramidal 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 slid into the groove from which the external cover at the end has been taken. This method is peculiarly useful in the day-time; 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 opaque 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 opaque 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 opaque 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 opaque 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 opaque 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 opaque, 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 mirror 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 became also an opaque solar microscope by turning the bar round to enlighten opaque 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 supercedes the use of a lantern. The image may be contracted occasionally by one of the large lenses."

With

Plate I. fig.
7. Appen-
dix.

Optica.

Or,
||
Oran.

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 (folded to the supporter), and which slips over the slider that carries the lens z.

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 *Cabeza 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 ba-

nished 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 Mafcomy 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

Orang's,
||
Orange.

Orange,
||
Orange-
Men.

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 intermitments. 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 Charlottesville, 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 downfall 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

Orange-
Men,
||
Orange-
town.

Orange-
town,
||
Orchard.

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. *Germerhausen*, 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 choked; 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 feed-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 Reqa, 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

Orchilla,
||
Ordeal.

(A) Shows are the refuse of flax when it is scutched or heckled.

Oreahou,
||
Orford.

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 *alibea* (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 *Oreahou*, 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 Grævesande, 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 Grævesande 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 Grævesande, 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.

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

Oxford,
||
Oricou'

Hutton's
Dictionary.

(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 audeat sustinere ignem sine nocimento.

Orient,
||
Oronoko.

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 Pafumpsick 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 basin 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 fouth 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

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Oronoko,
||
Orotava.

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 foundings, 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 port, 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. $51^{\circ} 29'$ north, and long. $139^{\circ} 39'$ 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 yurts, 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 stripped 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 these 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 bleary 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

Orotchys.

Orotchys,
|
Orrington.

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 Bucktown, 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. Geofroy, 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 castor* 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 fossil 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

Orthodromics,
|
Orycteropus.

Olages,
||
Ossipee.

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: *Dasytus*, *oryzeteropus myrmecophaga*, and *aculeata, manis, myrmecophaga, megaterium et bradytus*.

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 concurrence 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 *Maitica* 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 Winipiseogee Lake, between which and Ossipee Lake is *Ossipee Mountain*, described in the account of New Hampshire. Its waters run E. and, joined by South ri-

ver, 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*.

Offnobian,
||
Otabalo.

OSSNOBIAN, or *Affeneyboyne Indians*, a tribe found about the source of Offnobian or Affeneyboyne 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 Cataract. *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 Cataract 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,

Otabalo,
||
Osego.

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.*

OTÁBALO, 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 Wateoo, 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 Osego, 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, Osego, 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, 40lbs. each. The courts are held at Cooperstown, in the township of Osego.—*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 Osego, which separates it from Cherry Valley. Lake Osego 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 Saginam 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 *Bafon 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 *Sabara* or Great Desert of Africa, of whom almost nothing was known to Europeans till the publication of Biffon'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 Roufège, Rathidium, Chelus, Tucanois, and Ouadeli tribes, as they have no distinct boundaries, and change their habitations as the desert 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;

Ottawas,
||
Ouadelim.

Quadelim. 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 choleric, they are subject to few endemic diseases. The first disorder is caused by the reflection of light from the burning sands of the desert, 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. Briffon 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 Briffon) 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 Briffon), 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 Briffon and his companions received, without having recourse to inherent depravity of nature.” That treatment was indeed shocking.

Briffon 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, Briffon 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 desert. 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 Briffon 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

Quadelim. tion, the Arabs prepared a kind of soup, which they kneaded with their hands, and ate unchewed. They roasted a goat in heated sand, ate its fat raw, and after having devoured the flesh, gnawed the bones, and scraped them with their nails, threw them to Briffon and his companions, desiring them to eat quickly, and load the camels, that the journey might not be impeded. Proceeding eastward, they crossed a vast plain, covered with small stones white as snow, round and flat as a lentil, where not a single plant was produced. The earth beneath their feet resounded dull and hollow, and the small stones pricked them like sparks of fire. The reflection of the rays of the sun from the sand was scorching; the atmosphere was loaded with a red vapour, and the country appeared as if filled with flaming volcanoes. Neither birds nor insects could be seen in the air. The profound silence was frightful. If a gentle breeze ever arose, it produced extreme languor, chopping of the lips, burning heat of the skin, with small smarting pimples. This plain was even shunned by wild beasts. After traversing this plain, they entered another, where the wind had thrown up in furrows the sand, which was of a reddish colour. On the tops of the furrows grew a few sweet-scented plants, which were devoured by the camels. On quitting this sandy plain, they entered a valley surrounded by mountains, where the soil was white and slimy, and where they found water of a noxious smell, covered with green moss, and soon after discovered a horde of the friendly tribe Rouffye.

After another journey of sixteen days, they arrived at the tents of the Labdessa Arabs, to which Sidi Mahomet belonged. The tents pitched among thick bushy trees, and the numerous flocks feeding along the sides of the hills, presented at a distance an aspect of happiness and pastoral simplicity. On approaching near, the trees of beautiful green foliage proved to be only old gummy stumps, almost void of branches, so encircled with thorns that their shade was inaccessible. The women approached, with loud cries and the most fawning servility, to welcome their tyrants, to throw stones at the Christians, and spit in their faces, while the children imitated the example of their mothers. Briffon, who endeavoured to ingratiate himself with his master's favourite, not only failed in this, but incurred her implacable resentment, through his irritability, which to the Arab women seemed extremely to resemble petulance. During his residence with Sidi Mahomet, the hardships he endured were almost incredible. With the excessive heat, the milk of the sheep, goats, and camels, diminished, and then the dogs fared better than the Christians, who were forced to subsist on wild herbs and raw snails. When the rains fell, and the least pressure made the water to spring up through the sandy soil, the Christians slept behind a bush, unsheltered, on the bare ground. Briffon and his master sometimes reasoned about religion; when the latter always answered the harangues of the former by declaring, that he preferred a bowl of churned milk to such absurdities. Several of his companions perished, and were left by the Arabs to be devoured by the ravens, while in the struggles of death. One of them was supposed to be murdered by his master for milking his camels clandestinely. An application made by Briffon to the consul at Mogador, by a letter entrusted to a Jew-

ish merchant was frustrated through the negligence of the vice-consul; and the Labdessa Arabs thought the journey too dangerous to be encountered for the ransom of their slaves. He was however at last relieved, through the humanity of his master's brother-in-law, who carried him to Morocco, where his ransom was paid by the Emperor, and whence he returned to France. For a fuller account of these two savage tribes, see *Saugnier's and Briffon's Narratives*; or a very pleasing *Historical and Philosophical Sketch of the Discoveries, &c. of the Europeans in Northern and Western Africa*, published 1799 by Symington Edinburgh, and Vernor and Hood London.

