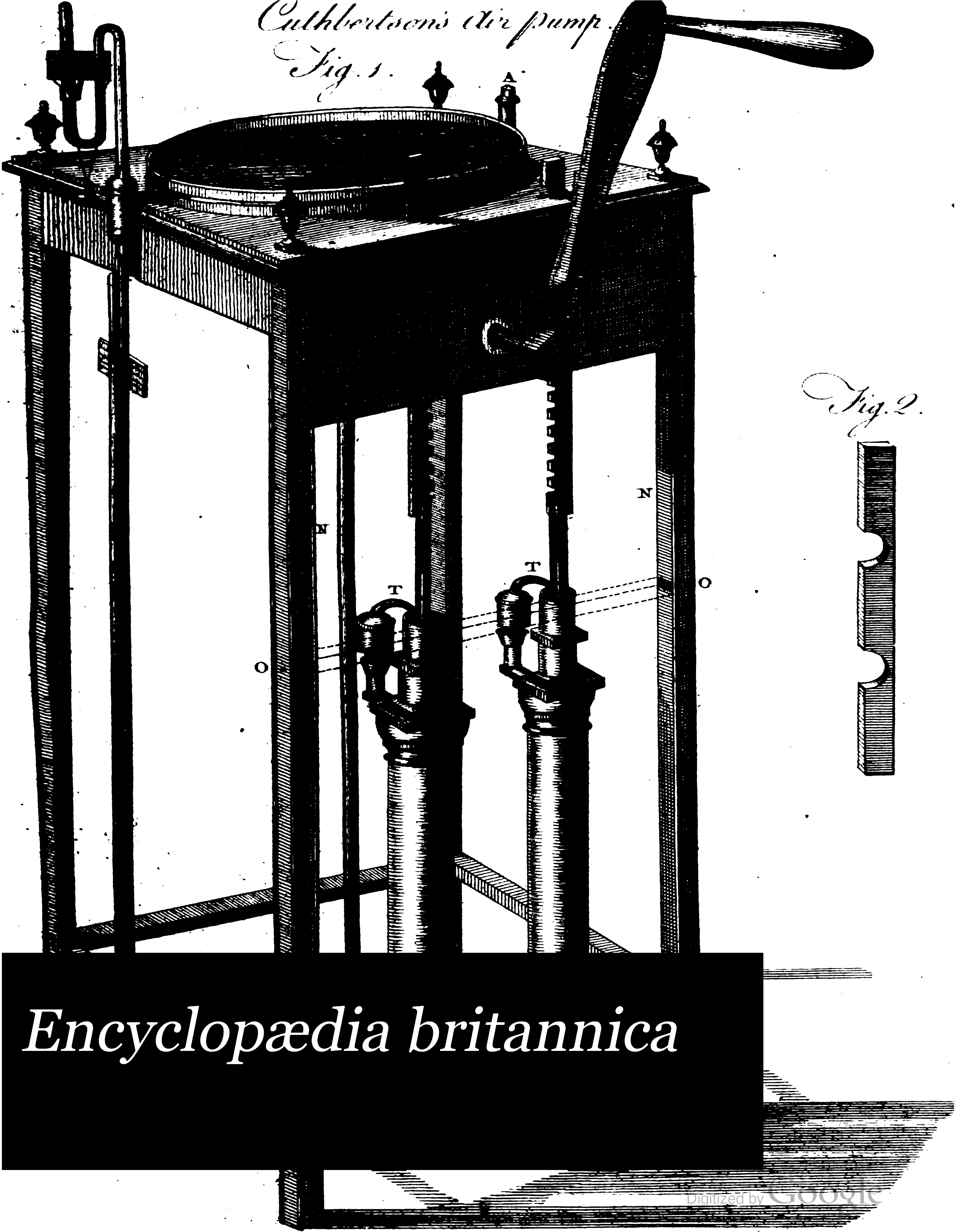
Cuthbertson's Air pump.
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Legacy from

G. A. Cunningham Esq of Halcraig

to

The Revd G Cunningham

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VOL. XV.

INDOCTI DISCANT, ET AMENT MEMINISSE PERITI.

EDINBURGH.
PRINTED FOR A. BELL AND C. MACFARQUHAR.
MDCCXCVII.

ENCYCLOPÆDIA BRITANNICA.

Plant PLANT is defined to be, an organical body, destitute of sense and spontaneous motion, adhering to another body in such a manner as to draw from it its nourishment, and having a power of propagating itself by seeds.

The vegetation and economy of plants is one of those subjects in which our knowledge is extremely circumscribed. A total inattention to the structure and economy of plants is the chief reason of the small progress that has been made in the principles of vegetation, and of the instability and fluctuation of our theories concerning it; for which reason we shall give a short description of the structure of plants, beginning with the seed, and tracing its progress and evolution to a state of maturity.

1. *Of Seeds.*] The seeds of plants are of various figures and sizes. Most of them are divided into two lobes; though some, as those of the cress-kind, have six; and others, as the grains of corn, are not divided, but entire.

But as the essential properties of all seeds are the same, when considered with regard to the principles of vegetation, our particular descriptions shall be limited to one seed, viz. the great garden-bean. Neither is the choice of this seed altogether arbitrary; for, after it begins to vegetate, its parts are more conspicuous than many others, and consequently better calculated for investigation.

This seed is covered with two coats or membranes. The outer coat is extremely thin, and full of pores; but may be easily separated from the inner one (which is much thicker), after the bean has been boiled, or lain a few days in the soil. At the thick end of the bean there is a small hole visible to the naked eye, immediately over the radicle or future root, that it may have Plate CCCXCIV a free passage into the soil (fig. 1. A). When these coats are taken off, the body of the seed appears, which is divided into two smooth portions or lobes. The smoothness of the lobes is owing to a thin film or cuticle with which they are covered.

At the basis of the bean is placed the radicle or future root (fig. 3. A). The trunk of the radicle, just as it enters into the body of the seed, divides into two capital branches, one of which is inserted into each lobe, and sends off smaller ones in all directions through Plate CCCXCI. the whole substance of the lobes (fig. 4. AA). These ramifications become so extremely minute towards the edges of the lobes, that they require the finest glasses to render them visible. To these ramifications Grew and Malpighi have given the name of *seminal root;* because, by means of it, the radicle and plume, before they are expanded, derive their principal nourishment. Plant.

The plume, bud, or germ (fig. 3.), is inclosed in two small corresponding cavities in each lobe. Its colour and consistence is much the same with those of the radicle, of which it is only a continuation, but having a quite contrary direction; for the radicle descends into the earth, and divides into a great number of smaller branches or filaments; but the plume ascends into the open air, and unfolds itself into all the beautiful variety of stem, branches, leaves, flowers, fruit, &c. The plume in corn shoots from the smaller end of the grain, and among maltsters goes by the name of *acrospire.* Plate CCCXCIV.

The next thing to be taken notice of is the substance or parenchymatous part of the lobes. This is not a mere concreted juice, but is curiously organized, and consists of a vast number of small bladders resembling those in the pith of trees (fig. 4.)

Besides the coats, cuticle, and parenchymatous parts, there is a substance perfectly distinct from these, distributed in different proportions through the radicle, plume, and lobes. This inner substance appears very plainly in a transverse section of the radicle or plume. Towards the extremity of the radicle it is one entire trunk; but higher up it divides into three branches; the middle one runs directly up to the plume, and the other two pass into the lobes on each side, and spread out into a great variety of small branches through the whole body of the lobes (fig. 4.) This substance is very properly termed the *seminal root:* for when the seed is sown, Plate CCCXCI. the moisture is first absorbed by the outer coats, which are everywhere furnished with sap and air-vessels; from these it is conveyed to the cuticle; from the cuticle it proceeds to the pulpy part of the lobes; when it has got thus far, it is taken up by the mouths of the small branches of the seminal root, and passes from one branch into another, till it is all collected into the main trunk, which communicates both with the plume and radicle, the two principle involved organs of the future plant. After this the sap or vegetable food runs in two opposite directions: part of it ascends into the plume, and promotes the growth and expansion of that organ; and part of it descends into the radicle, for nourishing and evolving the root and its various filaments. Thus the plume and radicle continue their progress in opposite directions till the plant arrives at maturity.

Plant.

It is here worth remarking, that every plant is really possessed of two roots, both of which are contained in the seed. The plume and radicle, when the seed is first deposited in the earth, derive their nourishment from the seminal root; but, afterwards, when the radicle begins to shoot out its filaments, and to absorb some moisture, not, however, in a sufficient quantity to supply the exigencies of the plume, the two lobes, or main body of the seed, rise along with the plume, assume the appearance of two leaves, resembling the lobes of the seed in size and shape, but having no resemblance to those of the plume, for which reason they have got the name of *dissimilar leaves*.

These dissimilar leaves defend the young plume from the injuries of the weather, and at the same time, by absorbing dew, air, &c. assist the tender radicle in nourishing the plume, with which they have still a connection by means of the seminal root above described. But when the radicle or second root has descended deep enough into the earth, and has acquired a sufficient number of filaments or branches for absorbing as much aliment as is proper for the growth of the plume; then the seminal or dissimilar leaves, their utility being entirely superseded, begin to decay and fall off.

Plate CCCXCIV. Fig. 1. A, the foramen or hole in the bean through which the radicle shoots into the soil.

Fig. 2. A transverse section of the bean; the dots being the branches of the seminal root.

Fig. 3. A, the radicle. B, the plume or bud.

Fig. 4. A, a longitudinal section of one of the lobes of the bean a little magnified, to show the small bladders of which the pulpy or parenchymatous part is composed.

Figs. 5. 6. A, a transverse section of the radicle. B, a transverse section of the plume, showing the organs or vessels of the seminal root.

Plate CCCXCI. Fig. 4. A view of the seminal root branched out upon the lobes.

Plate CCCXCIV. Fig. 7. The appearance of the radicle, plume, and seminal root, when a little further advanced in growth.

Having thus briefly described the seed, and traced its evolution into three principal organic parts, viz. the plume, radicle, and seminal leaves, we shall next take an anatomical view of the root, trunk, leaves, &c.

2. *Of the root.*] In examining the root of plants, the first thing that presents itself is the skin, which is of various colours in different plants. Every root, after it has arrived at a certain age, has a double skin. The first is coeval with the other parts, and exists in the seed: but afterwards there is a ring sent off from the bark, and forms a second skin; *e. g.* in the root of the dandelion, towards the end of May, the original or outer skin appears shrivelled, and is easily separated from the new one, which is fresher, and adheres more firmly to the bark. Perennial plants are supplied in this manner with a new skin every year; the outer one always falls off in the autumn and winter, and a new one is formed from the bark in the succeeding spring. The skin has numerous cells or vessels, and is a continuation of the parenchymatous part of the radicle. However, it does not consist solely of parenchyma; for the microscope shows that there are many tubular ligneous vessels interspersed through it.

When the skin is removed, the true cortical substance or bark appears, which is also a continuation of the parenchymatous part of the radicle, but greatly augmented. The bark is of very different sizes. In most trees it is exceeding thin in proportion to the wood and pith. On the other hand, in carrots, it is almost one-half of the semidiameter of the root; and, in dandelion, it is nearly twice as thick as the woody part.

The bark is composed of two substances; the parenchyma or pulp, which is the principal part, and a few woody fibres. The parenchyma is exceedingly porous, and has a great resemblance to a sponge; for it shrivels considerably when dried, and dilates to its former dimensions when infused in water. These pores or vessels are not pervious, so as to communicate with each other; but consist of distinct little cells or bladders, scarcely visible without the assistance of the microscope. In all roots, these cells are constantly filled with a thin watery liquor. They are generally of a spherical figure; though in some roots, as the bugloss and dandelion, they are oblong. In many roots, as the horse-radish, peony, asparagus, potatoe, &c. the parenchyma is of one uniform structure. But in others it is more diversified, and puts on the shape of rays, running from the centre towards the circumference of the bark. These rays sometimes run quite through the bark; as in lovage; and sometimes advance towards the middle of it, as in melilot and most of the leguminous and umbelliferous plants. These rays generally stand at an equal distance from each other in the same plant; but the distance varies greatly in different plants. Neither are they of equal sizes: in carrot they are exceedingly small, and scarcely discernible; in melilot and chervil, they are thicker. They are likewise more numerous in some plants than in others. Sometimes they are of the same thickness from one edge of the bark to the other; and some grow wider as they approach towards the skin. The vessels with which these rays are amply furnished, are supposed to be air-vessels, because they are always found to be dry, and not so transparent as the vessels which evidently contain the sap.

In all roots there are ligneous vessels dispersed in different proportions through the parenchyma of the bark. These ligneous vessels run longitudinally through the bark in the form of small threads, which are tubular, as is evident from the rising of the sap in them when a root is cut transversely. These ligneous sap-vessels do not run in direct lines through the bark, but at small distances incline towards one another, in such a manner that they appear to the naked eye to be inosculated; but the microscope discovers them to be only contiguous, and braced together by the parenchyma. These braces or coarctations are very various both in size and number in different roots; but in all plants they are most numerous towards the inner edge of the bark. Neither are these vessels single tubes; but, like the nerves in animals, are bundles of 20 or 30 small contiguous cylindrical tubes, which uniformly run from the extremity of the root, without sending off any branches or suffering any change in their size or shape.

In some roots, as parsnep, especially in the ring next the inner extremity of the bark, these vessels contain a kind of lymph, which is sweeter than the sap contained in the bladders of the parenchyma. From this circumstance they have got the name of *lymph-ducts*.

These lymph-ducts sometimes yield a mucilaginous lymph, as in the comphrey; and sometimes a white milky

Plant. milky glutinous lymph, as in the angelica, fonchus, burdock, fcorzonera, dandelion, &c. The lymph-ducts are fuppofed to be the veffels from which the gums and balfams are fecerned. The lymph of fennel, when expofed to the air, turns into a clear tranfparent balfam; and that of the fcorzonera, dandelion, &c. condenfes into a gum.

The fituation of the veffels is various. In fome plants they ftand in a ring or circle at the inner edge of the bark, as in afparagus; in others, they appear in lines or rays, as in borage; in the parfnep, and feveral other plants, they are moft confpicuous towards the outer edge of the bark; and in the dandelion, they are difpofed in the form of concentric circles.

The wood of roots is that part which appears after the bark is taken off, and is firmer and lefs porous than the bark or pith. It confifts of two diftinct fubftances, viz. the pulpy or parenchymatous, and the ligneous. The wood is connected to the bark by large portions of the bark inferted into it. Thefe infertions are moftly in the form of rays, tending to the centre of the pith, which are eafily difcernible by the eye in a tranfverfe fection of moft roots. Thefe infertions, like the bark, confift of many veffels, moftly of a round or oval figure.

The ligneous veffels are generally difpofed in collateral rows running longitudinally through the root. Some of thefe contain air, and others fap. The *air-veffels* are fo called, becaufe they contain no liquor. Thefe air-veffels are diftinguifhed by being whiter than the others.

The pith is the centrical part of the root. Some roots have no pith, as the ftramonium, nicotiana, &c.; others have little or none at the extremities of the roots, but have a confiderable quantity of it near the top. The pith, like every other part of a plant, is derived from the feed; but in fome it is more immediately derived from the bark: for the infertions of the bark running in betwixt the rays of the wood, meet in the centre, and conftitute the pith. It is owing to this circumftance, that, among roots which have no pith in their lower parts, they are amply provided with it towards the top, as in columbine, lovage, &c.

The bladders of the pith are of very different fizes, and generally of a circular figure. Their pofition is more uniform than in the bark. Their fides are not mere films, but a compofition of fmall fibres or threads; which gives the pith, when viewed with a microfcope, the appearance of a piece of fine gauze or net-work.

We fhall conclude the defcription of roots with obferving, that their whole fubftance is nothing but a congeries of tubes and fibres, adapted by nature for the abforption of nourifhment, and of courfe the extenfion and augmentation of their parts.

Plate CCCXCIV. Fig. 8. A tranfverfe fection of the root of wormwood as it appears to the naked eye.

Fig. 9. A fection of fig. 8. magnified. AA, the fkin, with its veffels. BBBB, the bark. The round holes CCC, &c. are the lymph-ducts of the bark: All the other holes are little cells and fap-veffels. DDD, parenchymatous infertions from the bark, with the cells, &c. EEEE, the rays of the wood, in which the holes are the air-veffels. *N. B.* This root has no pith.

3. *Of the Trunk, Stalk, or Stem.*] In defcribing the trunks of plants, it is neceffary to premife, that whatever is faid with regard to them applies equally to the branches.

The trunk, like the root, confifts of three parts, viz. the bark, wood, and pith. Thefe parts, though fubftantially the fame in the trunk as in the root, are in many cafes very different in their texture and appearance.

The fkin of the bark is compofed of very minute bladders, interfperfed with longitudinal woody fibres, as in the nettle, thiftle, and moft herbs. The outfide of the fkin is vifibly porous in fome plants, particularly the cane.

The principal body of the bark is compofed of pulp or parenchyma, and innumerable veffels much larger than thofe of the fkin. The texture of the pulpy part, though the fame fubftance with the parenchyma in roots, yet feldom appears in the form of rays running towards the pith; and when thefe rays do appear, they do not extend above half way to the circumference. The veffels of the bark are very differently fituated, and deftined for various purpofes in different plants. For example, in the bark of the pine, the inmoft are lymph ducts, and exceedingly fmall; the outmoft are gum or refiniferous veffels, deftined for the fecretion of turpentine; and are fo large as to be diftinctly vifible to the naked eye.

The wood lies between the bark and pith, and confifts of two parts, viz. a parenchymatous and ligneous. In all trees, the parenchymatous part of the wood, though much diverfified as to fize and confiftence, is uniformly difpofed in diametrical rays, or infertions running betwixt fimilar rays of the ligneous part.

The true wood is nothing but a congeries of old dried lymph-ducts. Between the bark and the wood a new ring of thefe ducts is formed every year, which gradually lofes its foftnefs as the cold feafon approaches, and towards the middle of winter is condenfed into a folid ring of wood. Thefe annual rings, which are diftinctly vifible in moft trees when cut through, ferve as natural marks to diftinguifh their age (fig. 10. 11.) The rings of one year are fometimes larger, fometimes lefs, than thofe of another, probably owing to the favourablenefs or unfavourablenefs of the feafon. Plate CCCXCIV.

The pith, though of a different texture, is exactly of the fame fubftance with the parenchyma of the bark, and the infertions of the wood. The quantity of pith is various in different plants. Inftead of being increafed every year like the wood, it is annually diminifhed, its veffels drying up, and affuming the appearance and ftructure of wood; infomuch that in old trees there is fcarce fuch a thing as pith to be difcerned.

A ring of fap-veffels are ufually placed at the outer edge of the pith, next the wood. In the pine, fig, and walnut, they are very large. The parenchyma of the pith is compofed of fmall cells or bladders, of the fame kind with thofe of the bark, only of a larger fize. The general figure of thefe bladders is circular; though in fome plants, as the thiftle and borage, they are angular. Though the pith is originally one connected chain of bladders, yet as the plant grows old they fhrivel, and open in different directions. In the walnut, after a certain age, it appears in the form of a regular tranfverfe hollow divifion. In fome plants it is altogether wanting; in others, as the fonchus, nettle, &c. there is only a tranfverfe partition of it at every joint. Many other varieties might be mentioned; but thefe muft be left to the obfervation of the reader.

Fig.

Plant. Fig. 10. A transverse section of a branch of ash, as it appears to the eye.

Plate CCCXCIV Fig. 11. The same section magnified. AA, the bark. BBB, an arched ring of sap-vessels next the skin. CCC, the parenchyma of the bark with its cells, and another arched ring of sap-vessels. DD, a circular line of lymph-ducts immediately below the above arched ring. EE, the wood. F, the first year's growth. G, the second. H, the third year's growth. III, the true wood. KK, the great air-vessels. LL, the lesser ones. MMM, the parenchymatous insertions of the bark represented by the white rays. NO, the pith, with its bladders or cells.

4. *Of the Leaves.*] The leaves of plants consist of the same substance with that of the trunk. They are full of nerves or woody portions, running in all directions, and branching out into innumerable small threads, interwoven with the parenchyma like fine lace or gauze.

The skin of the leaf, like that of an animal, is full of pores, which both serve for perspiration and for the absorption of dews, air, &c. These pores or orifices differ both in shape and magnitude in different plants, which is the cause of that variety of texture or grain peculiar to every plant.

The pulpy or parenchymatous part consists of very minute fibres, wound up into small cells or bladders. These cells are of various sizes in the same leaf.

All leaves, of whatever figure, have a marginal fibre, by which all the rest are bounded. The particular shape of this fibre determines the figure of the leaf.

The vessels of leaves have the appearance of inosculating; but, when examined by the microscrope, they are found only to be interwoven or laid along each other.

What are called *air-vessels*, or those which carry no sap, are visible even to the naked eye in some leaves. When a leaf is slowly broke, they appear like small woolly fibres, connected to both ends of the broken piece.

Plate CCCXCV. Fig. 14. The appearance of the air-vessels to the eye, in a vine-leaf drawn gently asunder.

Fig. 15. A small piece cut off that leaf.

Fig. 16. The same piece magnified, in which the vessels have the appearance of a screw.

Fig. 17. The appearance of these vessels as they exist in the leaf before they are stretched out.

5. *Of the Flower.*] It is needless here to mention any thing of the texture, or of the vessels, &c. of flowers, as they are pretty similar to those of the leaf. It would be foreign to our present purpose to take any notice of the characters and distinctions of flowers. These belong to the science of Botany, to which the reader is referred.

There is one curious fact, however, which must not be omitted, viz. That every flower is perfectly formed in its parts many months before it appears outwardly; that is, the flowers which appear this year are not properly speaking the flowers of this year, but of the last. For example, mezereon generally flowers in January; but these flowers were completely formed in the month of August preceding. Of this fact any one may satisfy himself by separating the coats of a tulip-root about the beginning of September; and he will find that the two innermost form a kind of cell, in the centre of which stands the young flower, which is not to make its appearance till the following April or May. Fig. 18. exhibits a view of the tulip-root when dissected in September, with the young flower towards the bottom.

6. *Of the Fruit.*] In describing the structure of fruits, a few examples shall be taken from such as are most generally known.

A *pear*, besides the skin, which is a production of the skin of the bark, consists of a double parenchyma or pulp, sap, and air-vessels, calculary and acetary.

The outer parenchyma is the same substance continued from the bark, only its bladders are larger and more succulent.

It is everywhere intersperssed with small globules or grains, and the bladders respect these grains as a kind of centres, every grain being the centre of a number of bladders. The sap and air-vessels in this pulp are extremely small.

Next the core is the inner pulp or parenchyma, which consists of bladders of the same kind with the outer, only larger and more oblong, corresponding to those of the pulp, from which it seems to be derived. This inner pulp is much sourer than the other, and has none of the small grains interspersed through it; and hence it has got the name of *acetary*.

Between the acetary and outer pulp, the globules or grains begin to grow larger, and gradually unite into a hard stony body, especially towards the corculum or stool of the fruit; and from this circumstance it has been called the *calculary*.

These grains are not derived from any of the organical parts of the tree; but seem rather to be a kind of concretions precipitated from the sap, similar to the precipitation from wine, urine, and other liquors.

The core is a roundish cavity in the centre of the pear, lined with a hard woody membrane, in which the seed is inclosed. At the bottom of the core there is a small duct or canal, which runs up to the top of the pear; this canal allows the air to get into the core, for the purpose of drying and ripening the seeds.

Fig. 19. a transverse section of a pear, as it appears to the naked eye. A, the skin, and a ring of sap-vessels. B, the outer parenchyma, or pulp, with its vessels, and ligneous fibres interspersed. C, the inner parenchyma, or acetary, with its vessels, which are larger than the outer one. D, the core and seeds. Plate CCCXCVI

Fig. 20. a piece cut off fig. 19.

Fig. 21. is fig. 20. magnified. A A A, the small grains or globules, with the vessels radiated from them.

Fig. 22. a longitudinal section of the pear, showing a different view of the same parts with those of fig. 19. A the channel, or duct, which runs from the top of the pear to the bottom of the core.

In a *lemon*, the parenchyma appears in three different forms. The parenchyma of the rind is of a coarse texture, being composed of thick fibres, woven into large bladders. Those nearest the surface contain the essential oil of the fruit, which bursts into a flame when the skin is squeezed over a candle. From this outmost parenchyma nine or ten insertions or lamellæ are produced, which run between as many portions of the pulp, and unite into one body in the centre of the fruit, which corresponds to the pith in trunks or roots. At the bottom and top of the lemon, this pith evidently joins with the rind, without the intervention of any lamellæ. This circumstance shows, that the pith and bark are actually connected in the trunk and roots of plants, though it is difficult to demonstrate the connection, on account of the closeness of their texture, and the minuteness of their fibres. Many vessels are dispersed through the whole of this parenchyma; but the largest ones stand on the inner edge of the rind, and the outer edge of the pith, just at the two extremities of each lamella.

The second kind of parenchyma is placed between the rind and the pith; is divided into distinct bodies by the lamellæ; and each of these bodies forms a large bag.

These bags contain a third parenchyma, which is a cluster of smaller bags, distinct and unconnected with each other, having a small stalk by which they are fixed to the large bag. Within each of these small bags are many hundreds of bladders, composed of extremely minute fibres. These bladders contain the acid juice of the lemon.

Plate CCCXCV. Fig. 12. a longitudinal section of a lemon. A A A, the rind with the vessels which contain the essential oil. B B, the substance corresponding to the pith, formed by the union of the lamellæ or insertions. C C, its continuation and connection with the rind, independent of the insertions.

Fig. 13. a tranverse section of the lemon. B B B, &c. the nine pulpy bags, or second parenchyma, placed between the rind and the pith; and the cluster of small bags, which contain the acid juice, inclosed in the large ones. C C, the large vessels that surround the pith. D D, two of the large bags laid open, showing the seeds, and their connection with the lamellæ or membranes which form the large bags.

Of the Perspiration of PLANTS, *and the quantity of moisture daily imbibed by them.*—These curious particulars have been determined with great accuracy by Dr Hales. The method he took to accomplish his purpose was as follows.—In the month of July, commonly the warmest season of the year, he took a large sun-flower three feet and an half high, which had been purposely planted in a flower-pot when young. He covered the pot with thin milled lead, leaving only a small hole to preserve a communication with the external air, and another by which he might occasionally supply the plant with water. Into the former he inserted a glass tube nine inches long, and another shorter tube into the hole by which he poured in the water; and the latter was kept close stopped with a cork, except when there was occasion to use it. The holes in the bottom of the pot were also stopped up with corks, and all the crevices shut with cement.—Things being thus prepared, the pot and plant were weighed for 15 several days; after which the plant was cut off close to the leaden plate, and the stump well covered with cement. By weighing, he found that there perspired through the unglazed porous pot two ounces every 12 hours; which being allowed for in the daily weighing of the plant and pot, the greatest perspiration, in a warm day, was found to be one pound 14 ounces; the middle rate of perspiration, one pound four ounces; the perspiration of a dry warm night, without any sensible dew, was about three ounces; but when there was any sensible though small dew, the perspiration was nothing; and when there was a large dew, or some little rain in the night, the plant and pot was increased in weight two or three ounces.

In order to know what quantity was perspired from a square inch of surface, our author cut off all the leaves of the plant, and laid them in five several parcels, according to their several sizes; and then measured the surface of a leaf of each parcel, by laying over it a large lattice made with threads, in which each of the little squares were $\frac{1}{4}$ of an inch; by numbering of which, he had the surface of the leaves in square inches; which, multiplied by the number of leaves in the corresponding parcels, gave the area of all the leaves. By this method he found the surface of the whole plant above ground to be 5616 square inches, or 39 square feet. He dug up another sun-flower of nearly the same size, which had eight main roots, reaching 15 inches deep and sidewise, from the stem. It had besides a very thick bush of lateral roots from the eight main roots, extending every way in a hemisphere about nine inches from the stem and main roots. In order to estimate the length of all the roots, he took one of the main roots with its laterals, and measured and weighed them; and then weighed the other seven with their laterals; by which means he found the sum of all their lengths to be 1448 feet. Supposing then the periphery of these roots at a medium to be 0.131 of an inch, then their surface will be 2276 square inches, or 15.8 square feet; that is, equal to 0.4 of the surface of the plant above ground. From calculations drawn from these observations, it appears, that a square inch of the upper surface of this plant perspires $\frac{1}{165}$ part of an inch in a day and a night; and that a square inch of the surface underground imbibed $\frac{1}{65}$ of an inch in the same time.

The quantity perspired by different plants, however, is by no means equal. A vine-leaf perspires only $\frac{1}{191}$ of an inch in 12 hours; a cabbage perspires $\frac{1}{80}$ of an inch in the same time; an apple-tree $\frac{1}{102}$ in 12 hours; and a lemon $\frac{1}{243}$ in 12 hours.

Of the circulation of the Sap in PLANTS.—Concerning this there have been great disputes; some maintaining, that the vegetable sap has a circulation analogous to the blood of animals; while others affirm, that it only ascends in the day-time, and descends again in the night. In favour of the doctrine of circulation it has been urged, that upon making a transverse incision into the trunk of a tree, the juice which runs out proceeds in greater quantity from the upper than the lower part; and the swelling in the upper lip is also much greater than in the lower. It appears, however, that when two similar incisions are made, one near the top and the other near the root, the latter expends much more sap than the former. Hence it is concluded, that the juice ascends by one set of vessels and descends by another. But, in order to show this clearly, it would be necessary first to prove that there is in plants, as in animals, some kind of centre from which the circulation begins, and to which it returns; but no such centre has been discovered by any naturalist; neither is there the least provision apparently made by nature whereby the sap might be prevented from descending in the very same vessels through which it ascends. In the lacteal vessels of animals, which we may suppose to be analogous to the roots of vegetables, there are valves which effectually ly prevent the chyle when once absorbed from returning into the intestines; but no such thing is observed in the vessels of vegetables: whence it must be very probable, that when the propelling force ceases, the juice descends by the very same vessels through which it ascended.— This matter, however, has been cleared up almost as well as the nature of the subject will admit of by the experiments of Dr Hales ‡. These experiments are so numerous, that for a particular account of them we must refer to the work itself; however, his reasoning against the circulation of the sap will be sufficiently intelligible without them. "We see (says he), in many of the foregoing experiments, what quantities of moisture trees daily imbibe and perspire: now the celerity of the sap must be very great, if that quantity of moisture must, most of it, ascend to the top of the tree, then descend, and ascend again, before it is carried off by perspiration.

‡ *Vegetable Statics*, vol. i. p. 142.

"The defect of a circulation in vegetables seems in some measure to be supplied by the much greater quantity of liquor, which the vegetable takes in, than the animal, whereby its motion is accelerated; for we find the sun-flower, bulk for bulk, imbibes and perspires 17 times more fresh liquor than a man, every 24 hours.

"Besides, Nature's great aim in vegetables being only that the vegetable life be carried on and maintained, there was no occasion to give its sap the rapid motion which was necessary for the blood of animals.

"In animals, it is the heart which sets the blood in motion, and makes it continually circulate; but in vegetables we can discover no other cause of the sap's motion but the strong attraction of the capillary sap-vessels, assisted by the brisk undulations and vibrations caused by the sun's warmth, whereby the sap is carried up to the top of the tallest trees, and is there perspired off through the leaves: but when the surface of the tree is greatly diminished by the loss of its leaves, then also the perspiration and motion of the sap is proportionably diminished, as is plain from many of the foregoing experiments: so that the ascending velocity of the sap is principally accelerated by the plentiful perspiration of the leaves, thereby making room for the fine capillary vessels to exert their vastly attracting power, which perspiration is effected by the brisk rarefying vibrations of warmth; a power that does not seem to be any ways well adapted to make the sap descend from the tops of vegetables by different vessels to the root.

"If the sap circulated, it must needs have been seen descending from the upper part of large gashes cut in branches set in water, and with columns of water pressing on their bottoms in long glass tubes. In both which cases, it is certain that great quantities of water passed through the stem, so that it must needs have been seen descending, if the return of the sap downwards were by trusion or pulsion, whereby the blood in animals is returned through the veins to the heart; and that pulsion, if there were any, must necessarily be exerted with prodigious force, to be able to drive the sap through the finer capillaries. So that, if there be a return of the sap downwards, it must be by attraction, and that a very powerful one, as we may see by many of these experiments. But it is hard to conceive what and where that power is which can be equivalent to that provision nature has made for the ascent of the sap in consequence of the great perspiration of the leaves.

"The instances of the jessamine-tree, and of the passion-tree, have been looked upon as strong proofs of the circulation of the sap, because their branches, which were far below the inoculated bud, were gilded: but we have many visible proofs in the vine, and other bleeding trees, of the sap's receding back, and pushing forwards alternately, at different times of the day and night. And there is great reason to think that the sap of all other trees has such an alternate, receding, and progressive motion, occasioned by the alternacies of day and night, warm and cool, moist and dry.

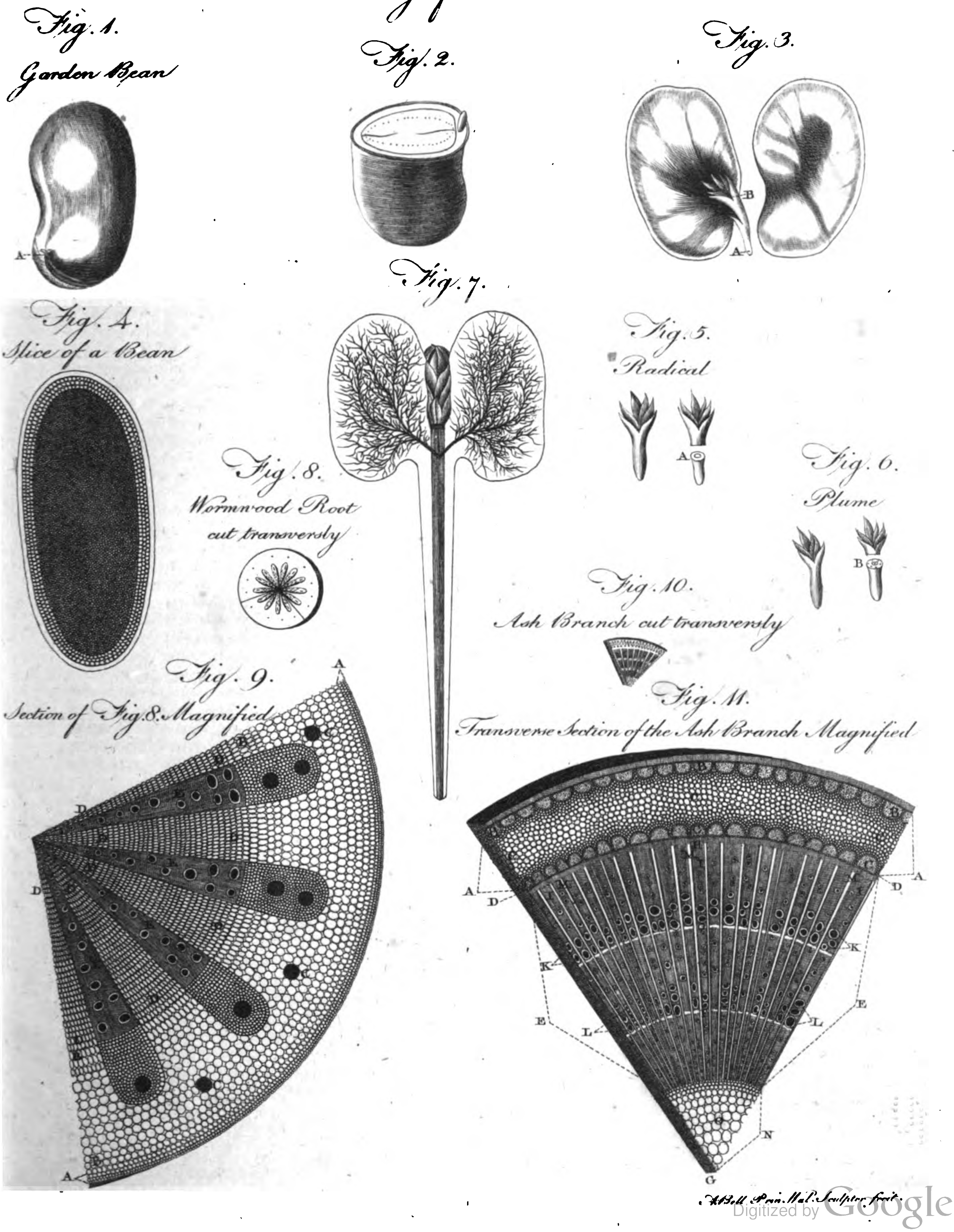
"For the sap in all vegetables does probably recede in some measure from the tops of the branches, as the sun leaves them; because its rarefying power then ceasing, the greatly rarefied sap, and air mixed with it, will condense, and take up less room than they did, and the dew and rain will then be strongly imbibed by the leaves; whereby the body and branches of the vegetable which have been much exhausted by the great evaporation of the day, may at night imbibe sap and dew from the leaves; for by several experiments, plants were found to increase considerably in weight, in dewy and moist nights. And by other experiments on the vine, it was found that the trunk and branches of vines were always in an imbibing state, caused by the great perspiration of the leaves, except in the bleeding season; but when at night that perspiring power ceases, then the contrary imbibing power will prevail, and draw the sap and dew from the leaves, as well as moisture from the roots.

"And we have a farther proof of this by fixing mercurial gages to the stems of several trees which do not bleed, whereby it is found that they are always in a strongly imbibing state, by drawing up the mercury several inches: whence it is easy to conceive, how some of the particles of the gilded bud in the inoculated jessamine may be absorbed by it, and thereby communicate their gilding miasma to the sap of other branches; especially when, some months after the inoculation, the stock of the inoculated jessamine is cut off a little above the bud; whereby the stock, which was the counteracting part to the stem, being taken away, the stem attracts more vigorously from the bud.

"Another argument for the circulation of the sap is, that some sorts of the graffs will infect and canker the stocks they are grafted on: but by mercurial gages fixed to fresh-cut stems of trees, it is evident that those stems were in a strongly imbibing state; and consequently the cankered stocks might very likely draw sap from the graff, as well as the graff alternately from the stock; just in the same manner as leaves and branches do from each other, in the vicissitudes of day and night. And this imbibing power of the stock is so great, where only some of the branches of a tree are grafted, that the remaining branches of the stock will, by their strong attraction, starve those graffs; for which reason it is usual to cut off the greatest part of the branches of the stock, leaving only a few small ones to draw up the sap.

"The instance of the ilex grafted upon the English oak, seems to afford a very considerable argument against a circulation. For, if there were a free uniform

Anatomy of PLANTS. Plate CCCXCIV.



A. Bell Prin. Wal. Sculptor fecit.

Fig. 12.
A Lemon cut down.

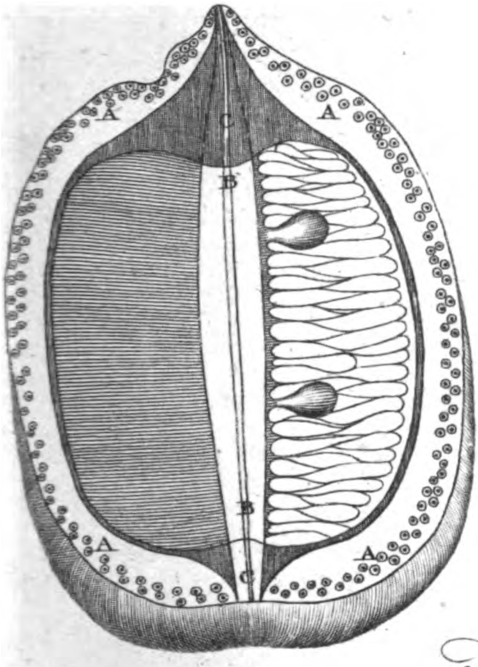


Fig. 13.
Lemon cut Transversly.

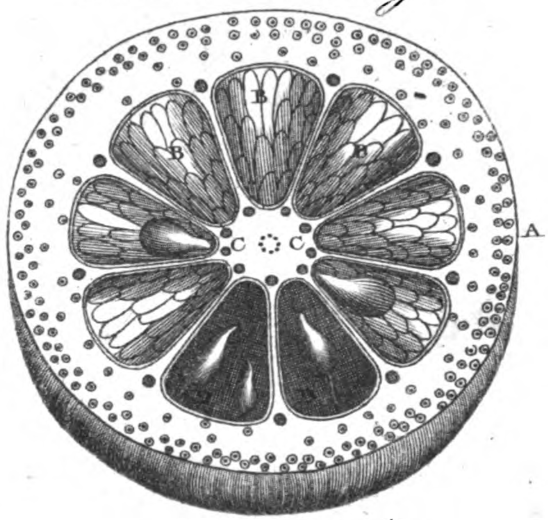


Fig. 16.

Fig. 14.
Vine Leaf.

Fig. 15.

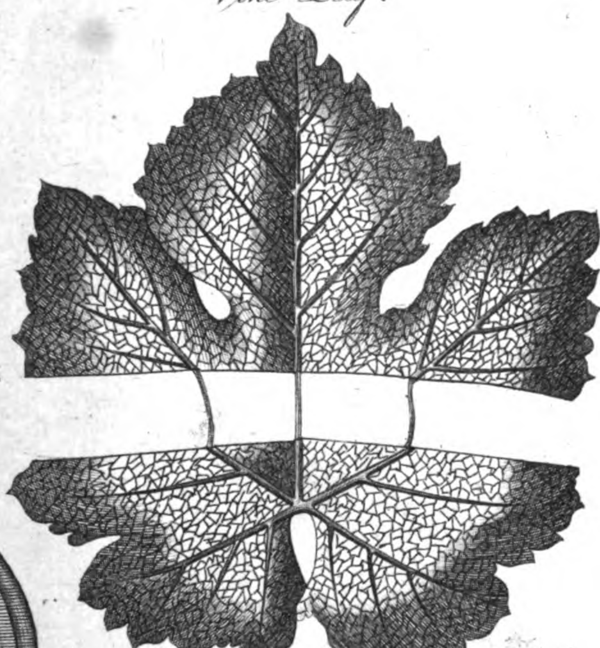


Fig. 17.

17.

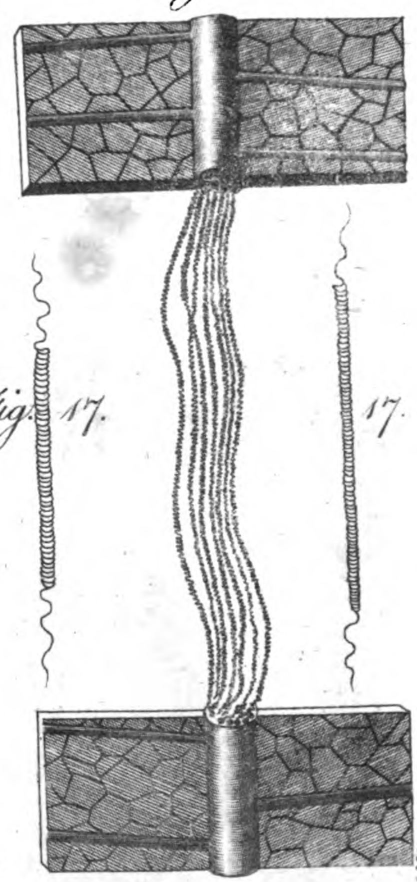


Fig. 18.
Tulip Root.

A. Bell Prin. Wal. Sculptor fecit.

Fig. 12.
A Lemon cut down.

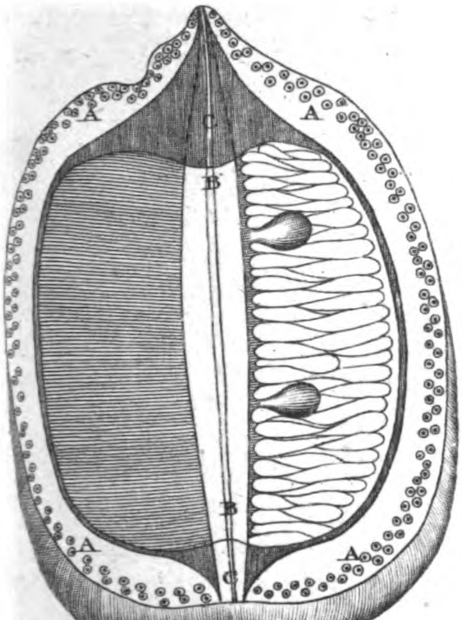


Fig. 13.
Lemon cut Transversly.

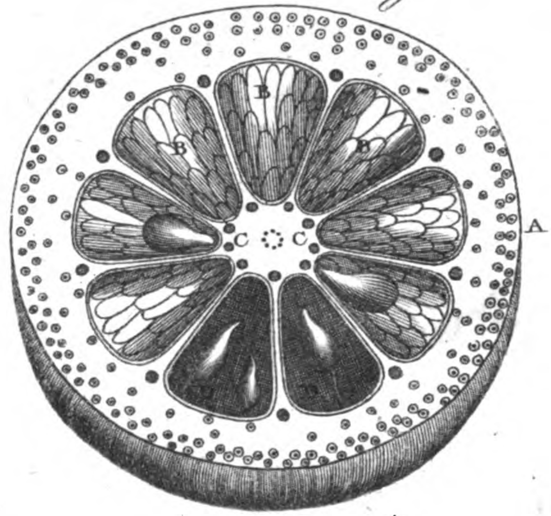


Fig. 16.

Fig. 17.

17.

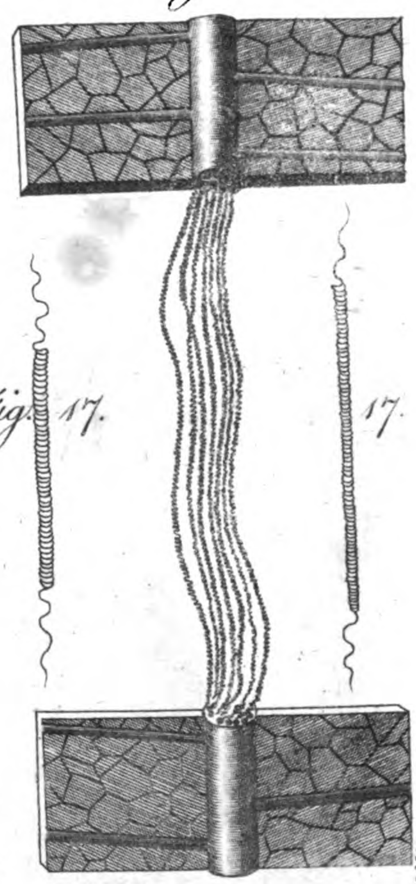


Fig. 14.
Vine Leaf.

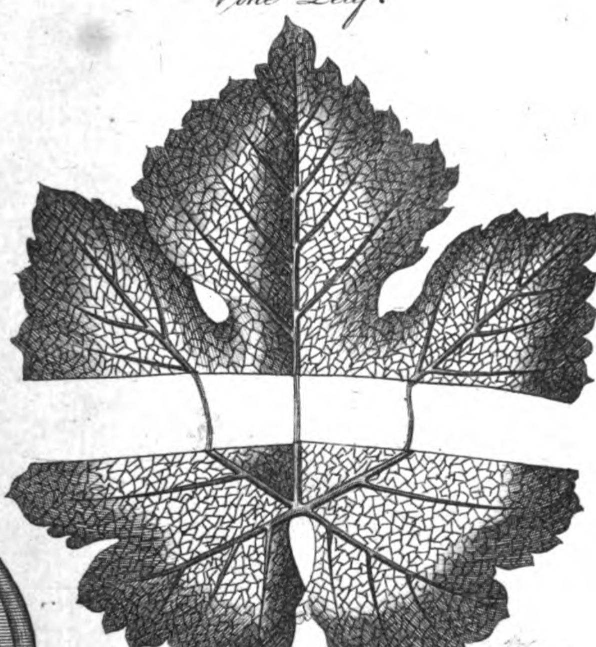


Fig. 15.

Fig. 18.
Tulip Root.

A. Bell Prin. Hal. Sculptor.

Anatomy of PLANTS.

Plate CCCXCVI.

Fig. 22.
Pear cut Longitudinally.

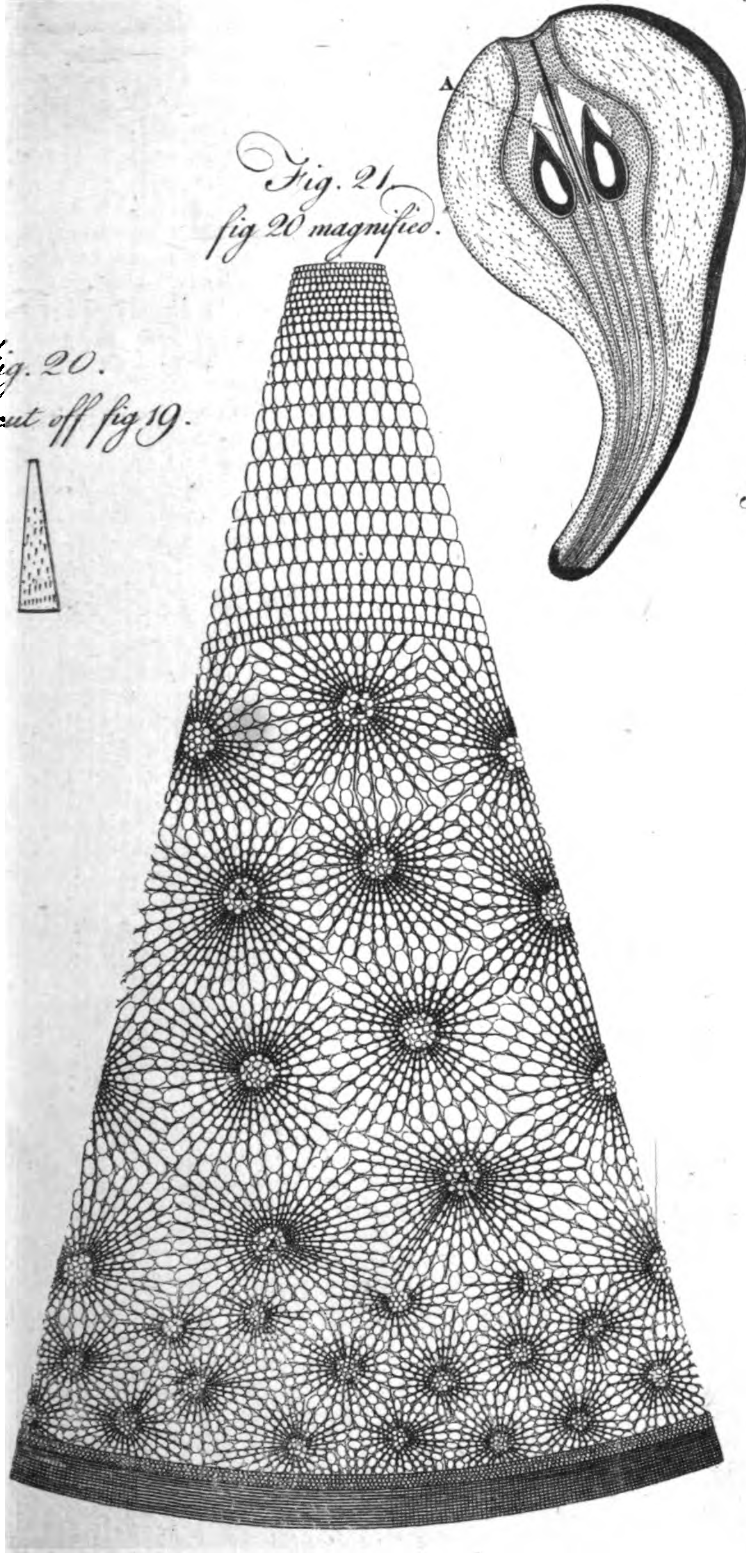


Fig. 19.
Pear cut Transversely.

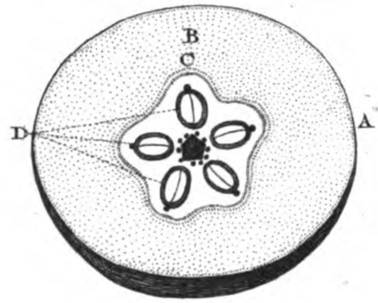


Fig. 21
fig 20 magnified.

Fig. 20.
piece cut off fig 19.

Patagonian Pinguin.

A.Bell Prin.Wal.Sculptor fecit.

Plant.

form circulation of the sap through the oak and ilex, why should the leaves of the oak fall in winter, and not those of the ilex?

"Another argument against an uniform circulation of the sap in trees, as in animals, may be drawn from an experiment, where it was found by the three mercurial gages fixed to the same vine, that while some of its branches changed their state of protruding sap into a state of imbibing, others continued protruding sap; one nine, and the other thirteen days longer."

To this reasoning of Dr Hales we shall subjoin an experiment made by Mr Mustel of the Academy of Sciences at Rouen, which seems decisive against the doctrine of circulation. His account of it is as follows.—"On the 12th of January I placed several shrubs in pots against the windows of my hot-house, some within the house and others without it. Through holes made for this purpose in the panes of glass, I passed a branch of each of the shrubs, so that those on the inside had a branch without, and those on the outside one within; after this, I took care that the holes should be exactly closed and luted. This inverse experiment, I thought, if followed closely, could not fail affording sufficient points of comparison, to trace out the differences, by the observation of the effects.

"The 20th of January, a week after this disposition, all the branches that were in the hot-house began to disclose their buds. In the beginning of February there appeared leaves; and towards the end of it, shoots of a considerable length, which presented the young flowers. A dwarf apple-tree, and several rose-trees, being submitted to the same experiment, showed the same appearance then as they commonly put on in May; in short, all the branches which were within the hot-house, and consequently kept in the warm air, were green at the end of February, and had their shoots in great forwardness. Very different were those parts of the same tree which were without and exposed to the cold. None of these gave the least sign of vegetation; and the frost, which was intense at that time, broke a rose-pot placed on the outside, and killed some of the branches of that very tree which, on the inside, was every day putting forth more and more shoots, leaves, and buds, so that it was in full vegetation on one side, whilst frozen on the other.

"The continuance of the frost occasioned no change in any of the internal branches. They all continued in a very brisk and verdant state, as if they did not belong to the tree which, on the outside, appeared in the state of the greatest suffering. On the 15th of March, notwithstanding the severity of the season, all was in full bloom. The apple-tree had its root, its stem, and part of its branches, in the hot-house. These branches were covered with leaves and flowers; but the branches of the same tree, which were carried on the outside, and exposed to the cold air, did not in the least partake of the activity of the rest, but were absolutely in the same state which all trees are in during winter. A rose-tree, in the same position, showed long shoots with leaves and buds; it had even shot a vigorous branch upon its stalk; whilst a branch which passed through to the outside had not begun to produce any thing, but was in the same state with other rose-trees left in the ground. This branch is four lines in diameter, and 18 inches high.

"The rose-tree on the outside was in the same state; but one of its branches drawn through to the inside of the hot-house was covered with leaves and rose-buds. It was not without astonishment that I saw this branch shoot as briskly as the rose-tree which was in the hot-house, whose roots and stalk, exposed as they were to the warm air, ought, it should seem, to have made it get forwarder than a branch belonging to a tree, whose roots, trunk, and all its other branches, were at the very time frost-nipped. Notwithstanding this, the branch did not seem affected by the state of its trunk; but the action of the heat upon it produced the same effect as if the whole tree had been in the hot-house."

Of the Perpendicularity of PLANTS.—This is a curious phenomenon in natural history, which was first observed by M. Dodart, and published in an essay on the affectation of perpendicularity observed in the stems or stalks of all plants, in the roots of many, and even in their branches, as much as possible. Though almost all plants rise a little crooked, yet the stems shoot up perpendicularly, and the roots sink down perpendicularly: even those, which by the declivity of the soil come out inclined, or those which are diverted out of the perpendicular by any violent means, again redress and straighten themselves and recover their perpendicularity, by making a second and contrary bend or elbow without rectifying the first. We commonly look upon this affectation without any surprise; but the naturalist who knows what a plant is, and how it is formed, finds it a subject of astonishment.

Memoires de l'Acad. Royal des Sciences, an. 1708.

Each seed we know contains in it a little plant, already formed, and needing nothing but to be unfolded; the little plant has its root; and the pulp, which is usually separated into two lobes, is the foundation of the first food it draws by its root when it begins to germinate. If a seed in the earth therefore be disposed so as that the root of the little plant be turned downwards, and the stem upwards, and even perpendiculary upwards, it is easy to conceive that the little plant coming to unfold itself, its stalk and root need only follow the direction they have to grow perpendicularly. But we know that the seeds of plants, whether sown of themselves or by man, fall in the ground at random; and among the great variety of situations with regard to the stalk of their plant, the perpendicular one upwards is but one. In all the rest, therefore, it is necessary that the stalk rectify itself, so as to get out of the ground: but what force effects this change, which is unquestionably a violent action? Does the stalk find a less load of earth above it, and therefore go naturally that way where it finds the least obstacle? Were this so, the little root, when it happens to be uppermost, must also follow that direction, and mount up.

To account for two such different actions, M. Dodart supposes that the fibres of the stalks are of such a nature as to be contracted and shortened by the heat of the sun, and lengthened out by the moisture of the earth; and, on the contrary, that the fibres of the roots are contracted by the moisture of the earth, and lengthened by the heat of the sun. When the plantule therefore is inverted, and the root at the top, the fibres which compose one of the branches of the root are not alike exposed to the moisture of the earth, the lower part being more exposed than the upper. The lower must of course contract the most; and this contraction is again promoted by the lengthening of the upper, whereon on the sun acts with the greatest force. This branch of the root must therefore recoil towards the earth, and, insinuating through the pores thereof, must get underneath the bulb, &c. By inverting this reasoning we discover how the stalk comes to get uppermost.

We suppose then that the earth attracts the root to itself, and that the sun contributes to its descent; and, on the other hand, that the sun attracts the stem, and the earth contributes to send it towards the same. With respect to the straightening of the stalks in the open air, our author imagines that it arises from the impression of external causes, particularly the sun and rain. For the upper part of a stalk that is bent is more exposed to the rain, dew, and even the sun, &c. than the under; and these causes, in a certain structure of the fibres, both equally tend to straighten the part most exposed by the shortening they successively occasion in it; for moisture shortens by swelling and heat by dissipating. What that structure is which gives the fibres such different qualities, or whereon it depends, is a mystery as yet beyond our depth.

M. de la Hire accounts for the perpendicularity of the stems or stalks of plants in this manner: he supposes that the root of plants draws a coarser and heavier juice, and the stem and branches a finer and more volatile one. Most naturalists indeed conceive the root to be the stomach of the plant, where the juices of the earth are subtilized so as to become able to rise through the stem to the extremity of the branches. This difference of juices supposes larger pores in the roots than the stalk, &c. and, in a word, a different contexture. This difference must be found even in the little invisible plant inclosed in the seed: in it, therefore, we may conceive a point of separation; such as, that all on one side, for example the root, shall be unfolded by the grosser juices, and all on the other side by the more subtile ones. Suppose the plantule, when its parts begin to unfold, to be entirely inverted, the root at the top, and the stalk below; the juices entering the root will be coarsest, and when they have opened and enlarged the pores so as to admit juices of a determinate weight, those juices pressing the root more and more will drive it downwards; and this will increase as the root is more extended or enlarged: for the point of separation being conceived as the fixed point of a lever, they will act by the longer arm. The volatile juices at the same time having penetrated the stalk, will give it a direction from below upwards; and, by reason of the lever, will give it more and more every day. The little plant is thus turned on its fixed point of separation till it become perfectly erect.

When the plant is thus erected, the stalk should still rise perpendicularly, in order to give it the more firm biding, and enable it to withstand the effort of wind and weather. M. Parent thus accounts for this effect: If the nutritious juice which arrived at the extremity of a rising stalk evaporate, the weight of the air which encompasses it on all sides will make it ascend vertically: but if, instead of evaporating, it congeal, and remain fixed to that extremity whence it was ready to go off, the weight of the air will give it the same direction; so that the stalk will have acquired a small new part vertically laid over it, just as the flame in a candle held in any way obliquely to the horizon still continues vertical by the pressure of the atmosphere. The new drops of juice that succeed will follow the same direction; and as all together form the stalk, that must of course be vertical, unless some particular circumstance intervene.

The branches, which are at first supposed to proceed laterally out of the stalk in the first embryo of the plant, though they should even come out in an horizontal direction, must also raise themselves upwards by the constant direction of the nutritious juice, which at first scarce meets any resistance in a tender supple branch; and afterwards, even though the branch grow more firm, it will act with the more advantage; since the branch, being become longer, furnishes it with a longer arm or lever. The slender action of even a little drop becomes very considerable by its continuity, and by the assistance of such circumstances. Hence may we account for that regular situation and direction of the branches, since they all make nearly the same constant angle of 45° with the stem, and with one another.

M. Astruc accounts for the perpendicularity of the stems, and their redressing themselves, thus: 1. He thinks the nutritious juice arises from the circumference of the plant, and terminates in the pith: And, 2. That fluids, contained in tubes either parallel or oblique to the horizon, gravitate on the lower part of the tubes, and not at all on the upper. Hence it follows, that, in a plant placed either obliquely or parallel to the horizon, the nutritious juice will act more on the lower part of the canals than on the upper; and by this means they will insinuate more into the canals communicating therewith, and be collected more copiously therein: thus the parts on the lower side will receive more accretion and be more nourished than those on the upper, the extremity of the plant will therefore be obliged to bend upwards.

This principle brings the seed into its due situation at first. In a bean planted upside down, the plume and radicle may be seen with the naked eye shooting at first directly for about an inch; after which they begin to bend, the one downward, and the other upward. The same is the case in a heap of barley to be made into malt, or in a quantity of acorns laid to sprout in a moist place, &c. Each grain of barley and each acorn has a different situation; and yet every sprout tends directly upward, and every root downward, and the curvity or bend they make is greater or less as their situation approaches more or less to the direction wherein no curvature at all would be necessary. But two such opposite motions cannot possibly arise without supposing some difference between the two parts: the only one we know of is, that the plume is fed by a juice imported to it by tubes parallel to its sides, whereas the radical imbibes its nourishment at every pore in its surface. When the plume therefore is either parallel or inclined to the horizon, the nutritious juice, feeding the lower parts more than the upper, will determine its extremes to turn upward, for the reasons before given. On the contrary, when the radicle is in the like situation, the nutritious juice penetrating through the upper part more copiously than through the under, there will be a greater accretion of the former than of the latter; and the radicle will therefore be bent downwards, and this mutual curvity of the plume and radicle must continue till such time as their sides are nourished alike, which cannot be till they are perpendicular.

Of the Food of Plants.—This hath been so fully discussed

Plants

discussed under the article AGRICULTURE †, that little remains to be said upon the subject in this place. The method of making dephlogisticated or vital air *de novo*, is now so much improved, that numberless experiments may be made with it both on animals and vegetables. It appears, indeed, that these two parts of the creation are a kind of counterbalance to one another; and the noxious parts or excrements of the one prove salutary food to the other. Thus, from the animal body continually pass off certain effluvia, which vitiate or *phlogisticate* the air. Nothing can be more prejudicial to animal life than an accumulation of these effluvia: on the other hand, nothing is more favourable to vegetables than those excrementitious effluvia of animals; and accordingly they greedily absorb them from the earth, or from the air. With respect to the excrementitious parts of living vegetables, the case is reversed. The purest air is the common effluvium which passes off from vegetables; and this, however favourable to animal life, is by no means so to vegetable; whence we have an additional proof of the doctrine concerning the food of plants delivered under the article AGRICULTURE.

† Part i. sect. i.

With regard to the effects of other kinds of air on vegetation, a difference of some consequence took place between Dr Priestley and Dr Percival. The former, in the first volume of his Experiments and Observations on Air, had asserted that fixed air is fatal to vegetable as well as to animal life. This opinion, however, was opposed by Dr Percival, and the contrary one adopted by Dr Hunter of York in the Georgical Essays, vol. v. The experiments related by these two gentlemen would indeed have been decisive, had they been made with sufficient accuracy. That this was the case, however, Dr Priestley denies; and in the 3d volume of his Treatise on Air has fully detected the mistakes in Dr Percival's Experiments; which proceeded in fact from his having used, not fixed air, but common air mixed with a small quantity of fixed air. His experiments, when repeated with the purest fixed air, and in the most careful manner, were always attended with the same effect, namely, the killing of the plant.

It had also been asserted by Drs Percival and Hunter, that water impregnated with fixed air was more favourable to vegetation than simple water. This opinion was likewise examined by Dr Priestley: however, his experiments were indecisive; but seem rather unfavourable to the use of fixed air than otherwise.

Another very remarkable fact with regard to the food of plants has been discovered by Dr Priestley; namely, that some of them, such as the willow, comfrey, and duck-weed, are nourished by inflammable air. The first, he says, flourishes in this species of air so remarkably, that, "it may be said to feed upon it with great avidity. This process terminates in the change of what remains of the inflammable air into phlogisticated air, and sometimes into a species of air as good as common air, or even better; so that it must be the *inflammable principle* in the air that the plant takes, converting it, no doubt, into its proper nourishment."

Priestley on Air, vol. v. p. 2.

What the followers of Stahl call phlogisticated air and inflammable air, are so closely allied to each other, that it is no wonder they should serve promiscuously for the food of plants. The reason why both are not agreeable to all kinds of plants, most probably is the different quantity of phlogistic matter contained in them, and the different action of the latent fire they contain: for all plants do not require an equal quantity of nourishment; and such as require but little, will be destroyed by having too much. The action of heat also is essentially necessary to vegetation; and it is probable that very much of this principle is absorbed from the air by vegetables. But if the air by which plants are partly nourished contains too much of that principle, it is very probable that they may be destroyed from this cause as well as the other; and thus inflammable air, which contains a vast quantity of that active principle, may destroy such plants as grow in a dry soil, though it preserves those which grow in a wet one. See VEGETATION.

Dissemination of PLANTS.—So great are the prolific powers of the vegetable kingdom, that a single plant almost of any kind, if left to itself, would, in a short time, over-run the whole world. Indeed, supposing the plant to have been only a single annual, with two seeds, it would, in 20 years, produce more than a million of its own species; what numbers then must have been produced by a plant whose seeds are so numerous as many of those with which we are acquainted? See *NATURAL History*, sect. iii. p. 654, &c. In that part of our work we have given particular examples of the very prolific nature of plants, which we need not repeat here; and we have made some observations on the means by which they are carried to distant places. This is a very curious matter of fact, and as such we shall now give a fuller account of it.

If nature had appointed no means for the scattering of these numerous seeds, but allowed them to fall down in the place where they grew, the young vegetables must of necessity have choaked one another as they grew up, and not a single plant could have arrived at perfection. But so many ways are there appointed for the dissemination of plants, that we see they not only do not hinder each others growth, but a single plant will in a short time spread through different countries. The most evident means for this purpose are,

1. The force of the air.—That the efficacy of this may be the greater, nature has raised the seeds of vegetables upon stalks, so that the wind has thus an opportunity of acting upon them with the greater advantage. The seed-capsules also open at the apex, lest the ripe seeds should drop out without being widely dispersed by the wind. Others are furnished with wings, and a pappous down, by which, after they come to maturity, they are carried up into the air, and have been known to fly the distance of 50 miles: 138 genera are found to have winged seeds.

2. In some plants the seed-vessels open with violence when the seeds are ripe, and thus throw them to a considerable distance; and we have an enumeration of 50 genera whose seeds are thus dispersed.

3. Other seeds are furnished with hooks, by which, when ripe, they adhere to the coats of animals, and are carried by them to their lodging places. Linnæus reckons 50 genera armed in this manner.

4. Many seeds are dispersed by means of birds and other animals; who pick up the berries, and afterwards eject the seeds uninjured. Thus the fox disseminates the privet, and man many species of fruit. The plants found growing upon walls and houses, on the tops of high

high rocks, &c. are mostly brought there by birds; and it is universally known, that by manuring a field with new dung, innumerable weeds will spring up which did not exist there before: 193 species are reckoned up which may be disseminated in this manner.

5. The growth of other seeds is promoted by animals in a different way. While some are eaten, others are scattered and trodden into the ground by them. The squirrel gnaws the cones of the pine, and many of the seeds fall out. When the loxica eats off their bark, almost his only food, many of their seeds are committed to the earth, or mixed in the morass with moss, where he had retired. The glandularia, when she hides up her nuts, often forgets them, and they strike root. The same is observable of the walnut; mice collect and bury great quantities of them, and being afterwards killed by different animals, the nuts germinate.

6. We are astonished to find mosses, fungi, byssus, and mucor, growing everywhere; but it is for want of reflecting that their seeds are so minute that they are almost invisible to the naked eye. They float in the air like atoms, and are dropped everywhere, but grow only in those places where there was no vegetation before; and hence we find the same mosses in North America and in Europe.

7. Seeds are also dispersed by the ocean, and by rivers. "In Lapland (says Linnæus), we see the most evident proofs how far rivers contribute to deposite the seeds of plants. I have seen Alpine plants growing upon their shores frequently 36 miles distant from the Alps; for their seeds falling into the rivers, and being carried along and left by the stream, take root there.—We may gather likewise from many circumstances how much the sea furthers this business.—In Roslagia, the island of Græsœa, Oeland, Gothland, and the shores of Scania, there are many foreign and German plants not yet naturalized in Sweden. The centaury is a German plant, whose seeds being carried by the wind into the sea, the waves landed this foreigner upon the coasts of Sweden. I was astonished to see the veronica maritima, a German plant, growing at Tornea, which hitherto had been found only in Græsœa: the sea was the vehicle by which this plant was transported thither from Germany; or possibly it was brought from Germany to Græsœa, and from thence to Tornea. Many have imagined, but erroneously, that seed corrupts in water, and loses its principle of vegetation. Water at the bottom of the sea is seldom warm enough to destroy seeds; we have seen water cover the surface of a field for a whole winter, while the seed which it contained remained unhurt, unless at the beginning of spring the waters were let down so low by drains, that the warmth of the sunbeams reached to the bottom. Then the seeds germinate, but presently become putrescent; so that for the rest of the year the earth remains naked and barren.

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Rain and showers carry seeds into the cracks of the earth, streams, and rivers; which last, conveying them to a distance from their native places, plant them in a foreign soil."

8. Lastly, some seeds assist their projection to a distance in a very surprising manner. The crupina, a species of centaury, has its seeds covered over with erect bristles, by whose assistance it creeps and moves about in such a manner, that it is by no means to be kept in the hand. If you confine one of them between the stocking and the foot, it creeps out either at the sleeve or neck-band, travelling over the whole body. If the bearded oat, after harvest, be left with other grain in the barn, it extricates itself from the glume; nor does it stop in its progress till it gets to the walls of the building. Hence, says Linnæus, the Dalecarlian, after he has cut and carried it into the barn, in a few days finds all the glumes empty, and the oats separate from them; for every oat has a spiral arista or beard annexed to it, which is contracted in wet, and extended in dry weather. When the spiral is contracted, it drags the oat along with it: the arista being bearded with minute hairs pointing downward, the grain necessarily follows it; but when it expands again, the oat does not go back to its former place, the roughness of the beard the contrary way preventing its return. If you take the seeds of equisetum, or fern, these being laid upon paper, and viewed in a microscope, will be seen to leap over any obstacle as if they had feet; by which they are separated and dispersed one from another; so that a person ignorant of this property would pronounce these seeds to be so many mites or small insects.

We cannot finish this article without remarking, that many ingenious men (A) believe that plants have a power of perception. Of this opinion we shall now give an account from the second volume of the Manchester Transactions, where we find some *speculations on the perceptive power of vegetables by Dr Percival*, who attempts to show, by the several analogies of organization, life, instinct, spontaneity, and self-motion, that plants, like animals, are endued with the powers both of perception and enjoyment. The attempt is ingenious, and is ingeniously supported, but in our opinion fails to convince. That there is an analogy between animals and vegetables is certain; but we cannot from thence conclude that they either perceive or enjoy. Botanists have, it is true, derived from *anatomy* and *physiology*, almost all the terms employed in the description of plants. But we cannot from thence conclude, that their organization, tho' it bears an analogy to that of animals, is the sign of *a living principle*, if to this *principle* we annex the idea of *perception*; yet so fully is our author convinced of the truth of it, that he does not think it extravagant to suppose, that, in some future period, perceptivity may be discovered to extend even beyond the limits now assigned to vegetable life. Corallines, madrepores, millepores, and spunges, were formerly considered as fossil bodies:

(A) The ingenious Dr Bell held this opinion, as appears from the close of his *Thesis de Physiologia Plantarum*, which was published at Edinburgh, June 1777, and a translation of which by Dr Currie we find in the second volume of the Manchester Transactions, where our readers will also find memoirs of its author. Dr Currie informs us, that Dr Hope, the late excellent professor of botany in Edinburgh, in his course of lectures, used to speak of Dr Bell with the highest esteem; but did not approve of the idea which he entertained respecting the feeling or perception of plants.

Plants. dies: But the experiments of Count Marsigli evinced, that they are endued with life, and led him to class them with the maritime plants. And the observations of Ellis, Jussieu, and Peyssonel, have since raised them to the rank of animals. The detection of error, in long established opinions concerning one branch of natural knowledge, justifies the suspicion of its existence in others, which are nearly allied to it. And it will appear from the prosecution of our inquiry into the instincts, spontaneity, and self-moving power of vegetables, that the suspicion is not without foundation.

He then goes on to draw a comparison between the instincts of animals and those of vegetables: the calf, as soon as it comes into the world, applies to the teats of the cow; and the duckling, though hatched under a hen, runs to the water.

"Instincts analogous to these (says our author), operate with equal energy on the vegetable tribe. A seed contains a germ, or plant in miniature, and a radicle, or little root, intended by nature to supply it with nourishment. If the seed be sown in an inverted position, still each part pursues its proper direction. The plumula turns upward, and the radicle strikes downward into the ground. A hop-plant, turning round a pole, follows the course of the sun, from south to west, and soon dies, when forced into an opposite line of motion: but remove the obstacle, and the plant will quickly return to its ordinary position. The branches of a honey-suckle shoot out longitudinally, till they become unable to bear their own weight; and then strengthen themselves, by changing their form into a spiral: when they meet with other living branches, of the same kind, they coalesce, for mutual support, and one spiral turns to the right and the other to the left; thus seeking, by an instinctive impulse, some body on which to climb, and increasing the probability of finding one by the diversity of their course: for if the auxiliary branch be dead, the other uniformly winds itself round from the right to the left.

"These examples of the instinctive economy of vegetables have been purposely taken from subjects familiar to our daily observation. But the plants of warmer climates, were we sufficiently acquainted with them, would probably furnish better illustrations of this acknowledged power of animality: and I shall briefly recite the history of a very curious exotic, which has been delivered to us from good authority; and confirmed by the observations of several European botanists." Plants.

The Doctor then goes on to give a description of the *dionaea muscipula* (B), for which see vol. vi. p. 32. and concludes, that if he has furnished any presumptive proof of the instinctive power of vegetables, it will necessarily follow that they are endued with some degree of spontaneity. More fully to evince this, however, the Doctor points out a few of those phenomena in the vegetable kingdom which seem to indicate spontaneity.—"Several years ago (says he), whilst engaged in a course of experiments to ascertain the influence of fixed air on vegetation, the following fact repeatedly occurred to me. A sprig of mint, suspended by the root, with the head downwards, in the middle glass vessel of Dr Nooth's machine, continued to thrive vigorously, without any other pabulum than what was supplied by the stream of mephitic gas to which it was exposed. In 24 hours the stem formed into a curve, the head became erect, and gradually ascended towards the mouth of the vessel; thus producing, by successive efforts, a new and unusual configuration of its parts. Such exertions in the sprig of mint, to rectify its inverted position, and to remove from a foreign to its natural element, seems to evince evolition to avoid what was evil, and to recover what had been experienced to be good. If a plant, in a garden-pot, be placed in a room which has no light except from a hole in the wall, it will shoot towards the hole, pass through it into the open air, and then vegetate upwards in its proper direction. Lord Kames relates, that, 'amongst the ruins of New Abbey, formerly a monastery in Galloway, there grows on the top of a wall a plane tree, 20 feet high. Straitened for nourishment in that barren situation, it several years ago directed roots down the side of the wall till they reached the ground ten feet below: and now the nourishment it afforded to these roots, during the time of descending, is amply repaid; having every year since that time made vigorous shoots. From the top of the wall to the surface of the earth, these roots have not thrown out a simple fibre, but are now united into a pretty thick hard root.

"The regular movements by which the sun-flower presents its splendid disk to the sun have been known to naturalists;

(B) Dr Watson, the present bishop of Landaff, who has espoused the same side of the question with Dr Percival (see the 5th vol. of his *Chemical Essays*), reasons thus on the motions of vegetables. "Whatever can produce any effect (says he) upon an animal organ as the impact of external bodies, heat and cold, the vapour of burning sulphur, of volatile alkali, want of air, &c. are found to act also upon the plants called *sensitive*. But not to insist upon any more instances, the muscular motions of the dionæa muscipula lately brought into Europe from America, seem far superior in quickness to those of a variety of animals. Now to refer the muscular motions of shell-fish and zoophytes to an internal principle of volition, to make them indicative of the perceptivity of the being, and to attribute the more notable ones of vegetables to certain mechanical dilatations and contractions of parts occasioned by external impulse, is to err against that rule of philosophizing which assigns the same causes for effects of the same kind. The motions in both cases are equally accommodated to the preservation of the being to which they belong, are equally distinct and uniform, and should be equally derived from mechanism, or equally admitted as criterions of perception.

"I am sensible that these and other similar motions of vegetables may by some be considered as analogous to the automatic or involuntary motions of animals; but as it is not yet determined amongst the physiologists, whether the motion of the heart, the peristaltic motion of the bowels, the contractions observable upon external impulse in the muscles of animals deprived of their heads and hearts, be attributable to an irritability unaccompanied with perceptivity, or to an uneasy sensation, there seems to be no reason for entering into so obscure a disquisition; especially since irritability, if admitted as the cause of the motions of vegetables, must *a fortiori* be admitted as the cause of the less exquisite and discernible motions of beings universally referred to the animal kingdom."

Plants.

naturalists, and celebrated by poets, both of ancient and modern times. Ovid founds upon it a beautiful story; and Thomson describes it as an attachment of love to the celestial luminary.

> 'But one, the lofty follower of the sun,
> 'Sad when he sets, shuts up her yellow leaves,
> 'Drooping all night; and when he warm returns,
> 'Points her enamour'd bosom to his ray.'
>
> SUMMER, line 216.

Dr Percival next touches on motion; he mentions corallines, seapens‡, oysters, &c as endued with the power of motion in a very small degree, and then he speaks in the following manner. "Mr Miller (says he), in his late account of the island of Sumatra, mentions a species of coral, which the inhabitants have mistaken for a plant, and have denominated it *lalan-cout*, or sea-grass. It is found in shallow bays, where it appears like a straight stick, but when touched withdraws itself into the sand. Now if self-moving faculties like these indicate animality, can such a distinction be denied to vegetables, possessed of them in an equal or superior degree? The water-lily, be the pond deep or shallow in which it grows, pushes up its flower-stems till they reach the open air, that the farina fecundans may perform without injury its proper office. About seven in the morning the stalk erects itself, and the flowers rise above the surface of the water: in this state they continue till four in the afternoon, when the stalk becomes relaxed, and the flowers sink and close. The motions of the sensitive plant have been long noticed with admiration, as exhibiting the most obvious signs of perceptivity. And if we admit such motions as criteria of a like power in other beings, to attribute them in this instance to mere mechanism, actuated solely by external impulse, is to deviate from the soundest rule of philosophizing, which directs us not to multiply causes when the effects appear to be the same. Neither will the laws of electricity better solve the phenomena of this animated vegetable: for its leaves are equally affected by the contact of electric and non-electric bodies; show no change in their sensibility whether the atmosphere be dry or moist; and instantly close when the vapour of volatile alkali or the fumes of burning sulphur are applied to them. The powers of chemical stimuli to produce contractions in the fibres of this plant may perhaps lead some philosophers to refer them to the *vis insita*, or irritability, which they assign to certain parts of organized matter, totally distinct from, and independent of, any sentient energy. But the hypothesis is evidently a solecism, and refutes itself. For the presence of irritability can only be proved by the experience of irritations, and the idea of irritation involves in it that of feeling.

‡ See *Pennatula*, *Ostrea*, *Mytilus*, &c.

"But there is a species of the order of decandria, which constantly and uniformly exerts a self-moving power, uninfluenced either by chemical stimuli, or by any external impulse whatsoever. This curious shrub, which was unknown to Linnæus, is a native of the East Indies, but has been cultivated in several botanical gardens here. I had an opportunity of examining it in the collection of the late Dr Brown. See HEDYSARUM.—I cannot better comment on this wonderful degree of vegetable animation than in the words of Cicero, *Inanimum est omne quod pulsu agitatur externo; quod autem est animal, id motu cietur interiore et suo.*

"I have thus attempted, with the brevity prescribed by the laws of this society, to extend our views of animated nature; to gratify the mind with the contemplation of multiplied accessions to the general aggregate of felicity; and to exalt our conceptions of the wisdom, power, and benificence of God. In an undertaking never yet accomplished, disappointment can be no disgrace: in one directed to such noble objects, the motives are a justification, independently of success. Truth, indeed, obliges me to acknowledge, that I review my speculations with much diffidence; and that I dare not presume to expect they will produce any permanent conviction in others, because I experience an instability of opinion in myself. For, to use the language of Tully, *Nescio quomodo, dum lego, assentior; cum posui librum, assensio omnis illa elabitur.*—But this scepticism is perhaps to be ascribed to the influence of habitual preconceptions, rather than to a deficiency of reasonable proof. For besides the various arguments which have been advanced in favour of vegetable perceptivity, it may be further urged, that the hypothesis recommends itself by its consonance to those higher analogies of nature, which lead us to conclude, that the greatest possible sum of happiness exists in the universe. The bottom of the ocean is overspread with plants of the most luxuriant magnitude. Immense regions of the earth are covered with perennial forests. Nor are the Alps, or the Andes, destitute of herbage, though buried in deeps of snow. And can it be imagined that such profusion of life subsists without the least sensation or enjoyment? Let us rather, with humble reverence, suppose, that vegetables participate, in some low degree, of the common allotment of vitality; and that our great Creator hath apportioned good to all living things, 'in number, weight, and measure." See *SENSITIVE Plant*, MIMOSA, *DIONÆA Muscipula*, *Vegetable MOTION*, &c.

To these ingenious and spirited observations, we shall subjoin nothing of our own, but leave our readers to determine for themselves (c). Speculations of this kind, when carried on by sober men, will never be productive of bad consequences; but by the subtle sceptic, or the more unwary inquirer, they may be made the engine of very dangerous errors. By this we do not mean to insinuate

(c) In the 2d volume of *Transactions of the Linnæan Society*, we find Dr Percival's reasoning very ably combated, as far as he draws his consequences from the external motions of plants; where it is argued, that these motions, though in some respects similar to those of animals, can and ought to be explained, without concluding that they are endowed either with perception or volition. Mr Townson concludes his paper in these words: "When all is considered (says he), I think we shall place this opinion amongst the many ingenious flights of the imagination, and soberly follow that blind impulse which leads us naturally to give sensation and perceptivity to animal life, and to deny it to vegetables; and so still say with Aristotle, and our great master Linnæus, *Vegetabilia crescunt & vivunt; animalia crescunt, vivunt, & sentiunt.*"

finuate that the fpirit of inquiry fhould be fuppreffed, becaufe that fpirit, in the hands of weak or of wicked men, may be abufed. By thofe, however, who know the bad confequences that may be drawn, and indeed that have been drawn, from the opinions we have now given an account of, our caution will not be deemed impertinent. See PHYSIOLOGY *paffim*, and particularly n° 42, and note (A), p. 678.

PLANTS growing on Animals. See *INSECTS giving root to Plants.*

Sexes of PLANTS. See SEXES, and BOTANY, fect. v.

Colours of PLANTS. See *COLOUR of Plants.*

Colours extracted from PLANTS. See *COLOUR-making*, n° 35, *et feq.*

Method of Drying and Preferving PLANTS for Botanifts.— Many methods have been devifed for the prefervation of plants: we fhall relate only thofe that have been found moft fuccefsful.

Withering's Botanical Arrangement, Introd. p. 48.

Firft prepare a prefs, which a workman will make by the following directions. Take two planks of a wood not liable to warp. The planks muft be two inches thick, 18 inches long, and 12 inches broad. Get four male and four female fcrews, fuch as are commonly ufed for fecuring fafh-windows. Let the four female fcrews be let into the four corners of one of the planks, and correfponding holes made through the four corners of the other plank for the male fcrews to pafs through, fo as to allow the two planks to be fcrewed tightly together. It will not be amifs to face the bearing of the male fcrews upon the wood with iron plates; and if the iron plates went acrofs from corner to corner of the wood, it would be a good fecurity againft the warping.

Secondly, get half a dozen quires of large foft fpongy paper (fuch as the ftationers call *bloffom blotting paper* is the beft), and a few fheets of ftrong pafteboard.

The plants you wifh to preferve fhould be gathered in a dry day, after the fun hath exhaled the dew; taking particular care to collect them in that ftate wherein their generic and fpecific characters are moft confpicuous. Carry them home in a tin-box nine inches long, four inches and a half wide, and one inch and a half deep. Get the box made of the thinneft tinned iron that can be procured; and let the lid open upon hinges. If any thing happens to prevent the immediate ufe of the fpecimens you have collected, they will be kept frefh two or three days in this box much better than by putting them in water. When you are going to preferve them, fuffer them to lie upon a table until they become limber; and then they fhould be laid upon a pafteboard, as much as poffible in their natural form, but at the fame time with a particular view to their generic and fpecific characters. For this purpofe it will be advifable to feparate one of the flowers, and to difplay the generic character. If the fpecific character depends upon the flower or upon the root, a particular difplay of that will be likewife neceffary. When the plant is thus difpofed upon the pafteboard, cover it with eight or ten layers of fpongy paper, and put it into the prefs. Exert only a fmall degree of preffure for the firft two or three days; then examine it, unfold any unnatural plaits, rectify any miftakes, and, after putting frefh paper over it, fcrew the prefs harder. In about three days more feparate the plant from the pafteboard, if it is fufficiently firm to allow of a change of place; put it upon a frefh pafteboard, and, covering it with frefh bloffom-paper, let it remain in the prefs a few days longer. The prefs fhould ftand in the fun-fhine, or within the influence of a fire.

When it is perfectly dry, the ufual method is to faften it down, with pafte or gum-water, on the right-hand inner page of a fheet of large ftrong writing-paper. It requires fome dexterity to glue the plant neatly down, fo that none of the gum or pafte may appear to defile the paper. Prefs it gently again for a day or two, with a half fheet of bloffom-paper betwixt the folds of the writing-paper. When it is quite dry, write upon the left-hand inner page of the paper the name of the plant; the fpecific character; the place where, and the time when, it was found; and any other remarks you may think proper. Upon the back of the fame page, near the fold of the paper, write the name of the plant, and then place it in your cabinet. A fmall quantity of finely powdered arfenic, or corrofive fublimate, is ufually mixed with the pafte or gum-water, to prevent the devaftations of infects; but the feeds of ftaves-acre finely powdered will anfwer the fame purpofe, without being liable to corrode or to change the colour of the more delicate plants. Some people put the dried plants into the fheets of writing paper, without faftening them down at all; and others only faften them by means of fmall flips of paper, pafted acrofs the ftem or branches. Where the fpecies of any genus are numerous, and the fpecimens are fmall, feveral of them may be put into one fheet of paper.

Another more expeditious method is to take the plants out of the prefs after the firft or fecond day; let them remain upon the pafteboard; cover them with five or fix leaves of bloffom paper, and iron them with a hot fmoothing iron until they are perfectly dry. If the iron is too hot, it will change the colours; but fome people, taught by long practice, will fucceed very happily. This is quite the beft method to treat the orchis and other flimy mucilaginous plants.

Another method is to take the plants when frefh gathered, and, inftead of putting them into the prefs, immediately to faften them down to the paper with ftrong gum water: then dip a camel-hair pencil into fpirit-varnifh, and varnifh the whole furface of the plant two or three times over. This method fucceeds very well with plants that are readily laid flat, and it preferves their colours better than any other. The fpirit varnifh is made thus. To a quart of highly rectified fpirit of wine put five ounces of gum fandarach; two ounces of maftich in drops; one ounce of pale gum elemi, and one ounce of oil of fpike-lavender. Let it ftand in a warm place, and fhake it frequently to expedite the folution of the gums.

Where no better convenience can be had, the fpecimens may be difpofed fyftematically in a large folio book; but a vegetable cabinet is upon all accounts more eligible. In Plate CCCXCVII. there is a fection of a cabinet, in the true proportions it ought to be made, for containing a complete collection of Britifh plants. By the affiftance of this drawing, and the adjoining fcale, a workman will readily make one. The drawers muft have backs and fides, but no other front than a

fmall

small ledge. Each drawer will be 14 inches wide, and 10 inches from the back to the front, after allowing half an inch for the thickness of the two sides, and a quarter of an inch for the thickness of the back. The sides of the drawers, in the part next the front, must be sloped off in a serpentine line, something like what the workmen call an *ogee*. The bottoms of the drawers must be made to slide in grooves cut in the uprights, so that no space may be lost betwixt drawer and drawer. After allowing a quarter of an inch for the thickness of the bottom of each drawer, the clear perpendicular space in each must be as in the following table.