OUAIS's *Bay and River*, are about 2 leagues round the north point of the island of Cape Breton, in the Gulf of St Lawrence, and south-south-west of the island of Limbach.—*Morse*.

OUANAMINTHE, a French parish and village on the N. side of the island of St Domingo, about a league and a half W. of Daxabon, in the Spanish part, from which it is separated by the river Massacre; 6 leagues from the mouth of the river, and 5 S. E. of Fort Dauphin.—*ib*.

OUAQUAPHENOGAW, or *Ekanfanoka* is a lake or rather marsh, between Flint and Oakmulgee rivers, in Georgia, and is nearly 300 miles in circumference. In wet seasons it appears like an inland sea, and has several large islands of rich land; one of which the present generation of Creek Indians represent as the most blissful spot on earth. They say it is inhabited by a peculiar race of Indians, whose women are incomparably beautiful. They tell that this terrestrial paradise has been seen by some enterprising hunters, when in pursuit of their game, who being lost in inextricable swamps and bogs, and on the point of perishing, were unexpectedly relieved by a company of beautiful women, whom they call daughters of the Sun, who kindly gave them such provisions as they had with them, consisting of fruit and corn cakes, and then enjoined them to fly for safety to their own country, because their husbands were fierce men and cruel to strangers. They further say that these hunters had a view of their settlements, situated on the elevated banks of an island, in a beautiful lake; but in all their endeavours to approach it, they were involved in perpetual labyrinths, and, like enchanted land, still as they imagined they had just gained it, it seemed to fly before them; and having quitted the delusive pursuit, they with much difficulty effected a retreat. They tell another story concerning this sequestered country, which seems not improbable, which is, that the inhabitants are the posterity of a fugitive remnant of the ancient *Tamases*, who escaped massacre after a bloody and decisive battle between them and the Creeks, (who it is certain, conquered and nearly exterminated that once powerful people) and here found an asylum, remote and secure from the fury of their proud conquerors. The rivers St Mary and Sitilla, which fall into the Atlantic, and the beautiful Little St Juan, which empties into the bay of Appalachi at St Mark's, are said, by Bartram, to flow from this lake.—*ib*.

OUASIOTO *Mountains* are situated 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,

Ouepas, lime, and free-stone. Their furnits are generally covered with good soil, and a variety of timber, and the intervalle 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, Musquitos, Pyankishaws, and a principal part of the Ouiatons. 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.*

OUICONSING, 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 west-erly 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

Owego,
||
Oxyglycus.

Oxyglycus, 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 expense 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

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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 $\frac{1}{4}$ calicoes, 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 canvas of the axis K. Both axes are 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 liquor 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

Oxy-Muriatic Acid.

Oxy-Muri-
atic Acid,
||
Oyster.

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 basin 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.*

Oyster,
||
Ozama.

P.

Pablo,
||
Pacajes.

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.*

Pacamores,
||
Pachacama.

PACAYITA, a volcano in Guatemala, 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 PACHACAMA, 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

Pachea,
Painting.

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 *Paquifa*, 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. Haguy 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 Genesee 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

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“ 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 decomposed 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

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Sign. Fabroni, after some farther observations, calculated to prove that metallic oxys 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 sennabar 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.*

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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 Paintings, 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 to be secured from wet or damp. If the paintings are on old walls in large buildings, 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 unbound 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 panels, 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

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dily 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 unnauling 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 superfluous 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

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Painting. 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 *Masafsoit*, the famous Indian chief, was situated on Namaiket 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 Caghawaga. 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 Rhyneck, 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,

Pajaro.
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Palm.

Palma,
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Palmyra.

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 subject 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 species of palm, which is but little known to naturalists, but which promises to be an important article of food to man. It has no stalk or stem above ground. The leaves spread regularly all round, and when fully expanded are flabelliform. In the centre of these leaves is produced the receptacle of the fruit, which is of the form and size of a common sugar-loaf. This receptacle consists of a vast number of drupes, or berries, of the size and shape of common plums: each is covered with a fibrous, farinaceous, pulpy coating, of considerable thickness. This substance is said to resemble manna in texture, colour, and taste; or, perhaps, it still more resembles moist brown sugar, with particles of loaf sugar mixed with it. It is a most delicious and nourishing food, and is diligently sought after in the places where it grows. Upon first tasting it, it is somewhat bitter and pungent.”

PALMAS, a large river on the west coast of the Gulf of Mexico, whose mouth is in lat. 25 N. and long. 98 36 W. Some of its branches run in a course almost directly east from the mountains to the eastward of the Gulf of California.—*Morse*.

PALMER, a rough and hilly township in Hampshire county, Massachusetts, 82 miles W. by S. of Boston. It is situated on the south side of Chickopee river, and bounded eastward by Western, in Worcester county. An act passed in last session, 1796, to incorporate a society to make a turnpike-road between these two towns. It was incorporated in 1752, and contains 809 inhabitants.—*ib*.

PALMER'S River, a water of Narraganset Bay, which empties with another small river, and forms Warren river, opposite the town of Warren.—*ib*.

PALMERSTON'S Island, of which one in particular has been so named, is in lat. 18 S. and long. 162 57 W. and is the second in situation from the S. E. of a group of 9 or 10, all known by the same general name. It affords neither anchorage nor water; but if the weather is moderate, a ship that is passing the S. Pacific Ocean in this track, may be supplied with grass for cattle, cocoa-nuts, fish, and other productions of the island. The principal island is not above a mile in circumference; nor is it elevated more than 3 feet above the surface of the sea.—*ib*.