I. Two tenths of an inch.
II. One inch and two-tenths.
III. Four inch, and six tenths.
IV. Two inches and three-tenths.
V. Seven inches and eight tenths.
VI. Two inches and two-tenths.
VII. Two tenths of an inch.
VII. One inch and four-tenths.
IX. Two-tenths of an inch.
X. Two inches and eight-tenths.
XI. One inch and two-tenths.
XII. Three inches and five-tenths.
XIII. Two inches and four-tenths.
XIV. Three inches and eight tenths.
XV. Three inches and four tenths.
XVI. One inch and three tenths.
XVII. Two inches and eight tenths.
XVIII. Six tenths of an inch.
XIX. Ten inches
XX. One inch and nine-tenths.
XXI. Four inches and four tenths.
XXII. Two inches and six-tenths.
XXIII. One inch and two-tenths.
XXIV. Seventeen inches.

This cabinet shuts up with two doors in front; and the whole may stand upon a base, containing a few drawers for the reception of duplicates and papers.

Fossil Plants. Many species of tender and herbaceous plants are found at this day, in great abundance, buried at considerable depths in the earth, and converted, as it were, into the nature of the matter they lie among; fossil wood is often found very little altered, and often impregnated with substances of almost all the different fossil kinds, and lodged in all the several strata, sometimes firmly imbedded in hard matter; sometimes loose: but this is by no means the case with the tenderer and more delicate subjects of the vegetable world. These are usually immersed either in a blackish slaty substance, found lying over the strata of coal, else in loose nodules of ferruginous matter of a pebble-like form, and they are always altered into the nature of the substance they lie among: what we meet with of these are principally of the fern kind; and what is very singular, though a very certain truth, is, that these are principally the ferns of American growth, not those of our own climate. The most frequent fossil plants are the polypody, spleenwort, osmund, trichomanes, and the several larger and smaller ferns; but besides these there are also found pieces of the equisetum or horse-tail, and joints of the stellated plants, as the clivers, madder, and the like; and these have been too often mistaken for flowers; sometimes there are also found complete grasses, or parts of them, as also reeds, and other watery plants; sometimes the ears of corn, and not unfrequently the twigs or bark, and impressions of the bark, and fruit of the pine or fir kind, which have been, from their scaly appearance, mistaken for the skins of fishes; and sometimes, but that very rarely, we meet with mosses and sea-plants.

Many of the ferns not unfrequently found, are of very singular kinds, and some species yet unknown to us; and the leaves of some appear set at regular distances, with round protuberances and cavities. The stones which contain these plants split readily, and are often found to contain, on one side, the impression of the plant, and on the other the prominent plant itself: and, beside all that have been mentioned, there have been frequently supposed to have been found with us ears of common wheat, and of the maize or Indian corn; the first being in reality no other than the common endmost branches of the firs, and the other the thicker boughs of various species of that and of the pine kind, with their leaves fallen off; such branches in such a state cannot but afford many irregular tubercles and papillæ, and, in some species, such as are more regularly disposed.

These are the kinds most obvious in England; and these are either immersed in the slaty stone which constitutes whole strata, or in flatted nodules, usually of about three inches broad, which readily split into two pieces on being struck.

They are most common in Kent, on coal-pits near Newcastle, and the forest of Dean in Gloucestershire; but are more or less found about almost all our coal-pits, and many of our iron mines. Though these seem the only species of plants found with us, yet in Germany there are many others, and those found in different substances. A whitish stone, a little harder than chalk, frequently contains them: they are found also often in a grey slaty stone of a firmer texture, not unfrequently in a blackish one, and at times in many others. Nor are the bodies themselves less various here than the matter in which they are contained: the leaves of trees are found in great abundance, among which those of the willow, poplar, whitethorn, and pear trees, are the most common; small branches of box, leaves of the olive-tree, and stalks of garden thyme, are also found there; and sometimes ears of the various species of corn, and the larger as well as the smaller mosses in great abundance.

These seem the tender vegetables, or herbaceous plants, certainly found thus immersed in hard stone, and buried at great depths in the earth: others of many kinds there are also named by authors; but as in bodies so imperfect errors are easily fallen into, these seem all that can be ascertained beyond mere conjecture.

Plants, method of preserving them in their original shape and colour. Wash a sufficient quantity of fine sand, so as perfectly to separate it from all other substances; dry it; pass it through a sieve to clear it from any gross particles which would not rise in the washing: take an earthen vessel, of a proper size and form, for every plant and flower which you intend to preserve; gather your plants and flowers when they are in a state of perfection, and in dry weather, and always with a convenient portion of the stalk: heat a little of the dry sand prepared as above, and lay it in the bottom of the vessel, so as equally to cover it; lay the plant or flower upon it, so as that no part of it may touch the sides of the vessel: sift or shake in more of the same sand by little upon it, so that the leaves may be extended by degrees, and without injury, till the plant or flower is covered about two inches thick: put the vessel into a stove, or hot-house, heated by little and little to the 50th degree; let it stand there a day or two, or perhaps more, according to the thickness and succulence of the flower or plant; then gently shake the sand out upon a sheet of paper, and take out the plant, which you will find in all its beauty, the shape as elegant, and the colour as vivid as when it grew.

Some flowers require certain little operations to preserve the adherence of their petals, particularly the tulip; with respect to which it is necessary, before it is buried in the sand, to cut the triangular fruit which rises in the middle of the flower; for the petals will then remain more firmly attached to the stalk.

A hortus siccus prepared in this manner would be one of the most beautiful and useful curiosities that can be.

Moving Plant. See HEDYSARUM.

Sea Plants. See *Sea Plants*.

Sensitive Plant. See MIMOSA and *Sensitive Plant*.

Plant-Lice, Vine-fretters, or *Pucerons.* See APHIS.

PLANTA, a PLANT. See PLANT.

Planta Faeminea, a female plant, is one which bears female flowers only. It is opposed to a *male* plant, which bears only male flowers; and to an *androgynous* one, which bears flowers of both sexes. Female plants are produced from the same seed with the male, and arrange themselves under the class of dioecia in the sexual method.

PLANTAGENET, the surname of the kings of England from Henry II. to Richard III. inclusive. Antiquarians are much at a loss to account for the origin of this name; and the best derivation they can find for it is, that Fulk, the first earl of Anjou of that name, being stung with remorse for some wicked action, went in pilgrimage to Jerusalem as a work of atonement; where, being soundly scourged with broom twigs, which grew plentifully on the spot, he ever after took the surname of *Plantagenet* or *broomstalk*, which was retained by his noble posterity.

PLANTAGO, PLANTAIN; a genus of the monogynia order, belonging to the tetrandria class of plants. To this genus Linnæus has joined the coronopus and psyllium of Tournefort. The first of these is called *hartshorn*, the latter *fleawort*. Of these there are several distinct species, and some varieties; but as they are rarely cultivated in gardens, we shall not enumerate them here, and shall only mention such of them as grow naturally in Britain. Of the plantain there are the following sorts: The common broad-leaved plantain, called *waybread;* the great hoary plantain, or lamb's-tongue; the narrow-leaved plantain, or ribwort: and the following varieties have also been found in England, which are accidental; the besom-plantain and rose-plantain. The plantains grow naturally in pastures in most parts of England, and are frequently very troublesome weeds. The common plantain and ribwort plantain are both used in medicine, and are so well known as to need no description. They are said to be slightly astringent; and the green leaves are commonly applied to fresh wounds by the common people.

Of the coronopus, or buckshorn plantain, there are two varieties growing in England, viz. the common buckshorn, which grows plentifully on heaths everywhere; and the narrow-leaved Welch sort, which is found upon many of the Welch mountains. The first of these was formerly cultivated as a salad herb in gardens, but has been long banished from thence for its rank disagreeable flavour; it is sometimes used in medicine.—There has been one species of psyllium or fleawort found growing naturally in England, which is used in medicine. It was found in the earth thrown out of the bottom of the canals which were dug for the Chelsea waterworks, where it grew in great plenty. The seeds of it must have been buried there some ages; for no person remembers any of the plants growing in that neighbourhood before. The seeds of this species are sometimes used, as they are imported from the south of France.

PLANTAIN. See PLANTAGO.

Plantain-Tree. See MUSA.

PLANTATION, in the West Indies, denotes a spot of ground which a planter, or person arrived in a new colony, pitches on to cultivate for his own use, or is assigned for that purpose. However, the term *plantation* is often used in a term synonymous with colony. See COLONY.

PLANTERSHIP, in a general sense, the business of a planter.

PLANTERSHIP, in the West Indies, denotes the management of a sugar plantation, including not only the cultivation of the cane, but the various processes for the extraction of the sugar, together with the making of sugar-spirits. See RUM, SACCHARUM, and SUGAR.

To effect a design so comprehensive, it is necessary for a planter to understand every branch of the art precisely, and to use the utmost attention and caution both in the laying down and executing of his plans. It is therefore the duty of a good planter to inspect every part of his plantation with his own eyes; to place his provisions, stores, and utensils, in regular order, and in safe repositories; that by preserving them in perfection, all kinds of waste may be prevented.

But as negroes, cattle, mules, and horses, are as it were the nerves of a sugar-plantation, it is expedient to treat that subject with some accuracy.

Of Negroes, Cattle, &c.] In the first place, then, as it is the interest of every planter to preserve his negroes in health and strength; so every act of cruelty is not less repugnant to the master's real profit, than it is contrary to the laws of humanity: and if a manager considers his own ease and his employer's interest, he will treat all negroes under his care with due benevolence; for good discipline is by no means inconsistent with humanity: on the contrary, it is evident from experience, that he who feeds his negroes well, proportions their labour to their age, sex, and strength, and treats them with kindness and good nature, will reap a much larger product, and with infinitely more ease and self-satisfaction, than the most cruel taskmaster, who starves his negroes, or chastises them with undue severity. Every planter then who wishes to grow rich with ease, must be a good economist; must feed his negroes with the most wholesome food, sufficient to preserve them in health and vigour. Common experience points out the methods by which a planter may preserve his people in health and strength. Some of his most fruitful land should be allotted to each negro in proportion to his family, and a sufficient portion of time allowed for the cultivation of it; but because such allotment cannot in long droughts produce enough for his comfortable support, it is the incumbent duty

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Plantership. duty of a good planter to have always his stores well filled with Guinea corn, yams, or eddoes, besides potatoes growing in regular succession: for plenty begets cheerfulness of heart, as well as strength of body; by which more work is effected in a day by the same hands than in a week when enervated by want and severity. Scanty meals may sustain life; but it is evident, that more is requisite to enable a negro or any other person to go through the necessary labours. He, therefore, who will reap plentifully, must plant great abundance of provisions as well as sugar-canes; and it is nature's economy so to fructify the soil by the growth of yams, plantains, and potatoes, as to yield better harvests of sugar, by that very means, than can be produced by many other arts of cultivation. Plantains are the principal support of all the negroes in Jamaica; and are also much cultivated, at great expence of manure, in Barbadoes; but ought not to be solely depended upon in climates subject to hurricanes. A celebrated planter and economist of the last mentioned island, who raised an immense fortune from very small beginnings only by planting, affirmed, that he fed constantly at least 300 negroes out of 12 acres of plantains. How that excellent produce came to be so long neglected in some of the islands it is hard to guess; but at present the neglect seems to be founded upon a vulgar error, that plantains cannot thrive in any other than low moist soils. In such places, no doubt, they flourish most luxuriantly; but yet they thrive and bear fruit abundantly on mountains and in marshes, and in the driest black mould upon marle or rocks, and even in sharp gravelly soils, as may be evinced by numberless instances.

However plenty of wholesome food may be conducive to health, there are also other means, equally necessary to strength and the longevity of negroes, well worth the planter's attention: and those are, to choose airy dry situations for their houses; and to observe frequently that they be kept clean, in good repair, and perfectly water-tight; for nastiness, and the inclemencies of weather, generate the most malignant diseases. If these houses are situated also in regular order, and at due distances, the spaces may at once prevent general devastations by fire, and furnish plenty of fruits and pot-herbs, to please an unvitiated palate, and to purify the blood. Thus then ought every planter to treat his negroes with tenderness and generosity, that they may be induced to love and obey him out of mere gratitude, and become real good beings by the imitation of his behaviour; and therefore a good planter, for his own ease and happiness, will be careful of setting a good example.

Having thus hinted the duties of a planter to his negroes, let the next care be of cattle, mules, and horses. The planters of Barbadoes (who are perhaps the most skilful of all others, and exact to a nicety in calculations of profit and loss), are, with respect to their cattle, the most remiss of any in all the islands; as if the carriage of canes to the mill, and of plantation-produce to the market, was not as essential as any other branch of plantership. At Barbadoes, in particular, the care of these animals is of more importance; because the soil, worn out by long culture, cannot yield any produce without plenty of dung. Some planters are nevertheless so ingeniously thrifty, as to carry their canes upon negroes heads; acting in that respect diametrically opposite to their own apparent interest, which cannot be served more effectually than by saving the labour of human hands, in all cases where the labour of brutes can be substituted; and for that end, no means of preserving those creatures in health and strength ought to be neglected.

The first care therefore is to provide plenty and variety of food. In crop-time, profusion of cane-tops may be had for the labour of carriage; but they will be more wholesome and nutritious if tedded like hay by the sun's heat, and sweated by laying them in heaps a few days before they are eaten. In this season of abundance, great ricks of cane-tops (the butt ends turned inwards) should be made in the most convenient corner of each field, to supply the want of pasturage and other food: and these are very wholesome if chopped into small parts, and mixed sometimes with common salt or sprinkled with melasses mixed with water: but yet the cattle require change of food to preserve them in strength; such as Guinea corn, and a variety of grass, which every soil produces with a little care in moist weather; and indeed this variety is found necessary in all climes.

But since that variety is not to be had during those severe droughts to which hot climates are liable, and much less in those small islands which cannot furnish large tracts of meadow-lands for hay, the only resource is the fodder of cane-tops or tedded Guinea-corn leaves; which are very nutritious, and may be preserved in perfection for more than a whole year, provided the tops or Guinea-corn are well tedded for three or four hot days as they lie spread in the field; and then, being tied into bundles or sheaves, must lie in the hot sun for three or four days more, when they may be fit to be put up into ricks. The best method of making them is in an oblong figure, about 30 feet in length, and 16 or 18 feet wide; seven feet high at the sides, and from thence sloping like the roof of an house, the ridge of which must be thatched very carefully; for the sides may be secured from wet by placing the bundles with the butts upwards towards the ridge, in courses, and lapping the upper over the lower course.

The best method of forming those ricks is to place the first course of bundles all over the base one way; the second course reversely; and so alternately till the rick be finished.

When cattle are to be fed with this fodder, it must be observed to take down the bundles from the top, at the west end of the rick, to the bottom; for all these ricks must stand east and west lengthwise, as well to secure them from being overturned by high winds, as for the convenience of preserving them from wet, which cannot be done when ricks are made round. By this husbandry, an herd of cattle may be kept in strength, either in severe droughts, or in wet seasons when grass is purgative; and thus the necessity or expence of large pastures may be totally saved. The hay-knife used in England for cutting hay, answers for cutting ricks of tops.

The method of tedding Guinea-corn to make a kind of hay, will require a little explanation here. When Guinea corn is planted in May, and to be cut down in July, in order to bear seed that year, that cutting, tedded properly, will make an excellent hay, which cattle prefer to meadow-hay. In like manner, after Guinea-corn has done bearing seed, the after crop will furnish a great

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great abundance of that kind of fodder which will keep well in ricks for two or three years.

The next care of a planter is to provide shade for his cattle; either by trees where they are fed in the heat of the day, if his soil requires not dung; or by building a flat shade over the pen where cattle are confined for making it. That such shades are essentially necessary to the well-being of all animals in hot weather, is apparent to every common observer, who cannot fail of seeing each creature forsaking the most luxuriant pastures in the heat of the day for the sake of shade; thus convincing the owners, by instinctive argument, that shade is almost as necessary to the well-being of the brute creatures as food. Yet, notwithstanding that demonstration from the unerring course of nature, throughout all our islands (except in a very few instances), these poor creatures are exposed to the scorching sun-beams without mercy. Such inhuman neglect is not always so much the effect of inattention as of a mistaken notion that shades are impedimental to the making of much dung; but a flat shade, covered with cane-trash, may be so made as to let rain pass through it without admission of sun-beams. This will do for cattle; but mules, which are spirited creatures, and work themselves by draught into a foaming heat, should be put into a warm stable, until quite cool: for turning them loose to pasture when so hot, is probably the cause of their destruction by the glanders.

If the care of providing shade for brute creatures is so much the duty and interest of their owners, how much more is it agreeable to the laws of humanity to provide shade for human creatures travelling upon the high-roads in this hot climate? Nothing surely of so much beauty costs so little expence as planting cocoa-nut or spreading timber trees in avenues along the highways, if each proprietor of the lands adjoining hath any taste of elegance, or feeling for other men: but both those kinds of trees will yield also great profit to the proprietor, by furnishing him with timber, when perhaps not otherwise to be had; or with a delicious milk, fitted by nature to cool the effervescence of the blood in this hot region; and also to improve the spirits made from sugar to the delicacy and softness of arrack. Cocoa-nut and cabbage-trees are both very beautiful and shady, bearing round heads of great expansion, upon natural trunks or pillars of elegant proportion, and of such an height as to furnish a large shade, with a free circulation of air equally refreshing to man and beast.

The common objection of injury to canes by the roots of such trees growing on their borders, may be easily removed by digging a small trench between the canes and trees, which may intercept their roots, and oblige them to seek sustenance in the common road. Let it also be considered, besides the benefits above suggested, that the planter will thus beautify his estate to the resemblance of a most sumptuous garden. And probably that very beauty might not only render the islands more healthful to the inhabitants, by preserving them from fevers kindled by the burning sun-beams, but also much more fruitful by making the weather more seasonable: for as, by cutting down all its woods, an hot country becomes more subject to excessive droughts; so, by replanting it in the manner above described, this inconvenience would probably be prevented.

Let then the planter be kind not only to his fellow-creatures but merciful to his beasts; giving them plenty and variety of wholesome food, clear water, cool shade, and a clean bed, bleeding them after a long course of hard labour, currying their hides from filth and ticks (A); affording them salt and other physic when necessary; protecting them from the flaying rope-lashes of a cruel driver (who needs no other instrument than a goad); proportioning their labour to their strength; and by every art rendering their work as easy as possible. The general management of planters is not, perhaps, more defective in any other respect than in this: for, by pairing the cattle unequally, and by the drivers ill conduct in writhing to the right and left, the poor creatures are fatigued by much needless labour. An horse ought therefore to be harnessed before them as a leader. This docile creature, by being led in a straight line, will soon learn to be an unerring guide, and the cattle will follow in the same direction with united strength, and consequently with more effect and less fatigue to each individual.

The Portuguese of Madeira, by their poverty and scantiness of pasture, breed the smallest kind of cattle; and yet one yoke of them will draw a much greater weight than a pair of our largest oxen, solely by an equal exertion of their joint strength. That equality or evenness of draught is preserved by boring gimblet holes through their horns, within two inches of the points, and running a thong of leather through those holes, so as to tie the horns of each pair at six inches distance from each other. By this ligature the pair of cattle are absolutely hindered from turning different ways, and draw in an even direction with united force. Thus it appears evidently from reason, as well as from experience, that the labour of our beasts may, by a little contrivance, be rendered more easy and effectual.

Of the Culture of various Soils.] In the British sugar-colonies there is as great a variety of soils as in any country of Europe; some naturally very rich or fruitful, yielding a luxuriant product with little labour or culture. This fruitful soil is of three kinds: a loose hazel mould mixed with sand, like that of St Christopher's, and is the best in the known world for producing sugar in great quantity, and of the best quality. The brick mould of Jamaica is somewhat of the same nature, and next in value; and then the various mixtures of mould and gravel, to be found in veins or plats over all the other islands. When any of these soils are exhausted of their fertility by long and injudicious culture, they may be restored by any kind of dung well rotted; for these (B) warm soils cannot bear hot unrotten dung, without being laid fallow for a consider-

able

(A) One pound of native sulphur, a quart of lamp-oil, and the like quantity of hog's-lard, intimately mixed and made into an ointment, is a cure for the mange, lice, &c.

(B) These soils, which are naturally loose and upon marle, Mr Martin calls *hot soils*; and these, he says, have been

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able time after it. Another improvement is by sea-sand or sea-weed; or by digging in the cane-trash into steep lands, and by letting it lie to rot for some months. A third method is, by ploughing and laying it fallow; and the fourth method (the best of all), is by folding the fallows by sheep. But this can be practised only where there are extensive pastures; nor can the plough be employed where the soil abounds with large stones. In that case, however, the former method of digging in trash will be nearly as effectual, though more expensive, by hand-labour or hoe-ploughing.

The next best soil for producing good sugar is a mould upon clay, which if shallow requires much culture and good labour, or its produce will be small in quantity, though of a strong grain and bright colour, so as to yield most profit to the refiner of any sugar, except that produced from an hazel or gravelly soil, as before-mentioned. All the black-mould soils upon marle are generally fruitful, and will take any kind of dung; but yield not so strong or large-grained sugar. Marle, however, of a white, yellow, or blue colour, or rich mould from washes, or ashes of every kind, are excellent for every strong soil, as the chief ingredient in the compost of dung: either of them will do alone for stiff lands; but the yellow and chocolate marle are the most soapy, and the richest kind of manure (except fine mould) for all stiff lands. If these are well opened, pulverized by culture, and mixed with hot dung, or any kind of loose earth or marle, they will produce as plentifully as lighter soils: and all kinds of clay-soils, except that of a white colour, have these two advantages above the finest gravel soils, that they do not scorch soon by dry weather, and never grow weary of the same manure, as most other soils do.

The extraordinary hand-labour bestowed in making dung, may be saved by the art of caving, now in general use in England. Ten mules or horses, and two light tumbrels with broad wheels, and ten able negroes, may, by the common use of spades, shovels, and light mattocks, or grubbing hoes, make more dung than 60 able negroes can do in the present methods.

If marle lies upon rising ground, or in hillocks, as it often does, the pit is to be opened at the foot of the declivity; which being dug inwards, till the bank is three feet high, then it is to be *caved* thus. Dig an hollow space of 12 or 18 inches deep under the foot of the bank; then dig into each side of it another perpendicular cut of the same depth, and 18 inches wide from the top of the bank to the bottom: that being finished, make a small trench a foot or two from the brink of the bank; pour into it water till full; and when that is done, fill it again, till the water soaking downward makes the marle separate and fall down all at once. This may be repeated till the pit rises to 50 feet high; and then many hundreds of cart-loads of marle may be thrown down by four negroes in two hours; from whence it may be carted into cattle-pens or laid out upon lands, as occasion requires. Five or six negroes with spades or shovels will keep two or three tumbrels employed, according to the distance of cartage: and thus as much dung may be made by ten negro men as will dung richly at least 70 or 80 acres of land every year, and laid out also with the assistance of cattle-carts: An improvement highly worth every planter's consideration, when negroes and feeding them are so expensive; and this is no speculation, but has been confirmed by practice. In level lands, the same operation may be as effectual, provided the mouth of the pit be opened by gradual descent to any depth: but when marle is to be found on the sides of hills, the operation is less laborious for the horses. But if the surface of the marle-pits (as it often happens) be covered with clay or stiff soil, so that the water cannot quickly soak from the trench above; in that case, pieces of hard wood, made like piles, four feet long, and four inches square, pointed at one end, and secured at the other square head by an iron clamp, may be driven by heavy mauls into the trench, as so many wedges, which will make the caved part tumble down: but a skilful eye must watch the last operation, or the labourers may be buried or hurt.

But then clay-soils that are level, and subject to be drowned, or to retain water in stagnated pools, can never be made fruitful by any kind of manure, without being first well drained: for water lying upon any soil will most certainly transform it to a stiff unfruitful clay; as appears evidently by the bogs of Ireland, the fens of Lincoln and Cambridgeshire, and even by the ponds of Barbadoes situated in the deepest and lightest black mould; for that fine soil being washed into those ponds, becomes the stiffest black clay, not fit even for an ingredient in dung, until it has been laid dry, and exposed to the sun for a whole year: but when these bogs and fens are well drained, they become the most fruitful soils. Natural clay the celebrated Boerhaave thinks the fattest of all soils; but then it must be opened by culture, marle, or sandy manures. It is hard to conjecture how the opinion prevailed in the British plantations, that sandy gut-mould was most unfit for clay-soils, as being the means of binding them to the compactness of brick; whereas it is proved, from long experience, to be one of the best means of opening clay-soils, and rendering them abundantly fruitful. Brick is made of *clay alone;* no sand being used in it, farther than to sprinkle the board, on which it is moulded into shape. From repeated experience it appears, that a mixture of sand in gut-mould is the best of all manure for stiff and barren clay-lands; provided they be well drained, by throwing the whole soil into round ridges of 12 feet wide, with furrows of three feet wide between each ridge. And this is done with little more hand-labour than that of hoe-ploughing well in the common way. For if a piece of land be marked in lines at seven feet and a half distance from each other, and the labourers are set in to hoe-plough at the second line, hauling back each clod 12 inches; half the ridge, and near half the furrow, is made at the same time: and thus a piece of land may be round-ridged, and the furrows all made at once, by the common operation of hoe-ploughing, provided the digger drives his hoe up to the eye at every stroke. Hoe-ploughing

been much injured in some of the islands by dung hastily made with marle: but if the sediment of lees were thrown into these pens, after being turned over, it would much improve the dung.

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ploughing in clay-soils that have lain long under water, is indeed hard labour; but it will every year grow the lighter by being well-drained by round-ridging: and in the meanwhile the labour may be rendered much more easy by the plough conducted by the lines above described. As therefore sandy mould is the best manure for stiff clay; so, by parity of reason, confirmed by long experience, stiff clay is the best manure for sandy or chaffy soils.

The method of round-ridging before described, is, by several years experience, found the most essential improvement of flat clayey soils: and yet there are some who will prefer speculation to ocular demonstration, fancying that all kinds of ridges will carry off the mould in heavy rains. The fact is otherwise in clay-soils: and plain reason, without experience, vouches, that where great confluxes of water are divided into many small rills, the force is broken; and therefore less mould carried off the land. Another objection made to round-ridgeing is, that by digging much clay to form the sides of the ridge, the soil is impoverished: but this objection stands good only against those ridges which are raised too high, and made too broad; but if land is ridged in the manner before directed, that is, 12 feet broad, and not above six or eight inches higher in the middle than at the sides, the objection vanishes. Ridges were never proposed for light soils or steep lands; and even in flat soils upon loam they should be made with great caution, because *loam melts away by water*. But there are poachy lands of a white clay, even upon small descents, too retentive of water; these may certainly be improved much by ridges of 12 feet wide, as above described, without fear of washes.

But supposing, as the objection urges, that a little clay should be turned up at the sides of such ridges, can it not be manured somewhat more than the other parts with marle or sandy mould, so as to become equally good with any other part of the soil? And is not this well worth the labour, since round-ridging not only improves the soil by draining it to a surprising degree, but adds one-fifth part to the depth of the staple? And will not a ridge made a little rounding, throw off the water much better than a flat ridge?

The general maxim of not burning cane-trash (which may be called the *stubble of cane-lands*) upon any kind of soil, is surely a great mistake; as may be evinced by observing the contrary practice of the best husbandmen in England, where burn-baiting or bastard burn-baiting, is found by experience an admirable method of fertilizing cold, stiff, or clayey lands. It must indeed be a constant practice, not only for the sake of contributing to warm and divide the soil, but as the only effectual means of destroying pernicious insects, and weeds of various kinds, such as French weed, wild pease, and wild vines.

Soon after the disuse of burning trash upon our lands in the islands, the blast made its first appearance with incredible devastation: to revive that practice therefore seems to be the most obvious means of expelling it. It may be presumed that the disuse of burning trash was founded upon the mistaken notion of burn-baiting, which is turning up a thick sod of very dry, light, and shallow soils, and burning the whole superficies or staple to ashes. This practice the writers upon husbandry condemn universally, and very justly: for though by this practice the land will produce two or three crops more plentifully than ever, yet the soil is blown away by the wind, and the substratum being generally an hungry gravel or chalk, can never be restored to fertility by the common arts of husbandry. But surely this has no resemblance to our superficial burning of the little trash we can spare from dung: and though this method of burn-baiting light and shallow soils be justly condemned, yet the best writers recommend that very practice in cold, moist, and heavy soils, as is observed above; and long experience justifies it.

Deep mould upon clay or loam being subject to the grub-worm (c), will not take any kind of dung, till perfectly rotten, except that of the sheep-fold; which is the best manure for all kinds of light soils, and is of all others the least expensive, as not requiring hand-labour. But the use of the fold is impracticable in any island not abounding with large savannas or sheep-pastures, as in Jamaica.

Those soils therefore which are subject to the grub, and must be fertilized by common dung, which is a proper nest for the mother-beetle to deposite its eggs, must be well impregnated with the brine of dissolved salt, after the dung is first cut up; two large hogsheads of salt will make brine enough for a dung-pen of 50 feet square.

This cure for the grub is a late discovery; and which has been attended with success, so far as the experiment is made. But though it proves effectual to destroy that pernicious insect in plant-canes, it probably will not be sufficient to save rattoons, without a new application of salt in powder; because the first brine must be washed away by the time when rattoons spring up.

The planter who would save his rattoons from the grub ought therefore to cut off the heads of his stools with sharp hoes three inches below the surface of the soil, and then strew an handful of salt round each stool, and cover it up to a level with fine mould taken from the edges.

In soils where there is no grub, and the planter wishes to have very good rattoons, let him, as soon as his canes are cut, draw all the trash from the stools into the alternate spaces, if planted in that manner; or into the furrows, if his land be round-ridged; and then cut off the head of his stools with sharp hoes, as above directed. Experience has shown the advantage of this practice, and reason demonstrates the great benefit of the rattoon-sprouts rising from three inches below the surface, instead of superficial shoots which come to nothing, and only starve the strong sprouts. Besides, the stubs which are left upon the stools after the canes are cut, canker, and rot the stools; which is one reason why good rattoons

8 C 2

(c) This pernicious insect is most apt to engender in dung made from mill-trash, which therefore never ought to be put into dung-compost or still-ponds; but after being burnt, the ashes will be as good as any other kind. Round-ridging, with manure of unwet ashes, sea-sand, or lime, or dry marle, kills the grub.

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toons are uncommon in soils long cultivated. Yet it is the opinion of some, that by hoe-ploughing and even dunging rattoons, the produce might be as good plant-canes, which would save the labour of holing and planting so often as planters commonly do.

Fallowing is of incredible advantage to every soil, not only by being divided into the minutest parts, but also by imbibing those vegetative powers with which the air is impregnated by the bountiful hand of Providence, whenever rain falls. What those powers are has been explained under the articles AGRICULTURE and PLANT; and experience evinces, that the tender vegetables of the earth are envigorated more by the smallest shower of rain, than by all the water which human art can bestow. Let it therefore be a constant maxim of the planter, never to plant his ground until the soil is well mellowed by fallowing, even though he bestows upon it a due proportion of dung: we say a due proportion; for too much will force up rank canes, which never yield good sugar; and though some advantage may be reaped from the rattoons, yet it will be found by experience not to compensate the loss by the plants. In stony or steep soils, where the plough cannot be used, or where a sufficient strength of cattle cannot be supported for that purpose, hand-labour or hoe-ploughing must be substituted: but even in that case, much labour may be saved by spreading the dung according to the English husbandry, and digging it into the soil. To evince this truth, let any planter compute his negroes labour of distributing dung by baskets, and by spreading it with dung-forks; and then judge for himself by one single experiment which is the most profitable.

But if some planters are so devoted to the old custom of distributing dung by baskets instead of wheel-barrows in level ground, or hand-barrows in uneven land, by which three times the labour may be accomplished in the same time and by the same hands; let them at least save much of their hand-labour, by the following method of laying out dung, before the distribution by baskets.

In holing a piece of land, let a space be left after 80 holes from the first interval, and then the like space after 80 holes throughout the whole plat, which spaces must run exactly parallel to the intervals on the right and left of the holes. Into these spaces the dung may be carted, even before it be rotten (D), at the most leisure times, and covered with mould or cane-trash, to prevent exhalation; and in such quantity as will suffice only to dung a row of 40 holes, from the point opposite to each side of it. In the intervals at each side of the cane-piece, which are parallel to those spaces, there must be dung enough carted to manure a row of 40 holes, and covered in like manner.

By thus placing the dung or gut-mould, it is evident at the first sight, that the farthest distance cannot be above 40 holes in distributing the dung: and in case it be not sufficiently rotten for present use, it may be distributed even in dry weather, and covered by the bank; which will both prevent its spirit from exhalation, and occasion it to rot sooner, which is no small advantage. Moreover, by being thus laid out at the most leisure times, and covered with the banks, the dung will be more intimately mixed with the soil, and therefore continue to nourish the plant for a longer time than if laid as usual at the bottom of the holes. A farther advantage of thus distributing the dung, and covering it, results from the more expeditious planting the land after a short or sudden shower: for the labour of covering the dung, and uncovering it when the land is planted, however it may appear in speculation, is in practice a trifle; and besides all the other advantages arising by the distribution of dung from the spaces above described, this is not the least, that not a bank is trodden under foot. But it is evident, that by distributing the dung with baskets in the present method, the soil is much trampled under foot; and by that means, the very end of hoe-ploughing, or loosening the soil, is much defeated. In like manner, by the present method of hoe-ploughing, the same ill effect is produced; for as the negroes hoe-plough or dig the soil directly forward, so they must necessarily tread the ground as fast as they dig it: whereas by putting the labourers to dig sidewise, no one puts a foot upon the soil after it is dug; and by lining the land before it is hoe-ploughed, each negro may have an equal share to dig. The only difficulty of hoe-ploughing sidewise is in first setting the negroes to that work; but it may be done without loss of time when working in a contiguous field. Whether hoe-ploughing before or after the land be holed for canes is most eligible, experience must determine; but certainly both operations will be most effectual: and therefore it will be advisable (E), first to plough the soil where the land will admit the plough; and where it will not, to hoe-plough it with or without dung, as requisite; then let it lie fallow till perfectly mellowed; then hole and plant it; and instead of weeding in the usual manner, let the weeds in all the spaces be dug into the soil: but as this is not to be done so well with the hoe, it is submitted to future experience, whether the dexterous use of spades, as in England, will not answer the purpose much better, and with equal dispatch. But whatever method is preferred, most certain it is, that by loosening the soil in all the spaces between the young canes after being come up, their fibres will more easily expand on every side, and acquire more nutrition to invigorate their growth. But where the planter grudges this labour, by thinking it needless in a rich loose soil, he may dispatch more weeding-work by the Dutch hoe than by any other; which being fastened upon

(D) In order to make dung rot the sooner, much labour is bestowed in digging and turning it over by hoes: but two-thirds of that labour may be saved by the use of hay-knives; six of which, used dexterously, will cut up a pen in less time than 60 negroes can do by hoes: but hay-knives cannot be used where gritty mould is used in pens.

(E) Deep and loose soils may be ploughed with a small strength of cattle or mules: but stiff lands in hot climates require more strength of cattle than can be maintained in the small pastures of the planters; for if those strong soils are either too wet or too dry (as is generally the case), ploughing is impracticable.

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upon the end of a stick, is pushed forward under the roots of the small weeds, in such a manner as to cut them up a little below the surface of the soil, and will do more execution at one shove than can be done at three strokes of the common hoe: but there is yet another practice of the horse-hoe plough, whereby all weeds growing in rows between beans and pease, are extirpated with incredible ease and expedition. It is a very simple machine, drawn by one or two horses, consisting of a pair of low wheels turning upon a common axis; from whence two square irons are let down at equal distances, and triangular hoes made at the ends, the points of the triangles being placed forward, and so fixed as to cut all weeds an inch below the surface, in the same manner as the Dutch garden hoe above-mentioned. By this machine a man and a boy, with two horses or mules, will clear perfectly all the spaces of a field of ten acres in two days, and may be of admirable use in all loose and dry soils in the sugar-islands: for while two horses or mules draw in the space before each other, the wheels pass on the outside of each row of canes, without doing the least injury, while the plough-holder attends to his business. In stiff soils which require draining, neither the horse-hoe plough nor the Dutch hoe can be proper; or any other instrument so effectual as the spade used in the manner above hinted, where the staple is deep.

But where the staple of land is shallow, care must be taken not to dig much below it, according to the universal opinion of all the best writers, supported by the experience of 100 years. Yet some good planters are fallen into the contrary practice, and dig up stiff clay far below the staple. This, Mr Martin says, was done in his own lands, during his absence, by injudiciously ploughing below the staple; and so injured the soil, that all the arts of culture for many years hardly retrieved its former fertility. Indeed, where the staple is shallow, upon a fat clay, the turning up a little of it at a time, from the bottom of the cane-holes, and mixing it with rich hot dung, made of marle, or sandy mould, which may take off its cohesive quality, will in due time, and by long fallow, convert it into good soil: but if stiff clay be turned up, without any such mixture, in large quantities, it will infallibly disappoint the operator's hopes: for though solid clay will moulder, by exposure, to a seeming fine earth, yet it will return to its primitive state very soon after being wet, and covered from the external air, if not divided, as above suggested.

After all, the common horse-hoeing plough drawn by two mules in a line before each other, or the hand-hoe in common use, will answer the purpose very well, where the lands are planted in Mr Tull's method; that is, where the spaces are equal to the land planted, in the following manner.

Suppose six feet planted in two rows of canes, and six feet of land left as a space unplanted; and so a whole piece of land, planted in alternate double rows (F), with equal spaces, may be hoe-ploughed with ease, as before hinted; and that at any time during the growth of canes, when it is most convenient to the planter, which is a considerable advantage; and yet it is the least of all attending this method of culture: for, by leaving these spaces, the canes will have both more air and sun: by hoe-ploughing them, the roots of each double row will have large room for expansion, and consequently, by gaining more nutriment, will grow more luxuriantly: by these spaces the canes may be cleaned from the blast with much more ease and convenience; and will serve as proper beds to plant great corn, without the least injury to the canes; as well as to contain the trash taken off the land, where, by rotting, and being hoe-ploughed into the soil, it will wonderfully enrich it, and will fit it to be planted immediately after the canes in the neighbouring double rows are cut down. Besides all these admirable advantages of planting the land in alternate double rows with equal spaces, the canes, when at full age, may be easily stripped of their trash, and by that means the juice rendered so mature as to yield double the produce, and much better sugars than unstripped canes. This method of culture may be recommended for all kinds of soil: for as by this practice the rank luxuriant canes will be more matured, so the poor soils will be rendered more fruitful; and as the roots of the canes which expand into these spaces will be kept moist by being covered with rotten trash, so they must bear dry weather much longer in the burning soils. In those low lands which require draining by furrows, the alternate double rows and spaces must be made cross the ridges; by which means those spaces, being hoe-ploughed from the centre to the sides, will be always preserved in a proper state of roundness. By this method of planting, the canes may be so well ripened as to yield double the quantity of sugar of canes planted in the close manner; which saves half the labour of cartage, half the time of grinding and boiling, and half the fuel, besides yielding finer sugar.

Yet, how well soever the method of planting in single or double alternate rows has succeeded in the loose and stiff soils, experience has shown that it is a wrong practice in stiff lands that are thrown into round or flat ridges: for these being most apt to crack, the sun-beams penetrate soon to the cane-roots, stop their growth, and have an ill influence upon the sugar. It is therefore advisable to plant such lands still, but in large holes, of 4 feet, by 5 feet towards the banks: after the plant-canes are cut, to dig out one, and leave two rows standing, hoe-ploughing the spaces after turning all the trash into furrows till almost rotten: for if the trash is drawn upon the hoe-ploughed spaces, they will hardly ever moulder, at least not till the trash is quite rotten. This is an infallible proof from experience of how little advantage trash is to the soil, unless it be in great droughts, to keep out the intense sun-beams: for, in all other respects, it prevents that joint operation of the sun and air in mouldering and fructifying the soil, as has been proved by repeated experiments.

But in flat stiff soils that are properly drained by round-ridging, no culture prevents cracking so effectually as hoe-ploughing into them a quantity of loose marle, of which that of a chocolate or of a yellow colour is best;

(F) In stiff lands, the single alternate rows of four feet distance, as preventive of much labour in weeding, are found best; and also yield more sugar by the acre; and are less apt to be affected by drought.

best; and it will be still much better, by lying upon the land, in small heaps, or in cane-holes, for some time, to imbibe the vegetative powers of the air before it is intimately mixed with the soil.

As to the manner of planting canes, the general practice of allowing four feet by five to an hole, and two fresh (G) plants, is found by common experience to be right and good in alternate rows. But the following precautions are necessary to be observed. First, let all the cane-rows run east and west, that the trade-wind may pass freely through them; because air and sunshine are as conducive to the growth and maturation of sugar-canes as of any other vegetable. Secondly, let not any accession of mould be drawn into hills round the young canes, except where water stagnates (H); because the fibres which run horizontally, and near the surface, are much broken and spoiled by that practice. Thirdly, let the sugar-canes be cut at their full maturity; which, in a dry loose soil, is generally at the end of 14 or 15 months after being planted; but in cold clay-soils, not till 16 or 17 months. Fourthly, as the cane-rows run east and west in as proper a direction as possible for cartage to the sugar work, so canes must be cut the contrary way if the planter expects any great produce from his rattoons: for by beginning to cut canes at the part of his field most remote from the works, the carts cannot often pass over the same tract, and consequently the cane-stools cannot be injured, more especially if he takes due care to cut the canes very close to their roots; for, by leaving a long stub (which must perish) the cane-stools are much injured. It may be objected to the practice of the cutting canes transversely to the rows, that the negroes labour will not be so equally divided: but let every man consider both sides of the question, and be determined by his own experience; and then he will be convinced, that it matters very little which way he cuts straight standing canes; but in cases where the sugar-canes lean, or are lodged by preceding high winds, it is a point of great importance to place the labourers so as to cut the canes first at the roots, and then, drawing them, cut off the tops: for thus by two strokes each cane will be cut; and twice the quantity cut in the same time, and by the same hands, more than by cutting in any other direction. In round-ridged land, it is proper to cut canes in the same direction of the ridges, throwing the tops and trash into the furrows to render the cartage easy, and to preserve the ridges in their proper form.

It is almost needless to suggest the expediency of planning the cane-pieces of a plantation in exact squares, so that the intervals may intersect at right angles; since such regularity is not only more beautiful, more safe in case of accidental fires, and a better disposition of the whole for dividing and planting one third or fourth part of a plantation every year, but also much easier guarded by a few watchmen: for one of these walking in a line from east to west, and the other from north to south, look through every avenue, where the most subtle thief cannot escape the watchful eye. And if the intervals surrounding the boundary of a regular plantation be made 24 feet wide, the proprietor will receive ample recompense for so much land, by the security of his canes from fires kindled in the neighbourhood, and by planting all that land in plantain-trees, which may at once yield food and shade to the watchmen, who by that means can have no excuse for absence from their proper stations. But as fuel grows very scarce in most of our islands, it is also expedient to plant a logwood or flower-fence in all the boundaries of every plantation, which, being cut every year, will furnish good store of faggots. Logwood makes the strongest and quickest of all fences, and agrees with every soil: the cuttings make excellent oven-fuel.

So much for the general operations of plantership, according to the approved directions of Mr Martin. For the particular cultivation of the sugar-canes, the extraction of the sugar, and the distillation of rum, see the articles SACCHARUM, SUGAR, and RUM.

PLANTIN (Christopher), a celebrated printer, was born near Tours in 1533, and bred to an art which he carried to the highest degree of perfection. He went and settled at Antwerp; and there erected a printing-office, which was considered not only as the chief ornament of the town, but as one of the most extraordinary edifices in Europe. A great number of ancient authors were printed here; and these editions were valued not only for the beauty of the characters, but also for the correctness of the text, with regard to which Plantin was so very nice, that he procured the most learned men to be correctors of his press. He got immense riches by his profession; which, however, he did not hoard up, but spent like a gentleman. He died in 1598, aged 65 years; and left a most sumptuous and valuable library to his grandson Balthasar.

PLANTING, in agriculture and gardening, is setting a tree or plant, taken from its proper place, in a new hole or pit; throwing fresh earth over its root, and filling up the hole to the level of the surface of the ground.

The first thing in planting is to prepare the ground before the trees or plants are taken out of the earth, that they may remain out of the ground as short a time as possible; and the next is, to take up the trees or plants, in order to their being transplanted. In taking up the trees, carefully dig away the earth round the roots, so as to come at their several parts to cut them off; for if they are torn out of the ground without care, the roots will be broken and bruised, to the great injury of the trees. When you have taken them up, the next thing is to prepare them for planting by pruning the roots and heads. And first, as to the roots; all the small fibres are to be cut off, as near to the place from whence they

(G) It is an odd fancy that stale plants grow best, when both reason and experience vouch that the most succulent plants are best: one good plant in the centre of a large hole is sufficient when the land is full holed.

(H) The stagnation of water in pools (usual in stiff level lands) is the most injurious circumstance attending it; for that, by long duration, will convert the finest mould into stiff clay. The proprietor of such a soil must therefore grudge no labour to drain it well; and yet by such easy gradation as to prevent the mould from being washed away by great floods, in case the under stratum be a loam.

Planting. they are produced as may be, except they are to be replanted immediately after they are taken up. Then prune off all the bruifed or broken roots, all fuch as are irregular and crofs each other, and all downright roots, efpecially in fruit-trees: fhorten the larger roots in proportion to the age, the ftrength, and nature of the tree; obferving that the walnut, mulberry, and fome other tender-rooted kinds fhould not be pruned fo clofe as the more hardy forts of fruit and foreft trees: in young fruit-trees, fuch as pears, apples, plums, peaches, &c. that are one year old from the time of their budding or grafting, the roots may be left only about eight or nine inches long; but in older trees, they muft be left of a much greater length: but this is only to be underftood of the larger roots; for the fmall ones muft be chiefly cut quite out, or pruned very fhort. The next thing is the pruning of their heads, which muft be differently performed in different trees; and the defign of the trees muft alfo be confidered. Thus, if they are defigned for walls or efpaliers, it is beft to plant them with the greateft part of their heads, which fhould remain on till they begin to fhoot in the fpring, when they muft be cut down to five or fix eyes, at the fame time taking care not to difturb the roots. But if the trees are defigned for ftandards, you fhould prune off all the fmall branches clofe to the place where they are produced, as alfo the irregular ones which crofs each other; and after having difplaced thefe branches, you fhould alfo cut off all fuch parts of branches as have by any accident been broken or wounded; but by no means cut off the main leading fhoots which are neceffary to attract the fap from the root, and thereby promote the growth of the tree. Having thus prepared the trees for planting, you muft now proceed to place them in the earth: but firft, if the trees have been long out of the ground, fo that the fibres of the roots are dried, place them eight or ten hours in water, before they are planted, with their heads erect, and the roots only immerfed therein; which will fwell the dried veffels of the roots, and prepare them to imbibe nourifhment from the earth. In planting them, great regard fhould be had to the nature of the foil: for if that be cold and moift, the trees fhould be planted very fhallow; and if it be a hard rock or gravel, it will be better to raife a hill of earth where each tree is to be planted, than to dig into the rock or gravel, and fill it up with earth, as is too often practifed, by which means the trees are planted as it were in a tub, and have but little room to extend their roots. The next thing to be obferved is, to place the trees in the hole in fuch a manner that the roots may be about the fame depth in the ground as before they were taken up; then break the earth fine with a fpade, and fcatter it into the hole, fo that it may fall in between every root, that there may be no hollownefs in the earth: then having filled up the hole, gently tread down the earth with your feet, but do not make it too hard; which is a great fault, efpecially if the ground be ftrong or wet. Having thus planted the trees, they fhould be faftened to ftakes driven into the ground to prevent their being difplaced by the wind, and fome mulch laid upon the furface of the ground about their roots; as to fuch as are planted againft walls, their roots fhould be placed about five or fix inches from the wall, to which their heads fhould be nailed to prevent their being blown up by the wind. The feafons for planting are various, according to the different forts of trees, or the foil in which they are planted. For the trees whofe leaves fall off in winter, the beft time is the beginning of October, provided the foil be dry; but if it be a very wet foil, it is better to defer it till the latter end of February, or the beginning of March: and for many kinds of evergreens, the beginning of April is by far the beft feafon; though they may be fafely removed at midfummer, provided they are not to be carried very far; but fhould always make choice of a cloudy wet feafon. Planting.

In the fecond volume of the papers, &c. of the Bath Society there is a letter on planting wafte grounds. The gentleman who writes it informs us, that in the county of Norfolk, where he refides, there were about 60 or 70 years ago vaft tracts of uncultivated ground, which were then thought totally barren. "The weftern parts of it (fays he) abounded with fand of fo light a texture, that they were carried about by every wind; and in many places the fands were fo loofe that no grafs could grow upon them. Art and induftry, however, have now fo altered the face of this once Arabian defert, that it wears a very different appearance. Moft of thefe tracts are either planted or rendered very good corn-land and fheep-walks.

"About 30 years fince, the fides of many of our little fand-hills were fown with the feeds of French furze, and when a wet feafon followed, they fucceeded very well, and grew fo faft, that once in three or four years they are cut for fuel, and fell at a good price at Thetford, Brandon, Harling, Swaffham, and places adjacent. This excited fome public fpirited gentlemen, among whom was the late Mr Buxton of Shadwell-Lodge, near Thetford, to attempt the planting of Scotch and fpruce firs, and other hardy foreft-trees. At firft they found fome difficulty from the extreme loofenefs of the fand. But as there is in all this part of the country fine white and yellow marle, at about three feet depth below the fand, they very judicioufly thought that incorporating it with the fand in the holes where their young trees were planted, would infure fuccefs; nor were they difappointed. The method fucceeded beyond expectation; the plantations throve exceedingly, and the roots foon reached below the fand, after which they were out of danger. This excited them to further attempts.

"On the fpots where they intended to raife new plantations from feeds and acorns, they laid on a thick coat of marle and clay, which after being rough fpread, and lying a winter in that ftate, was made fine, and ploughed in juft before planting. By thefe means the foil became fixed, and in a little time covered with grafs and herbage; fo that there are now vaft plantations of firs, oak, and foreft-trees, in the moft healthy and vigorous ftate, where within my memory ten acres of land would not maintain a fingle fheep three months.

"But the benefit of plantations, whether of fhrubs, copfe, or trees, is not confined to the immediate advantage, or even the future value of the wood. By annually fhedding a great number of leaves, which the winds difperfe, and the rains wafh into the foil, it is confiderably improved; and whenever fuch copfes have been ftubbed up, the ground (however unfruitful before planting) has thereby been fo enriched as to bear excellent crops for many years, without the additional help of manure. How much land-owners are interefted in planting wafte or barren fpots I need not mention; and nothing

thing but a degree of indolence or ignorance unpardonable in this enlightened age could induce them to neglect it.

"Nature has furnished us with plants, trees, and shrubs, adapted to almost every soil and situation; and as the laws of vegetation are now much better understood than formerly, it is a reproach to those whose practice does not keep pace with their knowledge in making the best use of her bounty. Let no man repine and say *the land is barren;* for those spots which appear to be so, owe that appearance to human negligence. Industry and art might soon render an eighth part of this kingdom nearly as valuable as the rest, which now remains in a state unprofitable to the owners, and disgraceful to the community."

Reverse PLANTING, a method of planting in which the natural position of the plant or shoot is inverted; the branches being set into the earth, and the root reared into the air. Dr Agricola mentions this monstrous method of planting, which he found to succeed very well in most or all sorts of fruit-trees, timber-trees, &c. Bradley affirms, that he has seen a lime-tree in Holland growing with its first roots in the air, which had shot out branches in great plenty, at the same time that its first branches produced roots and fed the tree. Mr Fairchild of Hoxton has practised the same with us, and gives the following directions for performing it: Make choice of a young tree of one shoot, of alder, elm, willow, or any other tree that easily takes root by laying; bend the shoot gently down into the earth, and so let it remain until it has taken root. Then dig about the first root, and raise it gently out of the ground, till the stem be nearly upright, and stake it up. Then prune the roots, now erected in the air, from the bruises and wounds they received in being dug up; and anoint the pruned parts with a composition of two ounces of turpentine, four ounces of tallow, and four ounces of bees wax, melted together, and applied pretty warm. Afterwards prune off all the buds or shoots that are upon the stem, and dress the wounds with the same composition, to prevent any collateral shootings, that might spoil the beauty of the stem.

PLANUDES (Maximus), a Greek monk of Constantinople, towards the end of the 14th century, who published a collection of epigrams intitled *Anthologia;* a Greek translation of Ovid's Metamorphoses; a Life of Æsop, which is rather a romance than a history; and some other works. We know nothing more of him, than that he suffered some persecution on account of his attachment to the Latin church.

PLASHING *of* HEDGES, is an operation thought by some persons to promote the growth and continuance of old hedges; but whether the fact be so or not will admit of some dispute. See HEDGES, n° 29, 37, &c.

It is performed in this manner: The old stubs must be cut off, &c. within two or three inches of the ground; and the best and longest of the middle-sized shoots must be left to lay down. Some of the strongest of these must also be left to answer the purpose of stakes. These are to be cut off to the height at which the hedge is intended to be left; and they are to stand at ten feet distance one from another: when there are not proper shoots for these at the due distances, their places must be supplied with common stakes of dead wood. The hedge is to be first thinned, by cutting away all but those shoots which are intended to be used either as stakes, or the other work of the plashing: the ditch is to be cleaned out with the spade; and it must be now dug as at first, with sloping sides each way; and when there is any cavity on the bank on which the hedge grows, or the earth has been washed away from the roots of the shrubs, it is to be made good by facing it, as they express it, with the mould dug from the upper part of the ditch: all the rest of the earth dug out of the ditch is to be laid upon the top of the bank: and the owner should look carefully into it that this be done; for the workmen, to spare themselves trouble, are apt to throw as much as they can upon the face of the bank; which being by this means overloaded, is soon washed off into the ditch again, and a very great part of the work undone; whereas what is laid on the top of the bank always remains there, and makes a good fence of an indifferent hedge.

In the plashing the quick, two extremes are to be avoided; these are, the laying it too low, and the laying it too thick. The latter makes the sap run all into the shoots, and leaves the plashes without sufficient nourishment; which, with the thickness of the hedge, finally kills them. The other extreme of laying them too high, is equally to be avoided; for this carries up all the nourishment into the plashes, and so makes the shoots small and weak at the bottom, and consequently the hedge thin. This is a common error in the north of England. The best hedges made anywhere in England are those in Hertfordshire; for they are plashed in a middle way between the two extremes, and the cattle are by that prevented both from cropping the young shoots, and from going through; and a new and vigorous hedge soon forms itself.

When the shoot is bent down that is intended to be plashed, it must be cut half way through with the bill: the cut must be given sloping, somewhat downwards, and then it is to be wound about the stakes, and after this its superfluous branches are to be cut off as they stand out at the sides of the hedge. If for the first year or two, the field where a new hedge is made can be ploughed, it will thrive the better for it; but if the stubs are very old, it is best to cut them quite down, and to secure them with good dead hedges on both sides, till the shoots are grown up from them strong enough to plash; and wherever void spaces are seen, new sets are to be planted to fill them up. A new hedge raised from sets in the common way, generally requires plashing in about eight or nine years after.

PLASSEY, is a grove near the city of Muxadab in India, famous for a battle fought between the English under Lord Clive and the native Hindoos under the Nabob Surajah Dowlah. The British army consisted of about 3200 men, of whom the Europeans did not exceed 900; while that of the Nabob consisted of 50,000 foot, and 18,000 horse. Notwithstanding this great disproportion, however, Lord Clive effectually routed the Nabob and his forces, with the loss of 3 Europeans and 26 Seapoys killed, and 5 Europeans and 40 Seapoys wounded. The Nabob's loss was estimated at about 200 men, besides oxen and elephants. See CLIVE.

PLASTER, or EMPLASTER, in pharmacy, an external application of a harder consistence than an ointment;

Plaster. ment; to be spread, according to the different circumstances of the wound, place, or patient, either upon linen or leather. See PHARMACY, n° 613—635.

PLASTER, or *Plaister*, in building, a composition of lime, sometimes with sand, &c. to parget, or cover the nudities of a building. See PARGETING and STUCCO.

Plaster of Paris, a preparation of several species of gypsum dug near Mount Maitre, a village in the neighbourhood of Paris; whence the name. See ALABASTER, GYPSUM, and CHEMISTRY, n° 635, &c.

The best sort is hard, white, shining, and marbly; known by the name of *plaster-stone* or *parget of Mount Maitre*. It will neither give fire with steel, nor ferment with aquafortis; but very freely and readily calcines in the fire into a fine plaster, the use of which in building and casting statues is well known.

The method of representing a face truly in plaster of Paris is this: The person whose figure is designed is laid on his back, with any convenient thing to keep off the hair. Into each nostril is conveyed a conical piece of stiff paper, open at both ends, to allow of respiration. These tubes being anointed with oil, are supported by the hand of an assistant; then the face is lightly oiled over, and the eyes being kept shut, alabaster fresh calcined, and tempered to a thinnish consistence with water, is by spoonfuls nimbly thrown all over the face, till it lies near the thickness of an inch. This matter grows sensibly hot, and in about a quarter of an hour hardens into a kind of stony concretion; which being gently taken off, represents, on its concave surface, the minutest part of the original face. In this a head of good clay may be moulded, and therein the eyes are to be opened, and other necessary amendments made. This second face being anointed with oil, a second mould of calcined alabaster is made, consisting of two parts joined lengthwise along the ridge of the nose; and herein may be cast, with the same matter, a face extremely like the original.

If finely powdered alabaster, or plaster of Paris, be put into a bason over a fire, it will, when hot, assume the appearance of a fluid, by rolling in waves, yielding to the touch, steaming, &c. all which properties it again loses on the departure of the heat; and being thrown upon paper, will not at all wet it, but immediately discover itself to be as motionless as before it was set over the fire; whereby it appears, that a heap of such little bodies, as are neither spherical nor otherwise regularly shaped, nor small enough to be below the discernment of the eye, may, without fusion, be made fluid, barely by a sufficiently strong and various agitation of the particles which compose it; and moreover lose its fluidity immediately upon the cessation thereof.

Two or three spoonfuls of burnt alabaster, mixed up thin with water, in a short time coagulate, at the bottom of a vessel full of water, into a hard lump, notwithstanding the water that surrounded it. Artificers observe, that the coagulating property of burnt alabaster will be very much impaired or lost, if the powder be kept too long, especially if in the open air, before it is made use of; and when it hath been once tempered with water, and suffered to grow hard, they cannot, by any burning or powdering of it again, make it serviceable for their purpose as before.

This matter, when wrought into vessels, &c. is still Plaster. of so loose and spongy a texture, that the air has easy passage through it. Mr Boyle gives an account, among his experiments with the air-pump, of his preparing a tube of this plaster, closed at one end and open at the other; and on applying the open end to the cement, as is usually done with the receivers, it was found utterly impossible to exhaust all the air out of it; for fresh air from without pressed in as fast as the other, or internal air, was exhausted, though the sides of the tube were of a considerable thickness. A tube of iron was then put on the engine; so that being filled with water, the tube of plaster of Paris was covered with it; and on using the pump, it was immediately seen, that the water passed through into it as easily as the air had done, when that was the ambient fluid. After this, trying it with Venice turpentine instead of water, the thing succeeded very well; and the tube might be perfectly exhausted, and would remain in that state several hours. After this, on pouring some hot oil upon the turpentine, the case was much altered; for the turpentine melting with this, that became a thinner fluid, and in this state capable of passing like water into the pores of the plaster. On taking away the tube after this, it was remarkable that the turpentine, which had pervaded and filled its pores, rendered it transparent, in the manner that water gives transparency to that singular stone called *oculus mundi*. In this manner, the weight of air, under proper management, will be capable of making several sorts of glues penetrate plaster of Paris; and not only this, but baked earth, wood, and all other bodies, porous enough to admit water on this occasion.

Plaster of Paris is used as a manure in Pennsylvania, as we find mentioned in a letter from a gentleman in that country inserted in the 5th volume of the Bath Society Papers, and which we shall insert here for the satisfaction and information of our agricultural readers. "The best kind is imported from hills in the vicinity of Paris: it is brought down the Seine, and exported from Havre de Grace. I am informed there are large beds of it in the Bay of Fundy, some of which I have seen nearly as good as that from France; nevertheless several cargoes brought from thence to Philadelphia have been used without effect. It is probable this was taken from the top of the ground, and by the influence of the sun and atmosphere dispossessed of the qualities necessary for the purposes of vegetation. The lumps composed of flat shining specula are preferred to those which are formed of round particles like sand: the simple method of finding out the quality is to pulverize some, and put it dry into an iron pot over the fire, when that which is good will soon boil, and great quantities of the fixed air escape by ebullition. It is pulverized by first putting it in a stamping-mill. The finer its pulverization the better, as it will thereby be more generally diffused.

"It is best to sow it in a wet day. The most approved quantity for grass is six bushels per acre. No art is required in sowing it more than making the distribution as equal as possible on the sward of grass. It operates altogether as a top manure, and therefore should not be put on in the spring until the principal frosts are over and vegetation hath begun. The general time for sowing with us is in April, May, June, July, August, and even as late as September. Its effects will generally

Plaster ‖ Plastic.

rally appear in 10 or 15 days; after which the growth of the grass will be so great as to produce a large burden at the end of six weeks after sowing.

"It must be sown on dry land, not subject to be overflown. I have sown it on sand, loam, and clay, and it is difficult to say on which it has best answered, although the effect is sooner visible on sand. It has been used as a manure in this state for upwards of twelve years. Its duration may, from the best information I can collect, be estimated from seven to twelve years; for, like other manure, its continuance very much depends on the nature of the soil on which it is placed.

"One of my neighbours sowed some of his grass ground six years ago, another four years ago; a great part of my own farm was sown in May 1788. We regularly mow two crops, and pasture in autumn; no appearance of failure, the present crop being full as good as any preceding. I have this season mowed fifty acres of red clover, timothy grass, white clover, &c. which was plastered last May, July, and September: many who saw the grass estimated the produce at two tons per acre, but I calculate the two crops at three tons. Several stripes were left in the different fields without plaster; these were in a measure unproductive, being scarce worth mowing. In April 1788, I covered a piece of grass land upwards of two inches thick with barn manure; in the same worn-out field I sowed plaster, to contrast it with the dung. I mowed the dunged and plastered land twice last year and once this; in every crop the plaster has produced the most. You will remember, in all experiments with clover, to mix about one-third timothy grass seed; it is of great advantage in serving as a support for the clover; it very much facilitates the curing of clover, and when cured is a superior fodder. The plaster operates equally as well on the other grasses as on clover. Its effect is said to be good on wheat, if sown in the spring; but I cannot say this from experience. On Indian corn I know its operation to be great; we use it at the rate of a tablespoonful for a hill, put in immediately after dressing.

"From some accurate experiments last year made and reported to our Agricultural Society, it appears that nine bushels of additional corn per acre were produced by this method of using plaster."

PLASTERING. See PARGETTING.

PLASTIC, denotes a thing endowed with a formative power, or a faculty of forming or fashioning a mass of matter after the likeness of a living being.

PLASTIC-Nature, a certain power by which, as an instrument, many philosophers, both ancient and modern, have supposed the great motions in the corporeal world, and the various processes of generation and corruption, to be perpetually carried on.

Among the philosophers of Greece, such a power was almost universally admitted. It seems, indeed, to have been rejected only by the followers of Democritus and Epicurus, who talk as if they had thought gravity essential to matter, and the *fortuitous* motion of atoms, which they held to have been from eternity, the source not only of all the *regular* motions in the universe, but also of the *organization* of all corporeal systems, and even of *sensation* and *intellection*, in brutes and in men. It is needless to say, that those men, whatever they might profess, were in reality atheists; and Democritus, it is universally known, avowed his atheism.

Plastic.

The greater part of the philosophers who held the existence of a plastic nature, considered it not as an *agent* in the strict sense of the word, but merely as an instrument in the hand of the Deity; though even among them there were some who held no superior power, and were of course as gross atheists as Democritus himself Such was *Strato* of Lampsacus. This man was originally of the peripatetic school, over which he presided many years, with no small degree of reputation for learning and eloquence. He was the first and chief assertor of what has been termed *Hylozoic atheism*; a system which admits of no power superior to a certein *natural* or *plastic life*, *essential*, *ingenerable*, and *incorruptible*, inherent in matter, but without sense and consciousness. That such was his doctrine we learn from Cicero, who makes *Velleius* the Epicurean say, "Nec audiendus *Strato* qui *Physicus* appellatur, qui omnem vim divinam in Natura sitam esse censet, quæ causas gignendi, augendi, minuendive habeat, sed careat omni sensu ‡." That Strato, in admitting this plastic principle, differed widely from Democritus, is apparent from the following account of him by the same author: "*Strato Lampsacenus* negat opera deorum se uti ad fabricandum mundum, quæcunque sint docet omnia esse effecta *naturæ*, nec ut ille, qui asperis, et levibus, et hamatis uncinatisque corporibus concreta hæc esse dicat, interjecto inani; somnia censet hæc esse *Democriti*, non docentis sed optantis §."

‡ *De Natura Deorum*, lib. i. cap. 13.

§ *Acad. Quæst.* lib. iv. cap. 38.

That the rough and smooth, and hooked and crooked, atoms of Democritus, were indeed dreams and dotages, is a position which no man will controvert; but surely Strato was himself as great a dreamer when he made sensation and intelligence result from a certain plastic or spermatic life in matter, which is itself devoid of sense and consciousness. It is, indeed, inconceivable, to use the emphatic language of Cudworth, "how any one in his senses should admit such a monstrous paradox as this, that every atom of dust has in itself as much wisdom as the greatest politician and most profound philosopher, and yet is neither conscious nor intelligent!" It is to be observed of Strato likewise, that though he attributed a certain kind of life to matter, he by no means allowed of one common life as ruling over the whole material universe. He supposed the several parts of matter to have so many several plastic lives of their own, and seems ‡ to have attributed something to chance in the production and preservation of the mundane system.

‡ *Cud. Int. Syst. ed. Mosheim*, lib. i. cap. 3.

In denying the existence of a God, perpetually directing his plastic principle, and in supposing as many of these principles as there are atoms of matter, Strato deviated far from the doctrine of Aristotle. The great founder of the peripatetic school, as well as his apostate disciple, taught that mundane things are not effected by fortuitous mechanism, but by such a *nature* as acts regularly and artificially for *ends*; yet he never considers this *nature* as the highest principle, or supreme *Numen*, but as subordinate to a perfect mind or intellect; and he expressly affirms, that "*mind*, together with *nature*, formed or fashioned this universe." He evidently considers mind as the principal and intelligent agent, and nature as the subservient and executive instrument. Indeed, we are strongly inclined to adopt the opinion of the learned Mosheim, who thinks that by nature Aristotle meant nothing more than that θερμοτης ψυχικη, or *animal heat*, to which he attributes immortality, and of which he expressly says ‡ that all things are full. Be

‡ *De Generatione Animal.* lib. iii. cap. 11.

Plastic.

this as it may, he always joins God and nature together, and affirms that they do nothing in vain. The same doctrine was taught before him by Plato, who affirms that "nature, together with reason, and according to it, orders all things." It must not, however, be concealed, that Plato seems to have attributed intelligence to the principle by which he supposed the world to be animated; for Chalcidius, commenting on the Timæus ‡, thus expresses himself: "Hæc est illa *rationabilis* anima mundi, quæ gemina juxta meliorem naturam veneratione tutelam præbet inferioribus, divinis dispositionibus obsequens, providentiam nativis impertiens, æternorum similitudine propter cognationem beata."—Apuleius, too, tells us ||, "Illam cœlestem animam, fontem animarum omnium, optimam virtutem esse genetricem, subserviri etiam Fabricatori Deo, et præsto esse ad omnia inventa ejus." *Plato pronunciat*.

‡ Sect. 53.

|| *De Dogmate Platonis*.

This doctrine of Plato has been adopted by many moderns of great eminence both for genius and for learning. The celebrated Berkeley bishop of Cloyne, after giving the view of Plato's *anima mundi*, which the reader will find in our article MOTION, n° 10, thus recommends the study of his philosophy *: "If that philosopher himself was not read only, but studied also with care, and made his own interpreter, I believe the prejudice that now lies against him would soon wear off, or be even converted into high esteem, for those exalted notions, and fine hints, that sparkle and shine throughout his writings; which seem to contain not only the most valuable learning of Athens and Greece, but also a treasure of the most remote traditions and early science of the east." Cudworth, and the learned author of *Ancient Metaphysics*, are likewise strenuous advocates for the Aristotelian doctrine of a plastic nature diffused through the material world; (see METAPHYSICS, n° 200, 201, 202.): and a notion very similar has lately occurred to a writer who does not appear to have borrowed it either from the *Lyceum* or the *Academy*.

* *Siris*, n° 338.

This writer is Mr Young, of whose *active substance*, and its agency in moving bodies, some account has been given elsewhere, (see MOTION). As a mere unconscious agent, *immaterial*, and, as he expresses himself, *immental*, it bears a striking resemblance to the *plastic nature* or *vegetable life* of Cudworth: but the author holds it to be not only the principle of motion, but also the *basis* or *substratum* of matter itself; in the production of which, by certain motions, it may be said to be more strictly *plastic* than the *hylarchical* principle, or *vis genitrix*, of any other philosopher with whose writings we have any acquaintance. Though this opinion be singular, yet as its author is evidently a man who thinks for himself, unawed by the authority of celebrated names, and as one great part of the utility of such works as ours consists in their serving as indexes to science and literature, we shall lay before our readers a short abstract of the reasonings by which Mr Young endeavours to support his hypothesis, and we shall take the liberty of remarking upon those reasonings as we proceed.

The author, after a short introduction, enters upon his work ‡, in a chapter intitled, *Analysis of Matter in general*. In that chapter there is little novelty. He treats, as others have done, of primary and secondary qualities, and adheres too closely to the language of Locke, when he says, that "the nature of bodies signifies the aggregate of all those *ideas* with which they furnish us, and by which they are made known." To say the best of it, this sentence is inaccurately expressed. An aggregate of *ideas* may be occasioned by the impulse of bodies on the organs of sense, but the effect of impulse cannot be that which impels. We should not have made this remark, which may perhaps be deemed captious, were we not persuaded that the vague and inaccurate use of terms is the source of those mistakes into which, we cannot help thinking, that the very ingenious author has sometimes fallen. Having justly observed, that we know nothing directly of bodies but their qualities, he proceeds to investigate the nature of solidity.

‡ *An Essay on the powers and mechanism of nature*.

"Solidity (he says) is the quality of body which principally requires our notice. It is that which fills extension, and which resists other solids, occupying the place which it occupies; thus making extension and figure real, and different from mere space and vacuity. If the secondary qualities of bodies, or their powers, variously to affect our senses, depend on their primary qualities, it is chiefly on this of solidity; which is therefore the most important of the primary qualities, and that in which the essence of body is by some conceived to consist. This idea of solidity has been judged to be incapable of any analysis; but it appears evident to me (continues our author), that the idea of solidity may be resolved into another idea, which is that of the power of resisting within the extension of body. Hence it becomes unnecessary, and even inadmissible, to suppose that solidity in the body is at all a pattern or archetype of our sensation."

That solidity in the body, and we know nothing of solidity any where else, is no pattern of any sensation of ours, is indeed most true, as we have shown at large in another place, (see METAPHYSICS, n° 44 and 171): but to reconcile this with what our author asserts immediately afterwards, that "solidity is no more in bodies than colours and flavours are, and that it is equally with them a *sensation* and an *idea*," would be a task to which our ingenuity is by no means equal. He affirms, indeed, that solidity, as it is said to be in bodies, is utterly incomprehensible; that we can perfectly comprehend it as a sensation in ourselves, but that in bodies nothing more is required than a power of active resistance to make upon our senses those impressions from which we infer the reality of primary and secondary qualities. This power of resistance, whether it ought to be called active or passive, we apprehend to be that which all other philosophers have meant by the word *solidity*; and though Locke, who uses the words *idea* and *notion* indiscriminately, often talks of the *idea* of solidity, we believe our author to be the first of human beings who has thought of treating *solidity* as a sensation in the mind.

Though it is wrong to innovate in language, when writing on subjects which require much attention, we must, however, acknowledge it to be unworthy of inquirers after truth to dispute about the proper or improper use of terms, so long as the meaning of him who employs them can be easily discovered. We shall, therefore, follow our author in his endeavours to ascertain what this power of resistance is which is commonly known by the name of solidity. All power he justly holds to be active; and having, by an argument (A) of which we do not

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"(A) We can only conceive of solidity as being a resistance of the *parts* of any body, to a power which endeavours

Plastic. not perceive the force, attempted to prove that it is by an inward *power*, and not by its *inertia*, that one body prevents another from occupying the same place with itself, he naturally enough infers matter to be essentially active. "But the activity of matter is to be considered in a certain limited sense, and its inertness is to be regarded in another limited sense; so that these are compatible within their respective limits. The activity of body may be considered as belonging to the parts of a compound; its inertia as the inertia formed of those parts. The actions of the parts are everywhere opposed to each other, and equal; and hence results the inactivity of the whole."

Solidity alone of the primary qualities being positive, and peculiar to bodies, and our author having resolved this into action or power, it follows, by his analysis, that the essence of body is reduced to power likewise. But, as he properly observes, power is an idea of reflection, not acquired by the senses, but suggested by thought. Hence our knowledge of real existence in body must be such as is suggested to us by our thoughts exercised about our sensations. "We are capable of acting and producing changes in appearances; and this faculty, which we experience to exist in ourselves, we call power. We are conscious of the exertion of our own power; and therefore, when we see action or change happen without any exertion of ours, we refer this to other powers without us, and necessarily conclude the power to exist where the change begins or the action is exerted. This power, then, referred to bodies, must exist in them, or it can exist no where."

In two chapters, which might easily have been compressed into one not so long as the shortest of them, our author analyzes *atoms* or the primary particles of matter, and strenuously opposes their impenetrability. He allows that there are atoms of matter not divisible by any known force; but as these, however small, must still be conceived as having extension, each of them must be composed of parts held together by the same power which binds together many atoms in the same body. This power, indeed, he acknowledges to operate much more forcibly when it cements the parts of a primary atom than when it makes many atoms cohere in one mass; but still it operates in the same manner: and as the ideal analysis may be carried on *ad infinitum*, the only positive idea which is suggested by atoms, or the parts of atoms, is the idea of a resisting power. That this power of resistance, which constitutes what is vulgarly called the solidity of bodies, may not be absolutely impenetrable, he attempts to prove, by showing that resistance does in fact take place in cases where impenetrability, and even solidity, are not supposed by any man.

"Let us endeavour (says he) to bring together two like poles of a magnet, and we shall experience a resistance to their approximation. Why, then, may not a piece of iron, which between our fingers resists their coming together, resist by an efficacy perfectly similar, though more strongly exerted? If magnetism were to act upon our bodies as upon iron, we should feel it; or were magnets endowed with sensation, they would feel that which resists their nearer approach. The resisting extension between the two magnets is permeable to all the rays of light, and reflecting none is therefore unseen; but it is easy to conceive that the same power which resists the approach of the iron might resist and reflect some rays of light. We should then have a visible object interposed between the two magnets, as we have before supposed it might be a tangible one. It is likewise easy to conceive that which is tangible and visible so applied to our organs of tasting, of smelling, and of hearing, as to excite ideas of flavours, odours, and sounds. Thus we see that an action, in which no supposition of solidity or impenetrability is involved, may be conceived to assume all the qualities of matter, by only supposing a familiar effect extended in its operation."

This reasoning is exceedingly ingenious, though perhaps not original; but what is of more importance, it does not approach so near to demonstration as the author seems to imagine. If magnets operate by means of a fluid issuing from them (see Magnetism, chap. 3.), those who hold the solidity or impenetrability of matter will maintain, that each atom of the magnetic fluid is solid and impenetrable. That we do not see nor feel these atoms, will be considered as no argument that they do not exist; for we do not see, nor in a close room feel, the atoms of the surrounding atmosphere; which yet Mr Young will acknowledge to have a real existence, and to be capable of operating upon our senses of hearing and smelling. Let us, however, suppose, that by this reasoning

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vours to *separate* them, or to bring them *nearer* together. Now that which resists any power, and prevents its effect, is also a power. By resistance, I mean here an active resistance, such as an animal can employ against an animal. If a horse pulls against a load, he draws it along; but if he draws against another horse, he is put to a stand, and his endeavour is defeated. When any endeavour to change the situation of the parts of any solid is in like manner prevented from taking effect, and the parts retain their situation, the situation has plainly been preserved by an active resistance or power, equivalent to that which was fruitlessly exerted on them."

Such is our author's reasoning to prove that matter is essentially active, and that from this activity results our notion of its solidity: but does he not here confound solidity with hardness, and impenetrability with cohesion? He certainly does; for *water* is as *solid*, in the proper sense of the word, as *adamant*, and the particles of *air* as the particles of *iron*. The parts of water are, indeed, separated with ease, and those of adamant with difficulty; but it is not because the latter have more solidity than the former, but because the power of cohesion, whatever it may be, operates upon them with greater force. Solidity is an attribute of a whole; hardness and softness results from the cohesion of parts. We do not at all perceive the propriety of the simile of the horse pulling a load, and afterwards pulling against another horse. Is it because both horses are *active* that one of them cannot prevail against the other, and because the load is *inactive* that either of them may drag along a mass of iron of half a tun weight? If so, double or triple the mass, and a very strange phenomenon will be the result; for we shall have an active whole compounded of two or three inactive parts, even though these parts should not be in contact!

reasoning he has established the non-existence of every thing in the primary atoms of matter but active powers of resistance, and let us see how he conceives the actions of these powers to constitute what gives us the notion of inert and solid body; for that we have such a notion cannot be denied.

To act he allows to be an attribute, and justly observes, that we cannot conceive an attribute to exist without a substance. "But (says he) we have traced all phenomena to action as to a generic idea, comprehending under it all forms of matter and motion as species of that genus. By this analysis, that complex idea we have usually denominated matter, and considered as the substance or substratum to which motion appertained as an attribute, is found to change its character, and to be itself an attribute of a substance essentially active, of which one modification of motion produces matter and another generates motion." The action of this substance Mr Young determines to be motion (see Motion, n° 16.); and he proceeds to inquire by what kind of motion it produces matter, or inert and resisting atoms.

"Whatever portion of the active substance is given to form an atom, the following things are necessary to be united in such portion of active substance: 1*st*, It must in some respect continually move; for otherwise it would lose its nature, and cease to be active. 2*dly*, It must also in some other respect be at rest, for otherwise it could not form an inactive atom. 3*dly*, It must preserve unity within itself." The author's proof of the first of these positions we have given elsewhere. The second he holds to be self-evident; and the third he thinks established by the following reasoning: "Solidity is the result of those actions among the parts of any whole, whereby the unity of the whole is preserved within itself. Several uncohering things may be united by an external bond: this does not constitute these one solid; it may be one bundle: but if several things cohere, and have a unity preserved within themselves, they become one solid. An atom is the least and most simple solid."

Having thus proved the necessity of these three requisites to the formation of an atom, he observes, that "the two first can only be united in a rotation of the portion of active substance about a centre or axis at rest. By such a motion, *all the parts* successively occupy *different places* in the orbit of rotation, and therefore move; the centre round which they revolve being at rest, the *whole portion* is also at rest; and thus the portion is at once moving and quiescent, as is required. The same kind of motion will also fulfil the terms of the third requisite; for a substance having a revolving motion around its own centre, preserves its unity by reason of all the parts preserving the same relation to the centre: and further, a motion of the active substance about a centre or axis will be an activity in the same orbit, which will act upon and resist whatever shall interfere to oppose its activity, or destroy the unity of the sphere, by diverting the course of the revolving motions. The activity or motion of a portion of active substance about a centre will, therefore, give solidity to such portion; for it will give it unity and resistance, and in a manner tie together all the parts, forming them into one mass about their common centre: for they move or are active not *towards* the centre, in which case they would be lost in non-extension; nor *from* the centre, where they would dissipate in boundless space; but *about* the centre, preserving the same limits of extension: and being in this way active, they in this way resist any other activity opposed to them, that is, they resist any action which tends to penetrate or divide this sphere of revolving activity. Therefore, since any portion of active substance does, by revolving about a centre, become an united, resisting, and quiescent whole, the smallest portions of the active substance which have such motions will become *atoms*, or make the smallest portions of matter."

Having thus shown to his own satisfaction how atoms of matter are formed, he next explains what at first he confesses may have appeared a paradox, "how the active substance, retaining its own nature and essential properties, continuing immaterial, unsolid, and active, puts on at the same time the form of matter, and becomes material, solid, and inert. A sphere of revolving active substance, as it revolves continually about a centre, and as parts of the substance, are considered as successively passing through every point in the orbit; considered thus in its parts, and in its motions, it is active substance, immaterial, and unsolid; but the whole sphere, considered unitically, collectively, and as quiescent, is in this point of view a solid atom, material, and inert."

Such is the active substance of Mr Young, and such his theory of the formation of matter. That he has not with servility copied from the ancients, every reader of his book, who is not an absolute stranger to Greek and Roman literature, will readily acknowledge; and yet if his theory be well founded, he has discovered a middle substance between mind and matter, more properly *plastic* than Aristotle or Plato, Cudworth or Berkeley, ever conceived. But truth compels us to add, that to us his theory appears to labour under insuperable objections. That there *may* be in the universe a substance essentially active, and at the same time not intelligent, is a proposition which we are by no means inclined to controvert. Various phenomena, both in vegetable and animal life, lead us to suspect that there is such a substance; but it does not follow that we are inclined to adopt our author's doctrine respecting the formation of matter. He conceives his proof, indeed, to be "in its nature not at all imperfect, or to fall short of demonstration; and if any one refuse it, he thinks it will be necessary for him to show, either that the explanation offered is not sufficient, or that some other explanation will serve equally well."

To show that the explanation offered is not sufficient, will not, we apprehend, be a very arduous task; but we have no inclination to attempt ourselves another explanation, because we believe that of the formation of matter no other account can be given than that which resolves it into the *fiat* of the Creator. That it cannot be formed by the motion of an immaterial substance in the manner which our author has very clearly described, seems to be a truth so evident as not to admit of proof; for if motion be, as he defines it, a change of place, every thing that is moved must have the quality of extension. But all the parts of this active substance which are given to form an atom, move round a centre, and are expressly said to occupy successively different *places* in the orbit of rotation. Every one of these parts, therefore, is an extended being; and since, according to our author, Plastic.

author, solidity is nothing but an *active power of resistance*, and the parts of this active substance, in their rotation round their centre, *act upon* and *resist* whatever interferes to oppose their activity, it follows that each of these parts is likewise a *solid being*. But, in the opinion of Mr Young himself, and of all mankind, whatever is extended and solid is material. This theory, therefore, exhibits a process in which atoms are formed of a substance, which, though it is said to be *active, immaterial*, and unsolid, appears, when narrowly inspected, to be nothing else than a collection of those very atoms of which the author pretends to explain the formation. Mr Young, who examines and very freely censures some of the doctrines of Newton and others, is too much a man of science to be offended at us for stating objections to a theory which is quite new, to a transformation which he himself acknowledges may to many "appear not only problematical and difficult to conceive, but wholly impossible, and implying contradictions absolutely and for ever irreconcileable." Whether this be a just character of it our readers must determine; but if we did not believe the author to be a man of ingenuity, we should not have introduced him or his work to their acquaintance.

Plastic Art, the art of representing all sorts of figures by the means of moulds. This term is derived from the Greek word πλαστικη, which signifies the "art of forming, modelling, or casting, in a mould." A mould in general is a body that is made hollow for that purpose. The artist makes use of them to form figures in bronze, lead, gold, silver, or any other metal or fusible substance. The mould is made of clay, stucco, or other composition, and is hollowed into the form of the figure that is to be produced; they then apply the jet, which is a sort of funnel, through which the metal is poured that is to form the figures, and that is called *running the metal into the mould.*

It is in this manner, but with much practice and attention, that the artist forms, 1. Equestrian and pedestrian statues of every kind; 2. Groups; 3. Pedestals; 4. Bass-reliefs; 5. Medallions; 6. Cannons, mortars, and other pieces of artillery; 7. Ornaments of architecture, as capitals, bases, &c.; 8. Various sorts of furniture, as lustres, branches, &c. in every kind of metal: and in the same manner figures are cast in stucco, plaster, or any other fusible matter. See *Plaster of Paris.*

Wax being a substance that is very easily put in fusion, plastics make much use of it. There are impressions which are highly pleasing in coloured wax, of medallions, basso and alto relievos, and of detached figures; which, however, are somewhat brittle. But this matter has been carried too far: they have not only formed moulds to represent the likeness and the bust of a living person, by applying the plaster to the face itself, and afterwards casting melted wax into the mould; but they have also painted that waxen bust with the natural colours of the face, and have then applied glass eyes and natural hair; to which they have joined a stuffed body and limbs, with hands of wax; and have, lastly, dressed their figure in a real habit; and by these means have produced an object the most shocking and detestable that it is possible to conceive. It is not a statue, a bust, a natural resemblance that they form; but a dead body, a lifeless countenance, a mere carcase. The stiff air, the inflexible muscles, the haggard eyes of glass, all contribute to produce an object that is hideous and disgustful to every man of taste. Figures like these offend by affording too exact an imitation of nature. In no one of the polite arts ought imitation ever to approach so near the truth as to be taken for nature herself. Illusion must have its bounds; without which it becomes ridiculous.

There is another invention far more ingenious and pleasing, which is that wherein M. Lippart, antiquary and artist at Dresden, has so much excelled. He has found the means of resembling, by indefatigable labour, great expence, and infinite taste, that immense number of stones, engraved and in camaieu, which are to be seen in the most celebrated cabinets. He has made choice of those that are the most beautiful; and, with a paste of his own invention, he takes from these stones an impression that is surprisingly accurate, and which afterwards become as marble: these impressions he calls *pasti.* He then gives them a proper colour, and incloses each with a gold rim; and, by ranging them in a judicious order, forms of them an admirable system. They are fixed on pasteboards, which form so many drawers, and are then inclosed in cases, which represent folio volumes, and have titles wrote on their backs; so that these fictitious books may conveniently occupy a place in a library. Nothing can be more ingenious than this invention; and, by means of it, persons of moderate fortune are enabled to make a complete collection of all antiquity has left that is excellent of this kind; and the copies are very little inferior to the originals.

There is also another method of taking the impressions of camaieus, medals, and coins, which is as follows: They wash or properly clean the piece whose impression is to be taken, and surround it with a border of wax. They then dissolve isinglass in water, and make a decoction of it, mixing with it some vermilion, to give it an agreeable red colour. They pour this paste, when hot, on the stone or medal, to the thickness of about the tenth part of an inch; they then leave it exposed to the sun, in a place free from dust. After a few days this paste becomes hard, and offers to the eye the most admirable and faithful representation of the medal that it is possible to conceive: they are then carefully placed in drawers; and thousands of these impressions, which comprehend many ages, may be included in a small compass.

The proficients in plastics have likewise invented the art of casting in a mould papier maché or dissolved paper, and forming it into figures in imitation of sculpture, of ornaments and decorations for ceilings, furniture, &c. and which they afterwards paint or gild. There are, however, some inconveniences attending this art; as, for example, the imperfections in the moulds, which render the contours of the figures inelegant, and give them a heavy air: these ornaments, moreover, are not so durable as those of bronze or wood, seeing that in a few years they are preyed on by the worm.

The figures that are given to porcelain, Delft ware, &c. belong also to plastics; for they are formed by moulds, as well as by the art of the sculptor and turner; and by all these arts united are made vases of every kind, figures, groups, and other designs, either for use or ornament.

From this general article the reader is referred to Foundery, Cast, Glazing, Porcelain, *Papier-Maché*, Pottery, *Delft Ware.*

Plata.

PLATA, the name of a very great river of South America, running through the province of Paraguay; whence the whole country is sometimes called *Plata*; though this name is usually bestowed only upon a part of Paraguay. In the latter sense it comprehends all that country bounded on the east and south-east by the Atlantic Ocean; on the south, by Terra Magellanica; on the west, by Tucuman; and on the north, by the provinces of Paraguay Proper and Parana. The great river La Plata, from which the country has its name, was first discovered, in 1515, by Juan Diaz de Solis; but denominated *La Plata* by Sebastian Gabato, from the great quantity of the precious metals he procured from the adjacent inhabitants, imagining it was the produce of the country, though in fact they brought it from Peru.

The country lies between 32° and 37° of south latitude. The climate is pleasant and healthy. Their winter is in May, June, and July, when the nights are indeed very cold, but the days moderately warm; the frost is neither violent nor lasting, and the snows are very inconsiderable.

The country consists mostly of plains of a vast extent, and exceeding rich soil, producing all sorts of European and American fruits, wheat, maize, cotton, sugar, honey, &c. and abounding with such excellent pastures, that the beasts brought hither from Spain are multiplied to such a degree, that they are all in common, no man claiming any property in them, but every man takes what he hath occasion for. The number of black cattle, especially, is so prodigious, that many thousands of them are killed merely for their hides, every time the ships go for Spain, and their carcases left to be devoured by wild beasts and birds of prey, which are also very numerous. Sometimes, when they cannot vend their hides, they will kill them for their tongues; and those who care not to be at the trouble to fetch them from the plains, may buy them for a trifle. There is a curious account in Lord Anson's voyage of the manner of hunting them on horseback; and of catching and killing them, by throwing a noose on their horns at full gallop, the horses being trained to the sport. Horses are no less numerous, and in common like the other cattle; so that a man may have as many as he pleases for the catching; and of those that are already broke, one may buy some of the best, and of the true Spanish breed, for a piece-of-eight per head. Wild-fowl also is in great plenty here; partridges in particular are more numerous, and as large and tame as our hens, so that one may kill them with a stick. Their wheat makes the finest and whitest of bread; and, in a word, they seem to want for nothing here, especially the natives, but salt and fuel. The former the Spaniards have brought to them from other parts; and the latter they supply themselves with, by planting vast numbers of almond, peach, and other trees, which require no other trouble than putting the kernels into the ground, and by the next year, we are told, they begin to bear fruit. The return for European commodities is so great here, that it almost exceeds belief; an ordinary two-penny knife fetching a crown, and a gun of the value of 10 or 12 shillings 20 or 30 crowns, and so of the rest.