PALMETTO, the most easterly point of the bay so called, on the south-west coast of the island of St Christopher's, in the West Indies. The shore is rocky, and a fort protects the bay.—Also the most northerly point of the island of Jamaica, having Manatee Bay on the west, and Island Bay on the east.—*ib*.

PALMISTE Point, on the north side of the N. W. part of the island of St Domingo; three leagues south of Point Portugal, the east point of the small island La Tortue, and 5 east of Port de Paix.—*ib*.

PALMYRA, a town, and the only port of entry and delivery, in the state of Tennessee, constituted a port of entry by law of the United States, January 31, 1797.—*ib*.

PALOMINOS, small islands on the coast of Peru, Palominos, South America; 3 miles west of St Lawrence Island, or St Lorenzo. They have from 13 to 18 fathoms water round them.—*ib*.

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Panama.

PALONQUE, the cape east of Nisao Point, at the mouth of Nilao river, on the south side of the island of St Domingo, in lat. 18 13 N. and long. 73 2 W. of Paris.—*ib*.

PALTZ, *New*, a township on the W. side of Hudson's river, in Ulster county, New York, about 20 miles N. W. of Newburgh, and 32 north of Goshen. It contains 2,309 inhabitants, including 302 slaves.—*ib*.

PAMBAMACCA, a lofty mountain in the province of Quito, being one of the pikes of the eastern Cordilleras.—*ib*.

PAMLICO Sound, on the east coast of N. Carolina, is a kind of lake or inland sea, from 10 to 20 miles broad, and nearly 100 miles in length. It is separated from the Atlantic Ocean, in its whole length, by a beach of sand hardly a mile wide, generally covered with small trees or bushes. Through this bank are several small inlets, by which boats may pass; but Ocrecock Inlet is the only one that will admit vessels of burden into the districts of Edenton and Newbern. This inlet is in lat. 35 10 N. and opens between Ocrecock Island and Core Bank. This sound communicates with Core and Albemarle Sounds; and receives Pamlico or Tar river, the river Neus, besides other small streams.—*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 Maricao.—*ib*.

PAMUNKY, the ancient name of York river, in Virginia; but this name is now confined to the southern branch, formed by the confluence of the North and South Anna. This and the northern branch, Mattaponi, unite and form York river, just below the town of De La War.—*ib*.

PANA, an island on the coast of Peru, 7 leagues E. N. E. of Santa Clara, and as far from Guayaquil. At Point Arena, which is the westernmost point, all ships bound farther into Guayaquil Bay stop for pilots, as there is good anchorage over against the middle of the town in 5 fathoms, and a soft oozy ground. It is also called *Puna*.—*ib*.

PANACA, a burning mountain on the W. coast of New Mexico, about 3 leagues from the volcano of Sanfonate.—*ib*.

PANADOU, or *Menadou*, a bay on the coast of Cape Breton Island, near the S. part of the Gulf of St Lawrence.—*ib*.

PANAMA is the capital of Terra Firma Proper, S. America; situated on a capacious bay of its name, on the south side of the Isthmus of Panama, or Darien, opposite to Porto Bello, on the N. side of the isthmus. It is the great receptacle of the vast quantities of gold and silver, with other rich merchandize from all parts of Peru and Chili. Here they are lodged in storehouses, till the proper season arrives to transport them to Europe. The harbour of Panama is formed in its road by the shelter of several islands, where ships lie very safe, at about 2½ or 3 leagues distant from the city. The tides are regular, and it is high water at the full and change at 3 o'clock. The water rises and falls

Panama,
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Panorama.

falls considerably; so that the shore, lying on a gentle slope, is at low water left dry to a great distance. Pearls are found here in such plenty, that there are few persons of property near Panama, who do not employ all, or at least part of their slaves, in this fishery. The Negroes who fish for pearls must be both expert swimmers, and capable of holding their breath a long time, the work being performed at the bottom of the sea. This city is a bishop's see, whose bishop is the primate of Terra Firma. It was built by the Spaniards, who, in 1521, constituted it a city, with the usual privileges. In 1670 it was taken, sacked and burnt by John Morgan, an English adventurer. The new town was built in a more convenient situation, about a league and a half from the former. In 1737, this new town was almost entirely destroyed by an accidental fire. It is surrounded with a stone wall and other fortifications, and the public buildings are very handsome. 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 most writers *Terra Firma Proper*. It contains 3 cities, 12 villages, and a great number of *rancheries* or assemblages of Indian huts; these are situated in small plains along the shore, the rest of the country being covered with enormous and craggy barren and uninhabited mountains. It has several gold mines; but the pearl fishery affords a more certain profit, and at the same time is acquired with much greater ease.—*ib.*

PANAMARIBO, on the coast 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 supplies that city with excellent water.—*ib.*

PANIS. There are two Indian nations so named. The White Panis inhabit S. E. of the Missouri, and can furnish 1500 warriors; and the Speckled Panis S. of the Missouri, 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 represents an entire view of any country, city, or other natural objects, as they appear to a person standing in any situation, and turning quite round. To produce this effect, the painter or drawer must fix his station, and delineate correctly and connectedly every object which presents itself to his view as he turns round, concluding his drawing by a connection with where he began. He must observe the lights and shadows, how they fall, and perfect his piece to the best of his abilities. There must be a circular building or framing erected, on which this drawing or painting may be performed; or the same may be done on canvas, or other materials, and fixed or suspended on the same building or framing, to answer the purpose complete. It must be lighted entirely from the top, either by a glazed dome, or otherwise as the artist may think proper. There must be an inclosure within the said circular building or framing, which shall prevent an observer going too near the drawing or painting, so as it may, from all parts it can be viewed, have its proper effect. This inclosure may represent a room, or platform, or any other situation, and may be of any form thought most convenient; but the circular form is particularly recommended. Of

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whatever extent this inside inclosure may be, there must be over it (supported from the bottom, or suspended from the top) a shade or roof; which, in all directions, should project so far beyond this inclosure, as to prevent an observer from seeing above the drawing or painting when looking up; and there must be without this inclosure another interception, to represent a wall, paling, or other interception, as the natural objects represented, or fancy, may direct, so as effectually to prevent the observer from seeing 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 represent nature. The entrance to the inner inclosure must be from below, a proper building or framing being erected for that purpose, so that no door or other interruption may disturb the circle on which the view is to be represented. And there should be, below the painting or drawing, proper ventilators fixed, so as to render a current circulation of air through the whole; and the inner inclosure may be elevated, at the will of an artist, so as to make observers, on whatever situation he may wish they should imagine themselves, feel as if really on the very spot.