The river Plata rises in Peru, and receives a great many others in its course; the chief of which is the Paraguay. The water of it is said to be very clear and sweet, and to petrify wood; and contains such plenty and variety of fish, that the people catch great quantities of them without any other instrument than their hands. It runs mostly to the south and south-east; and is navigable the greater part of its course by the largest vessels, and full of delightful islands. All along its banks are seen the most beautiful birds of all kinds; but it sometimes overflows the adjacent country to a great extent, and is infested by serpents of a prodigious bigness. From its junction with the Paraguay to its mouth is above 200 leagues. We may form some judgement of its largeness by the width of its mouth, which is said to be about 70 leagues. Before it falls into the Paraguay it is called *Panama*. See PANAMA.

Platææ, Platalea.

PLATÆÆ (anc. geog.), a very strong town of Bœotia, in its situation exposed to the north wind (Theophrastus); burnt to the ground by Xerxes (Herodotus, Justinus); mentioned much in the course of the Persian war: Famous for the defeat of Mardonius, the Persian general; and for the most signal victory of the Lacedemonians and other Greeks under Pausanias the Lacedemonian, and Aristides an Athenian general (Nepos, Diodorus, Plutarch); in memory of which the Greeks erected a temple to Jupiter Eleutherius, and instituted games which they called *Eleutheria*; and there they show the tombs of those who fell in that battle (Strabo). It stood at the foot of mount Cithæron, between that and Thebes to the north, on the road to Athens and Megara, and on the confines of Attica and Megaris. Now in ruins.

PLATALEA, the SPOONBILL, in ornithology, a genus belonging to the order of grallæ. The beak is plain, and dilates towards the point into an orbicular form; the feet have three toes, and are half palmated. There are three species distinguished by their colour: and of these species there are three varieties; two of what is called the *white species*, and one of the *roseate*. Plate CCCXCVII.

1. The white species, which Linnæus calls *platalea leucorodia*, is about the size of a heron, but somewhat shorter in the neck and legs. The bill is more than half a foot long, and, like that of the rest of the genus, is shaped like a spoon: the colour of the bill is very various, being in some birds black, in others brown, and sometimes spotted; from the base to two-thirds of its length several indentations cross it, the rising parts of which are of a dark colour: the tongue is short and heart-shaped: the irides are grey: the skin of the lore round the eyes and of the throat is bare and black: the plumage is entirely white, though there have been specimens where the quills were tipped with black: the legs are generally either black or of a greyish brown colour; between the toes there is a membrane connected to the outer one as far as the second, and to the inner as far as the first joint.

"This bird (says Mr Latham) is found in various parts of the old continent, and from the Ferro isles near Iceland to the Cape of Good Hope. It frequents the neighbourhood of the sea; and has been met with on the coasts of France; at Sevenhuys, near Leyden, once in great plenty, annually breeding in a wood there. The nest is placed on high trees near the sea-side. The female lays three or four white eggs, powdered with a few pale red spots, and of the size of those of an hen. They are very noisy during breeding-time, like our rooks; are seldom found high up the rivers, chiefly frequenting the

the mouths of them. Their food is fish, which they are said not unfrequently to take from other birds, in the manner of the bald eagle; also mussels and other shell-fish being found in greatest numbers where these are plenty; and they will also devour frogs and snakes, and even grass and weeds, which grow in the water, as well as the roots of reeds. They are migratory, retiring to the warmer parts as the winter approaches, and are rarely seen in England. Their flesh is said to have the flavour of a goose, and is eaten by some, and the young birds have been thought good food. By many authors they are called *pelicans*."

The two varieties of this species are equal in size to the roseate species. The bill of the first is reddish; the plumage mostly white; the feathers of the wings partly white and partly black, and the legs reddish. The plumage of the other is entirely white, not excepting even the quills. It has a crest of feathers whose webs are very loose, and separated from one another; the bill is of a rufous grey colour, having red edges, and the legs are of a dull pale red. They both inhabit the *Philippine islands*.

2. The roseate species, or *platalea ajaja*, is but a little less than the white. The bill is marked all round with a furrow parallel to the edge, and is of a greyish white colour, so transparent as to show the ramification of the blood-vessels belonging to it: the forehead is of a whitish colour between the bill, and eyes, and throat: the plumage is a fine rose-colour, deepest on the wings: the legs are grey; the claws blackish; and the toes have membranes as in the last species. The variety of this species is entirely of a beautiful red colour, having a collar of black at the lower part of the neck; the irides are red. Mr Latham imagines it is the roseate in full plumage. It is said to be of a blackish chesnut the first year; becomes rose-coloured the second, and of a deep scarlet the third. It lives on small fish.

3. The dwarf species, or *platalea pigmea*, is about the size of a sparrow. The bill is black, longer than the head, flat at the end, and nearly of a rhomboidal form; the angles and top of the upper mandible are white; the tongue is smooth; the body is brown above and white beneath; the quills have white shafts; the tail is rounded, short, and of a brownish white colour; the feet have four toes, are cloven, and the claws are pointed. It inhabits Surinam and Guiana.

PLATANUS, the Plane-tree; a genus of the polyandria order, belonging to the monœcia class of plants.

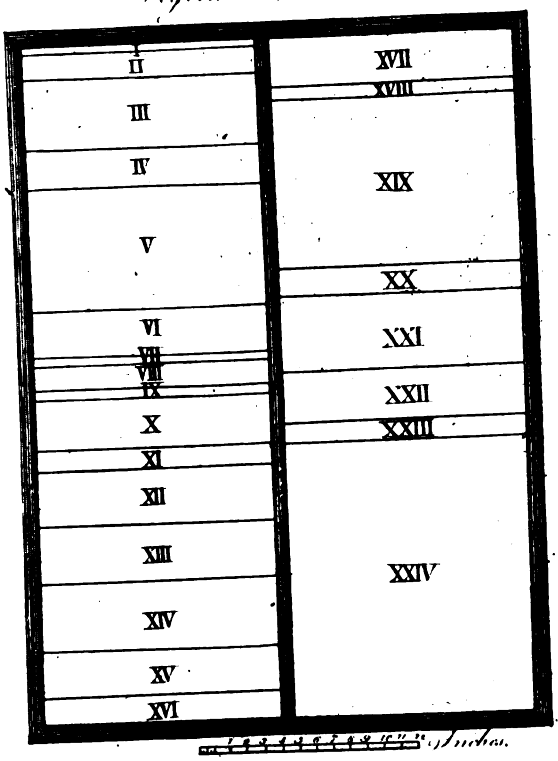
Species. 1. The orientalis, oriental or eastern plane-tree, rises with a very straight smooth branching stem to a great height. It has palmated leaves, six or eight inches long and as much broad, divided into five large segments, having the side ones cut into two smaller, green above, and pale underneath; and long pendulous pedunculi, each sustaining several round heads of close-sitting very small flowers; succeeded by numerous downy seeds, collected into round, rough, hard balls. It is a native of Asia and many parts of the east, and grows in great plenty in the Levant. 2. The occidentalis, occidental, or western plane-tree, rises with a straight smooth stem, to a great height, branching widely round: it has lobated leaves, seven or eight inches long, and from nine or ten to twelve or fourteen broad, divided into three large lobes; and very small flowers, collected into round heads, succeeded by round rough balls of seed. It is a native of Virginia and other parts of North America; where it attains an enormous size, and is remarkable for having its stem all of an equal girt for a considerable length: we have an account of some trees being eight or nine yards in circumference, and which, when felled, afforded 20 loads of wood. The varieties of these two species are the Spanish or middle plane-tree, having remarkably large leaves of three or five narrower segments; and the maple-leaved plane-tree, having smaller leaves, somewhat lobated into five segments, resembling the mapple-tree leaf.

All these elegant trees are of hardy temperature, so as to prosper here in any common soil and exposure in our open plantations, &c. and are some of the most desirable trees of the deciduous tribe. They were in singular esteem among the ancients of the east, for their extraordinary beauty, and the delightful shade they afforded by their noble foliage. The leaves commonly expand in May, and fall off early in autumn; and the flowers appear in spring, a little before the leaves, being succeeded by seeds, which in fine seasons frequently ripen here in September. These fine trees are singularly fitted for all ornamental plantations. Their straight growth, regular branching heads, and the lofty stature they attain, together with the extraordinary breadth of their luxuriant leaves, render them extremely desirable furniture to adorn avenues, lawns, parks, and woods; some disposed in ranges, some as single standards, others in clumps, some in groves, &c. They are most excellent for shade; for it is observable, that no tree is better calculated to defend us from the heat in summer, by its noble spreading foliage, and to admit the sun's rays more freely in winter, on account of the distance of its branches, which is always in proportion to the size of the leaves. They may also be employed in the collection of forest-trees, in woods, to grow up to timber, in which case they will also prove advantageous in time. In short, these noble trees claim the esteem of every one concerned in plantations of every kind; but more particularly in extensive ones, where they may be so variously disposed as to have a charming effect.

The *propagation* of these trees is by seed, layers, and cuttings. The seeds frequently ripen in these parts, and are also procured from other countries, and may be obtained of the nurserymen or seedsmen. The best season for sowing them is autumn, if they can be then possibly procured. Choose a somewhat shady moist soil; and having dug the ground, and raked it fine, form it into four-feet wide beds, and either scatter the seeds evenly on the surface and rake them in, or previously with the back of a rake turn the earth off the surface near half an inch deep into the alleys; then sow the seed, and directly, with the rake turned the proper way, draw the earth evenly over the seeds, and trim the surface smooth: many of the plants will rise in spring, and probably may not till the spring following. When they are one or two years old, plant them out in nursery rows, two or three feet asunder, and about half that distance in the lines; here to remain till of a proper size for final transplantation. The method of propagation by layers is very commonly practised in the nurseries, in default of seed, and by which they most readily grow; for which purpose, some stout plants for stools must be planted, which in a year after must be headed down

Plate CCCXCVII.

Vegetable Cabinet.



PLATALEA
or Spoon Bill.

The Mines of Pissasfalto in the Island of Bua.

A.Bell Prin. Wal. Sculptor fec.

Platband, Plate.

near the bottom, that they may throw out many shoots near the ground, convenient for laying; which, in the autumn after they are produced, lay by for slit-laying; and by autumn after, they will be well rooted, and form plants two or three feet high, so may be separated, and planted in nursery-rows like the seedlings. All the sorts will take tolerably by cutting off the strong young shoots; but the *platanus occidentalis* more freely than the oriental kind. Autumn is the best season: as soon as the leaf fails, choose strong young shoots, and plant them in a moist soil; many of them will grow, and make tolerable plants by next autumn. It should be remarked, that, in order to continue the distinction of the varieties more effectually, they should be propagated either by layers or cuttings: for when raised from seed, those of the respective species generally vary.

PLATBAND, in gardening, a border or bed of flowers, along a wall, or the side of a parterre, frequently edged with box, &c.

Platband of a door or window, is used for the lintel, where that is made square, or not much marked.

PLATE, a term which denotes a piece of wrought silver, such as the shallow vessel off which meat is eaten. It is likewise used by our sportsmen to express the reward given to the best horse at our races.

Sportsman's Dictionary. The winning a plate is not the work of a few days to the owner of the horse; but great care and preparation is to be made for it, if there is any great dependence on the success. A month is the least time that can be allowed to draw the horse's body clean, and to refine his wind to that degree of perfection that is attainable by art.

It is first necessary to take an exact view of his body, whether he be low or high in flesh; and it is also necessary to consider whether he be dull and heavy, or brisk and lively when abroad. If he appear dull and heavy, and there is reason to suppose it is owing to too hard riding, or, as the jockeys express it, to some grease that has been dissolved in hunting, and has not been removed by scouring, then the proper remedy is half an ounce of diapente given in a pint of good sack; this will at once remove the cause, and revive the creature's spirits. After this, for the first week of the month, he is to be fed with oats, bread, and split beans; giving him sometimes the one and sometimes the other as he likes best; and always leaving some in the locker, that he may feed at leisure when he is left alone. When the groom returns at the feeding-time, whatever is left of this must be removed, and fresh given; by this means the creature will soon become high-spirited, wanton, and full of play. Every day he must be rode out an airing, and every other day it will be proper to give him a little more exercise; but not so much as to make him sweat too much. The beans and oats in this case are to be put into a bag, and beaten till the hulls are all off, and then winnowed clean; and the bread, instead of being chipped in the common way, is to have the crust clean cut off. If the horse be in good flesh and spirits when taken up for its month's preparation, the diapente must be omitted; and the chief business will be to give him good food, and so much exercise as will keep him in wind, without oversweating him or tiring his spirits. When he takes larger exercises afterwards, towards the end of the month, it will be proper to have some horses in the place to run against him. This will put him upon his mettle, and the beating them will give him spirits. This, however, is to be cautiously observed, that he has not a bloody heat given him for ten days or a fortnight before the plate is to be run for; and that the last heat that is given him the day before the race, must be in his clothes: this will make him run with greatly more vigour, when stripped for the race, and feeling the cold wind on every part.

Platform, Platina.

In the second week, the horse should have the same food, and more exercise. In the last fortnight, he must have dried oats, that have been hulled by beating. After this they are to be wetted in a quantity of whites of eggs beaten up, and then laid out in the sun to dry; and when as dry as before, the horse is to have them. This sort of food is very light of digestion, and very good for the creature's wind. The beans in this time should be given more sparingly, and the bread should be made of three parts wheat and one part beans. If he should become costive under this course, he must then have some ale and whites of eggs beaten together; this will cool him, and keep his body moist.

In the last week the mash is to be omitted, and barley-water given him in its place, every day, till the day before the race: he should have his fill of hay; then he must have it given him more sparingly, that he may have time to digest it; and in the morning of the race day he must have a toast or two of white bread soaked in sack, and the same just before he is let out to the field. This is an excellent method, because the two extremes of fullness and fasting are at this time to be equally avoided; the one hurting his wind, and the other occasioning faintness that may make him lose. After he has had his food, the litter is to be shook up, and the stable kept quiet, that he may be disturbed by nothing till he is taken out to run.

PLATFORM, in the military art, an elevation of earth, on which cannon is placed to fire on the enemy; such are the mounts in the middle of curtins. On the ramparts there is always a platform, where the cannon are mounted. It is made by the heaping up of earth on the rampart, or by an arrangement of madriers, rising insensibly, for the cannon to roll on, either in a casemate or on attack in the outworks. All practitioners are agreed, that no shot can be depended on, unless the piece can be placed on a solid platform; for if the platform shakes with the first impulse of the powder, the piece must likewise shake, which will alter its direction, and render the shot uncertain.

Platform, in architecture, is a row of beams which support the timber-work of a roof, and lie on the top of a wall where the entablature ought to be raised.

This term is also used for a kind of terrace or broad smooth open walk at the top of a building, from whence a fair prospect may be taken of the adjacent country. Hence an edifice is said to be covered with a platform, when it is flat at top, and has no ridge. Most of the oriental buildings are thus covered, as were all those of the ancients.

Platform, or *Orlop*, in a man of war, a place on the lower deck, abaft the main-mast, between it and the cockpit, and round about the main capstan, where provision is made for the wounded men in time of action.

PLATINA is a metallic substance lately discovered. The name, which has an allusion to its colour, is a diminutive of *plata*, and signifies "little silver." From its great specific gravity, and other resemblances which it

Platina.

it has to gold, it has been called *or blanc*, or *white gold*; from its refractory nature, *diabolus metallorum*; from some doubts entertained of its character as a metal, *juan blanco*, *white jack*, *white rogue*, or *white mock metal*. It has also received the appellation of the *eighth metal*; and, probably from some district which affords it, has gotten the name of *platina del Pinto*.

The first in Europe who mentioned it by its present name was Don Antonio Ulloa, a Spanish mathematician, who in 1735 accompanied the French academicians that were sent by their sovereign to determine the figure of the earth by measuring a degree of the meridian in Peru. In the relation of his voyage, which was published at Madrid in 1748, he says, that the golden mines in the territory of Choco had been abandoned on account of platina; which he represents as a hard stone not easily broken by a blow on the anvil, which could not be subdued by calcination, and from which the gold could not be extracted without much labour, much expence, and great difficulty.

The particular places of Choco where it is found are Novita and Citara; but in what quantity it is there to be met with is not ascertained. The miners, discovering at an early period that it was a metal, had begun to employ it in adulterating their gold; and the court of Spain, it is said, dreading the consequences, took measures not only to prevent its exportation, but partly to conceal the knowledge of it from the world. It is reported in the Chemical Annals for July 1792, that when the gold is brought from Choco to be coined in the two mints of Santa-fe, in that of Bogota and Popayan, the gold undergoes a new examination, the platina that remains is carefully separated, and being given to officers appointed by the king, they, as soon as a certain quantity is collected, carry it away, and before witnesses throw it into the river Bogota, at two leagues distance from Santa-fe, or into the Cauca, about one league distant from Popayan.

In the Physical Journals for November 1785 we are told, that the primitive mines which produced it have not yet been discovered in any part of the globe, and that those which furnish it at present are of the secondary kind, being strata of loose earth washed down from the higher grounds. In these strata the particles are reported to be from the size of a millet seed to that of a pea. The author of the account says, that he had some pieces which weighed from 15 to 20 grains; and adds, that on trying some of them between steel rollers in the presence of Messrs Darcet and Tillet at Paris, they were perfectly laminated. He says also, that a native piece of platina was found nearly of a square figure, and almost as large as a pigeon's egg, which was deposited in the Royal Society of Biscay. M. de Buffon, however, says expressly, that "a person of credit had assured him that platina is sometimes found in large masses; and that he had seen a lump of it weighing no less than 20 lib. which had not been melted, but taken in that state out of the mine." As to the small particles, they are of a whiter colour than iron, with a smooth surface. Their figure is generally of an oblong form, very flat, rounded in the edge, and has been ascribed to the hammering of the mills in which the gold is amalgamated.

The heterogeneous substances with which the platina is generally mixed are particles of gold, grains of quartz or crystal, some sand of a brownish hue, and some dust of a dark colour obedient to the magnet, and which seems to be fragments of other irregular dark-coloured particles, which resemble pieces of emery or loadstone. Dr Ingenhousz, however, says, that every particle even of some fine platina which he examined obeyed the magnet more or less, excepting some that were transparent and stony; and that these were all magnets in themselves, or that each of these particles had two poles, which he could change at pleasure by magnetic bars. In about 72 pounds weight of platina which was brought from Spanish America, M. Magellan found not only a large quantity of ferruginous sand, but many pieces of vegetable stalks, a number of seeds, and some very small red crystals like rubies. These crystals being sent to M. Achard of Berlin, he tried them as far as their minuteness and small quantity would permit, and at last concluded that they really were rubies. As for the mercurial globules which are sometimes intermixed with the particles of platina, they are entirely foreign to its mines. They are now generally thought to be part of the mercury that has been employed in amalgamation; and which could not be brought from a place less distant than Guancavelica, about 900 miles from the province of Choco where the platina is found.

This metal, though not under its present name, which was first mentioned by Don Ulloa, has perhaps been known in Europe since 1741. At that period Charles Wood found in Jamaica some platina which was brought from Carthagena. He even made some chemical trials of it. Among others, he attempted to cupel it; and observes, in the account which he gave of it in 1749, that the Spaniards had a method of casting it into different sorts of toys, which are common enough in the Spanish West Indies. It was probably, too, imported into Spain soon after its discovery in America. It is said that Rudenschoel carried some of it from Spain to Stockholm in 1745; and the first important set of experiments that appeared on the subject were those of Scheffer, one of the members of the Swedish Academy. They were published in 1752; and gave this information, that platina is easily fusible with arsenic, but when alone remains unchanged by the most violent heat of the furnace. Two years after Dr Lewis published some papers concerning this metal in the Royal Philosophical Transactions of London. This eminent chemist, in the course of his experiments, had examined it both in the dry and the wet way; discovered a number of its relative affinities; mixed it in different proportions with different metals; and had fused it with arsenic, though he did not afterwards attempt to separate them.

In 1757 Margraaf published several very interesting observations about the method of separating it from the iron which always accompanies it.

In 1758 and 1763 Macquer and Beaumé made upon it a considerable number of experiments together, and formed of it at last a concave mirror. See *Chemistry*, n° 1321.

And it was in 1780 that the *Journaux de Physique* gave an account of the labours of Bergman on the same subject.

The platina of which the toys were made in the Spanish West Indies was found by Dr Lewis to be always mixed with some other metals. What these particular mixtures were is not well known; but many of the allays formed by Dr Lewis himself have promised to be *Ibid* n° 1339—1347.

both

Platina. both ornamental and useful. He found that platina, which is $\frac{1}{7}$ of the whole mass, will render gold no paler than a guinea, which contains only $\frac{1}{12}$ of silver. He found that copper was much improved by allaying it with platina in certain proportions; and that equal parts of platina and brass formed a compound not subject to tarnish, and which might be employed with great advantage for the speculums of telescopes.

Besides allaying it with the different metals, it was an object equally interesting to the chemists and society that platina should be obtained pure and unmixed; and that means should be contrived to render it fusible, malleable, and ductile. We are now to see what the chemists have done to accomplish these ends. They readily saw that it would be necessary, in the first place, to bring it to a state of ultimate division, and that this should be tried in one or other of these two ways; by dissolving it in acids, or by fusing it along with some other metal; for by itself it had hitherto proved absolutely unfusible, except when exposed to the focus of a large burning glass, or the kindled stream of dephlogisticated or vital air. Among the methods which they employed to separate it from gold, the principal were the following: The first was by uniting the mixture of platina and gold with mercury, and grinding the amalgam for a considerable time with water; in which process the platina was gradually thrown out, and the gold retained by the quicksilver. Another method was by mixing a few drops of a solution of platina with above a hundred times the quantity of a solution of gold, and gradually adding a pure fixed alkaline salt as long as it occasioned any effervescence or precipitation. The remaining liquor in this case was so yellow, that it has been judged the platina would discover itself, though its proportion had been less than a thousandth part of that of gold. A third mode of separating platina and gold was that of precipitation, by means of mineral fixed alkali; for when this alkali is mixed with a solution of gold containing platina, the gold alone is precipitated, and all the platina remains dissolved. Another method was by precipitation of the platina with sal ammoniac. For this purpose, to a solution of the metal in aqua regia a small quantity of the solution of sal ammoniac in water was added; and if the gold contained any platina, the liquor instantly grew turbid, and a fine yellow or reddish precipitate quickly fell to the bottom; if the gold was pure, no precipitation or change of transparency ensued. The fifth method of separation was by means of inflammable liquors. The compound to be examined was dissolved in aqua regia: the solution mingled with twice its quantity or more of rectified spirit of wine, and the mixture suffered to stand for some days in a glass slightly covered, the gold rose to the surface, leaving the platina dissolved. Otherwise, to the solution of the metal in aqua regia about half its quantity of any colourless essential oil was added: the two were shaken well together, and suffered to rest; upon which the oil rose immediately to the surface, carrying the gold with it, and leaving the platina dissolved in the acid under it. Or, the gold was taken up still more readily and more perfectly by ether, or the etherial spirit of wine. But, after all, the most effectual and advantageous method of separating platina from gold was founded on a property which gold has, and not platina, of being capable of precipitation from aqua regia by martial vitriol; and upon a property which platina has, and not gold, of being capable of precipitation from aqua regia by sal ammoniac. When therefore we would discover if gold be allayed with platina, let it be dissolved in aqua regia; and to this solution, which will contain both metals, let some sal ammoniac dissolved in water be added; upon which the platina will be precipitated in form of a brick-coloured sediment. If, on the other side, we would know if platina contain any gold, let this platina be dissolved in aqua regia, and to the solution add a solution of martial vitriol in water; upon which the liquor will become turbid, and the gold will form a precipitate which may be easily separated by decanting and filtrating the liquor. This property which platina possesses of being precipitated by martial vitriol was first discovered by M. Scheffer.

With respect to the iron contained among the platina, M. de Buffon separated, by means of a magnet, six parts out of seven of a parcel of platina. He distinguished two different matters in platina; of which one was black, friable, and attractable by magnets; and the other consisted of larger grains, was of a livid white or yellowish colour, much less attractable, and was extensible. Between these two different matters were many intermediate particles, some partaking more of the former, and some of the latter. He thought that the black matter was chiefly iron; and says, that he had observed a similar black powder in many ores of iron.

M. Morveau found, that a Prussian blue could be obtained from the black part of the platina, by pouring upon it spirit of nitre, and afterwards adding to the solution diluted some phlogisticated alkali; and that the particles of platina which could not be attracted by magnets, did not by this method show any sign of their containing iron.

But the most important discovery concerning the separation of platina from other metals was a method of melting it, by which it became a perfect metal, malleable, and denser than gold. It was in 1773 and 1774 that M. de Lisle effected this, by dissolving crude platina in aqua regia, precipitating it from the acid menstruum by sal ammoniac, and by fusing this precipitate, without addition, in a double crucible, exposed to the intense heat of a forge-fire excited by double bellows. M. Morveau has repeated the experiment, and found that he could melt the precipitate with several fluxes; he found likewise that by means of white glass, borax, and charcoal, he could melt even crude platina, and could allay together platina and steel in various proportions.

M. de Sickengen was the inventor of another method: he dissolved his platina in aqua regia, and precipitated the iron by the prussiate of potass. In evaporating this liquor he obtained small octaedral crystals of the colour of rubies; which, being exposed to a strong heat, yielded a metal which bore easily the stroke of the hammer, which could be readily drawn into wire, and was extremely malleable.

In attempting to refine platina by the dry way, cupellation was a method to which the chemists early had recourse; but, notwithstanding their utmost endeavours, it has not been attended with all the success which could have been wished. It was found that the scorification proceeded as well at the beginning of the operation, as when gold and silver are cupelled; but the cupellation after-

afterwards became more and more difficult; because, as the quantity of lead diminished, the matter became less and less fusible, and at last ceased to be fluid, notwithstanding the most violent heat; and also because, when the quantity of platina was greater than that of the lead, this latter metal was protected, and not converted into litharge. Hence the regulus obtained was always dark-coloured, rough, adhering to the cupel, brittle, and weighing more than the platina originally employed, from the lead which remained united with it. Mess. Macquer and Beaumé appear nevertheless to have carried this experiment further: they kept the matter exposed to a violent fire during a longer time; that is, about 50 hours successively: and therefore, although their platina was tarnished and rough on its surface, it was internally white and shining, easily separable from the cupel, and a little diminished in weight; a certain proof that no lead remained in it. This platina was also ductile, and capable of extension under the hammer.

Cupellation, therefore, though not the best, is at least a certain method of applying platina to use, and of forming it into utensils.

What has been thought a preferable method, is first to fuse the platina with arsenic, and afterwards dissipate this last metal by a strong heat: by this means Achard and Rochon were able to obtain a pure platina; of which the former made some small crucibles, and the latter, by allaying it with copper and tin, some large mirrors for reflecting telescopes.

Jeanety of Paris has gone still farther: besides snuff-boxes, watch-chains, and a coffee pot of platina prepared by this artist, the world has seen a lens weighing six pounds, a ball weighing nine, and two bars 19 feet long, and weighing no less than 11 pounds each. This gentleman has the merit of being the first who wrought this metal in the great way. The method he employed was far from being new; it had been suggested by Scheffer, by Willis, by Margraaf, and was afterwards practised by Achard, Morveau, and a great many others, but who always prepared it in very small quantities. In the Chemical Annals for July 1792, the following account of it is given by himself.

The platina is first pounded in water to disengage it from the ferruginous and other heterogeneous particles that are mixed with it. "This being done, I take (says he) one pound and a half of platina, two pounds of white arsenic in powder, and one pound of purified potash. I mix the whole: I put a crucible in the fire capable of containing about 20 pounds; when my furnace and crucible are well heated, I throw into the crucible one third of the mixture, and apply a good heat; I then add a second quantity and a third, and so on, always taking care at every time to mix the whole with a rod of platina. I give now a considerable force to the fire; and when I am certain that the whole is completely in a state of fusion, I withdraw my crucible and leave it to cool. After breaking it, I find a button that is well formed and attractable by the magnet. I bruise this button into small pieces, and fuse it a second time in the same manner: if this second fusion, which it generally is, be not sufficient to effect the separation of the iron from the platina, I fuse it a third time; but if I be obliged to do it a third time, I always put two buttons together, to save at once a crucible and charcoal.

This first operation being finished, I take a crucible with a flat bottom and of a circumference to give to the button about three inches and a quarter in diameter. I make this crucible red hot, and throw into it one pound and a half of the platina which has been already fused with the arsenic after it was broken into small pieces; to this I add a quantity of arsenic of the same weight, and about half a pound of refined potash. I give to the fire a considerable force; and when I am certain that the whole is completely in a state of fusion, I withdraw my crucible and leave it to cool, taking care always to place it horizontally, that the button may be of an equal thickness. After breaking the crucible, I find a button clear and sonorous, and weighing commonly about 1 pound and 11 ounces. I have remark[ed] that in proportion to the quantity of arsenic combined with the platina, the purification always succeeds with the more or less promptness and ease; and the greater the proportion so much the better. In this state I put my button into a furnace under a muffle, which ought not to be higher than the edge of the button lying on its flat side, and inclining a little to the walls of the muffle. In this manner I place three buttons on each side of the muffle, and apply fire to my furnace, that the muffle may be equally heated throughout: as soon as the buttons begin to evaporate I shut the doors of my furnace, that the heat may be kept up to the same degree; this ought always to be carefully attended to even to the end of the operation, for even a temporary excess of heat might spoil the whole of my past operations and render them abortive. I cause my buttons to volatilize during six hours, always taking care to change their situation, that every part may receive an equal portion of heat: I then put them in common oil, and for a like time keep them in a fire sufficient to dissipate the oil in smoke. I continue this operation as long as the button emits vapours; and when the evaporation has ceased I push the fire as far as it will go by means of the oil. These arsenical vapours have a bright shining metallic appearance, which I never can obtain any other way, and without which I have never been able to render platina perfectly malleable.

"If these steps which are here pointed out be properly followed, the operation lasts only eight days. My buttons are then thrown into the nitrous acid, and afterwards boiled in distilled water, till no part of the acid remains with them: I now heap them together one above another, apply the strongest possible heat, and beat them with a hammer, taking always care at the first heat to make them red hot in the crucible, that no foreign bodies may mix with them, as before this compression they are only so many spongy masses. I afterwards heat them in a naked state (*les chauffe à nud*); and bringing them to a square form, I hammer them on all sides for a shorter or longer time according to their bulk."

Such is the process observed by Jeanety in fusing platina; but he thinks that the working of this metal is susceptible of still greater improvement. In 1788 it was accordingly proposed by some of the French chemists to fuse platina by mixing it with charcoal and phosphoric glass, and afterwards to expose the phosphure of platina to a heat sufficient to volatilize and dissipate the phosphorus. This method succeeded remarkably well with M. Pelletier; but, besides being tedious, it is difficult to separate the last portions of the phosphorus; and as these operations are always costly, there are few artists

artists who are willing to undertake them. M. de Morveau has also fused platina with his vitreous flux, made of pounded glass, borax, and charcoal: and Beaumé has advised to fuse it with a slight addition of lead, bismuth, antimony, or arsenic, and by keeping the alloy in the fire a long time to dissipate the metals which have facilitated the fusion. Platina may likewise be fused with a metal soluble in an acid: the mixture being pulverized, the alloyed metal may be dissolved, and the powder of platina may then be fused with the flux of De Morveau; or, instead of using a soluble metal, a calcinable metal may be employed, and heated as before †.

† *Chaptal.*

The colour of platina, when properly refined, is something between that of iron and silver; it has no smell, and is the heaviest body yet known in nature. According to Mr Kirwan its specific gravity is to that of water as 23 to 1. It may likewise be said to be the most durable of all the metals: it is harder than iron; it undergoes no alteration in the air, and fire alone does not even appear to possess the power of changing it; for which reason it forms the best of all crucibles that have yet been invented. It resists the action of acids, alkalis, and sulphurs: it may be rolled into plates as fine as leaves of gold which are used in gilding; it is likewise extremely ductile: and Dr Withering tells us, that a wire of platina is stronger than a wire of gold or of silver of the same thickness; it is preferable to gold by the property which it has of soldering or welding without mixture; and it unites, says Chaptal, two qualities never before found in one and the same substance. When formed into a mirror, it reflects but one image, at the same time that it is as unchangeable as a mirror of glass.

As those motives which at first prepossessed the court of Spain against this metal no longer exist, it is to be hoped that the decree which was passed against it will soon be revoked, and that the Spanish monarch will neither despise so rich a treasure as his mines of platina, nor refuse to the world the numerous advantages that may be derived from a substance that promises to be of so much importance in commerce and the arts.

PLATING is the art of covering baser metals with a thin plate of silver either for use or for ornament. It is said to have been invented by a spur-maker, not for show but for real utility. Till then the more elegant spurs in common use were made of solid silver, and from the flexibility of that metal they were liable to be bent into inconvenient forms by the slightest accident. To remedy this defect, a workman at Birmingham contrived to make the branches of a pair of spurs hollow, and to fill that hollow with a slender rod of steel or iron. Finding this a great improvement, and being desirous to add cheapness to utility, he continued to make the hollow larger, and of course the iron thicker and thicker, till at last he discovered the means of coating an iron spur with silver in such a manner as to make it equally elegant with those which were made wholly of that metal. The invention was quickly applied to other purposes; and to numberless utensils which were formerly made of brass or iron are now given the strength of these metals, and the elegance of silver, for a small additional expence.

The silver plate is generally made to adhere to the baser metal by means of solder; which is of two kinds, the *soft* and the *hard*, or the *tin* and *silver* solder. The former of these consists of tin alone, the latter generally of three parts of silver and one of brass. When a buckle, for instance, is to be plated by means of the soft solder, the ring, before it is bent, is first tinned, and then the silver-plate is gently hammered upon it, the hammer employed being always covered with a piece of cloth. The silver now forms, as it were, a mould to the ring, and whatever of it is not intended to be used is cut off. This mould is fastened to the ring of the buckle by two or three cramps of small iron-wire; after which the buckle, with the plated side undermost, is laid upon a plate of iron sufficiently hot to melt the tin, but not the silver. The buckle is then covered with powdered resin or anointed with turpentine; and lest there should be a deficiency of tin, a small portion of rolled tin is likewise melted on it. The buckle is now taken off with a tongs, and commonly laid on a bed of sand, where the plate and the ring, while the solder is yet in a state of fusion, are more closely compressed by a smart stroke with a block of wood. The buckle is afterwards bent and finished.

Sometimes the melted tin is poured into the silver mould, which has been previously rubbed over with some flux. The buckle ring is then put among the melted tin, and the plating finished. This is called by the workmen *filling up*.

When the hard solder is employed, the process is in many respects different. Before the plate is fitted to the iron or other metal, it is rubbed over with a solution of borax. Stripes of silver are placed along the joinings of the plate; and instead of two or three cramps, as in the former case, the whole is wrapped round with small wire; the solder and joinings are again rubbed with the borax, and the whole put into a charcoal fire till the solder be in fusion. When taken out the wire is instantly removed, the plate is cleaned by the application of some acid, and afterwards made smooth by the strokes of a hammer.

Metal plating is when a bar of silver and copper are taken of at least one equal side. The equal sides are made smooth, and the two bars fastened together by wire wrapped round them. These bars are then sweated in a charcoal fire; and after sweating, they adhere as closely together as if they were soldered. After this they are flattened into a plate between two rollers, when the copper appears on one side and the silver on the other. This sort of plate is named *plated metal*.

French plating is when silver-leaf is burnished on a piece of metal in a certain degree of heat.

When silver is dissolved in aquafortis, and precipitated upon another metal, the process is called *silvering*. See SOLDERING.

PLATO, an illustrious philosopher of antiquity, was by descent an Athenian, though the place of his birth was the Island of Egina. His lineage through his father is traced back to Codrus the last king of Athens and through his mother to Solon the celebrated legislator. The time of his birth is commonly placed in the beginning of the 88th Olympiad; but Dr Enfield thinks it may be more accurately fixed in the third year of the 87th Olympiad, or 430 years before the Christian era. He gave early indications of an extensive and original genius, and had an education suitable to his high rank, being instructed in the rudiments of letters by the grammarian Dionysius, and trained in athletic exercises by

Aristo

Plato.

Aristo of Argos. He applied with great diligence to the study of the arts of painting and poetry; and made such proficiency in the latter, as to produce an epic poem, which, upon comparing it with the poems of Homer, he committed to the flames. At the age of 20 he composed a dramatic piece; but after he had given it to the performers, happening to attend upon a discourse of Socrates, he was so captivated by his eloquence, that he reclaimed his tragedy without suffering it to be acted, renounced the muses, burnt all his poems, and applied himself wholly to the study of wisdom.

It is thought that Plato's first masters in philosophy were Cratylus and Hermogenes, who taught the systems of Heraclitus and Parmenides; but when he was 20 years old, he attached himself wholly to Socrates, with whom he remained eight years in the relation of a scholar. During this period, he frequently displeased his companions, and sometimes even his master, by grafting upon the Socratic system opinions which were taken from some other stock. It was the practice of the scholars of Socrates to commit to writing the substance of their master's discourses. Plato wrote them in the form of dialogues; but with so great additions of his own, that Socrates, hearing him recite his Lysis, cried out, "O Hercules! how many things does this young man feign of me!"

Plato, however, retained the warmest attachment to his master. When that great and good man was summoned before the senate, his illustrious scholar undertook to plead his cause, and begun a speech in his defence; but the partiality and violence of the judges would not permit him to proceed. After the condemnation, he presented his master with money sufficient to redeem his life; which, however, Socrates refused to accept. During his imprisonment, Plato attended him, and was present at a conversation which he held with his friends concerning the immortality of the soul; the substance of which he afterwards committed to writing in the beautiful dialogue intitled *Phedo*, not, however, without interweaving his own opinions and language.

The philosophers who were at Athens were so alarmed at the death of Socrates, that most of them fled from the city to avoid the injustice and cruelty of the government. Plato, whose grief upon this occasion is said by Plutarch to have been excessive, retired to Megara; where he was friendly entertained by Euclid, who had been one of Socrates's first scholars, till the storm was over. Afterwards he determined to travel in pursuit of knowledge; and from Megara he went to Italy, where he conferred with Eurytus, Philolaus, and Archytas. These were the most celebrated of the followers of Pythagoras, whose doctrine was then become famous in Greece; and from these the Pythagoreans have affirmed that he had all his natural philosophy. He dived into the most profound and mysterious secrets of the Pythagoric doctrines; and perceiving other knowledge to be connected with them, he went to Cyrene, where he learned geometry of Theodorus the mathematician. From thence he passed into Egypt, to acquaint himself with the theology of their priests, to study more nicely the proportions of geometry, and to instruct himself in astronomical observations; and having taken a full survey of all the country, he settled for some time in the province of Sais, learning of the wise men there, what they held concerning the universe, whether it had a beginning, whether it moved wholly or in part, &c.; and Pausanias affirms, that he learned from these the immortality, and also the transmigration, of souls. Some of the fathers will have it, that he had communication with the books of Moses, and that he studied under a learned Jew of Heliopolis; but there is nothing that can be called evidence for these assertions. St Austin once believed that Plato had some conference with Jeremiah; but afterwards discovered, that that prophet must have been dead at least 60 years before Plato's voyage to Egypt.

Plato's curiosity was not yet satisfied. He travelled into Persia to consult the magi about the religion of that country: and he designed to have penetrated even to the Indies, and to have learned of the Brachmans their manners and customs; but the wars in Asia hindered him.

"He then returned into Italy, to the Pythagorean school at Tarentum, where he endeavoured to improve his own system, by incorporating with it the doctrine of Pythagoras, as it was then taught by Archytas, Timæus, and others. And afterwards, when he visited Sicily, he retained such an attachment to the Italic school, that, through the bounty of Dionysius, he purchased at a vast price several books which contained the doctrine of Pythagoras, from Philolaus, one of his followers.

"Returning home richly stored with knowledge of various kinds, Plato settled in Athens, and executed the design, which he had doubtless long had in contemplation, of forming a new school for the instruction of youth in the principles of philosophy. The place which he made choice of for this purpose was a public grove, called the *Academy*, from Hecademus, who left it to the citizens for the purpose of gymnastic exercises. Adorned with statues, temples, and sepulchres, planted with lofty plane-trees, and intersected by a gentle stream, it afforded a delightful retreat for philosophy and the muses. Of this retreat Horace speaks:

Atque inter sylvas Academi quærere verum,

"'Midst Academic groves to search for truth."

Within this inclosure he possessed, as a part of his humble patrimony, purchased at the price of three thousand drachmas, a small garden, in which he opened a school for the reception of those who might be inclined to attend his instructions. How much Plato valued mathematical studies, and how necessary a preparation he thought them for higher speculations, appears from the inscription which he placed over the door of his school: Οὐδεὶς ἀγεωμέτρητος εἰσίτω. "Let no one who is unacquainted with geometry enter here."

"This new school soon became famous, and its master was ranked among the most eminent philosophers. His travels into distant countries, where learning and wisdom flourished, gave him celebrity among his brethren of the Socratic sect. None of these had ventured to institute a school in Athens except Aristippus; and he had confined his instructions almost entirely to ethical subjects, and had brought himself into some discredit by the freedom of his manners. Plato alone remained to inherit the patrimony of public esteem which Socrates had left his disciples; and he possessed talents and learning adequate to his design of extending the study of philosophy beyond the limits within which it had been inclosed

Plato.

closed by his master. The consequence was, not only that young men crowded to his school from every quarter, but that people of the first distinction in every department frequented the academy. Even females, disguised in mens clothes, often attended his lectures. Among the illustrious names which appear in the catalogue of his followers are Dion the Syracusan prince, and the orators Hyperides, Lycurgus, Demosthenes, and Isocrates.

"Greatness was never yet exempted from envy. The distinguished reputation of Plato brought upon him the hatred of his former companions in the school of Socrates, and they loaded him with detraction and obloquy. It can only be ascribed to mutual jealousy, that Xenophon and he, though they relate the discourses of their common master, studiously avoid mentioning one another. Diogenes the Cynic ridiculed Plato's doctrine of ideas and other abstract speculations. In the midst of these private censures, however, the public fame of Plato daily increased; and several states, among which were the Arcadians and Thebans, sent ambassadors with earnest requests that he would come over, not only to instruct the young men in philosophy, but also to prescribe them laws of government. The Cyrenians, Syracusians, Cretans, and Eleans, sent also to him: he did not go to any of them, but gave laws and rules of governing to all. He lived single, yet soberly and chastly. He was a man of great virtues, and exceedingly affable; of which we need no greater proof, than his civil manner of conversing with the philosophers of his own times, when pride and envy were at their height. His behaviour to Diogenes is always mentioned in his history. The Cynic was vastly offended, it seems, at the politeness and fine taste of Plato, and used to catch all opportunities of snarling at him. He dined one day at his table with other company, and, trampling upon the tapestry with his dirty feet, uttered this brutish sarcasm, "I trample upon the pride of Plato;" to which Plato wisely reparteed, "With greater pride."

The fame of Plato drew disciples to him from all parts; among whom were Speusippus an Athenian, his sister's son, whom he appointed his successor in the academy, and the great Aristotle.

The admiration of this illustrious man was not confined to the breasts of a few philosophers. He was in high esteem with several princes, particularly Archelaus king of Macedon, and Dionysius tyrant of Sicily. At three different periods he visited the court of this latter prince, and made several bold but unsuccessful attempts to subdue his haughty and tyrannical spirit. A brief relation of the particulars of these visits to Sicily may serve to cast some light upon the character of our philosopher; and we shall give it in the words of Dr Enfield, from whose elegant history of philosophy we have extracted by much the most valuable parts of this article.

"The professed object of Plato's first visit to Sicily, which happened in the 40th year of his age, during the reign of the elder Dionysius the son of Hermocrates, was, to take a survey of the island, and particularly to observe the wonders of Mount Ætna. Whilst he was resident at Syracuse, he was employed in the instruction of Dion, the king's brother-in-law, who possessed excellent abilities, though hitherto restrained by the terrors of a tyrannical government, and relaxed by the luxuries of a licentious court. Disgusted by the debauched manners of the Syracusans, he endeavoured to rescue his pupil from the general depravity. Nor did Dion disappoint his preceptor's expectations. No sooner had he received a taste of that philosophy which leads to virtue, than he was fired with an ardent love of wisdom. Entertaining an hope that philosophy might produce the same effect upon Dionysius, he took great pains to procure an interview between Plato and the tyrant. In the course of the conference, whilst Plato was discoursing on the security and happiness of virtue, and the miseries attending injustice and oppression, Dionysius, perceiving that the philosopher's discourse was levelled against the vices and cruelties of his reign, dismissed him with high displeasure from his presence, and conceived a design against his life. It was not without great difficulty that Plato, by the assistance of Dion, made his escape. A vessel which had brought over Pollis, a delegate from Sparta, was fortunately at that time returning to Greece. Dion engaged Pollis to take the charge of the philosopher, and land him safely in his native country; but Dionysius discovered the design, and obtained a promise from Pollis, that he would either put him to death or sell him as a slave upon the passage. Pollis accordingly sold him in the island of Ægina; the inhabitants of which were then at war with the Athenians. Plato could not long remain unnoticed: Anicerris, a Cyrenaic philosopher, who happened to be at that time in the island, discovered the stranger, and thought himself happy in an opportunity of showing his respect for so illustrious a philosopher: he purchased his freedom for 30 minæ, or 84l. 10s. Sterling money, and sent him home to Athens. Repayment being afterwards offered to Anicerris by Plato's relations, he refused the money, saying, with that generous spirit which true philosophy always inspires, that he saw no reason why the relations of Plato should engross to themselves the honour of serving him."

After a short interval, Dionysius repented of his ill-placed resentment, and wrote to Plato, earnestly requesting him to repair his credit by returning to Syracuse; to which Plato gave this high-spirited answer, that philosophy would not allow him leisure to think of Dionysius. He was, however, prevailed upon by his friend Dion to accept of the tyrant's invitation to return to Syracuse, and take upon him the education of Dionysiu the younger, who was heir apparent to the monarchy. He was received by Dionysius the reigning sovereign with every possible appearance of respect; but after seeing his friend banished, and being himself kept as a prisoner at large in the palace, he was by the tyrant sent back into his own country, with a promise that both he and Dion should be recalled at the end of the war in which the Sicilians were then engaged. This promise was not fulfilled. The tyrant wished for the return of Plato; but could not resolve to recal Dion. At last, however, having probably promised that the philosopher should meet his friend at the court of Syracuse, he prevailed upon Plato to visit that capital a third time. When he arrived, the king met him in a magnificent chariot, and conducted him to his palace. The Sicilians too rejoiced in his return; for they hoped that the wisdom of Plato would at length triumph over the tyrannical spirit of the prince. Dionysius seemed wholly divested of his former resentments, listened with apparent pleasure to the philosopher's doctrine, and, among other expressions of regard, presented him with eighty talents of

Plato. of gold. In the midst of a numerous train of philosophers, Plato now possessed the chief influence and authority in the court of Syracuse. Whilst Aristippus was enjoying himself in splendid luxury; whilst Diogenes was freely indulging his acrimonious humour; and whilst Æschines was gratifying his thirst after riches;—Plato supported the credit of philosophy with an air of dignity, which his friends regarded as an indication of superior wisdom, but which his enemies imputed to pride. After all, it was not in the power of Plato to prevail upon Dionysius to adopt his system of policy, or to recal Dion from his exile. Mutual distrust, after a short interval, arose between the tyrant and the philosopher; each suspected the other of evil designs, and each endeavoured to conceal his suspicion under the disguise of respect. Dionysius attempted to impose upon Plato by condescending attentions, and Plato to deceive Dionysius by an appearance of confidence. At length, the philosopher became so much dissatisfied with his situation, that he earnestly requested permission to return to Greece, which was at last granted him, and he was sent home loaded with rich presents. On his way to Athens, passing through Elis during the celebration of the Olympic games, he was present at this general assembly of the Greeks, and engaged universal attention.

From this narrative it appears, that if Plato visited the courts of princes, it was chiefly from the hope of seeing his ideal plan of a republic realized; and that his talents and attainments rather qualified him to shine in the academy than in the council or the senate.

Plato, now restored to his country and his school, devoted himself to science, and spent the last years of a long life in the instruction of youth. Having enjoyed the advantage of an athletic constitution, and lived all his days temperately, he arrived at the 81st, or according to some writers the 79th, year of his age, and died, through the mere decay of nature, in the first year of the hundred and eighth Olympiad. He passed his whole life in a state of celibacy, and therefore left no natural heirs, but transferred his effects by will to his friend Adiamantus. The grove and garden, which had been the scene of his philosophical labours, at last afforded him a sepulchre. Statues and altars were erected to his memory; the day of his birth long continued to be celebrated as a festival by his followers; and his portrait is to this day preserved in gems: but the most lasting monuments of his genius are his writings, which have been transmitted, without material injury, to the present times.

The character of this philosopher has always been high. Besides the advantages of a noble birth, he had a large and comprehensive understanding, a vast fund of wit and good taste, great evenness and sweetness of temper, all cultivated and refined by education and travel; so that it is no wonder if he was honoured by his countrymen, esteemed by strangers, and adored by his scholars. The ancients thought more highly of Plato than of all their philosophers: they always called him the *Divine Plato*; and they seemed resolved that his descent should be more than human. "There are (says Apuleius) who assert Plato to have sprung from a more sublime conception; and that his mother Perictione, who was a very beautiful woman, was impregnated by Apollo in the shape of a spectre." Plutarch, Suidas, and others, affirm this to have been the common report at Athens. When he was an infant, his father Aristo went to Hymettus, with his wife and child, to sacrifice to the muses; and while they were busied in the divine rites, a swarm of bees came and distilled their honey upon his lips. This, says Tully, was considered as a presage of his future eloquence. Apuleius relates, that Socrates, the night before Plato was recommended to him, dreamed that a young swan fled from Cupid's altar in the academy, and settled in his lap; thence soared to heaven, and delighted the gods with its music: and when Aristo the next day presented Plato to him, "Friends (says Socrates), this is the swan of Cupid's academy." The Greeks loved fables: they show however in the present case, what exceeding respect was paid to the memory of Plato. Tully perfectly adored him; tells us, how he was justly called by Panætius the *divine*, the *most wise*, the *most sacred*, the *Homer of philosophers*; intitled him to Atticus, *Deus ille noster*; thinks, that if Jupiter had spoken Greek, he would have spoken in Plato's language; and made him so implicitly his guide in wisdom and philosophy, as to declare, that he had rather err with Plato than be right with any one else. But, panegyric aside, Plato was certainly a very wonderful man, of a large and comprehensive mind, an imagination infinitely fertile, and of a most flowing and copious eloquence. Nevertheless, the strength and heat of fancy prevailing in his composition over judgment, he was too apt to soar beyond the limits of earthly things, to range in the imaginary regions of general and abstracted ideas; and on which account, though there is always a greatness and sublimity in his manner, he did not philosophize so much according to truth and nature as Aristotle, though Cicero did not scruple to give him the preference.

The writings of Plato are all in the way of dialogue; where he seems to deliver nothing from himself, but every thing as the sentiments and opinions of others, of Socrates chiefly, of Timæus, &c. He does not mention himself anywhere, except once in his Phædo, and another time in his Apology for Socrates. His style, as Aristotle observed, is betwixt prose and verse: on which account, some have not scrupled to rank him with the poets. There is a better reason for so doing than the elevation and grandeur of his style: his matter is oftentimes the offspring of imagination, instead of doctrines or truths deduced from nature. The first edition of Plato's works in Greek was put out by Aldus at Venice in 1513; but a Latin version of him by Marsilius Ficinus had been printed there in 1491. They were reprinted together at Lyons in 1588, and at Francfort in 1602. The famous printer Henry Stephens, in 1578, gave a most beautiful and correct edition of Plato's works at Paris, with a new Latin version by Serranus, in three volumes folio; and this deservedly passes for the best edition of Plato: yet Serranus's version is very exceptionable, and in many respects, if not in all, inferior to that of Ficinus.

PLATONIC, something that relates to Plato, his school-philosophy, opinions, or the like. Thus, platonic love denotes a pure spiritual affection, for which Plato was a great advocate, subsisting between the different sexes, abstracted from all carnal appetites, and regarding no other object but the mind and its beauties;

Platonic, Platonism. or it is even a sincere disinterested friendship subsisting between persons of the same sex, abstracted from any selfish views, and regarding no other object than the person, if any such love or friendship has aught of a foundation in nature.

Platonic Year, or the *Great Year*, is a period of time determined by the revolution of the equinoxes, or the space wherein the stars and constellations return to their former places, in respect of the equinoxes. The platonic year, according to Tycho Brahe, is 25816, according to Ricciolus 25920, and according to Cassini 24800 years.

This period once accomplished, it was an opinion among the ancients that the world was to begin anew, and the same series of things to turn over again.

PLATONISM, the philosophy of Plato, which was divided into three branches, *theology*, *physics*, and *mathematics*. Under *theology* was comprehended metaphysics and ethics, or that which in modern language is called *moral* philosophy. Plato wrote likewise on *dialectics*, but with such inferiority to his pupil Aristotle, that his works in that department of science are seldom mentioned.

The ancient philosophers always began their theological systems with some disquisition on the nature of the gods, and the formation of the world; and it was a fundamental doctrine with them, that *from nothing nothing can proceed*. We are not to suppose that this general axiom implied nothing more than that for every effect there must be a cause; for this is a proposition which no man will controvert who understands the terms in which it is expressed: but the ancients believed that a proper creation is impossible even to Omnipotence, and that to the production of any thing a *material* is not less *necessary* than an *efficient* cause, (see Metaphysics, n° 264, 304.) That with respect to this important question, Plato agreed with his predecessors and contemporaries, appears evident to us from the whole tenor of his *Timæus*. We agree with Dr Enfield § in thinking, that in this dialogue, which comprehends his whole doctrine on the subject of the formation of the universe, matter is so manifestly spoken of as eternally co-existing with God, that this part of his doctrine could not have been mistaken by so many learned and able writers, had they not been seduced by the desire of establishing a coincidence of doctrine between the writings of Plato and Moses. It is certain that neither Cicero ‡, nor Apuleius ‖, nor Alcinous †, nor even the later commentator Chalcidius, understood their master in any other sense than as admitting two primary and incorruptible principles, God and matter; to which we shall afterwards see reason to add a third, namely ideas. The passages quoted by those who maintain the contrary opinion are by no means sufficient for their purpose. Plato, it is true, in his Timæus, calls God the *parent of the universe*, and in his Sophista speaks of him as "forming animate and inanimate beings, which did not before exist:" but these expressions do not necessarily imply that this offspring of Deity was produced from nothing, or that no prior matter existed from which these new beings were formed. Through the whole dialogue of the Timæus, Plato supposes two eternal and independent causes of all things; one, that by which all things are made, which is God; the other, that from which all things are made, which is matter. He distinguishes between God, matter, and the universe, and supposes the Architect of the world to have formed it out of a mass of pre-existent matter. Matter, according to Plato, is an eternal and infinite principle. His doctrine on this head is thus explained by Cicero ‡. "Matter, from which all things are produced and formed, is a substance without form or quality, but capable of receiving all forms, and undergoing every kind of change; in which, however, it never suffers annihilation, but merely a solution of its parts, which are in their nature infinitely divisible, and move in portions of space which are also infinitely divisible. When that principle which we call quality is moved, and acts upon matter, it undergoes an entire change, and those forms are produced, from which arises the diversified and coherent system of the universe." This doctrine Plato unfolds at large in his Timæus, and particularly insists upon the notion, that matter has originally no form, but is capable of receiving any. He calls it the mother and receptacle of forms, by the union of which with matter the universe becomes perceptible to the senses; and maintains, that the visible world owes its forms to the energy of the divine intellectual nature.

§ Hist. of Phil.

‡ Ac. Qu. l. i. c. 6.

‖ Lib. I.

† C. 12.

‡ Ac. Qu. l. i. c. 8.

Our author is supported in drawing this inference by the testimony of Diogenes Laertius, who surely understood the language and dogmas of Plato better than the most accomplished modern scholar can pretend to do; yet a learned writer ‡ has lately expressed great surprise that any one should consider matter as having been, in Plato's opinion, uncreated; and he boldly affirms, that Laertius, instead of asserting that spirit and matter were the principles of all things, ought to have said that God alone, in Plato's estimation, was their original.— To prove this, he gives from the Timæus a quotation, in which the founder of the Academy declares that God *framed* heaven and earth, and the inferior deities; and that as he *fashioned*, so he pervades all nature. He observes, that Cicero denominates the god of Plato the *maker*, and the god of Aristotle only the *governor*, of the world. And, to satisfy those who may demand a particular proof of Plato's having taught a real creation, he affirms that his writings abound with declarations on the subject, of which the meaning cannot be misapprehended. "With this purpose (says he) Plato denominates at one time the principles or substance of all things, Γινοματα Θεου Δημιουργου, the productions of the efficient Deity, and at others enters more particularly into the question. Thus, he observes, that many persons are ignorant of the nature and power of mind or intellect, 'as having existed at the beginning, antecedent to all bodies.' Of this mind, he observes, that it is without exception Παντων πρεσβυτατη, *of all things the most ancient*; and he subjoins, in order to remove all doubt of his purpose, that it is also Αρχη κινησεως, *the cause or principle of motion*."

‡ Dr Ogilvie.

Theology of Plato.

With all possible respect for Dr Ogilvie, of whose piety and erudition we are thoroughly convinced, we must take the liberty to say, that to us the declarations of Plato on this subject appear much less precise and explicit than they appear to him; and that the inference which he would draw from the *words* of Cicero seems not to flow necessarily from the *sense* of those words. That Plato believed God to have *framed* the heaven and the earth, and to have *fashioned* all nature, is a position which, as far as we know, has never been controverted; but between *framing* or *fashioning* the chaos or ὑλη πρωτη, and calling the universe into existence from non-entity, Platonism.

entity, there is an infinite and an obvious difference. The distinction made by Cicero between the God of Plato and the God of Aristotle is a just distinction, but it will not bear the superstructure which the learned Doctor builds upon it. Aristotle maintained the eternity of the world in its present form. Plato certainly taught that the first matter was in time reduced from a chaotic state into *form* by the power of the Demiurgus; but we have seen nothing in his writings which explicitly declares his belief that the *first matter* was itself *created*.

The learned Cudworth, who wished, like Dr Ogilvie, to find a coincidence of doctrine between the theology of Plato and that of the Gospel, strained all his faculties to prove that his favourite philosopher taught a proper creation; but he laboured in vain. He gives a number of quotations in support of his position; of which we shall here insert only those two upon which Dr Ogilvie seems to lay the greatest stress. Plato, says the author of the Intellectual System, calls the one God (A) ὁς γην ουρανον και θεους, και παντα τα εν ουρανω και τα εν ἀδου, και ὑπο γης ἀπαντα εργαζεται—*He that makes earth, and heaven, and the gods, and doth all things both in heaven, and hell, and under the earth.* And, again, "he by whose efficiency the things of the world (ὑστερον εγενετο, προτερον ουκ οντα) *were afterwards made when they were not before* *." Both Cudworth and Ogilvie think this last sentence an explicit declaration of Plato's belief in the creative power of God: but that they are mistaken has been evinced by Mosheim with a force of argument which will admit of no reply. In that part of *the Sophist* from which the quotation is taken, Plato considers the δυναμιν ποιητικην, of which he is treating, as belonging both to God and to man; and he defines it in general to be "a certain power which is the cause that things may afterwards be which were not before." Cudworth wishes to confine this definition to the divine power; and adds from himself to the text which he quotes the following words, which are not in Plato, OR FROM AN ANTECEDENT NON-EXISTENCE BROUGHT FORTH INTO BEING! That the incomparable author intended to deceive his reader, we are far from imagining: his zeal for Platonism had deceived himself. Plato's definition comprehends the δυναμιν ποιητικην † as well of man as of God; and therefore cannot infer a creative power anywhere, unless the father of the academy was so very absurd as to suppose human artists the creators of those machines which they have invented and made! Mosheim thinks that Cudworth was misled by too implicit a confidence in *Ficinus;* and it is not impossible that Dr Ogilvie may have been swayed by the authority, great indeed, of the author of the Intellectual System.

* *Sophista*, p. 168.

† *Mosch. ed. Cud. Syst. Intel.* cap. 4. § 23. n. II.

That intellect existed antecedent to all bodies is indeed a Platonic dogma, from which Dr Ogilvie, after Cudworth, wishes to infer that the doctrine of the creation was taught in the academy; but Dr Ogilvie knows, and no man knew better than Cudworth, that Plato, with every other Greek philosopher, distinguished between *body* and *matter;* and that though he held the priority of intellect to the former, it by no means follows that he believed it to have existed antecedent to the latter. That he believed *mind*, or rather *soul* (for he distinguishes between the two), to be the cause or principle of motion, cannot be denied; but we are not therefore authorised to conclude that he likewise believed it to be the cause of the existence of matter. That he believed mind to be the most ancient of *all things*, taking the word *things* in the most absolute sense, cannot be true, since by Dr Ogilvie's own acknowledgment he held the existence and eternity of *ideas*, not to add that he believed το ἑν or τ' αγαθον—the first hypostasis in his trinity, to be superior to mind and prior to it, though not in time, yet in the order of nature. When therefore he calls mind the most ancient of *all things*, he must be supposed to mean only that it is more ancient than *all bodies* and inferior souls. It is no reflection on the character of Plato that he could not, by the efforts of his own reason, acquire any notion of a proper creation; since we, who have the advantage of his writings, and of writings infinitely more valuable, to instruct us, find it extremely difficult, if not impossible, to conceive how any thing can begin to be. We believe the fact on the authority of revelation; but should certainly have never agitated such a question, had it not been stated to us by writers inspired with celestial wisdom.

In the Platonic cosmogony we cannot therefore doubt but that the eternity of the ὑλη πρωτη was taken for granted. Whether it was an eternal and necessary emanation from an eternal mind, is not perhaps quite so evident, though our own opinion is, that it was believed to be self-existent. But be this as it may, which is not worth disputing, one thing is certain, that Plato did not believe it to have a single form or quality which it did not receive either from the *Demiurgus* or the *Psyche*—the second or third person of his trinity. Except Aristotle, all the Greek philosophers, who were not materialists, held nearly the same opinions respecting the origin of the world; so that in examining their systems we shall be greatly misled if we understand the terms *incorporeal* and *immaterial* as at all synonymous. It was also a doctrine of Plato, that there is in matter a necessary but blind and refractory force; and that hence arises a propensity in matter to disorder and deformity, which is the cause of all the imperfection which appears in the works of God, and the origin of evil. On this subject Plato writes with wonderful obscurity: but, as far as we are able to trace his conceptions, he appears to have thought, that matter, from its nature, resists the will of the Supreme Artificer, so that he cannot perfectly execute his designs; and that this is the cause of the

(A) Mosheim affirms that this quotation is nowhere to be found in the writings of Plato. He therefore at first suspected that the learned author, in looking hastily over Plato's 10th book *De Legibus*, had transferred to God what is there said of the *anima mundi*, leading by its own motions every thing in the heaven, the earth, and the sea, and that he had added something of his own. He dropped that opinion, however, when he found Plato, in the 10th book of his Republic, declaring it to be as "easy for God to produce the sun, moon, stars, and earth, &c. from himself, as it is for us to produce the image of ourselves, and whatever else we please, only by interposing a looking-glass." In all this power, however, there is nothing similar to that of creation.

Platonism. the mixture of good and evil which is found in the material world.

Plato, however, was no materialist. He taught, that there is an intelligent cause, which is the origin of all spiritual being, and the former of the material world. The nature of this great being he pronounced it difficult to discover, and when discovered impossible to divulge. The existence of God he inferred from the marks of intelligence, which appear in the form and arrangement of bodies in the visible world: and from the unity of the material system he concluded, that the mind by which it was formed must be one. God, according to Plato, is the supreme intelligence, incorporeal, without beginning, end, or change, and capable of being perceived only by the mind. He certainly distinguished the Deity not only from body, and whatever has corporeal qualities, but from matter itself, from which all things are made. He also ascribed to him all those qualities which modern philosophers ascribe to immaterial substance; and conceived him to be in his nature simple, uncircumscribed in space, the author of all regulated motion, and, in fine, possessed of intelligence in the highest perfection.

His notions of God are indeed exceedingly refined, and such as it is difficult to suppose that he could ever have acquired but from some obscure remains of primeval tradition, gleaned perhaps from the priests of Egypt or from the philosophers of the East. In the Divine Nature he certainly believed that there are two, and probably that there are three, *hypostases*, whom he called το ον and το εν, νους and ψυχη. The first he considered as self-existent, and elevated far above all mind and all knowledge; calling him, by way of eminence, *the being*, or *the one*. The only attribute which he acknowledged in this person was goodness; and therefore he frequently styles him το αγαθον—*the good*, or *essential goodness*. The second he considered as mind, the *wisdom* or *reason* of the first, and the *maker of the world*; and therefore he styles him νους, λογος, and δημιουργος. The third he always speaks of as the *soul of the world*; and hence calls him ψυχη, or ψυχη του κοσμου. He taught that the *second* is a necessary emanation from the *first*, and the *third* from the *second*, or perhaps from the *first* and *second*.

Some have indeed pretended, that the *Trinity*, which is commonly called *Platonic*, was a fiction of the later Platonists, unknown to the founder of the school: but any person who shall take the trouble to study the writings of Plato, will find abundant evidence that he really asserted a triad of divine hypostases, all concerned in the formation and government of the world. Thus in his 10th book of Laws, where he undertakes to prove the existence of a Deity in opposition to atheists, he ascends no higher in the demonstration than to the ψυχη or mundane soul, which he held to be the immediate and proper cause of all the motion that is in the world. But in other parts of his writings he frequently asserts, as superior to the self-moving principle, an immoveable νους or intellect, which was properly the *demiurgus* or framer of the world; and above this *hypostasis* one most simple and absolutely perfect being, who is considered in his *Theology* as αυτοθεος, the *original deity*, in contradistinction from the others, who are only θεοι εκ θεου. These doctrines are to be gathered from his works at large, particularly from the *Timeus*, *Philebus*, *Sophista*, and *Epinomis*: but there is a passage in his second epistle to Dionysius, apparently written in answer to a letter in which that monarch had required him to give a more explicit account than he had formerly done of the nature of God, in which the doctrine of a Trinity seems to be directly asserted. "After having said that he meant to wrap up his meaning in such obscurity, as that an adept only should fully comprehend it, he adds expressions to the following import: 'The Lord of Nature is surrounded on all sides by his works: whatever is, exists by his permission: he is the fountain and source of excellence: around the second person are placed things of the second order; and around the third those of the third degree (B).'' Of this obscure passage a very satisfactory explanation is given in Dr Ogilvie's *Theology of Plato*, to which the narrow limits prescribed to such articles as this compel us to refer the reader. We shall only say, that the account which we have given of the Platonic Trinity is ably supported by the Doctor.

In treating of the eternal emanation of the second and third Hypostases from the first, the philosophers of the academy compare them to light and heat proceeding from the sun. Plato himself, as quoted by Dr Cudworth, illustrates his doctrine by the same comparison. For "ταγαθον, or the first hypostasis, is in the intellectual world the same (he says) to intellect and intelligibles that the sun is in the corporeal world to vision and visibles; for as the sun is not vision itself but the cause of vision, and as that light by which we see is not the sun but only a thing like the sun; so neither is the Supreme or Highest Good properly knowledge, but the cause of knowledge; nor is intellect, considered as such, the best and most perfect being, but only a being having the form of perfection." Again, "as the sun causes other things not only to become visible but also to be generated; so the Supreme Good gives to things not only their capability of being known, but also their very essences by which they subsist; for this fountain of the Deity, this highest good, is not itself properly essence, but above essence, transcending it in respect both of dignity and of power."

The resemblance which this trinity of Plato bears to that revealed in the gospel must be observed by every attentive reader; but the two doctrines are likewise in some respects exceedingly dissimilar. The third hypostasis in the Platonic system appears in no point of view co-ordinate with the first or second. Indeed the first is elevated far above the second, and the third sunk still farther beneath it, being considered as a mere soul immersed in matter, and forming with the corporeal world, to which it is united, one compound animal. Nay, it does not appear perfectly clear, that Plato considered his ψυχη του κοσμου as a pure spirit, or as having subsisted from eternity as a distinct *Hypostasis*. "This governing spirit, of whom the earth, properly so called, is the body,

(B) "Περι τον παντων βασιλεα, παντ' εστι, και εκεινου ενεκα παντα. Εκεινος αιτια παντων των καλων. Δευτερον δε περι τα δευτερα, και τριτον περι τα τριτα." Oper. p. 1269.

body, consisted, according to our author's philosophy, of the same and the other; that is, of the first matter, and of pure intelligence, framed to actuate the machinery of nature. The Supreme Being placed him in the middle of the earth; which, in the vivid idea of Plato, seemed itself to live, in consequence of an influence that was felt in every part of it. From this seat his power is represented as being extended on all sides to the utmost limit of the heavens; conferring life, and preserving harmony in the various and complicated parts of the universe. Upon this being God is said to have looked with peculiar complacency after having formed him as an image of himself, and to have given beauty and perfect proportion to the mansion which he was destined to occupy. According to the doctrine of Timæus, the Supreme Being struck out from this original mind innumerable spirits of inferior order, endowed with principles of reason; and he committed to divinities of secondary rank the task of investing these in material forms, and of dispersing them as inhabitants of the sun, moon, and other celestial bodies. He taught also, that at death the human soul is reunited to the ψυχη του κοσμου, as to the source from which it originally came."

Such is the third person of the Platonic triad, as we find his nature and attributes very accurately stated by Dr Ogilvie; and the Christian philosopher, who has no particular system to support, will not require another proof that the triad of Plato differs exceedingly from the Trinity of the Scriptures. Indeed the third hypostasis in this triad has so much the appearance of all that the ancients could mean by that which we call a *creature*, that the learned Cudworth, who wished, it is difficult to conceive for what reason, to find the sublimest mystery of the Christian faith explicitly taught in the writings of a pagan philosopher, was forced to suppose that Plato held a double ψυχη or soul, one εγκοσμιον incorporated with the material world, and the other υπερκοσμιον or *supramundane*, which is not the soul but the governor of the universe. We call this a mere hypothesis; for though the author displays vast erudition, and adduces many quotations in which this double *psyche* is plainly mentioned, yet all those quotations are taken from Platonists who lived after the propagation of the gospel, and who, calling themselves *eclectics*, freely stole from every sect such dogmas as they could incorporate with their own system, and then attributed those dogmas to their master. In the writings of Plato himself, there is not so much as an allusion to this supramundane *psyche**; and it is for this reason (the ψυχη of which he treats being so very inferior to the δημιουργος and ταγαθον) that we have expressed with hesitation his belief of *three* hypostases in the divine nature. Yet that he did admit so many, seems more than probable both from the passage illustrated by Dr Ogilvie and from the attempt of Plotinus, one of his followers, to demonstrate that the number can be neither greater nor less. That his doctrine on this subject should be inaccurate and erroneous, can excite no wonder; whilst it must be confessed to have such a resemblance to the truth, and to be so incapable of being proved by reasoning from effects to causes, that we could not doubt of his having inherited it by tradition, even though we had not complete evidence that something very similar to it was taught long before him, not only by Pythagoras and Parmenides, but by the philosophers of the east.

* *Mosh. ed. Cud. Syst. Intel. c.* 4. § 36. *n.* 43.

We have said that the Demiurgus was the maker of the world from the first matter which had existed from eternity; but in Plato's cosmogony there is another principle, more mysterious, if possible, than any thing which we have yet mentioned. This is his intellectual system of *ideas*, which it is not easy to collect from his writings, whether he considered as *independent* existences, or only as archetypal *forms*, which had subsisted from eternity in the λογος or divine intellect. On this subject he writes with such exceeding obscurity, that men of the first eminence, both among the ancients and the moderns, have differed about his real meaning. Some have supposed, that by *ideas* he meant real beings subsisting from eternity, independent of all minds, and separate from all matter; and that of these ideas he conceived some to be living and others to be without life. In this manner his doctrine is interpreted by Tertullian* among the ancients, and by the celebrated Brucker† among the moderns; and not by them only, but by many others equally learned, candid, and acute. Cudworth, on the other hand, with his annotator Mosheim, contend, that by his ideal world Plato meant nothing more than that there existed from eternity in the λογος or mind of God a notion or conception of every thing which was in time to be made. This is certainly much more probable in itself, than that a man of enlarged understanding should have supposed, that there are somewhere in extramundane space real living incorporeal beings eating and drinking, which are the *ideas* of all the animals which ever have been or ever will be eating and drinking in this world. Yet Mosheim candidly acknowledges, that if the controversy were to be decided by the votes of the learned, he is doubtful whether it would be given for or against him; and Cudworth, though he pleads the cause of his master with much ingenuity, owns, that on this subject his language cannot be vindicated. This indeed is most true; for Plato contends, that his ideas are not only the objects of science, but also the proper or physical causes of all things here below; that the *idea* of similitude is the *cause* of the resemblance between two globes; and the *idea* of dissimilitude the cause that a globe does not resemble a pyramid: he likewise calls them ουσιας, *essences* or *substances*, and many of his followers have pronounced them to be *animals*.

* *Lib. de Anima.*
† *Histor. Doctrin. de Ideis.*

These wonderful expressions incline us to adopt with some hesitation the opinion stated by Dr Enfield. This historian of philosophy having observed, that some of the admirers of Plato contend, that by ideas existing in the reason of God, nothing more is meant than conceptions formed in the Divine mind, controverts this opinion with much effect. "By ideas, Plato (says he) appears to have meant something much more mysterious; namely, patterns or archetypes subsisting by themselves, as real beings, οντως οντα in the Divine reason, as in their original and eternal region, and issuing thence to give form to sensible things, and to become objects of contemplation and science to rational beings. It is the doctrine of the Timæus, that ὁ λογισμος του Θεου, the reason of God, comprehends exemplars of all things, and that this reason is one of the primary causes of things. Plutarch says, that Plato supposes three principles, God, Matter, and Idea. Justin Martyr, Pseudo-Origen, and others, assert the same thing.

"That this is the true Platonic doctrine of ideas will

Platonism. appear probable; if we attend to the manner in which Plato framed his system of opinions concerning the origin of things. 'Having been from his youth (says Aristotle) conversant with Cratylus, a disciple of Heraclitus, and instructed in the doctrine of that school, that all sensible things are variable, and cannot be proper objects of science, he reasonably concluded, that if there be any such thing as science, there must exist, besides sensible objects, certain permanent natures, perceptible only by the intellect.' Such natures, divine in their origin, and eternal and immutable in their existence, he admitted into his system, and called them *ideas*. Visible things were regarded by Plato as fleeting shades, and ideas as the only permanent substances. These he conceived to be the proper objects of science to a mind raised by divine contemplation above the perpetually varying scenes of the material world."

It was a fundamental doctrine in the system of Plato, that the Deity formed the material world after a perfect model, consisting of those ideas which had eternally subsisted in his own reason; and yet, with some appearance of contradiction, he calls this model "*self*-existent, indivisible, and eternally *generated*." Nay, he talks of it as being intelligent as well as eternal, and wholly different from the transcripts, which are subjected to our inspection. There is so much mystery, confusion, and apparent absurdity, in the whole of this system, as it has come down to us, that we must suppose the friends of Plato to have been intrusted with a key to his esoteric doctrines, which has long been lost, otherwise it would be difficult to conceive how that philosopher could have had so many admirers.

With almost every ancient theist of Greece the founder of the academy believed in an order of beings called *dæmons*, which were superior to the souls of men, and struck off by the Demiurgus from the soul of the world. Of these the reader will find some account elsewhere: (See DÆMON and POLYTHEISM). We mention them at present because they make an important appearance in Plato's system of physics, which was built upon them and upon the doctrine which has been stated concerning God, matter, and ideas. He taught, that the visible world was formed by the Supreme Architect, uniting eternal and immutable ideas to the first matter; that the universe is one animated being*, including within its limits all animated natures; that, in the formation of the visible and tangible world, fire and earth were first formed, and were afterwards united by means of air and water; that from perfect parts one perfect whole was produced, of a spherical figure, as most beautiful in itself, and best suited to contain all other figures †; that the elementary parts of the world are of regular geometrical forms, the particles of earth being cubical, those of fire pyramidical, those of air in the form of an octohedron, and those of water in that of an icosohedron; that these are adjusted in number, measure, and power, in perfect conformity to the geometrical laws of proportion; that the soul which pervades this sphere is the cause of its revolution round its centre; and, lastly, that the world will remain for ever, but that by the action of its animating principle, it accomplishes certain periods, within which every thing returns to its ancient place and state. This periodical revolution of nature is called the *Platonic* or *great year*. See the preceding article.

* *Tim.*

† *Ibid.*

The metaphysical doctrines of Plato, which treat of the human soul, and the principles of his system of ethics, have been detailed in other articles (See METAPHYSICS, Part III. chap. iv.; and MORAL *Philosophy*, nº 6.): but it is worthy of observation in this place, that, preparatory to the study of all philosophy, he required from his disciples a knowledge of the elements of mathematics. In his Republic, he makes Glaucus, one of the speakers, recommend them for their usefulness in human life. "Arithmetic for accounts and distributions; geometry for incampments and mensurations; music for solemn festivals in honour of the gods; and astronomy for agriculture, for navigation, and the like. Socrates, on his part, denies not the truth of all this, but still insinuates that they were capable of answering an end more sublime. 'You are pleasant (says he) in your seeming to fear the multitude, lest you should be thought to enjoin certain sciences that are useless. 'Tis indeed no contemptible matter, though a difficult one, to believe, that through these particular sciences the soul has an organ purified and enlightened, which is destroyed and blinded by studies of other kinds; an organ better worth saving than a thousand eyes, in as much as *truth* becomes visible through *this alone*."

"Concerning policy, Plato has written at large in his Republic and in his Dialogue on Laws. He was so much enamoured with his own conceptions on this subject, that it was chiefly the hope of having an opportunity to realise his plan of a republic which induced him to visit the court of Dionysius. But they who are conversant with mankind, and capable of calmly investigating the springs of human actions, will easily perceive that his projects were chimerical, and could only have originated in a mind replete with philosophical enthusiasm. Of this nothing can be a clearer proof than the design of admitting in his republic a community of women, in order to give reason an entire controul over desire. The main object of his political institutions appears to have been, the subjugation of the passions and appetites, by means of the abstract contemplation of ideas. A system of policy, raised upon such fanciful grounds, cannot merit a more distinct consideration."

Such is genuine Platonism as it was taught in the old academy by the founder of the school and his immediate followers; but when Arcesilaus was placed at the head of the academics, great innovations were introduced both into their doctrines and into their mode of teaching (See ARCESILAUS). This man was therefore considered as the founder of what was afterwards called the *middle* academy. Being a professed sceptic, he carried his maxim of uncertainty to such a height, as to alarm the general body of philosophers, offend the governors of the state, and bring just odium upon the very name of the academy. At length *Carneades*, one of the disciples of this school, relinquishing some of the more obnoxious tenets of Arcesilaus, founded what has been called the *new* academy with very little improvement on the principles of the middle. See CARNEADES.

Under one or other of these forms Platonism found its way into the Roman republic. Cicero was a Platonist, and one of the greatest ornaments of the school. A school of Platonists was likewise founded in Alexandria in the second century of the Christian era; but their doctrines differed in many particulars from those taught in-

in the three academies. They professed to seek truth wherever they could find it, and to collect their dogmas from every school. They endeavoured to bend some of the principles of Plato into a conformity with the doctrines of the gospel; and they incorporated with the whole many of the maxims of Aristotle and Zeno, and not a few of the fictions of the east. Their system was therefore extremely heterogeneous, and seldom so rational as that of the philosopher after whose name they were called, and of whose doctrines we have given so copious a detail. See AMMONIUS, ECCLECTICS, and PLOTINUS.

PLAUTUS (Marcus Accius), a comic writer of ancient Rome, born at Umbria, a province of Italy. His proper name was *Marcus Accius*, and he is supposed to have acquired the surname of *Plautus* from having splay feet. His parentage appears to have been mean; so that some have thought he was the son of a slave. Aulus Gellius says that Plautus was distinguished for his poetry on the theatre, and Cato for his eloquence in the Forum, at the same time; and observes elsewhere from Varro, that he was so well paid for his plays as to double his stock in trading, in which he lost all he gained by the muses. He is said to have been reduced to work at a mill for his subsistence; but Varro adds, that his wit was his best support, as he composed three of his plays during this drudgery. He died in the first year of the elder Cato's censorship, about the year of Rome 560, and 184 B. C. We have 20 of his plays extant, though not all of them entire. Five of them, comedies, have been elegantly translated into English by Mr B. Thornton, and published in 2 vols 8vo, 1767.

PLAYS. See PLAY-HOUSE.

PLAY-HOUSE. See THEATRE, AMPHITHEATRE, &c. The most ancient English play-houses were the Curtain in Shoreditch and the Theatre. In the time of Shakespeare, who commenced a dramatic writer in 1592, there were no less than 10 theatres open. Four of these were private houses, viz. that in Blackfriars, the Cockpit or Phœnix in Drury-Lane, a theatre in Whitefriars, and one in Salisbury court. The other six were called public theatres, viz. the Globe, the Swan, the Rose, and the Hope, on the Bank-side; the Red Bull, at the upper end of St John's-street, and the Fortune in White-cross Street. The two last were chiefly frequented by citizens. Mr Malone gives us a pretty copious account of these play-houses, in a supplement to his last edition of Shakespeare, which we shall here insert.

"Most, if not all (says he) of Shakespeare's plays were performed either at the Globe or at the Theatre in Blackfriars. It appears that they both belonged to the same company of comedians, viz. his majesty's servants, which title they assumed, after a licence had been granted to them by King James in 1603, having before that time been called the servants of the lord chamberlain.

"The theatre in Blackfriars was a private house; but the peculiar and distinguishing marks of a private play-house it is not easy to ascertain. It was very small, and plays were there usually represented by candle light. The Globe, situated on the southern side of the river Thames, was a hexagonal building, partly open to the weather, partly covered with reeds. It was a public theatre, and of considerable size, and there they always acted by day-light. On the roof of the Globe, and the other public theatres, a pole was erected, to which a flag was affixed. These flags were probably displayed only during the hours of exhibition; and it should seem from a passage in one of the old comedies that they were taken down during Lent, in which season no plays were presented. The Globe, though hexagonal at the outside, was probably a rotunda within, and perhaps had its name from its circular form. It might, however, have been denominated only from its sign, which was a figure of Hercules supporting the Globe. This theatre was burnt down in 1613, but it was rebuilt in the following year, and decorated with more ornament than had been originally bestowed upon it. The exhibitions at the Globe seem to have been calculated chiefly for the lower class of people; those at Blackfriars for a more select and judicious audience.

"A writer informs us, that one of these theatres was a winter and the other a summer house. As the Globe was partly exposed to the weather, and they acted there usually by day-light, it was probably the summer theatre. The exhibitions here seem to have been more frequent than at Blackfriars, at least till the year 1604 or 1605, when the Bank-side appears to have become less fashionable and less frequented than it formerly had been. Many of our ancient dramatic pieces were performed in the yards of carriers inns; in which, in the beginning of queen Elizabeth's reign, the comedians, who then first united themselves in companies, erected an occasional stage. The form of these temporary play-houses seems to be preserved in our modern theatre. The galleries are in both ranged over each other on three sides of the building. The small rooms under the lowest of these galleries answer to our present boxes; and it is observable that these, even in theatres which were built in a subsequent period expressly for dramatic exhibitions, still retained their old name, and are frequently called rooms by our ancient writers. The yard bears a sufficient resemblance to the pit, as at present in use. We may suppose the stage to have been raised in this area, on the fourth side, with its back to the gateway of the inn, at which the money for admission was taken. Hence, in the middle of the Globe, and I suppose of the other public theatres, in the time of Shakespeare, there was an open yard or area, where the common people stood to see the exhibition; from which circumstance they are called by our author groundlings, and by Ben Johnson 'the understanding gentlemen of the ground.'

"In the ancient play-houses there appears to have been a private box, of which it is not easy to ascertain the situation. It seems to have been placed at the side of the stage towards the rear, and to have been at a lower price: in this some people sat, either from economy or singularity. The galleries, or scaffolds as they are sometimes called, and that part of the house which in private theatres was named the pit, seem to have been at the same price; and probably in houses of reputation, such as the Globe, and that in Blackfriars, the price of admission into those parts of the theatre was 6 d. while in some meaner play-houses it was only 1 d. in others only 2 d. The price of admission into the best rooms or boxes was, I believe, in our author's time, 1 s.; though after-

Play-house. afterwards it appears to have risen to 2 s. and half-a-crown.

"From several passages in our old plays, we learn, that spectators were admitted on the stage, and that the critics and wits of the time usually sat there. Some were placed on the ground; others sat on stools, of which the price was either 6 d. or 1 s. according, I suppose, to the commodiousness of the situation; and they were attended by pages, who furnished them with pipes and tobacco, which was smoaked here as well as in other parts of the house; yet it should seem that persons were suffered to sit on the stage only in the private play-houses, such as Blackfriars, &c. where the audience was more select, and of a higher class; and that in the Globe and other public theatres no such licence was permitted.

"The stage was strewed with rushes, which, as we learn from Hentzner and Caius de Ephemera, was, in the time of Shakespeare, the usual covering of floors in England. The curtain which hangs in the front of the present stage, drawn up by lines and pulleys, though not a modern invention, for it was used by Inigo Jones in the masques at court, was yet an apparatus to which the simple mechanism of our ancient theatres had not arrived, for in them the curtains opened in the middle, and were drawn backwards and forwards on an iron rod. In some play-houses they were woollen, in others made of silk.—Towards the rear of the stage there appears to have been a balcony, the platform of which was probably eight or ten feet from the ground. I suppose it to have been supported by pillars. From hence, in many of our old plays, part of the dialogue was spoken; and in the front of this balcony curtains likewise were hung.

"A doubt has been entertained whether in our ancient theatres there were side and other scenes. The question is involved in so much obscurity, that it is very difficult to form any decided opinion upon it. It is certain, that in the year 1605 Inigo Jones exhibited an entertainment at Oxford, in which moveable scenes were used; but he appears to have introduced several pieces of machinery in the masques at court, with which undoubtedly the public theatres were unacquainted. A passage which has been produced from one of the old comedies, proves, it must be owned, that even these were furnished with some pieces of machinery, which were used when it was requisite to exhibit the descent of some god or saint; but from all the contemporary accounts, I am inclined to believe that the mechanism of our ancient stage seldom went beyond a painted chair or a trap-door, and that few, if any of them, had any moveable scenes. When king Henry VIII. is to be discovered by the dukes of Suffolk and Norfolk, reading in his study, the scenical direction in the first folio, 1623, (which was printed apparently from play-house copies), is, 'the king draws the curtain, (*i. e.* draws it open), and sits reading pensively;' for, besides the principal curtains that hung in the front of the stage, they used others as substitutes for scenes. If a bed-chamber is to be exhibited, no change of scene is mentioned; but the property-man is simply ordered to thrust forth a bed. When the fable requires the Roman capitol to be exhibited, we find two officers enter, 'to lay cushions, as it were, in the capitol,' &c. On the whole, it appears, that our ancient theatres, in general, were only furnished with curtains, and a single scene composed of tapestry, which were sometimes, perhaps, ornamented with pictures; and some passages in our old dramas incline one to think, that when tragedies were performed the stage was hung with black.

"In the early part, at least, of our author's ‡ acquaintance with the theatre, the want of scenery seems to have been supplied by the simple expedient of writing the names of the different places where the scene was laid in the progress of the play, which were disposed in such a manner as to be visible to the audience. The invention of trap-doors, however, appears not to be modern; for in an old *morality*, intitled *All for Money*, we find a marginal direction which implies that they were very early in use. The covering, or internal roof of the stage, was anciently termed the heavens. It was probably painted of a sky-blue colour, or perhaps pieces of drapery tinged with blue were suspended across the stage to represent the heavens.

‡ Shakespeare.

"It is probable that the stage was formerly lighted by two large branches, of a form similar to those now hung in churches. They gave place in a subsequent period to small circular wooden frames, furnished with candles, eight of which were hung on the stage, four at either side, and these within a few years were wholly removed by Mr Garrick, who, on his return from France, first introduced the present commodious method of illuminating the stage by lights not visible to the audience. Many of the companies of players were formerly so thin, that one person played two or three parts; and a battle on which the fate of an empire was supposed to depend was decided by half a dozen combatants. It appears to have been a common practice in their mock engagements to discharge small pieces of ordnance on the stage. Before the exhibition began, three flourishes or pieces of music were played, or, in the ancient language, there were three soundings. Music was likewise played between the acts. The instruments chiefly used were trumpets, cornets, and hautboys. The band, which did not consist of more than five or six performers, sat in an upper balcony, over what is now called the stage-box.