PANSE, DE LA, a branch of Wabash river, in the N. W. Territory.—*Morse.*

PANTON, a township in Addison county, Vermont, situated on the E. side of Lake Champlain, between Addison and Ferrisburg, and about 87 miles N. of Bennington. It contains 220 inhabitants.—*ib.*

PANUCO, or *Guaslica*, a province of N. America, in New Spain, bounded E. by the Gulf of Mexico, and W. by the provinces of Mechoacan and New Biscay. The tropic of Cancer divides this province. It is about 55 leagues each way. The part nearest to Mexico is much the best and richest, abounding with provisions, and having some veins of gold, and mines of salt. Other parts are wretchedly poor and barren.—*ib.*

PANUCO, the capital of the above-mentioned province; it is the see of a bishop, and stands upon a river of its own name, 17 leagues from its mouth, on the W. shore of the Gulf of Mexico, and 60 N. W. of the city of Mexico. The river is navigable for large ships a great way above the city; but the harbour has so large a bar before it, that no ships 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. side of the Isthmus of Nicaragua, a small distance from the western parts of the lake of Nicaragua, and in lat. about 11 15 N.—*ib.*

PAPALOAPAIN, the largest river of Guaxaca, in New Spain, called also Alvarada. It rises in the mountains Zoncolincan, and, being enlarged by the accession of lesser rivers, falls into the North Pacific Ocean.—*ib.*

PAPER is an article of such importance, and at present* of so enormous a price, that no improvement in its manufacture should pass unnoticed in a work of this nature. The discovery made in France by M. Bertholet of the efficacy of oxy-muriatic acid in expediting the process of BLEACHING (see that article in this *Suppl.*), has contributed essentially to facilitate the manufactures, not only of cotton and linen cloths, but also of paper, of which it has even increased the materials. Formerly writing paper could be made of *unprinted* linen alone; but by means of the process of M.

Panse,
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Paper.

* 1801.

Paper.

Bertholet 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 Bermondsey, 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 airtight 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 unwholesome 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

Papina-
chois,

Parabolic.

Parabolic,
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Parachute.

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 parallelepipedon. 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 Canggallan 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 Mauffeux 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 aerial 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 aeronaut, 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 Figueres 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 bhds. 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

Paradise,
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Paraiba.

Parallax,
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Paramar-
ibo.

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 strewn 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, cocoa, 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 mackerel salted, spermaceti candles, horses, and lumber; for which they receive chiefly molasses to be distilled into rum. This

Paramar-
ibo.

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 inconveniences 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.

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 Francezes. 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 Antigna, 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,

Parana,
||
Paris.

Paris.

fused 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.

2^{dly}, 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?

3^{dly}, 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.

4^{thly}, 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, had 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.

5^{thly}, 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.

6^{thly}, 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.

7^{thly}, 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,

8^{thly}, 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 Jeremyquam 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.

Paris,
||
Parker's

Parkhurst. arches. It is on the post-road from Bolton 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 fought 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 unphilosophical 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 Myfter, daughter, and, we believe, heiress of John Myfter, 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

Parkhurst. 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 to 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 Hutchinsonianism, 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 betray-

ed 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 Epfom 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. Diç. 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. *Paradisus 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 Saufe, &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.

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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 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. Diç. 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 se-

cretary 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 mea-

Parsons.

Parsons. sure been forestalled by a writer now very little known or read. This Dr Parsons proved in a very satisfactory manner; and he had the pleasure to find the French philosopher did not refuse to the Jesuit his share in the invention, and was not at all offended by the liberty he had taken. Another French discovery, I mean a new kind of painting fathered upon the ancients, was reduced to its real value, in a paper which shewed our author was possessed of a good taste for the fine arts: and I am informed that his skill in music was by no means inferior, and that his favourite amusement was the flute. Richly, it appears from these performances, did our author merit the honour of being a member of the Antiquarian Society, which long ago had associated him to its labours. To another society, founded upon the great principles of humanity, patriotism, and natural emulation, he undoubtedly was greatly useful (A). He assisted at most 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 useful improvements, and to oppose the interested views of fraud and ignorance, so inseparable from very extensive associations. No sooner was *this* society (B) formed, than Dr Parsons became a member of it. Intimately convinced of the nobleness of its views, though from his station in life little concerned in its success, he grudged neither attendance nor expense. Neither ambitious of taking the lead, nor fond of opposition, he joined in any measure he thought right; and submitted cheerfully to the sentiments of the majority, though against his own private opinion. The just ideas he had of the dignity of our profession, as well as of the common links which ought to unite all its members, notwithstanding the differences of country, religion, or places of education, made him bear impatiently the shackles laid upon a great number of respectable practitioners: he wished, fondly wished, to see these broken; not with a view of empty honour and dangerous power, but as the only means of serving mankind more effectually, checking the progress of designing men and illiterate practitioners, and diffusing through the whole body a spirit of emulation. Though by frequent disappointments he foresaw, as well as we, the little chance of a speedy redress, he nobly persisted in the attempt; and had he lived to the final event, would undoubtedly, like Cato, still have preferred the conquered cause to that supported by the gods. After having tried to retire from business and from London, for the sake of his health, and having disposed of most of his books with that view, he found it inconsistent with his happiness to forsake all the advantages which a long residence in the capital, and the many connections he had formed, had rendered habitual to him. He therefore returned to his old house, and died in it, after a short illness, April 4. 1770. The style of our friend's composition was sufficiently clear in description, tho' in argument not so close as could have been wished. Full of his ideas, he did not always so dispose and connect them together, as to produce in the minds of his readers that conviction which was in his own. He too

much despised those additional graces which command attention when joined to learning, observation, and sound reasoning. Let us hope that his example and spirit will animate all his colleagues; and that those practitioners who are in the same circumstances will be induced to join their brethren, sure to find amongst them those great blessings of life, freedom, equality, information, and friendship. As long as these great principles shall subsist in this society, and I trust they will outlast the longest liver, there is no doubt but the members will meet with the reward honest men are ambitious of, the approbation of their conscience, the esteem of the virtuous, the remembrance of posterity."