"The person who spoke the prologue was ushered in by trumpets, and usually wore a long black velvet cloak, which, I suppose, was considered as best suited to a supplicatory address. Of this custom, whatever might have been its origin, some traces remained till very lately, a black coat having been, if I mistake not, within these few years, the constant stage-habiliment of our modern prologue-speakers. The dress of the ancient prologue-speaker is still retained in the play that is exhibited in Hamlet before the king and court of Denmark. The performers of male characters generally wore periwigs, which in the age of Shakespeare were not in common use. It appears, from a passage in Puttenham's *Art of English Poesy*, 1589, that vizards were on some occasions used by the actors of those days; and it may be inferred, from a scene in one of our author's comedies, that they were sometimes worn in his time by those who performed female characters; but this I imagine was very rare. Some of the female part of the audience likewise appeared in masks. The stage-dresses, it is reasonable to suppose, were much more costly at some theatres than at others; yet the wardrobe of even the king's servants at the Globe and Blackfriars, was, we find, but scantily furnished; and our author's dramas derived very little aid from the splendor of exhibition.

"It is well known, that in the time of Shakespeare, and for many years afterwards, female characters were repre-

Play-house. represented by boys or young men. Sir William D'Avenant, in imitation of the foreign theatres, first introduced females in the scene, and Mrs Betterton is said to have been the first woman that appeared on the English stage. Andrew Pennycuicke played the part of Matilda in a tragedy of Davenport's, in 1655; and Mr Kynaston acted several female parts after the Restoration. Downes, a contemporary of his, assures us, 'that being then very young he made a complete stage beauty, performing his parts so well, particularly Arthiope and Aglaura, that it has since been disputable among the judicious whether any woman that succeeded him touched the audience so sensibly as he.'

"Both the prompter, or book-holder, as he was sometimes called, and the property-man, appear to have been regular appendages of our ancient theatres. No writer that I have met with intimates, that in the time of Shakespeare it was customary to exhibit more than a single dramatic piece on one day. The Yorkshire tragedy, or *All's One*, indeed, appears to have been one of four pieces that were represented on the same day; and Fletcher has also a piece called *Four Plays in One;* but probably these were either exhibited on some particular occasion, or were ineffectual efforts to introduce a new species of amusement; for we do not find any other instances of the same kind. Had any shorter pieces been exhibited after the principal performance, some of them probably would have been printed: but there are none extant of an earlier date than the time of the Restoration. The practice, therefore, of exhibiting two dramas successively in the same evening, we may be assured was not established before that period. But though the audiences in the time of our author were not gratified by the representation of more than one drama in the same day, the entertainment was diversified, and the populace diverted, by vaulting, tumbling, slight of hand, and morris-dancing, a mixture not much more heterogeneous than that with which we are daily presented, a tragedy and a farce.

"The amusements of our ancestors, before the commencement of the play, were of various kinds, such as reading, playing at cards, drinking ale, or smoaking tobacco. It was a common practice to carry table-books to the theatre, and either from curiosity or enmity to the author, or some other motive, to write down passages of the play that was represented: and there is reason to believe that the imperfect and mutilated copies of some of Shakespeare's dramas, which are yet extant, were taken down in short-hand during the exhibition. At the end of the piece, the actors, in noblemens houses and in taverns, where plays were frequently performed, prayed for the health and prosperity of their patrons; and in the public theatres for the king and queen. This prayer sometimes made part of the epilogue. Hence, probably, as Mr Steevens has observed, the addition of *Vivant rex et regina* to the modern play-bills.

"Plays, in the time of our author, began at one o'clock in the afternoon; and the exhibition was usually finished in two hours. Even in 1667 they commenced at three. When Gosson wrote his *School of Abuse* in 1579, it seems the dramatic entertainments were usually exhibited on Sundays. Afterwards they were performed on that and other days indiscriminately. It appears from a contemporary writer, that exhibiting plays on Sunday had not been abolished in the third year of king Charles I.

"The modes of conveyance to the theatre, anciently as at present, seem to have been various; some going in coaches, others on horseback, and many by water.— To the Globe play-house the company probably were conveyed by water; to that in Blackfriars the gentry went either in coaches or on horseback, and the common people on foot. In an epigram to Sir John Davis, the practice of riding to the theatre is ridiculed as a piece of affectation or vanity, and therefore we may presume it was not very general. Play house.

"The long and whimsical titles that are prefixed to the quarto copies of our author's plays, I suppose to have been transcribed from the play-bills of the time. A contemporary writer has preserved something like a play-bill of those days, which seems to corroborate this observation; for if it were divested of rhime, it would bear no very distant resemblance to the title pages that stand before some of our author's dramas:

" ———Prithee, what's the play?
" (The first I visited this twelvemonth day)
" They say—" A new invented play of Purle,
" That jeoparded his neck to steal a girl
" Of twelve; and lying fast impounded for't,
" Has hither sent his bearde to act his part;
" Against all those in open malice bent,
" That would not freely to the theft consent:
" Feigns all to's wish, and in the epilogue
" Goes out applauded for a famous—rogue."
" —Now hang me if I did not look at first
" For some such stuff, by the fond people's thrust."

"It is uncertain at what time the usage of giving authors a benefit on the third day of the exhibition of their pieces commenced. Mr Oldys, in one of his manuscripts, intimates that dramatic poets had anciently their benefit on the first day that a new play was represented; a regulation which would have been very favourable to some of the ephemeral productions of modern times. But for this there is not, I believe, any sufficient authority. From D'Avenant, indeed, we learn, that in the latter part of the reign of queen Elizabeth the poet had his benefit on the second day. As it was a general practice in the time of Shakespeare to sell the copy of the play to the theatre, I imagine in such cases an author derived no other advantage from his piece than what arose from the sale of it. Sometimes, however, he found it more beneficial to retain the copyright in his own hands; and when he did so, I suppose he had a benefit. It is certain that the giving authors the profit of the third exhibition of their play, which seems to have been the usual mode during almost the whole of the last century, was an established custom in the year 1612; for Decker, in the prologue to one of his comedies printed in that year, speaks of the poet's third day. The unfortunate Otway had no more than one benefit on the production of a new play; and this too, it seems, he was sometimes forced to mortgage before the piece was acted. Southerne was the first dramatic writer who obtained the emoluments arising from two representations; and to Farquhar, in the year 1700, the benefit of a third was granted. When an author sold his piece to the sharers or proprietors of a theatre, it remained for several years unpublished; but when that was not the case, he printed it for sale, to which many seem to have been induced, from an apprehension that an imperfect copy might be issued from the press without

Play-house. Plea.

out their consent. The customary price of the copy of a play in the time of Shakespeare appears to have been twenty nobles, or six pounds thirteen shillings and four pence. The play when printed was sold for sixpence; and the usual present from a patron in return for a dedication was forty shillings. On the first day of exhibiting a new play, the prices of admission appear to have been raised; and this seems to have been occasionally practised on the benefit-nights of authors to the end of the last century. The custom of passing a final censure on plays at their first exhibition is as ancient as the time of our author; for no less than three plays of his rival Ben Jonson appear to have been damned; and Fletcher's Faithful Shepherdess, and The Knight of the Burning Pestle, written by him and Beaumont, underwent the same fate.

"It is not easy to ascertain what were the emoluments of a successful actor in the time of Shakespeare. They had not then annual benefits as at present. The performers at each theatre seem to have shared the profits arising either from each day's exhibition or from the whole season among them. From Ben Jonson's Poetaster we learn, that one of either the performers or proprietors had seven shares and a half; but of what integral sum is not mentioned. From the prices of admission into our ancient theatres, which have been already mentioned, I imagine the utmost that the sharers of the Globe play-house could have received on any one day was about L. 35. So lately as the year 1685, Shadwell received by his third day on the representation of the Squire of Alsatia, L. 130; which Downes the prompter says was the greatest receipt that had been ever taken at Drury-Lane playhouse at single prices. It appears from the MSS. of Lord Stanhope, treasurer of the chambers to King James I. that the customary sum paid to John Heminge and his company for the performance of a play at court was twenty nobles, or six pounds thirteen shillings and four pence. And Edward Alleyn mentions in his Diary, that he once had so slender an audience in his theatre called the *Fortune*, that the whole receipts of the house amounted to no more than three pounds and some odd shillings.

"Thus scanty and meagre were the apparatus and accommodations of our ancient theatres, on which those dramas were first exhibited, that have since engaged the attention of so many learned men, and delighted so many thousand spectators. Yet even then, we are told by a writer of that age, 'that dramatic poesy was so lively expressed and represented on the public stages and theatres of this city, as Rome in the age of her pomp and glory never saw it better performed; in respect of the action and art, not of the cost and sumptuousness.'"

PLEA, in law, is what either party alleges for himself in court, in a cause there depending; and in a more restrained sense, it is the defendant's answer to the plaintiff's declaration.

Pleas are usually divided into those of the crown and common pleas. Pleas of the crown are all suits in the king's name, or in the name of the attorney-general in behalf of the king, for offences committed against his crown and dignity, and against his peace; as treason, murder, felony, &c. See ARRAIGNMENT.

Blackst. Comment.

Common pleas are such suits as are carried on between common persons in civil cases. These pleas are of two sorts; *dilatory* pleas, and pleas *to the action*. Dilatory pleas are such as tend merely to delay or put off the suit, by questioning the propriety of the remedy, rather than by denying the injury: pleas to the action are such as dispute the very cause of suit.

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I. *Dilatory* pleas are, 1. To the jurisdiction of the court: alleging, that it ought not to hold plea of this injury, it arising in Wales or beyond sea; or because the land in question is of ancient demesne, and ought only to be demanded in the lord's court, &c. 2. To the disability of the plaintiff, by reason whereof he is incapable to commence or continue the suit; as, that he is an alien enemy, outlawed, excommunicated, attainted of treason or felony, under a præmunire, not *in rerum natura* (being only a fictitious person), an infant, a feme-covert, or a monk professed. 3. In abatement: which abatement is either of the writ, or the count, for some defect in one of them; as by misnaming the defendant, which is called a *misnomer*; giving him a wrong addition, as esquire instead of knight; or other want of form in any material respect. Or, it may be that the plaintiff is dead; for the death of either party is at once an abatement of the suit.

These pleas to the jurisdiction, to the disability, or in abatement, were formerly very often used as mere dilatory pleas, without any foundation in truth, and calculated only for delay; but now by stat. 4 & 5 Ann. c. 16. no dilatory plea is to be admitted without affidavit made of the truth thereof, or some probable matter shown to the court to induce them to believe it true. And with respect to the pleas themselves, it is a rule, that no exception shall be admitted against a declaration or writ, unless the defendant will in the same plea give the plaintiff a better; that is, show him how it might be amended, that there may not be two objections upon the same account.

All pleas to the jurisdiction conclude to the cognizance of the court; praying "judgment whether the court will have farther cognizance of the suit." Pleas to the disability conclude to the person; by praying "judgment, if the said A the plaintiff ought to be answered:" And pleas in abatement (when the suit is by original) conclude to the writ or declaration; by praying "judgment of the writ, or declaration, and that the same may be quashed," *cassetur*, made void, or abated: but if the action be by bill, the plea must pray "judgement of the bill," and not of the declaration; the bill being here the original, and the declaration only a copy of the bill.

When these dilatory pleas are allowed, the cause is either dismissed from that jurisdiction, or the plaintiff is stayed till his disability be removed; or he is obliged to sue out a new writ, by leave obtained from the court, or to amend and new-frame his declaration. But when, on the other hand, they are over-ruled as frivolous, the defendant has judgment of *respondeat ouster*, or to answer over in some better manner. It is then incumbent on him to plead.

2. A plea *to the action*; that is, to answer to the merits of the complaint. This is done by confessing or denying it.

A confession of the whole complaint is not very usual; for then the defendant would probably end the matter sooner, or not plead at all, but suffer judgment to go

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by default. Yet sometimes, after tender and refusal of a debt, if the creditor harasses his debtor with an action, it then becomes necessary for the defendant to acknowledge the debt, and plead the tender; adding, that he has always been ready, *tout temps prist*, and is still ready, *uncore prist*, to discharge it: for a tender by the debtor and refusal by the creditor will in all cases discharge the costs, but not the debt itself; though in some particular cases the creditor will totally lose his money. But frequently the defendant confesses one part of the complaint (by a *cognovit actionem* in respect thereof), and traverses or denies the rest; in order to avoid the expence of carrying that part to a formal trial, which he has no ground to litigate. A species of this sort of confession is the *payment of money into court*: which is for the most part necessary upon pleading a tender, and is itself a kind of tender to the plaintiff; by paying into the hands of the proper officer of the court as much as the defendant acknowledges to be due, together with the costs hitherto incurred, in order to prevent the expence of any farther proceedings. This may be done upon what is called a *motion*, which is an occasional application to the court by the parties or their counsel, in order to obtain some rule or order of court, which becomes necessary in the progress of a cause; and it is usually grounded upon an *affidavit* (the perfect tense of the verb *affido*), being a voluntary oath before some judge or officer of the court, to evince the truth of certain facts, upon which the motion is grounded: though no such affidavit is necessary for payment of money into court. If, after the money is paid in, the plaintiff proceeds in his suit, it is at his own peril: for if he does not prove more due than is so paid into court, he shall be nonsuited and pay the defendant's costs; but he shall still have the money so paid in, for that the defendant has acknowledged to be his due. To this head may also be referred the practice of what is called a *set off*; whereby the defendant acknowledges the justice of the plaintiff's demand on the one hand; but on the other, sets up a demand of his own, to counterbalance that of the plaintiff, either in the whole or in part; as, if the plaintiff sues for ten pounds due on a note of hand, the defendant may set off nine pounds due to himself for merchandize sold to the plaintiff; and, in case he pleads such set-off, must pay the remaining balance into court.

Pleas that totally deny the cause of complaint are either the general issue, or a special plea in bar.

1. The *general issue*, or general plea, is what traverses, thwarts, and denies at once, the whole declaration, without offering any special matter whereby to evade it. As in trespass either *vi et armis*, or on the case, "*non culpabilis*, not guilty;" in debt upon contract, "*nihil debet*, he owes nothing;" in debt on bond, "*non est factum*, it is not his deed;" on an *assumpsit*, "*non assumpsit*, he made no such promise." Or in real actions, "*nul tort*, no wrong done; *nul disseisin*, no disseisin;" and in a writ of right, the mise or issue is, that "the tenant has more right to hold than the demandant has to demand." These pleas are called the *general issue*, because, by importing an absolute and general denial of what is alleged in the declaration, they amount at once to an issue; by which we mean a fact affirmed on one side and denied on the other.

2. *Special* pleas in bar of the plaintiff's demands are very various, according to the circumstances of the defendant's case. As, in real actions, a general release or a fine; both of which may destroy and bar the plaintiff's title. Or, in personal actions, an accord, arbitration, conditions performed, nonage of the defendant, or some other fact which precludes the plaintiff from his action. A *justification* is likewise a special plea in bar; as in actions of assault and battery, *son assault demesne*, that it was the plaintiff's own original assault; in trespass, that the defendant did the thing complained of in right of some office which warranted him so to do; or, in an action of slander, that the plaintiff is really as bad a man as the defendant said he was.

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Also a man may plead the statutes of limitation in bar; or the time limited by certain acts of parliament, beyond which no plaintiff can lay his cause of action. This, by the statute of 32 Hen. VIII. c. 2. in a writ of right is 60 years: in assises, writs of entry, or other possessory actions real, of the seisin of one's ancestors in lands; and either of their seisin, or one's own, in rents, suits, and services, 50 years: and in actions real for lands grounded upon one's own seisin or possession, such possession must have been within 30 years. By statute 1 Mar. st. 2. c. 5. this limitation does not extend to any suit for advowsons. But by the statute 21 Jac. I. c. 2. a time of limitation was extended to the case of the king; viz. 60 years precedent to 19th Feb. 1623: but, this becoming ineffectual by efflux of time, the same date of limitation was fixed by statute 9 Geo. III. c. 16. to commence and be reckoned backwards, from the time of bringing any suit or other process to recover the thing in question; so that a possession for 60 years is now a bar even against the prerogative, in derogation of the ancient maxim, *Nullum tempus occurrit regi*. By another statute, 21 Jac. I. c. 16. 20 years is the time of limitation in any writ of formedon: and, by a consequence, 20 years is also the limitation in every action of ejectment; for no ejectment can be brought, unless where the lessor of the plaintiff is intitled to enter on the lands, and by the statute 21 Jac. I. c. 16. no entry can be made by any man, unless within 20 years after his right shall accrue. Also all actions of trespass (*quare clausum fregit*, or otherwise), detinue, trover, replevin, account, and case (except upon accounts between merchants), debt on simple contract, or for arrears of rent, are limited by the statute last mentioned to six years after the cause of action commenced: and actions of assault, menace, battery, mayhem, and imprisonment, must be brought within four years, and actions for words two years, after the injury committed. And by the statute 31 Eliz. c. 5. all suits, indictments, and informations, upon any penal statutes, where any forfeiture is to the crown, shall be sued within two years, and where the forfeiture is to a subject, within one year, after the offence committed, unless where any other time is specially limited by the statute. Lastly, by statute 10 W. III. c. 14. no writ of error, *scire facias*, or other suit, shall be brought to reverse any judgment, fine, or recovery, for error, unless it be prosecuted within 20 years. The use of these statutes of limitation is to preserve the peace of the kingdom, and to prevent those innumerable perjuries which might ensue if a man were allowed to bring an action for any injury committed at any distance of time. Upon both these accounts the law therefore holds, that *interest reipublicae ut sit finis litium*: and upon the same principle the Athenian laws in general prohibited

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hibited all actions where the injury was committed five years before the complaint was made. If therefore, in any suit, the injury, or cause of action, happened earlier than the period expressly limited by law, the defendant may plead the statutes of limitations in bar: as upon an *assumpsit*, or promise to pay money to the plaintiff, the defendant may plead, *Non assumpsit infra sex annos*, He made no such promise within six years; which is an effectual bar to the complaint.

An *estoppel* is likewise a special plea in bar; which happens where a man hath done some act, or executed some deed, which estops or precludes him from averring any thing to the contrary. As if a tenant for years (who hath no freehold) levies a fine to another person. Tho' this is void as to strangers, yet it shall work as an estoppel to the cognizor; for, if he afterwards brings an action to recover these lands, and his fine is pleaded against him, he shall thereby be estopped from saying, that he had no freehold at the time, and therefore was incapable of levying it.

The conditions and qualities of a plea (which, as well as the doctrine of estoppels, will also hold equally, *mutatis mutandis*, with regard to other parts of pleading), are, 1. That it be single and containing only one matter; for duplicity begets confusion. But by statute 4 and 5 Ann. c. 16. a man, with leave of the court, may plead two or more distinct matters or single pleas; as in an action of assault and battery, these three, Not guilty, *son assault demesne*, and the statute of limitations. 2. That it be direct and positive, and not argumentative. 3. That it have convenient certainty of time, place, and persons. 4. That it answer the plaintiff's allegations in every material point. 5. That it be so pleaded as to be capable of trial.

Special pleas are usually in the affirmative, sometimes in the negative, but they always advance some new fact not mentioned in the declaration; and then they must be averred to be true in the common form:—"And this he is ready to verify."—This is not necessary in pleas of the general issue, those always containing a total denial of the facts before advanced by the other party, and therefore putting him upon the proof of them. See PLEADINGS.

Blackst. Comment.

PLEA to Indictment, the defensive matter alleged by a criminal on his indictment: (see ARRAIGNMENT.) This is either, 1. A plea to the jurisdiction; 2. A demurrer; 3. A plea in abatement; 4. A special plea in bar; or, 5. The general issue.

I. A plea to the *jurisdiction*, is where an indictment is taken before a court that hath no cognizance of the offence; as if a man be indicted for a rape at the sheriff's tourn, or for treason at the quarter-sessions: in these or similar cases, he may except to the jurisdiction of the court, without answering at all to the crime alleged.

II. A *demurrer* to the indictment, is incident to criminal cases, as well as civil, when the fact as alleged is allowed to be true, but the prisoner joins issue upon some point of law in the indictment by which he insists, that the fact, as stated, is no felony, treason, or whatever the crime is alleged to be. Thus, for instance, if a man be indicted for feloniously stealing a greyhound; which is an animal in which no valuable property can be had, and therefore it is not felony, but only a civil trespass to steal it; in this case the party indicted may demur to the indictment; denying it to be felony, tho' he confesses the act of taking it. Some have held, that if, on demurrer, the point of law be adjudged against the prisoner, he shall have judgment and execution, as if convicted by verdict. But this is denied by others, who hold, that in such case he shall be directed and received to plead the general issue, Not guilty, after a demurrer determined against him. Which appears the more reasonable; because it is clear, that if the prisoner freely discovers the fact in court, and refers it to the opinion of the court whether it be felony or no; and upon the fact thus shown, it appears to be felony, the court will not record the confession, but admit him afterwards to plead not guilty. And this seems to be a case of the same nature, being for the most part a mistake in point of law, and in the conduct of his pleading; and, though a man by mispleading may in some cases lose his property, yet the law will not suffer him by such niceties to lose his life. However, upon this doubt, demurrers to indictments are seldom used: since the same advantages may be taken upon a plea of not guilty; or afterwards, in arrest of judgment, when the verdict has established the fact.

III. A plea in *abatement* is principally for a *misnomer*, a wrong name, or a false addition to the prisoner. As, if James Allen, gentleman, is indicted by the name of *John Allen, esquire*, he may plead that he has the name of *James*, and not of *John*; and that he is a *gentleman*, and not an *esquire*. And, if either fact is found by a jury, then the indictment shall be abated, as writs or declarations may be in civil actions. But, in the end, there is little advantage accruing to the prisoner by means of these dilatory pleas; because, if the exception be allowed, a new bill of indictment may be framed, according to what the prisoner in his plea avers to be his true name and addition. For it is a rule, upon all pleas in abatement, that he who takes advantage of a flaw, must at the same time show how it may be amended. Let us therefore next consider a more substantial kind of plea, *viz.*

IV. Special pleas in *bar*; which go to the merits of the indictment, and give a reason why the prisoner ought not to answer it at all, nor put himself upon his trial for the crime alleged. These are of four kinds: a former acquittal, a former conviction, a former attainder, or a pardon. There are many other pleas which may be pleaded in bar of an appeal: but these are applicable to both appeals and indictments.

1. First, the plea of *auterfoits acquit*, or a former acquittal, is grounded on this universal maxim of the common law of England, that no man is to be brought into jeopardy of his life, more than once, for the same offence. And hence it is allowed as a consequence, that when a man is once fairly found not guilty upon any indictment, or other prosecution, before any court having competent jurisdiction of the offence, he may plead such acquittal in bar of any subsequent accusation for the same crime.

2. Secondly, the plea of *auterfoits convict*, or a former conviction for the same identical crime, though no judgment was ever given, or perhaps will be (being suspended by the benefit of clergy or other causes), is a good plea in bar to an indictment. And this depends upon the same principle as the former, that no man ought to be twice brought in danger of his life for one and the same crime.

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3. Thirdly, the plea of *autersoits attaint*, or a former attainder, is a good plea in bar, whether it be for the same or any other felony. For wherever a man is attainted of felony, by judgment of death either upon a verdict or confession, by outlawry, or heretofore by abjuration, and whether upon an appeal or an indictment; he may plead such attainder in bar to any subsequent indictment or appeal, for the same or for any other felony. And this because, generally, such proceeding on a second prosecution cannot be to any purpose; for the prisoner is dead in law by the first attainder, his blood is already corrupted, and he hath forfeited all that he had: so that it is absurd and superfluous to endeavour to attaint him a second time. Though to this general rule, as to all others, there are some exceptions; wherein, *cessante ratione, cessat et ipsa lex*.

4. Lastly, a pardon may be pleaded in bar; as at once destroying the end and purpose of the indictment, by remitting that punishment, which the prosecution is calculated to inflict. There is one advantage that attends pleading a pardon in bar, or in arrest of judgment, before sentence is past; which gives it by much the preference to pleading it after sentence or attainder. This is, that by stopping the judgment it stops the attainder, and prevents the corruption of the blood: which, when once corrupted by attainder, cannot afterwards be restored otherwise than by act of parliament.

V. The *general issue*, or plea of not guilty, upon which plea alone the prisoner can receive his final judgment of death. In case of an indictment of felony or treason, there can be no special justification put in by way of plea. As, on an indictment for murder, a man cannot plead that it was in his own defence against a robber on the highway, or a burglar; but he must plead the general issue, Not guilty, and give this special matter in evidence. For (besides that these pleas do in effect amount to the general issue; since, if true, the prisoner is most clearly not guilty) as the facts in treason are laid to be done *proditorie et contra ligeantiæ suæ debitum*; and, in felony, that the killing was done *felonice*; these charges, of a traiterous or felonious intent, are the points and very *gist* of the indictment, and must be answered directly, by the general negative, Not guilty; and the jury upon the evidence will take notice of any defensive matter, and give their verdict accordingly as effectually as if it were or could be specially pleaded. So that this is, upon all accounts, the most advantageous plea for the prisoner.

When the prisoner hath thus pleaded not guilty, *non culpabilis*, or *nient culpable*: which was formerly used to be abbreviated upon the minutes, thus, *Non* (or *nient*) *cul.* the clerk of the assize, or clerk of arraigns, on behalf of the crown replies, that the prisoner is guilty, and that he is ready to prove him so. This is done by two monosyllables in the same spirit of abbreviation, *cul. prit.*: which signifies first that the prisoner is guilty, (*cul. culpable*, or *culpabilis*); and then that the king is ready to prove him so, (*prit, presto sum*, or *paratus, verificare*). By this replication the king and the prisoner are therefore at issue: for when the parties come to a fact which is affirmed on one side and denied on the other, then they are said to be at issue in point of fact: which is evidently the case here, in the plea of *non cul.* by the prisoner; and the replication of *cul.* by the clerk.

Plea, Pleadings.

How the courts came to express a matter of this importance in so odd and obscure a manner, can hardly be pronounced with certainty. It may perhaps, however, be accounted for by supposing, that these were at first short notes, to help the memory of the clerk, and remind him what he was to reply; or else it was the short method of taking down in court, upon the minutes, the replication and averment; *cul. prit*: which afterwards the ignorance of succeeding clerks adopted for the very words to be by them spoken (A).

But however it may have arisen, the joining of issue seems to be clearly the meaning of this obscure expression; which has puzzled our most ingenious etymologists, and is commonly understood as if the clerk of the arraigns, immediately on plea pleaded, had fixed an opprobrious name on the prisoner, by asking him, "*culprit*, how wilt thou be tried?" for immediately upon issue joined it is inquired of the prisoner, by what trial he will make his innocence appear. This form has at present reference to appeals and approvements only, wherein the appellee has his choice, either to try the accusation by BATTLE or by JURY. But upon indictments, since the abolition of ORDEAL, there can be no other trial but by jury, *per pais*, or by the country: and therefore, if the prisoner refuses to put himself upon the inquest in the usual form, that is, to answer that he will be tried by God and the country, if a commoner; and, if a peer, by God and his peers; the indictment, if in treason, is taken *pro confesso*; and the prisoner, in cases of felony, is judged to stand mute, and, if he perseveres in his obstinacy, shall now be convicted of the felony.

When the prisoner has thus put himself upon his trial, the clerk answers in the humane language of the law, which always hopes that the party's innocence rather than his guilt may appear, "God send thee a good deliverance." And then they proceed, as soon as conveniently may be, to the trial. See the article TRIAL.

PLEADINGS, in law, are the mutual altercations between the plaintiff and defendant, (see SUIT, WRIT, and PROCESS). They form the third part or stage of a fact; and at present are set down and delivered into the proper office in writing, though formerly they were usually put in by their council *ore tenus*, or *viva voce*, in court, and then minuted down by the chief clerks or prothonotaries; whence, in our old law-French, the pleadings are frequently denominated the *parol*.

The first of these is the *declaration, narratio*, or *count*, anciently called the *tale*; in which the plaintiff sets forth his cause of complaint at length: being indeed only an amplification

(A) Of this ignorance we may see daily instances, in the abuse of two legal terms of ancient French: one, the prologue to all proclamations, "*Oyez*, or Hear ye," which is generally pronounced, most unmeaningly, "O yes: the other, a more pardonable mistake, viz. when a jury are all sworn, the officer bids the crier number them, for which the word in law French is, "*Countez*;" but we now hear it pronounced in very good English, "Count these."

Pleadings. Blackst. Comment.

amplification or exposition of the original writ upon which his action is founded, with the additional circumstances of time and place, when and where, the injury was committed.

In *local* actions, where possession of land is to be recovered, or damages for an actual trespass, or for waste, &c. affecting land, the plaintiff must lay his declaration, or declare his injury to have happened in the very county and place that it really did happen; but in *transitory* actions, for injuries that might have happened anywhere, as debt, detinue, slander, and the like, the plaintiff may declare in what county he pleases, and then the trial must be in that county in which the declaration is laid. Though, if the defendant will make affidavit that the cause of action, if any, arose not in that but another county, the court will direct a change of *the venue* or *visne* (that is, the *vicinia* or neighbourhood in which the injury is declared to be done), and will oblige the plaintiff to declare in the proper county. For the statute 6 Ric. II. c. 2. having ordered all writs to be laid in their proper counties, this, as the judges conceived, impowered them to change the *venue*, if required, and not to insist rigidly on abating the writ: which practice began in the reign of James I. And this power is discretionally exercised, so as not to cause but prevent a defect of justice. Therefore the court will not change the *venue* to any of the four northern counties previous to the spring circuit; because there the assises are holden only once a-year, at the time of summer circuit. And it will sometimes remove the *venue* from the proper jurisdiction (especially of the narrow and limited kind), upon a suggestion, duly supported, that a fair and impartial trial cannot be had therein.

It is generally usual, in actions upon the case, to set forth several cases, by different counts in the same declaration; so that if the plaintiff fails in the proof of one, he may succeed in another. As in an action on the case upon an ASSUMPSIT for goods sold and delivered, the plaintiff usually counts or declares, first, upon a settled and agreed price between him and the defendant; as, that they bargained for 20 l.: and lest he should fail in the proof of this, he counts likewise upon a *quantum valebant;* that the defendant bought other goods, and agreed to pay him so much as they were reasonably worth: and then avers that they were worth other 20 l. and so on in three or four different shapes; and at last concludes with declaring, that the defendant had refused to fulfil any of these agreements, whereby he is endamaged to such a value. And if he proves the case laid in any one of his counts, though he fails in the rest, he shall recover proportionable damages. This declaration always concludes with these words, "and thereupon he brings suit," &c. *inde producit sectam, &c.* By which words, *suit* or *secta (a sequendo)*, were anciently understood the witnesses or followers of the plaintiff. For in former times, the law would not put the defendant to the trouble of answering the charge till the plaintiff had made out at least a probable case. But the actual production of the *suit, secta,* or *followers*, is now antiquated, and hath been totally disused, at least ever since the reign of Edward III. though the form of it still continues.

At the end of the declaration are added also the plaintiff's common pledges of prosecution, John Doe and Richard Roe; which, as we elsewhere observe, (see WRIT), are now mere names of form; though formerly they were of use to answer to the king for the amercement of the plaintiff, in case he were nonsuited, barred of his action, or had a verdict and judgment against him. For if the plaintiff neglects to deliver a declaration for two terms after the defendant appears, or is guilty of other delays or defaults against the rules of law in any subsequent stage of the action, he is adjudged not to follow or pursue his remedy as he ought to do; and thereupon a *nonsuit*, or *non prosequitur*, is entered, and he is said to be *non-pros*'d. And for thus deserting his complaint, after making a false claim or complaint *(pro falso clamore suo)*, he shall not only pay costs to the defendant, but is liable to be amerced to the king. A *retraxit* differs from a nonsuit, in that the one is negative and the other positive: the nonsuit is a default and neglect of the plaintiff, and therefore he is allowed to begin his suit again upon payment of costs; but a *retraxit* is an open and voluntary renunciation of his suit in court; and by this he for ever loses his action. A *discontinuance* is somewhat similar to a nonsuit; for when a plaintiff leaves a chasm in the proceedings of his cause, as by not continuing the process regularly from day to day, and time to time, as he ought to do, the suit is discontinued, and the defendant is no longer bound to attend; but the plaintiff must begin again, by suing out a new original, usually paying costs to his antagonist.

When the plaintiff hath stated his case in the declaration, it is incumbent on the defendant, within a reasonable time, to make his defence, and to put in a plea; or else the plaintiff will at once recover judgment by *default*, or *nihil dicit*, of the defendant.

Defence, in its true legal sense, signifies not a justification, protection, or guard, which is now its popular signification; but merely an *opposing* or *denial* (from the French verb *defendre*) of the truth or validity of the complaint. It is the *contestatio litis* of the civilians: a general assertion that the plaintiff hath no ground of action; which assertion is afterwards extended and maintained in his plea.

Before defence made, if at all, cognizance of the suit must be claimed or demanded; when any person or body-corporate hath the franchise, not only of holding pleas within a particular limited jurisdiction, but also of the cognizance of pleas; and that either without any words exclusive of other courts, which intitles the lord of the franchise, whenever any suit that belongs to his jurisdiction is commenced in the courts at Westminster, to demand the cognizance thereof; or with such exclusive words, which also intitle the defendant to plead to the jurisdiction of the court. Upon this claim of cognizance, if allowed, all proceedings shall cease in the superior court, and the plaintiff is left at liberty to pursue his remedy in the special jurisdiction. As, when a scholar or other privileged person of the universities of Oxford or Cambridge is impleaded in the courts at Westminster, for any cause of action whatsoever, unless upon a question of freehold. In these cases, by the charter of those learned bodies, confirmed by act of parliament, the chancellor, or vice-chancellor, may put in a claim of cognizance; which, if made in due time and form, and with due proof of the facts alleged, is regularly

Pleadings.

Pleadings. larly allowed by the courts. It must be demanded before full defence is made or imparlance prayed; for these are a submission to the jurisdiction of the superior court, and the delay is a *laches* in the lord of the franchise: and it will not be allowed if it occasions a failure of justice, or if an action be brought against the person himself who claims the franchise, unless he hath also a power in such case of making another judge.

After defence made, the defendant must put in his plea. But before he defends, if the suit is commenced by *capias* or *latitat*, without any special original, he is intitled to demand one *imparlance*, or *licentia loquendi*; and may, before he pleads, have more granted by consent of the court, to see if he can end the matter amicably without farther suit, by talking with the plaintiff: a practice which is supposed to have arisen from a principle of religion, in obedience to that precept of the gospel, "agree with thine adversary quickly, whilst thou art *in the way* with him." And it may be observed, that this gospel-precept has a plain reference to the Roman law of the twelve tables, which expressly directed the plaintiff and defendant to make up the matter while they were in the way, or going to the prætor;—*in via, rem uti pacent orato*. There are also many other previous steps which may be taken by a defendant before he puts in his plea. He may, in real actions, demand a view of the thing in question, in order to ascertain its identity and other circumstances. He may crave *oyer* of the writ, or of the bond, or other specialty upon which the action is brought; that is, to hear it read to him; the generality of defendants in the times of ancient simplicity being supposed incapable to read it themselves: whereupon the whole is entered *verbatim* upon the record; and the defendant may take advantage of any condition, or other part of it, not stated in the plaintiff's declaration. In real actions also the tenant may pray in *aid*, or call for the assistance of another, to help him to plead, because of the feebleness or imbecility of his own estate. Thus a tenant for life may pray in aid of him that hath the inheritance in remainder or reversion; and an incumbent may pray in aid of the patron and ordinary; that is, that they shall be joined in the action, and help to defend the title. *Voucher* also is the calling in of some person to answer the action, that hath warranted the title to the tenant or defendant. This we still make use of in the form of common recoveries, which are grounded on a writ of entry; a species of action that relies chiefly on the weakness of the tenant's title, who therefore vouches another person to warrant it. If the vouchee appears, he is made defendant instead of the voucher; but if he afterwards makes default, recovery shall be had against the original defendant; and he shall recover an equivalent in value against the deficient vouchee. In assizes, indeed, where the principal question is, whether the demandant or his ancestors were or were not in possession till the ouster happened, and the title of the tenant is little (if at all) discussed, there no voucher is allowed; but the tenant may bring a writ of *warrantia chartæ* against the warrantor, to compel him to assist him with a good plea or defence, or else to render damages and the value of the land, if recovered against the tenant. In many real actions also, brought by or against an infant under the age of 21 years, and also in actions of debt brought against him, as heir to any deceased ancestor, either party may suggest the nonage of the infant, and pray that the proceedings may be deferred till his full age, or, in our legal phrase, that the infant may have his age, and that the *parol may demur*, that is, that the pleadings may be staid; and then they shall not proceed till his full age, unless it be apparent that he cannot be prejudiced thereby. But by the statutes of Westm. 1. 3 Edw. I. c. 46. and of Glocester, 6 Edw. I. c. 2. in writs of entry *sur disseisin* in some particular cases, and in actions auncestrel brought by an infant, the parol shall not demur; otherwise he might be deforced of his whole property, and even want a maintenance, till he came of age. So likewise in a writ of dower the heir shall not have his age; for it is necessary that the widow's claim be immediately determined, else she may want a present subsistence. Nor shall an infant patron have it in a *quare impedit*, since the law holds it necessary and expedient that the church be immediately filled.

When these proceedings are over, the defendant must then put in his excuse or plea. See Plea.

It is a rule in pleading, that no man be allowed to plead specially such a plea as amounts only to the general issue, or a total denial of the charge; but in such case he shall be driven to plead the general issue in terms, whereby the whole question is referred to a jury. But if the defendant, in an assize or action of trespass, be desirous to refer the validity of his title to the court rather than the jury, he may state his title specially; and at the same time give colour to the plaintiff, or suppose him to have an appearance or colour of title, bad indeed in point of law, but of which the jury are not competent judges. As if his own true title is, that he claims by feoffment with livery from A, by force of which he entered on the lands in question, he cannot plead this by itself, as it amounts to no more than the general issue, *nul tort*, *nul disseisin*, in assize, or *not guilty* in an action of trespass. But he may allege this specially, provided he goes farther, and says, that the plaintiff claiming by colour of a prior deed of feoffment, without livery, entered; upon whom he entered; and may then refer himself to the judgment of the court which of these two titles is the best in point of law.

When the plea of the defendant is thus put in, if it does not amount to an issue or total contradiction of the declaration, but only evades it, the plaintiff may plead again, and reply to the defendant's plea: Either traversing it, that is, totally denying it; as if, on an action of debt upon bond, the defendant pleads *solvit ad diem*, that he paid the money when due; here the plaintiff in his replication may totally traverse this plea, by denying that the defendant paid it: Or he may allege new matter in contradiction to the defendant's plea; as when the defendant pleads no award made, the plaintiff may reply, and set forth an actual award, and assign a breach: Or the replication may confess and avoid the plea, by some new matter or distinction, consistent with the plaintiff's former declaration; as in an action for trespassing upon land whereof the plaintiff is seized, if the defendant shows a title to the land by descent, and that therefore he had a right to enter, and gives colour to the plaintiff, the plaintiff may either traverse and totally deny the fact of the descent; or he may confess and avoid it, by replying, that true it is that such descent

Pleadings. scent happened, but that since the descent the defendant himself demised the lands to the plaintiff for term of life. To the replication the defendant may *rejoin*, or put in an answer called a *rejoinder*. The plaintiff may answer the rejoinder by a *sur-rejoinder*; upon which the defendant may *rebut*, and the plaintiff answer him by a *sur-rebutter*. Which pleas, replications, rejoinders, sur-rejoinders, rebutters, and sur-rebutters, answer to the *exceptio*, *replicatio*, *duplicatio*, *triplicatio*, and *quadruplicatio*, of the Roman laws.

The whole of this process is denominated the *pleading*; in the several stages of which it must be carefully observed, not to depart or vary from the title or defence which the party has once insisted on. For this (which is called a *departure* in pleading) might occasion endless altercation. Therefore the replication must support the declaration, and the rejoinder must support the plea, without departing out of it. As in the case of pleading no award made in consequence of a bond of arbitration, to which the plaintiff replies, setting forth an actual award; now the defendant cannot rejoin that he hath performed this award, for such rejoinder would be an entire departure from his original plea, which alleged that no such award was made: therefore he has now no other choice, but to traverse the fact of the replication, or else to demur upon the law of it.

Again, all duplicity in pleading must be avoided. Every plea must be simple, entire, connected, and confined to one single point: it must never be entangled with a variety of distinct independent answers to the same matter; which must require as many different replies, and introduce a multitude of issues upon one and the same dispute. For this would often embarrass the jury, and sometimes the court itself, and at all events would greatly enhance the expence of the parties. Yet it frequently is expedient to plead in such a manner as to avoid any implied admission of a fact, which cannot with propriety or safety be positively affirmed or denied. And this may be done by what is called a *protestation*; whereby the party interposes an oblique allegation or denial of some fact, protesting (by the gerund, *protestando*) that such a matter does or does not exist; and at the same time avoiding a direct affirmation or denial. Sir Edward Coke hath defined a protestation (in the pithy dialect of that age) to be, "an exclusion of a conclusion." For the use of it is, to save the party from being concluded with respect to some fact or circumstance which cannot be directly affirmed or denied without falling into duplicity of pleading; and which yet, if he did not thus enter his protest, he might be deemed to have tacitly waved or admitted. Thus, while tenure in villainage subsisted, if a villain had brought an action against his lord, and the lord was inclined to try the merits of the demand, and at the same time to prevent any conclusion against himself that he had waved his signiory; he could not in this case both plead affirmatively that the plaintiff was his villain, and also take issue upon the demand; for then his plea would have been double, as the former alone would have been a good bar to the action: but he might have alleged the villainage of the plaintiff by way of protestation, and then have denied the demand. By this means the future vassalage of the plaintiff was saved to the defendant, in case the issue was found in his (the defendant's) favour; for the protestation prevented that conclusion which would otherwise have resulted from the rest of his defence, that he had enfranchised the plaintiff, since no villain could maintain a civil action against his lord. So also if a defendant, by way of inducement to the point of his defence, alleges (among other matters) a particular mode of seisin or tenure which the plaintiff is unwilling to admit, and yet desires to take issue on the principal point of the defence, he must deny the seisin or tenure by way of protestation, and then traverse the defensive matter. So, lastly, if an award be set forth by the plaintiff, and he can assign a breach in one part of it (viz. the non-payment of a sum of money), and yet is afraid to admit the performance of the rest of the award, or to aver in general a non-performance of any part of it, lest something should appear to have been performed; he may save to himself any advantage he might hereafter make of the general non-performance, by alleging that by protestation, he can plead only the non-payment of the money.

In any stage of the pleadings, when either side advances or affirms any new matter, he usually (as was said) avers it to be true; "and this he is ready to verify." On the other hand, when either side traverses or denies the facts pleaded by his antagonist, he usually tenders an *issue*, as it is called; the language of which is different according to the party by whom it is tendered: for if the traverse or denial comes from the defendant, the issue is tendered in this manner, "And of this he puts himself upon the country," thereby submitting himself to the judgment of his peers: but if the traverse lies upon the plaintiff, he tenders the issue or prays the judgment of the peers against the defendant in another form; thus, "and this he prays may be inquired of by the country."

But if either side (as, for instance, the defendant) pleads a special negative plea, not traversing or denying any thing that was before alleged, but disclosing some new negative matter; as where the suit is on a bond conditioned to perform an award, and the defendant pleads, negatively, that no award was made; he tenders no issue upon this plea, because it does not yet appear whether the fact will be disputed, the plaintiff not having yet asserted the existence of any award: but when the plaintiff replies, and sets forth an actual specific award, if then the defendant traverses the replication, and denies the making of any such award, he then, and not before, tenders an issue to the plaintiff. For when in the course of pleading they come to a point which is affirmed on one side and denied on the other, they are then said to be at issue; all their debates being at last contracted into a single point, which must now be determined either in favour of the plaintiff or of the defendant. See Issue.

PLEASING, art of. See Politeness.

PLEASURE is a word so universally understood as to need no explanation. Lexicographers, however, who must attempt to explain every word, call it "the gratification of the mind or senses." It is directly opposite to Pain, and constitutes the whole of positive happiness as that does of misery.

Pleadings ‖ Pleasure.

The Author of Nature has furnished us with many pleasures, as well as made us liable to many pains; and we are susceptible of both in some degree as soon as we have life and are endowed with the faculty of sensation. A French writer, in a work* which once raised high expectations

* Encyclopédie Methodique, Logique, Metaphysique, et Morale, tom. 4.

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expectations, contends, that a child in the womb of its mother feels neither pleasure nor pain. "These sensations (says he) are not innate; they have their origin from without: and it is at the moment of our birth that the soul receives the first impressions; impressions slight and superficial at the beginning, but which by time and repeated acts leave deeper traces in the sensorium, and become more extensive and more lasting. It is when the child sends forth its first cries that sensibility or the faculty of sensation is produced, which in a short time gathers strength and stability by the impression of exterior objects. Pleasure and pain not being innate, and being only acquired in the same manner as the qualities which we derive from instruction, education, and society, it follows that we learn to suffer and enjoy as we learn any other science."