PARTY ARCHES, in architecture, are arches built between separate tenures, where the property is intermixed, and apartments over each other do not belong to the same estate.

PARTY WALLS, are partitions of brick made between buildings in separate occupations, for preventing the spread of fire. These should be thicker than the external walls; and their thickness in London is regulated by act of parliament of the 14th of George III.

PARSONSFIELD, a township of the District of Maine, in York county, situated on the New Hampshire line, between great and Little Ossipee rivers; and is 118 miles north of Boston. It was incorporated in 1785, and contains 655 inhabitants.—*Morse*.

PARTIDO, a small island, under the high hill of St Martin, in the south-west part of Campeachy Gulf. It lies in the fair way across the bay from Cape Catoche to Vera Cruz.—*ib*.

PARTRIDGEFIELD, a township of Massachusetts, in Berkshire county, 26 miles W. N. W. of Northampton, and 128 westward of Boston. It was incorporated in 1775, and contains 1041 inhabitants.—*ib*.

PASCAGOULA, a river of the Georgia Western Territory, which pursues a S. by E. course through West Florida, and empties into the Gulf of Mexico, by several mouths, which together occupy a space of 3 or 4 miles; which is one continued bed of oyster-shells, with very shoal water. The westernmost branch has 4 feet water, and is the deepest. After crossing the bar, there is from 3 to 6 fathoms water for a great distance, and the river is said to be navigable more than 150 miles. The soil on this river, like that on all the others that pass through Georgia into the Gulf of Mexico, grows better as you advance to its source.—*ib*.

PASCAGOULA, an Indian village on the E. side of the river Mississippi, which can furnish about 20 warriors. It is about 10 miles above the Tonica village.—*ib*.

PASCATAQUA, or *Piscataqua*, is the only large river, whose whole course is in New Hampshire. Its head is a pond in the N. E. corner of the town of Wakefield, and its general course thence to the sea is S. S. E. about 40 miles. It divides New Hampshire from York county, in the District of Maine, and is called Salmon-Fall river, from its head, to the lower falls at Berwick, where it assumes the name of Newichawannock, which it bears till it meets with Cochecho river, which comes from Dover, when both run together

(A) The Society for the Encouragement of Arts, Manufactures, and Commerce. He likewise was associated to the Economical Society at Berne, Dec. 26. 1763.

(B) A Medical Society instituted by Dr Fothergill, and other respectable physicians, licentiates, in vindication of their privileges; where, it should seem, this eulogy was intended to be pronounced.

Paspaya,
||
Passaik.

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 Swanfocot 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 Patterfon 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 Cobcook 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.*

Passama-
quoddy,
||
Passump-
sick.

PASSYUNK,

Passyunk,
||
Patow-
mack.

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.*

PATAGOIA, a river on the coast of Brazil, which enters the ocean S. W. of Rio Janeiro.—*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 Paiza 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 *Paticca*, 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 Ptolemaic 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 Conococheague 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, Georgetown, 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 1½ at Alexandria. Its soundings are 7 fathoms at the mouth; 5 at St George's Island; 4½ at Lower Matchodie; 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 Jefferon'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 north-westerly 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 chafins 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

Patrick's,
||
Patucket.

Patuxent, the beauty and grandeur of the scene, which would otherwise have been indescribably charming and romantic.—*ib.*

Paulf-
burgh.

PATUXENT, or *Patuxet*, a navigable river of Maryland, which rises near the source of Patapsco river, and empties into the W. side of Chesapeake 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.*

PAULINGSFOWN, or *Pauling*, 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 Grafton 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, Sonsonate, Realejo, and Panama, to Col-lao, 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

Paulus,
Paz.

Paz,
||
Pearl.

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 Castell 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 fastened, 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 (*æsofagus*) 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. Those which have a thick calcareous crust upon them, to which *serpula* (sea tubes) *Tubuli marini irregulariter intorti*, *Crista gali Chamar lazuras*, *Lepas tintinabulum*, *Madreporee*, *Milipore*, *Cellipore*, *Gorgontæ*, *Spongia*, 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:

Pearl.

Pearl,
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Pedra.

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 Chastaw 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 hoghead staves, masts, yards, and all kinds of plank for ship-building.

PEARL'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 Wakamaw 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 Brandibi 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 Pacafmayo, 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. ¾ 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.*

PEORO, *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

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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 fort; 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 pyramidal 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, feat-

ed on their hams, each with a large club on the right shoulder.

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 *Maba Sundere*, 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 *Galadzet* 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 re-

Pegue.

Pegue,
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Pelham.

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 Palham, 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, O. S. 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

Pelican,
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Pell.

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 negotiations 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 Whittler 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.

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 in-composite, &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 \div for division, \textcircled{a} for involution, lu for evolution.*

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 development of their natural talents, no master 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 advantage 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 ha-

Pell,
||
Pelletier.

* Hutton's
Mathematical Dictionary.

Pelletier. ving remarked in him that sagacity which may be called the instinct of science, admitted him among the pupils attached to the chemical laboratory of the college of France. Five years of constant application and study under such a master, who was himself formed by nature, perfected by experience, and affectionately disposed towards his pupil, afforded this young man a stock of knowledge very unusual at his age. He soon gave a convincing proof of this, by publishing, at the age of 21, a set of very excellent observations on the arsenical acid. Macquer, by mixing nitre with the oxyd of arsenic, had discovered in the residue of this operation a salt soluble in water, susceptible of crystallization in tetrahedral prisms, which he denominated the neutral arsenical salt. It is the arseniat of potash. He was of opinion that no acid could decompose it; but Pelletier shewed, that the sulphuric acid distilled from it does disengage the acid of arsenic. He shewed the true cause why the neutral arsenical salt is not decomposable in closed vessels; and particularly the order of affinity by which the salt itself is formed in the distillation of the nitrate of potash, and the white oxyd of arsenic. He explains in what respects this salt differs from what Macquer called the liver of arsenic. Pelletier had been anticipated in this work by Scheele, by Bergman, by the academicians of Dijon, and by Berthollet; but he possessed at least the merit, in the first essay 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 same principles it was that he decomposed the arsenico-ammoniacal salt, by shewing how, in the decomposition of this last, the pure arsenical acid is obtained in the form of a deliquescent glass. In this work we may observe all the phenomena of these compositions and decompositions, by tracing those delicate threads of scientific relation which connect the series of facts, and are imperceptible to ordinary minds.

Encouraged by the success of these first works, which he presented with the sensibility of grateful attachment to his instructor, he communicated his observations on the crystallization of sulphur, cinnabar, and the deliquescent salts; the examination of zeolites, particularly the false zeolite of Fribourg in Brisgaw, which he found to be merely an ore of zinc; observations on the dephlogisticated, or oxygenated muriatic acid, relative to the absorption of oxygen; on the formation of ethers, particularly the muriatic and the acetous; and several memoirs on the operation of phosphorus made in the large way; its conversion into phosphoric acid, and its combination with sulphur and most metallic substances.

It was by his operations on that most astonishing production of chemistry, phosphorus, that he burned himself so dangerously as nearly to have lost his life. After the cure of his wound, which confined him to his bed for six months, he immediately began the analysis of the various plumbagos of France, England, Germany, Spain, and America, and found means to give novelty and interest to his work, even after the publication of Scheele on the same object. The analysis of the carbonat of barytes led him to make experiments on animals; which prove that this earth is a true poison, whether it be administered in the form of the native carbonat of barytes, or whether it be taken from the de-

composition of the sulphat, even though again combined with another acid.

Chemists have given the name of *frontian* to a newly discovered earth, from the name of the place where it was first found. Pelletier analysed it, and discovered it in the sulphat of barytes. He likewise analysed the verditer of England, of which painters and paper-hangers make so much use. He discovered a process for preparing it in the large way, by treating with lime the precipitate obtained from the decomposition of nitrat of copper by lime. By this process, verditer is afforded equal in beauty to that which comes from England. He was likewise one of the first chemists who shewed the possibility of refining bell metal, and separating the tin. His first 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 shortly afterwards went to La Fere, with Borda and General Daboville, to assist in experiments upon a new gunpowder. Being obliged, in order to render his experiments more decisive, to pass great part of the day in the open air during a cold and humid season, his health, which was naturally delicate, became considerably impaired. He began to recover his health, when he again became the victim of his zeal for the science he so successfully cultivated. He had nearly perished by respiring the oxygenated muriatic acid gas. A violent attack of convulsive asthma, which returned during several days, was the first consequence of this unhappy accident. The disorder then seemed to abate; but it was incurable. The assistance of art was insufficient to save him; and he died in Paris, on the 21st of July 1797, of a pulmonary consumption, in the flower of his age.

PEMAQUID, a bay on the sea-coast of Lincoln county, District of Maine. It lies east of Sheepscot river, and contains a number of islands, many of which are under cultivation.—*Morse*.

PEMAQUID Point, on the west side of the above bay, lies 2 miles east of Booth Bay, and about 4 leagues northwest of Menhegan Island. N. lat. 44 5, W. long. 69.—*ib*.

PEMAGON, a settlement of the District of Maine, 7 miles from Denney's river, and 14 from Moofe Island.—*ib*.

PEMBROKE, a township of Massachusetts, in Plymouth county, 31 miles south by east of Boston. It was incorporated in 1712, and contains 1954 inhabitants. It lies 18 miles from the mouth of North river; and vessels of 300 tons have been built here.—*ib*.

PEMBROKE, the *Suncook* of the Indians, a township of New-Hampshire, in Rockingham county, on the east side of Merrimack river, opposite to Concord. It lies upon two small rivers, Bowcook and Suncook, which run a south-by-west course into Merrimack river. In 1728, it was settled and called *Loverwell's Town*. It was incorporated in 1759, and contains 956 inhabitants.—*ib*.

PEMIGEWASSET, a river of New-Hampshire, which springs from the eastern 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 township of Franconia. Its length is about 50 miles; its course generally S. and it receives from both sides a number of streams. Winipiseogee river, comes from

Pelletier,
||
Pemigewasset.

Pendleton, from the lake of that name, and unites its waters with the Pemigewasset at the lower end of Sanborntown. From this junction, the confluent stream bears the name of Merrimack to the sea.—*ib.*

PENDLETON, a county of Virginia, bounded north-west by Randolph, and south by Rockingham counties; watered by the south branch of the Patowmack. It contains 2,452 inhabitants, including 73 slaves. Chief-town, Frankford.—*ib.*

PENDLETON, a county of Washington district, S. Carolina, on Keowee and Savannah rivers. It contained, in 1795, 9,568 inhabitants, of whom 834 are slaves; and sends three representatives and 1 senator to the State legislature. The court-house in this county is 33 miles N. N. E. of Franklin court-house in Georgia, and 52 westward of Cambridge. A post-office is kept at this court-house.—*ib.*

PENDULUM (See *Encycl.*). Besides the effects of heat and cold on the length of the pendulum rod, and of course on its isochronism, it may certainly be worth while, in the construction of clocks intended to measure time with the utmost possible exactness, to take into consideration the resistance of the air, which, by its unequal density, varying the weight of the pendulum, must in a small degree accelerate or retard its motion. The celebrated David Rittenhouse, who paid particular attention to this subject, estimates the extreme difference of velocity, arising from this cause, at half a second a day; and he observes, that a remedy dependent on the barometer will not be strictly accurate, as the weight of the entire column of air does not precisely correspond with the density of its base. He proposes, therefore, as a very simple and easy remedy, that the pendulum shall, as usual, consist of an inflexible rod carrying the ball beneath, and continued above the centre of suspension to an equal (or an unequal) distance upwards. At this extremity is to be fixed another ball of the same dimensions (or greater or less, according as the continuation is shorter or longer), but made as light as possible. The oscillations of this upper ball will be accelerated by its buoyancy by the same quantity as those of the lower would be retarded; and thus, by a proper adjustment, the two effects might be made to balance and correct each other.

Our author made a compound pendulum on these principles, of about one foot in its whole length. This pendulum, on many trials, made in the air 57 vibrations in a minute. On immersing the whole in water, it made 59 vibrations in the same time; shewing evidently, that its returns were quicker in so dense 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 island in the Atlantic Ocean, about 10 miles N. E. of the coast 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 also an island of the same name, on the coast of Patagonia, in the S. Atlantic Ocean, 3 leagues south-east of Port Desire. It is an uninhabited rock, high at the ends and low in the middle, and is the largest and outermost of a number of small isles or rocks, and is about a musket-shot from the main land. It abounds in an extraordinary manner, with penguins and seals. It is

three-fourths of a mile in length, and half a mile in breadth from E. to W.—*Morse.*

PENNANT (Thomas, Esq.), so well known in the republic of letters as a writer of travels, and of natural history, was an ancient Briton by birth, having drawn his first breath in Flintshire, in 1726. His family has been settled in that county for many centuries; we learn from himself that he received the rudiments of his education at Wrexham, whence he was removed to Fulham. Soon after this he was sent to Oxford; and having made a considerable proficiency in the classics, he applied himself within the walls of that university to attain a knowledge of jurisprudence; but we do not find that he ever entered himself of any of the inns of court, or followed the law as a profession.

The ruling passions of mankind are excited, and the future current of their lives frequently directed, by trivial circumstances. One of the greatest painters of our age was attracted with an irresistible impulse towards his art by the perusal of a treatise on it; and we have the authority of the subject of this memoir for asserting, that a present of Willoughby's Ornithology, at an early period, first gave him a turn for natural history, which has never once abandoned him through the course of a very long life.

Mr Pennant commenced his travels with great propriety at home, where he made himself acquainted with the manners, productions, and curiosities, of his native country, before he sallied forth to inspect those of other nations. He then repaired to the continent; and not only acquired considerable additional knowledge relative to his favourite studies, but became acquainted, and established a correspondence, with some of the greatest 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-seven years of age, at which time he was settled at Downing.

Having lost his wife, he appears to have set out once more for the continent, and to have formed an acquaintance with Voltaire, Buffon, Haller, Pallas, &c. He had by this time acquired considerable reputation as a scientific man, having commenced his career as an author so early as 1750. His *British Zoology** established his reputation as a naturalist; and this received a fresh accession of celebrity in consequence of his acquaintance with Linnæus, and his intercourse by letters with all the celebrated naturalists in Europe.

Early in life he had undertaken a most interesting tour to Cornwall; and he now entertained an ardent desire to survey the works of nature in the northern extremities of the island. He accordingly set out for Scotland, and in 1771 favoured the public with an entertaining account of his Tour†, which was so well received as to pass through several editions. Not content with the main land of Great Britain, he was ambitious to survey the islands in the vicinity, and accordingly penetrated to the Hebrides, and visited Man.

It is not to be supposed that he would leave his own country unexplored; on the contrary, he minutely described all its wonders. He did not fail on this occasion to present the world with the result of his enquiries, for in 1778 he commenced the publication of his *Welch Tour*‡.

In four years after this (1782) appeared the account

Pennant.

* Four vols. 4to.

† Three vols. 4to.

‡ Two vols. 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 composed 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 *Napaul 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 cheerful, 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 Hindoostan* composed the xivth and xvth volumes.

Mr Pennant possessed a well-compacted frame of body, an open and intelligent aspect, an active and cheerful disposition, and a vivacity which rendered him always entertaining, as well in conversation as in writing. Though not without a share of irascibility, 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.

Pennatula, 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 flattened 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*.

||
Pennsborough.
Plate.XLI.

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.*

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Pennsbury.
||
Penobscot.

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 *Norombega* 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 site 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 Scodick 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,
Pepperel-
borough.

PENOESCOTS, 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 Tlascalala, 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.

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 fire 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

Pepy's, 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.
Dist. new
edi.

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*.

PERQUANACK, 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*.

PERQUANNOCK *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 *Perames*, in Bergen county, New-Jersey, lies on the point of land formed by the branches of Saddle river, a north water of Passaic; 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 Passaic river, and 6 miles N. of Morristown.—*ib*.

SUPL. VOL. II.

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

Percussion.

cise 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 on 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 mechanic 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 mis-

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taken 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

Percussion. 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 scorns 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 stiled 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 croneous 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 vive*, as the most remarkable example of the errors into which the unguarded use of Cavalieri'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 employ'd. But, at the same time, these are all very vague expressions, and they do not authorize 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,

Percussion. 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.

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. *Percussion.*

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.

Percussion. 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 ab be the abscissa of a line $adbk$, whose ordinates cd, gb, ik , &c. are as the elastic reaction of the spring when it is compressed into the lengths cb, gb, ib , &c. Suppose that, when it is compressed into the form CD , it will just support the weight of a ball lying on C . Then cd will be a reaction equal to the weight of the ball, and the rectangle $acdf$ will express the square of the velocity which this ball would acquire by falling freely through ac . 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 adf . (See *DYNAMICS, Suppl. n° 95.*) It will compress the spring into the length gb , such that the area $cgbd$ is equal to the area adf . If the ball, instead of being gently laid on A , be dropped from M , it will compress the spring into such a length ib , that the area aik is equal to the rectangle $mc dn$; 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 accessory to the effect. It would be very unfair to con-

clude 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.*

Percussion,
||
Perdido.

Peres,
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Perkinism.

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 surgical 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. Perkinism.

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 same 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*.

Perkinism. 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 super-sensation, 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 surpris'd 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 *Perkinism.* M. Blech, the tractors were of use in *hemiplegia* 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 mattresses, &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

Perkinism. 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.”

* *The Efficacy of Perkins's Patent Metallic Tractors, &c.* 1800.

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 objec-

Perkinism. tions 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.

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 landlocked 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

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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.

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 *Amazon*, 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

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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 sciolists 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 site 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 Willburg, 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 pleafantest 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 $1\frac{1}{2}$ 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 3 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,

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&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 Susquehanna 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. be-

rides the value of peach and apple brandy, which y, &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 co-partner 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 consultants, 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 *cenfor 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

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altercations on the spot, and keep a watchful eye on all that passes.

The number of the nightly watch in the city amounts to 500. They have their stations assigned them in watch-houses at the corners of streets: and, besides their proper destination, are to assist in the taking up of offenders, and in any service, by day or night, as their commanders shall require. Besides these, for the execution of the police orders, and to act as patrols, there is also a commando of 120 men, who, in cases of emergency, are supported by a company of kosaks, or a regiment of hussars.

This machine, consisting of so many subordinate parts, preserves in its orderly course that security and peace which excite the admiration of all foreigners. The activity of every individual member is unobserved in the operation of the whole; and by such a distribution alone is the attainment of so complicated an aim practicable.—All the quarter-inspectors of a department repair every morning, at seven o'clock, to their inspector's house, to lay before him the report of all that has happened in their quarters during the last 24 hours; and at eight o'clock, all the inspectors bring together these several reports into the police-office, whereupon they first and immediately take into examination the cases of persons taken into custody during the night. On urgent occasions, the police-office assembles at all hours.

This organization, and the extraordinary vigilance of the police, which is found competent to the business of a numerous and restless people, render all secret inquiries unnecessary. The police has knowledge of all persons in the residence; travellers who come and go are subject to certain formalities, which render it extremely difficult to conceal their place of abode, or their departure from the city. To this end, every householder and innkeeper is obliged to declare to the police, who lodges with him, or what strangers have put up at his house. If a stranger or lodger stays out all night, the landlord must inform the police of it at latest on the third day of his absence from his house. The cautionary rules, in regard to travellers quitting the town, are still more strict. These must publish in the newspapers their name, their quality, and their place of abode, three several times, and produce the newspapers containing the advertisement, as a credential in the government from which they then receive their passport; without which, it is next to impossible to get out of the empire. This regulation not only secures the creditor of the person about to depart, but also enables the police to keep a closer inspection over all suspected inhabitants.

If individuals may be suspected by the government, because their means of support, the company they keep, and their whole course of action, are closely wrapped up in mystery; so likewise may whole societies be less indifferent to it, if they carefully conceal the object of their connection, or their very existence, from the eye of the public. The police watches here, with laudable attention, over secret societies of all kinds; and frequently as the fanatical spirit of religious or political sectaries, or the enthusiasm of pretended mystagogues, have attempted to nestle here, they have never been able to proceed, or only for a very short time. Animal magnetism, Martinism, Rosycrucianism, and by whatever other name the conceits of distempered imagi-

nations may be called, have always been attended with the same bad success on this stage.

From this sketch it will be readily imagined, that the number of impostors and disturbers of the public peace can be but small. Quarrels and affrays in the street or in the cabaks but seldom happen. The person attacked calls the nearest watchman; and in a moment both the aggressor and the aggrieved are taken into custody, and led to the next *sieja* (police-watch-house), where the cause of their quarrel is inquired into, and the aggressor is punished. For matters of some descriptions, there is a peculiar tribunal, under the denomination of the oral court, which, on account of its singularity, deserves to be briefly noticed.

In each quarter of the town are one or more judges of the oral court, who are chosen from the class of burghers, and with whom are associated a few jurats. This court sits 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 causes and decisions of the court, and which must be every week laid before the magistrate. When a charge is brought, the court declares it orally to the president of the quarter: whereupon the accused must not delay his appearance before the police longer than one day after he has received the summons. Every cause must be determined in one day, or, if the examinations require more time in collecting, in three days. The oral court communicates the decision to the president of the quarter by means of his day-book, in order to its ratification. If either party is not satisfied with the sentence, he may appeal to the court as appointed in the regulations.

This is a very favourable account of the police of St. Peterburgh; but it is differently represented in *Beaulin's Travels of two Frenchmen through Russia, in 1790—1792*. According to him, the police of the capital of that empire is far from being on the most respectable footing. There happen, indeed, but few accidents in the night; yet sometimes murders are committed, and especially thefts; for which, according to our author, it is exceedingly rare to obtain justice. When a person has been assassinated in some place of bad repute, the police-officer is engaged to secrecy by means of a few rubles; so that the affair is soon hushed up, unless the deceased belonged to some powerful family, whose interest makes it necessary that inquiries should be instituted. When two persons quarrel, either in the street or in a public-house, he who *pays* the inquirer is always in the right: the inferior police-officers are never proof against money; and the *poor* individual, whether he be in the right or wrong, is almost sure of a beating.

PETERSHAM, a flourishing and pleasant township in Worcester county, Massachusetts, formerly called by the Indians *Nicheawang*; situated 28 miles N. W. of Worcester, and 66 W. of Bolton. Swift river, a branch of Chickopee river, passes through this town. The soil is rich and fertile, and here are large and excellent orchards.—*Morse*.

PETIT ANSE, a village on the north side of the island of St. Domingo, 2½ leagues south of Cape Francois.—*ib.*

PETITCODIAK, a river which falls into an arm of the Bay of Fundy, called Chegnesto Channel. The Indians

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Petit-Goufre, Indians have a communication from the head of it with St John's river, by a portage across to the head of Kennebecus.—*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-GUAIVES, 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, $2\frac{1}{2}$ leagues westward of Grand Guave, and $14\frac{1}{4}$ 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 $5\frac{1}{2}$ 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 found, on account of the sand-banks, called the *Portetes*.—*ib.*

PETIT TERRE *Island*, near Desceada, 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 $1\frac{1}{2}$ 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 Baradares; $4\frac{1}{2}$ 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 con-

siderable 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.*

He gave the world several publications on various subjects of natural history: 1. *Musei Petiveriani Centuria decem*, 1692—1703, 8vo. 2. *Gazophylacii Natura, 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, *Plantae Rariiores Chineses 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.

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Petiver,
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Phasianus.

* Pultney's Sketches of Botany in England.

Petiver,
Philip's.

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 Eaton 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.

Philip,
Philosophist.

DIRECTIONS FOR PLACING THE PLATES.

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