This is strange reasoning and strange language. That sensations are not innate is universally acknowledged; but it does not therefore follow that the soul receives its first impressions and first sensations at the moment of birth. The child has life, the power of locomotion, and the sense of touch, long before it is born; and every mother will tell this philosopher, that an infant unborn exhibits symptoms both of pain and of pleasure. That many of our organs of sense are improved by use is incontrovertible; but it is so far from being true that our sensible pleasures become more exquisite by being often repeated, that the direct contrary is experienced of far the greater part of them; and though external objects, by making repeated impressions on the senses, certainly leave deeper traces on the memory than an object once perceived can do, it by no means follows that these impressions become the more delightful the more familiar that they are to us. That we learn to suffer and enjoy as we learn any other science, is a most extravagant paradox; for it is self-evident that we cannot live without being capable in some degree both of suffering and enjoyment, though a man may certainly live to old age in profound ignorance of all the sciences.

The same writer assures us, indeed, that sensation is not necessary to human life. "Philosophers (says he) make mention of a man who had lost every kind of feeling in every member of his body: he was pinched or pricked to no purpose. Meanwhile this man made use of all his members; he walked without pain, he drank, ate, and slept, without perceiving that he did so. Sensible neither to pleasure nor pain, he was a true natural machine."

To the tale of these anonymous philosophers our author gives implicit credit, whilst he favours us at the same instant with the following argumentation, which completely proves its falsehood. "It is true that sensation is a relative quality, susceptible of increase and diminution; that it is not necessary to existence; and that one might live without it: but in this case he would live as an automaton, without feeling pleasure or pain; and he would possess neither idea, nor reflection, nor desire, nor passion, nor will, nor sentiment; his existence would be merely passive, he would live without knowing it, and die without apprehension."

But if this man of the philosophers, whom our author calls an *automaton*, and a *true natural machine*, had neither *idea*, nor *desire*, nor *passion*, nor *will*, nor *sentiment* (and without sensation he certainly could have none of them), what induced him to *walk*, *eat*, or *drink*, or to *cease* from any of these operations after they were accidentally begun? The instances of the *automata* which played on the flute and at chess are not to the purpose for which they are adduced; for there is no parallel between them and this natural machine, unless the philosophers wound up their man to eat, drink, walk, or sit, as Vacanson and Kempeler wound up their automata to play or cease from playing on the German flute and at chess. See ANDROIDES.

Our author having for a while sported with these harmless paradoxes, proceeds to put the credulity of his reader to the test with others of a very contrary tendency. He institutes an inquiry concerning the superiority, in number and degree, of the pleasures enjoyed by the different orders of men in society; and labours, not indeed by argument, but by loose declamation, to propagate the belief that happiness is very unequally distributed. The pleasures of the rich, he says, must be more numerous and exquisite than those of the poor; the nobleman must have more enjoyments than the plebeian of equal wealth; and the king, according to him, must be the happiest of all men. He owns, indeed, that although "birth, rank, honours, and dignity, add to happiness, a man is not to be considered as miserable because he is born in the lower conditions of life. A man may be happy as a mechanic, a merchant, or a labourer, provided he enters into the spirit of his profession, and has not imbibed by a misplaced education those sentiments which make his condition insupportable. Happiness is of easy acquisition in the middling stations of life; and though perhaps we are unable to know or to rate exactly the pleasure which arises from contentment and mediocrity, yet happiness being a kind of aggregate of delights, of riches, and of advantages more or less great, every person must have a share of it; the division is not exactly made, but all other things equal, there will be more in the elevated than in the inferior conditions of society; the enjoyment will be more felt, the means of enjoying more multiplied, and the pleasures more varied. Birth, rank, fortune, talents, wit, genius, and virtue, are then the great sources of happiness: those advantages are so considerable, that we see men contented with any one of them, but their union forms supreme felicity.

"There is so vast a difference, says Voltaire, between a man who has made his fortune and one who has to make it, that they are scarcely to be considered as creatures of the same kind. The same thing may be said of birth, the greatest of all advantages in a large society; of rank, of honours, and of great abilities. How great a difference is made between a person of high birth and a tradesman; between a Newton or Descartes and a simple mathematician? Ten thousand soldiers are killed on the field of battle, and it is scarcely mentioned; but if the general falls, and especially if he be a man of courage and abilities, the court and city are filled with the news of his death, and the mourning is universal.

"Frederic the Great, the late king of Prussia, felt in a more lively manner than perhaps any other man the value of great talents. I would willingly renounce, said he to Voltaire, every thing which is an object of desire and ambition to man; but I am certain if I were not

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not a prince I should be nothing. Your merit alone would gain you the esteem, and envy, and admiration of the world; but to secure respect for me, titles, and armies, and revenues, are absolutely necessary."

For what purpose this account of human happiness was published, it becomes not us to say. Its obvious tendency is to make the lower orders of society discontented with their state, and envious of their superiors; and it is not unreasonable to suppose, that it contributed in some degree to excite the ignorant part of the author's countrymen to the commission of those atrocities of which they have since been guilty. That such was his intention, the following extract will not permit us to believe; for though in it the author attempts to support the same false theory of human happiness, he mentions virtuous kings with the respect becoming a loyal subject of the unfortunate Louis, whose character he seems to have intentionally drawn, and whose death by the authority of a savage faction he has in effect foretold.

"Happiness, in a state of society, takes the most variable forms: it is a Proteus susceptible of every kind of metamorphosis: it is different in different men, in different ages, and in different conditions, &c. The pleasures of youth are very different from those of old age: what affords enjoyment to a mechanic would be supreme misery to a nobleman; and the amusements of the country would appear insipid in the capital. Is there then nothing fixed with regard to happiness? Is it of all things the most variable and the most arbitrary? Or, in judging of it, is it impossible to find a standard by which we can determine the limits of the greatest good to which man can arrive in the present state? It is evident that men form the same ideas of the beautiful and sublime in nature, and of right and wrong in morality, provided they have arrived at that degree of improvement and civilization of which human nature is susceptible; and that different opinions on these subjects depend on different degrees of culture, of education, and of improvement. The same thing may be advanced with regard to happiness: all men, if equal with respect to their organs, would form the very same ideas on this subject if they reached the degree of improvement of which we are presently speaking; and in fact, do we not see in the great circles at Rome, at Vienna, at London, and Paris, that those who are called people of fashion, who have received the same education, have nearly the same taste, the same desires, and the same spirit for enjoyment? there is doubtless a certain degree of happiness to be enjoyed in every condition of life; but as there are some conditions preferable to others, so are there degrees of happiness greater and less; and if we were to form an idea of the greatest possible in the present state, it perhaps would be that of a sovereign, master of a great empire, enjoying good health and a moderate spirit; endowed with piety and virtue, whose whole life was employed in acts of justice and mercy, and who governed by fixed and immoveable laws. Such a king is the image of the divinity on earth, and he must be the idol of a wise people. His whole life should present a picture of the most august felicity. Although such sovereigns are rare, yet we are not without examples of them. Ancient history affords us Titus and Marcus Aurelius, and the present age can boast of piety and munificence in the character of some of its kings. This state of the greatest happiness to which man can reach not being ideal, it will serve as a standard of comparison by which happiness and misery can be estimated in all civilized countries. *He is as happy as a king*, is a proverbial expression, because we believe with justice that royalty is the extreme limit of the greatest enjoyments; and in fact, happiness being the work of man, that condition which comprehends all the degrees of power and of glory, which is the source of honour and of dignity, and which supposes in the person invested with it all means of enjoyment either for himself or others, leaves nothing on this earth to which any reasonable man would give the preference.

"We can find also in this high rank the extreme of the greatest evils to which the condition of nature is exposed. A king condemned to death, and perishing on a scaffold, by the authority of a faction, while at the same time he had endeavoured by every means in his power to promote the general happiness of his subjects, is the most terrible and striking example of human misery; for if it be true that a crown is the greatest of all blessings, then the loss of it, and at the same time the loss of life by an ignominious and unjust sentence, are of all calamities the most dreadful.

"It is also in the courts of kings that we find the most amiable and perfect characters; and it is there where true grandeur, true politeness, the best tone of manners, the most amiable graces, and the most eminent virtues, are completely established. It is in courts that men seem to have acquired their greatest improvement: Whosoever has seen a court, says La Bruyere, has seen the world in the most beautiful, the most enchanting, and attractive colours. The prejudices of mankind in behalf of the great are so excessive, that if they inclined to be good they would be almost the objects of adoration."

In this passage there are doubtless many just observations; but there is at least an equal number of others both false and dangerous. That a crown is the greatest of earthly blessings, and that it is in the courts of kings that we meet with the most amiable and perfect characters, are positions which a true philosopher will not admit but with great limitations. The falsehood of the author's general theory respecting the unequal distribution of happiness in society, we need not waste time in exposing. It is sufficiently exposed in other articles of this work, and in one of them by a writer of a very superior order (See Happiness; and *Moral Philosophy*, Part II. chap. ii.) He enters upon other speculations respecting the pleasures and pains of savages, which are ingenious and worthy of attention; but before we proceed to notice them, it will be proper to consider the connection which subsists between pleasure and pain.

"That the cessation of pain is accompanied by pleasure, is a fact (says a philosopher of the first rank †) which has been repeatedly observed, but perhaps not sufficiently accounted for. Let us suppose a person in a state of indifference as to heat. Upon coming near a fire, he will experience at first an agreeable warmth, *i. e.* pleasure. If the heat be increased, this state of pleasure will, after a time, be converted into one of pain, from the increased action upon the nerves and

† Dr Sayers.

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brain, the undoubted organs of all bodily sensations. Let the heat now be gradually withdrawn, the nervous system must acquire again, during this removal, the state of agreeable warmth or pleasure; and after passing through that state it will arrive at indifference. From this fact then we may conclude, that a state of pleasure may be pushed on till it is converted into one of pain; and, on the other hand, that an action which produces pain will, if it go off gradually, induce at a certain period of its decrease a state of pleasure. The same reasoning which has thus been applied to the body may be extended also to the mind. Total languor of mind is not so pleasant as a certain degree of action or emotion; and emotions pleasant at one period may be increased till they become painful at another; whilst painful emotions, as they gradually expire, will, at a certain period of their decrease, induce a state of pleasure. Hence then we are able to explain why pleasure should arise in all cases from the gradual cessation of any action or emotion which produces pain."

The same author maintains, that from the mere removal of pain, whether by degrees or instantaneously, we always experience pleasure; and if the pain removed was exquisite, what he maintains is certainly true. To account for this phenomenon he lays down the following law of nature, which experience abundantly confirms, *viz.* "that the temporary withdrawing of any action from the body or mind invariably renders them more susceptible of that action when again produced." Thus, after long fasting, the body is more susceptible of the effects of food than if the stomach had been lately satisfied; the action of strong liquors is found to be greater on those who use them seldom than on such as are in the habit of drinking them. Thus, too, with respect to the mind; if a person be deprived for a time of his friend's society, or of a favourite amusement, the next visit of his friend, or the next renewal of his amusement, is attended with much more pleasure than if they had never been withheld from him.

"To apply this law to the case of a person suddenly relieved from acute pain. While he labours with such pain, his mind is so totally occupied by it, that he is unable to attend to his customary pursuits or amusements. He becomes therefore so much more susceptible of their action, that when they are again presented to him, he is raised above his usual indifference to positive pleasure. But all pains do not proceed from an excess of action. Many of them arise from reducing the body or the mind to a state below indifference. Thus, if a person have just sufficient warmth in his body to keep him barely at ease or in a state of indifference, by withdrawing this heat a state of uneasiness or pain is produced; and if in a calm state of mind one be made acquainted with a melancholy event, his quiet is interrupted, and he sinks below indifference into a painful state of mind. If now, without communicating any new source of positive pleasure, we remove in the former case the cold, and in the latter the grief, the persons from whom they are removed will experience real pleasure. Thus, then, whether pain arises from excess or deficiency of action, the gradual or the sudden removal of it must be in all cases attended with pleasure ‡." It is equally true that the gradual or sudden removal of pleasure is attended with pain.

‡ *Disquisitions Metaphysical and Literary.*

We are now prepared to examine our French author's account of the pleasures and pains of savages. "Every age (says he) has its different pleasures; but if we were to imagine that those of childhood are equal to those of confirmed age, we should be much mistaken in our estimation of happiness. The pleasures of philosophy, either natural or moral, are not unfolded to the infant; the most perfect music is a vain noise; the most exquisite perfumes and dishes highly seasoned offend his young organs instead of affording delight; his touch is imperfect; forty days elapse before the child gives any sign of laughter or of weeping; his cries and groans before that period are not accompanied with tears; his countenance expresses no passion; the parts of his face bear no relation to the sentiments of the soul, and are moreover without consistency. Children are but little affected with cold; whether it be that they feel less, or that the interior heat is greater than in adults. In them all the impressions of pleasure and pain are transitory; their memory has scarcely begun to unfold its powers; they enjoy nothing but the present moment; they weep, laugh, and give tones of satisfaction without consciousness, or at least without reflection; their joy is confined to the indulgence of their little whims, and constraint is the greatest of their misfortunes; few things amuse, and nothing satisfies them. In this happy condition of early infancy nature is at the whole expence of happiness; and the only point is not to contradict her. What desires have children? Give them liberty in all their movements, and they have a plenitude of existence, an abundance of that kind of happiness which is confined in some sort to all the objects which surround them: but if all beings were happy on the same conditions, society would be at no expence in procuring the happiness of the different individuals who compose it. Sensation is the foundation of reflection; it is the principal attribute of the soul; it is by this that man is elevated to sublime speculations, and secures his dominion over nature and himself. This quality is not stationary, but susceptible, like all other relative qualities, of increase and decay, of different degrees of strength and intenseness: it is different in different men; and in the same man it increases from infancy to youth, from youth to confirmed manhood: at this period it stops, and gradually declines as we proceed to old age and to second childishness. Considered physically, it varies according to age, constitution, climate, and food; considered in a moral point of view, it takes its different appearances from individual education, and from the habits of society; for man in a state of nature and society, with regard to sensation and the unfolding of his powers, may be considered as two distinct beings: and if one were to make a calculation of pleasure in the course of human life, a man of fortune and capacity enjoys more than ten thousand savages.

"Pleasure and pain being relative qualities, they may be almost annihilated in the moment of vehement passion. In the heat of battle, for example, ardent and animated spirits have not felt the pain of their wounds; and minds strongly penetrated with sentiments of religion, enthusiasm, and humanity, have supported the most cruel torments with courage and fortitude. The sensibility of some persons is so exquisitely alive, that one can scarcely approach them without throwing them into convulsions. Many diseases show the effect of sensibility pushed to an extreme; such as hysteric affections, certain

certain kinds of madness, and some of those which proceed from poison, and from the bite or sting of certain animals, as the viper and the tarantula. Excessive joy or grief, fear and terror, have been known to destroy all sensation, and occasion death (A)"

Having made these preliminary observations on pleasure and pain in infancy, and as they are increased or diminished by education, and the different conditions of body and mind, our author proceeds to consider the capability of savages to feel pleasure and pain. "By savages he understands all the tribes of men who live by hunting and fishing, and on those things which the earth yields without cultivation. Those tribes who possess herds of cattle, and who derive their subsistence from such possessions, are not to be considered as savages, as they have some idea of property. Some savages are naturally compassionate and humane, others are cruel and sanguinary. Although the physical constitution of man be everywhere the same, yet the varieties of climate, the abundance or scarcity of natural productions, have a powerful influence to determine the inclinations. Even the fierceness of the tyger is softened under a mild sky; now nature forms the manners of savages just as society and civil institutions form the manners of civilized life. In the one case climate and food produce almost the whole effect; in the other they have scarcely any influence. The habits of society every moment contend with nature, and they are almost always victorious. The savage devotes himself to the dominion of his passions; the civilized man is employed in restraining, in directing, and in modifying them: so much influence have government, laws, society, and the fear of censure and punishment, over his soul.

"It is not to be doubted that savages are susceptible both of pleasure and pain; but are the impressions made on their organs as sensible, or do they feel pain in the same degree with the inhabitants of a civilized country?

"Their enjoyments are so limited, that if we confine ourselves to truth, a few lines will be sufficient to describe them: our attention must therefore be confined to pain, because the manner in which they support misfortune, and even torture, presents us with a view of character unequalled in the history of civilized nations. It is not uncommon in civilized countries to see men braving death, meeting it with cheerfulness, and even not uttering complaints under the torture; but they do not insult the executioners of public vengeance, and defy pain in order to augment their torments; and those who are condemned by the laws suffer the punishment with different degrees of fortitude. On those mournful occasions, the common ranks of mankind in general die with less firmness: those, on the other hand, who have received education, and who, by a train of unfortunate events, are brought to the scaffold, whether it be the fear of being reproached with cowardice, or the consideration that the stroke is inevitable, such men discover the expiring sighs of self-love even in their last moments; and those especially of high rank, from their manners and sentiments, are expected to meet death with magnanimity: but an American savage in the moment of punishment appears to be more than human; he is a hero of the first order who braves his tormentors, who provokes them to employ all their art, and who considers as his chief glory to bear the greatest degree of pain without shrinking (See AMERICA, n° 14, 27, 28, 29). The recital of their tortures would appear exaggerated, if it were not attested by the best authority, and if the savage nations among whom those customs are established were not sufficiently known; but the excess of the cruelty is not so astonishing as the courage of the victim. The European exposed to sufferings of the same dreadful nature would rend heaven and earth with his piercing cries and horrible groans; the reward of martyrdom, the prospect of eternal life, could alone give him fortitude to endure such torments; but the savage is not animated with this exalted hope. What supports him then in scenes of so exquisite suffering? The feeling of shame, the fear of bringing reproach on his tribe, and giving a stain to his fellows never to be wiped away, are the only sentiments which influence the mind of a savage, and which always, present to his imagination, animate him, support him, and lend him spirit and resolution. At the same time, however powerful those motives may be, they would not be alone sufficient, if the savage felt pain in the same degree with the European. Sensibility, as we have already observed, is increased by education; it is influenced by society, manners, laws, and government; climate and food work it into a hundred different shapes; and all the physical and moral causes contribute to increase and diminish it. The habitual existence of a savage would be a state of suffering to an inhabitant of Europe. You must cut the flesh of the one and tear it away with your nails, before you can make him feel in an equal degree to a scratch or prick of a needle in the other. The savage, doubtless, suffers under torture, but he suffers much less than an European in the same circumstances: the reason is obvious; the air which the savages breathe is loaded with fog and moist vapours; their rivers not being confined by high banks, are by the winds as well as in floods spread over the level fields, and deposite on them a putrid and pernicious slime; the trees squeezed one upon another, in that rude uncultivated country serve rather as a covering to the earth than an ornament. Instead of those fresh and delicious shades, those openings in the woods, and walks crossing each

(A) There are instances of persons who have died at the noise of thunder without being touched. A man frighted with the fall of a gallery in which he happened to be, was immediately seized with the black jaundice. M. le Cat mentions a young person on whom the insolence of another made such an impression, that his countenance became at first yellow, and then changed into black, in such a manner that in less than eight days he appeared to wear a mask of black velvet: he continued in this state for four months without any other symptom of bad health or any pain. A sailor was so terrified in a storm, that his face sweated blood, which like ordinary sweat returned as it was wiped off. Stahl, whose testimony cannot be called in question, cites a similar case of a girl who had been frightened with soldiers. The excess of fear, according to many physicians, produces madness and epilepsy.

Pleasure. each other in all directions, which delight the traveller in the fine forests of France and Germany; those in America serve only to intercept the rays of the sun, and to prevent the benign influence of his beams. The savage participates of this cold humidity; his blood has little heat, his humours are gross, and his constitution phlegmatic. To the powerful influence of climate, it is necessary to join the habits of his life. Obliged to traverse vast deserts for subsistence, his body is accustomed to fatigue; food not nourishing, and at the same time in no great plenty, blunts his feelings; and all the hardships of the savage state give a rigidity to his members which makes him almost incapable of suffering. The savage in this state of nature may be compared to our water-women and street-porters, who, though they possess neither great vigour nor strength, are capable of performing daily, and without complaint, that kind of labour which to a man in a different condition of life would be a painful and grievous burden. Feeling, in less perfection with the savage, by the effects of climate and food, and the habits of his life, is still farther restrained by moral considerations. The European is less a man of nature than of society: moral restraints are powerful with him; while over the American they have scarcely any influence. This latter then is in a double condition of imperfection with regard to us; his senses are blunted, and his moral powers are not disclosed. Now, pleasure and pain depending on the perfection of the senses and the unfolding of the intellectual faculties, it cannot be doubted, that in enjoyments of any kind savages experience less pleasure, and in their suffering less pain, than Europeans in the same circumstances. And in fact, the savages of America possess a very feeble constitution. They are agile without being strong; and this agility depends more on their habits than on the perfection of their members: they owe it to the necessity of hunting; and they are moreover so weak, that they were unable to bear the toil which their first oppressors imposed on them. Hence a race of men in all respects so imperfect could not endure torment under which the most robust European would sink, if the pain which they feel were really as great as it appears to be. Feeling is then, and must necessarily be, less in the savage condition; for this faculty disclosing itself by the exercise of all the physical and moral qualities, must be less as they are less exercised. Every thing shows the imperfection of this precious quality, this source of all our affections, in the American savages.

"All the improvements in Europe have had a tendency to unfold sensibility: the air is purified that we may breathe more freely; the morasses are drained, the rivers are regulated in their courses, the food is nourishing, and the houses commodious. With the savages, on the contrary, every thing tends to curb it; they take pleasure even in hardening the organs of the body, in accustoming themselves to bear by degrees the most acute pain without complaining. Boys and girls among the savages amuse themselves with tying their naked arms together, and laying a kindled coal between them, to try which of them can longest suffer the heat; and the warriors who aspire to the honour of being chief, undergo a course of suffering which exceeds the idea of torture inflicted on the greatest criminals in Europe."

These observations on the pleasures and pains of savages appear to be well-founded, and, as the attentive reader will perceive, are perfectly agreeable to the theory of Dr Sayers. If indeed that theory be just, as we believe it to be, it will follow, that the few pleasures of sense which the American enjoys, he ought to enjoy more completely than any European, because to him they recur but seldom. This may very possibly be the case; and certainly would be so, were not his fibres, by climate and the habits of his life, rendered more rigid than those of the civilized part of the inhabitants of Europe. But if we agree with our author§ in what he says of the pains and pleasures of savages, we cannot admit, without many exceptions, his theory of the enjoyments of children. It is so far from being true, that few things amuse, and that nothing satisfies them, that the direct contrary must have been observed by every man attentive to the operations of the infant mind, which is amused with every thing new, and often completely satisfied with the merest trifle. The pleasures of philosophy are not indeed unfolded to the infant; but it by no means follows that he does not enjoy his rattle and his drum as much as the philosopher enjoys his telescope and air-pump; and if there be any truth in the science of physiognomy, the happiness of the former is much more pure and exquisite than that of the latter. That the most perfect music is vain noise to an infant, is far from being self-evident, unless the author confines the state of infancy to a very few months; and we are not disposed to believe, without better proof than we have yet received, that the relish of exquisite perfumes and highly-seasoned dishes adds much to the sum of human felicity.

§ *Encyclopédie Methodique, Logique, Metaphysique, et Morale*, tom. 4.

But however much we disapprove of many of these reflections, the following we cordially adopt as our own. "If we compare (says our author) the pleasures of sense with those which are purely intellectual, we shall find that the latter are infinitely superior to the former, as they may be enjoyed at all times and in every situation of life. What are the pleasures of the table, says Cicero, of gaming, and of women, compared with the delights of study? This taste increases with age, and no happiness is equal to it. Without knowledge and study, says Cato, life is almost the image of death (B). The pleasures of the soul are such, that it is frequent enough to see men preserve their gaiety during their whole life, notwithstanding a weak, diseased, and debilitated body. Scaron, who lived in the last century, was an example of this. Balzac, speaking of him, says, that Prometheus, Hercules, and Philoctetes, in profane, and Job in sacred, history, said many great things while they

(B) "Savages, barbarians, and peasants, enjoy little happiness except that of sensation. The happiness of a civilized and well-informed man consists of sensations, of ideas, and of a great number of affinities, altogether unknown to them. He not only enjoys the present, but the past and the future. He recals the agreeable idea of pleasures which he has tasted. It is great happiness, says an ancient, to have the recollection of good actions, of an upright intention, and of promises which we have kept."

they were afflicted with violent pain, but Scarron alone said pleasant things. I have seen, continues he, in many places of ancient history, constancy, and modesty, and wisdom, and eloquence, accompanying affliction, but he is the only instance wherein I have seen pleasantry.

"There are men whose understandings are constantly on the stretch, and by this very means they are improved; but if the body were as constantly employed in the pursuit of sensual gratification, the constitution would soon be destroyed. The more we employ the mind we are capable of the greater exertion; but the more we employ the body we require the greater repose. There are besides but some parts of the body capable of enjoying pleasure; every part of it can experience pain. A toothach occasions more suffering than the most considerable of our pleasures can procure of enjoyment. Great pain may continue for any length of time; excessive pleasures are almost momentary. Pleasure carried to an extreme becomes painful; but pain, either by augmenting or diminishing it, never becomes agreeable. For the moment, the pleasures of the senses are perhaps more satisfactory; but in point of duration those of the heart and mind are infinitely preferable. All the sentiments of tenderness, of friendship, of gratitude, and of generosity, are sources of enjoyment for man in a state of civilization. The damned are exceedingly unhappy, said St Catherine de Sienna, if they are incapable of loving or being beloved.

"Pleasure, continued for a great length of time, produces languor and fatigue, and excites sleep; the continuation of pain is productive of none of these effects. Many suffer pain for eight days and even a month without interruption; an equal duration of excessive pleasure would occasion death.

"Time is a mere relative idea with regard to pleasure and pain; it appears long when we suffer, and short when we enjoy. If there existed no regular and uniform movement in nature, we would not be able from our sensations alone to measure time with any degree of exactness, for pain lengthens and pleasure abridges it. From the languor of unoccupied time has arisen the proverb expressive of our desire to *kill* it. It is a melancholy reflection, and at the same time true, that there is no enjoyment which can effectually secure us from pain for the remainder of our lives; while there are examples of evils which hold men in constant sorrow and pain during their whole existence. Such then is the imperfection of the one and the power of the other.

"Pleasure and pain are the sources of morality; an action is just or unjust, good or otherwise, only as its natural tendency is to produce suffering or enjoyment to mankind. No crime could be committed against a being altogether insensible, nor could any good be bestowed on it. Unless he were endowed with the desire of pleasure and the apprehension of pain, man, like an automaton, would act from necessity, without choice and without determination.

"All our passions are the developement of sensibility. If we were not possessed of feeling, we should be destitute of passions; and as sensibility is augmented by civilization, the passions are multiplied; more active and vigorous in an extensive and civilized empire than in a small state; more in the latter than among barbarous nations; and more in these last than among savages (See PASSION). There are more passions in France and England than in all the nations of Europe; because every thing which serves to excite and foster them is always in those countries in the greatest state of fermentation. The mind is active; the ideas great, extensive, and multiplied. And is it not the soul, the mind, and heart, which are the focus of all the passions?"

But wherever the passions are multiplied, the sources of pleasure and pain are multiplied with them. This being the case, it is impossible to prescribe a fixed and general rule of happiness suited to every individual. There are objects of pleasure with regard to which all men of a certain education are agreed; but there are perhaps many more, owing to the variety of tempers and education, about which they differ. Every man forms ideas of enjoyment relative to his character; and what pleases one may be utterly detested by another. In proportion as a nation is civilized and extensive, those differences are remarkable. Savages, who are not acquainted with all the variety of European pleasures, amuse themselves with very few objects. Owing to the want of civilization, they have scarcely any choice in the objects of taste. They have few passions; we have many. But even in the nations of Europe pleasure is infinitely varied in its modification and forms. Those differences arise from manners, from governments, from political and religious customs, and chiefly from education. Meanwhile, however different and variable the ideas of pleasure may be among nations and individuals, it still remains a fact, that a certain number of persons in all civilized states, whether distinguished by birth, or rank, or fortune, or talents, as they have nearly the same education so they form nearly the same ideas of happiness: but to possess it, a man must give his chief application to the state of his mind; and notwithstanding all his efforts it is of uncertain duration. Happiness is the sunshine of life: we enjoy it frequently at great intervals; and it is therefore necessary to know how to use it. All the productions of art perish; the largest fortunes are dissipated; rank, honour, and dignity pass away like a fleeting shadow; the memory is impaired; all the faculties of the soul are extinguished; the body sinks under the infirmities of old age; and scarcely has one reached the boundaries of happiness marked out by his imagination, when he must give place to another, and renounce all his pleasures, all his hopes, all his illusions; the fugitive images of which had given happiness to the mind.

There are pleasures, however, on which the mind may securely rest, which elevate man above himself, dignify his nature, fix his attention on spiritual things, and render him worthy of the care of Providence. These are to be found in true religion; which procures for those who practise its duties inexpressible happiness in a better country, and is in this world the support of the weak, and the sweet consolation of the unfortunate.

PLEBEIAN, any person of the rank of the common people. It is chiefly used in speaking of the ancient Romans, who were divided into senators, patricians, and plebeians. The distinction was made by Romulus the founder of the city; who confined all dignities, civil, military, and sacerdotal, to the rank of patricians. But to prevent the seditions which such a distinction might produce through the pride of the higher order and the envy of the lower, he endeavoured to engage them

them to one another by reciprocal ties and obligations. Every plebeian was allowed to choose, out of the body of the patricians, a protector, who should be obliged to assist him with his interest and substance, and to defend him from oppression. These protectors were called *patrons*; the protected, *clients*. It was the duty of the patron to draw up the contracts of the clients, to extricate them out of their difficulties and perplexities, and to guard their ignorance against the artfulness of the crafty. On the other hand, if the patron was poor, his clients were obliged to contribute to the portions of his daughters, the payment of his debts, and the ransom of him and his children if they happened to be taken in war. The client and patron could neither accuse nor bear witness against each other; and if either of them was convicted of having violated this law, the crime was equal to that of treason, and any one might with impunity slay the offender as a victim devoted to Pluto and the infernal gods. For more than 600 years we find no dissensions nor jealousies between the patrons and their clients; not even in the times of the republic, when the people frequently mutinied against the great and powerful.

PLECTRANTHUS, in botany: A genus of the gymnospermia order, belonging to the didynamia class of plants; and in the natural method ranking under the 42d order, *Verticillatæ*. The calyx is monophyllous, short, and bilabiated; the upper lip of which is large, oval, and bent upwards; the inferior lip is quadrifid, and divided into two laciniæ: the corolla is monopetalous, ringent, and turned back; the labiæ look different ways, and from the base of the tube there is a nectarium like a spur: the filaments are in a declining situation, with simple antheræ: the stylus filiform; the stigma bifid. It has four seeds covered only by the calyx. There are two species, viz. 1. The *fruticosus*, a native of the Cape of Good Hope; 2. *Punctatus*, a native of Africa. The first flowers from June to September, the latter from January to May.

PLEDGE (*Plegius*), in common law, a surety or gage, either real or personal, which the plaintiff or demandant is to find for his prosecuting the suit.

The word is sometimes also used for *Frank Pledge*, which see.

To Pledge, in drinking, denotes to warrant, or be surety to one, that he shall receive no harm while he is taking his draught. The phrase is referred by our antiquaries to the practice of the Danes, heretofore in England, who frequently used to stab or cut the throats of the natives while they were drinking.

Pledges of Goods for money. See Pawn.

PLEDGERY, or Pleggery, in law, suretiship, or an undertaking or answering for another.

PLEDGET, Bolster, or *Compress*, in surgery, a kind of flat tent laid over a wound, to imbibe the superfluous humours, and to keep it clean.

PLEIADES, in fabulous history, the seven daughters of Atlas king of Mauritania and Pleione, were thus called from their mother. They were Maia, Electra, Taygete, Asterope, Merope, Halcyone, and Celœno; and were also called *Atlantides*, from their father Atlas. These princesses were carried off by Busiris king of Egypt; but Hercules having conquered him, delivered them to their father: yet they afterwards suffered a new persecution from Orion, who pursued them five years, till Jove, being prevailed on by their prayers, took them up into the heavens, where they form the constellation which bears their name.

Pleiades, in astronomy, an assemblage of seven stars, in the neck of the constellation Taurus.

They are thus called from the Greek πλειν, *navigare*, "to sail;" as being terrible to mariners, by reason of the rains and storms that frequently rise with them. The Latins called them *vergiliæ*, from *ver*, "spring;" because of their rising about the time of the vernal equinox. The largest is of the third magnitude, and is called *lucida pleiadum*.

PLENARY, something complete or full. Thus we say the pope grants *plenary* indulgences; *i. e.* full and entire remissions of the penalties due to all sins. See Indulgences.

PLENIPOTENTIARY, a person vested with full power to do any thing. See Ambassador.

PLENITUDE, the quality of a thing that is full, or that fills another. In medicine, it chiefly denotes a redundancy of blood and humours.

PLENUM, in physics, denotes, according to the Cartesians, that state of things wherein every part of space is supposed to be full of matter, in opposition to a Vacuum, which is a space supposed devoid of all matter.

PLENUS flos, a full flower; a term expressive of the highest degree of luxuriance in flowers. See Botany, p. 428, 2d column. Such flowers, although the most delightful to the eye, are both vegetable monsters, and, according to the sexualists, vegetable eunuchs; the unnatural increase of the petals constituting the first; the consequent exclusion of the stamina or male organs, the latter. The following are well known examples of flowers with more petals than one; ranunculus, anemone, marsh-marygold, columbine, fennel-flower, poppy, pæony, pink, gilliflower, campion, viscous campion, lily, crown imperial, tulip, narcissus, rocket, mallow, Syrian mallow, apple, pear, peach, cherry, almond, myrtle, rose, and strawberry.

Flowers with one petal are not so subject to fullness. The following, however, are instances: polianthus, hyacinth, primrose, crocus, meadow-saffron, and thorn-apple, tho' Kramer has asserted that a full flower with one petal is a contradiction in terms. In flowers with one petal, the mode of luxuriance, or impletion, is by a multiplication of the divisions of the limb or upper part; in flowers with more petals than one, by a multiplication of the petals or nectarium.

To take a few examples. Columbine is rendered full in three different ways: 1. By the multiplication of its petals, and total exclusion of the nectaria; 2. By the multiplication of the nectaria, and exclusion of the petals; or, 3. By such an increase of the nectaria only as does not exclude the petals, between each of which are interjected three nectaria, placed one within another. Again, fennel-flower is rendered full by an increase of the nectaria only; narcissus, either by a multiplication of its cup and petals, or of its cup only; lark-spur commonly by an increase of the petals and exclusion of the spur, which is its nectarium. In *saponaria concava anglia*, the impletion is attended with the singular effect of incorporating the petals, and reducing their number from five to one; and in gelder-rose, the luxuriance is effected by an increase both in magnitude and number of of the circumference or margin of the head of flowers, in the plain, wheel-shaped, barren florets; and an exclusion of all the bell-shaped hermaphrodite florets of the centre or disk.

Hitherto we have treated of plenitude in simple flowers only: the instance just now adduced seems to connect the different modes of impletion in them and compound flowers. Before proceeding farther, however, it will not be improper to premise, that as a simple luxuriant flower is frequently, by beginners, mistaken for a compound flower in a natural state, such flowers may always be distinguished with certainty by this rule: That in simple flowers, however luxuriant, there is but one pistillum or female organ; whereas in compound flowers, each floret, or partial flower, is furnished with its own proper pistillum. Thus in hawk-weed, a compound flower, each flat or tongue-shaped floret in the aggregate has its five stamina and naked seed, which last is in effect its pistillum; whereas, in a luxuriant lychnis, which is a simple flower, there is found only one pistillum or female organ common to the whole.

In a compound radiated flower, which generally consists of plain florets in the margin or radius, and tubular or hollow florets in the centre or disc; plenitude is effected either by an increase of the florets in the margin, and a total exclusion of those in the disc; which mode of luxuriance is termed *impletion by the radius*, and resembles what happens in the gelder-rose: or by an elongation of the hollow florets in the centre, and a less profound division of their brims; which is termed *impletion by the disc*. In the first mode of luxuriance, the florets in the centre, which are always hermaphrodite or male, are entirely excluded; and in their place succeed florets similar in sex to those of the radius. Now, as the florets in the margin of a radiated compound flower are found to be always either female, that is, furnished with the pistillum only; or neuter, that is, furnished with neither stamina nor pistillum; it is evident, that a radiated compound flower, filled by the radius, will either be entirely female, as in feverfew, daisy, and African marigold; or entirely neuter, as in sunflower, marygold, and centaury: hence it will always be easy to distinguish such a luxuriant flower from a compound flower with plain florets in a natural state; as these flowers are all hermaphrodite, that is, furnished with both stamina and pistillum. Thus the full flowers of African marigold have each floret furnished with the pistillum or female organ only: the natural flowers of dandelion, which, like the former, is composed of plain florets, are furnished with both stamina and pistillum.

In the second mode of luxuriance, termed *impletion by the disc*, the florets in the margin sometimes remain unchanged: but most commonly adopt the figure of those in the centre, without, however, suffering any alteration in point of sex; so that confusion is less to be apprehended from this mode of luxuriance than from the former; besides, the length to which the florets in the centre run out is of itself a sufficient distinction, and adapted to excite at once an idea of luxuriance. Daisy, feverfew, and African marigold, exhibit instances of this as well as of the former mode of impletion.

In luxuriant compound flowers with plain florets, the *semiflosculosi* of Tournefort, the stigma or summit of the style in each floret is lengthened, and the seed-buds are enlarged and diverge; by which characters such flowers may always be distinguished from flowers of the same kind in a natural state. Scorzonera, nipple-wort, and goat's-beard, furnish frequent instances of the plenitude alluded to.

Lastly, the impletion of compound flowers with tubular or hollow florets, the *flosculosi* of Tournefort, seems to observe the same rules as that of radiated flowers just delivered. In everlasting-flower, the *xeranthemum* of Linnæus, the impletion is singular, being effected by the enlargement and expansion of the inward chaffy scales of the calyx. These scales, which become coloured, are greatly augmented in length, so as to overtop the florets, which are scarce larger than those of the same flower in a natural state. The florets too in the margin, which in the natural flower are female, become, by luxuriance, barren; that is, are deprived of the pistillum; the style, which was very short, spreads, and is of the length of the chaffy scales; and its summits, formerly two in number, are metamorphosed into one.

Full flowers are more easily referred to their respective genera in methods founded upon the calyx, as the flower-cup generally remains unaffected by this highest degree of luxuriance.

PLEONASM, a figure in rhetoric, whereby we use words seemingly superfluous, in order to express a thought with the greater energy; such as, "I saw it with my own eyes," &c. See ORATORY, n° 67.

PLESCOW, a town of Russia, capital of a duchy of the same name, with an archbishop's see, and a strong castle. It is a large place, and divided into four parts, each of which is surrounded with walls. It is seated on the river Muldow, where it falls into the lake Plescow, 80 miles south of Narva, and 150 south by west of Petersburg. E. Long. 27. 52. N. Lat. 57. 58.

PLESCOW, a duchy in Russia, between the duchies of Novogorod, Lithuania, Livonia, and Ingria.

PLESSIS-LES-TOURS, a royal palace of France, within half a league of Tours. It was built by Louis XI. and in it he died in the year 1483. It is situated in a plain surrounded by woods, at a small distance from the Loire. The building is yet handsome, though built of brick, and converted to purposes of commerce.

PLETHORA, in medicine, from πληθος, "plenitude." A plethora is when the vessels are too much loaded with fluids. The plethora may be sanguine or serous. In the first there is too much crassamentum in the blood, in the latter too little. In the sanguine plethora, there is danger of a fever, inflammation, apoplexy, rupture of the blood-vessels, obstructed secretions, &c.: in the serous, of a dropsy, &c. A rarefaction of the blood produces all the effects of a plethora; it may accompany a plethora, and should be distinguished therefrom. Mr Bromfield observes, that a sanguine plethora may thus be known to be present by the pulse. An artery overcharged with blood is as incapable of producing a strong full pulse, as one that contains a deficient quantity; in both cases there will be a low and weak pulse. To distinguish rightly, the pulse must not be felt with one or two fingers on the carpal artery; but if three or four fingers cover a considerable length of the artery, and we press hard for some time on it, and then suddenly raise all these fingers except that which is nearest to the patient's hand, the influx of the blood, if there is a plethora, will be so rapid as to raise the other finger, and make us sensible of the fulness. The sanguine

sanguine plethora is relieved by bleeding: the serous by purging, diuretics, and sweating. See MEDICINE, n° 100.

PLEURA, in anatomy, a thin membrane covering the inside of the thorax. See ANATOMY, n° 113.

PLEURITIS, or PLEURISY. See MEDICINE, n° 185.

PLEURONECTES, in ichthyology, a genus belonging to the order of thoracici. Both eyes are on the same side of the head; there are from four to five rays in the gill-membrane; the body is compressed; the one side resembling the back, the other the belly. There are 17 species; the most remarkable are,

1. The hyppoglossus, or holibut. This is the largest of the genus: some have been taken in our seas weighing from 100 to 300 pounds; but much larger are found in those of Newfoundland, Greenland, and Iceland, where they are taken with a hook and line in very deep water. They are part of the food of the Greenlanders, who cut them into large slips, and dry them in the sun. They are common in the London markets, where they are exposed to sale cut into large pieces. They are very coarse eating, excepting the part which adheres to the side fins, which is extremely fat and delicious, but surfeiting. They are the most voracious of all flat fish. There have been instances of their swallowing the lead weight at the end of a line, with which the seamen were sounding the bottom from on board a ship. The holibut, in respect to its length, is the narrowest of any of this genus except the sole. It is perfectly smooth, and free from spines either above or below. The colour of the upper part is dusky; beneath, of a pure white. We do not count the rays of the fins in this genus; not only because they are so numerous, but because nature hath given to each species characters, independent of these rays, sufficient to distinguish them by. These flat fish swim sidewise; for which reason Linnæus hath styled them *pleuronectes*.

2. The platessa, or plaise, are very common on most of our coasts, and sometimes taken of the weight of 15 pounds; but they seldom reach that size, one of eight or nine pounds being reckoned a large fish. The best and largest are taken off Rye on the coast of Sussex, and also off the Dutch coasts. They spawn in the beginning of February. They are very flat, and much more square than the preceding. Behind the left eye is a row of six tubercles, that reaches to the commencement of the lateral line. The upper part of the body and fins are of a clear brown, marked with large bright orange-coloured spots: the belly is white.

3. The flesus, or flounder, inhabits every part of the British sea, and even frequents our rivers at a great distance from the salt waters; and for this reason some writers call it the *passer fluviatilis*. It never grows large in our rivers, but is reckoned sweeter than those that live in the sea. It is inferior in size to the plaise, seldom or never weighing more than six pounds. It may very easily be distinguished from the plaise, or any other fish of this genus, by a row of sharp small spines that surround its upper sides, and are placed just at the junction of the fins with the body. Another row marks the side-line, and runs half way down the back. The colour of the upper part of the body is a pale brown, sometimes marked with a few obscure spots of dirty yellow; the belly is white.

4. The limanda, or dab, is found with the other species, but is less common. It is in best season during February, March, and April: they spawn in May and June, and become flabby and watery the rest of summer. They are superior in quality to the plaise and flounder, but far inferior in size. It is generally of an uniform brown colour on the upper side, though sometimes clouded with a darker. The scales are small and rough, which is a character of this species. The lateral line is extremely incurvated at the beginning, then goes quite straight to the tail. The lower part of the body is white.

5. The solea, or sole, is found on all our coasts; but those on the western shores are much superior in size to those on the north. On the former they are sometimes taken of the weight of six or seven pounds, but towards Scarborough they rarely exceed one pound; if they reach two, it is extremely uncommon. They are usually taken in the trawl-net: they keep much at the bottom, and feed on small shell-fish. It is of a form much more narrow and oblong than any other of the genus. The irides are yellow; the pupils of a bright sapphirine colour: the scales are small, and very rough: the upper part of the body is of a deep brown; the tip of one of the pectoral fins black; the under part of the body white; the lateral line is straight; the tail rounded at the end. It is a fish of a very delicate flavour; but the small soles are in this respect much superior to large ones. By the ancient laws of the Cinque Ports, no one was to take soles from the 1st of November to the 15th of March; neither was any body to fish from sun-setting to sun-rising, that the fish might enjoy their night-food. The chief fishery for them is at Brixham in Torbay.

6. The maximus, or turbot, grows to a very large size: Mr Pennant has seen them of 23 pounds weight, but has heard of some that weighed 30. The turbot is of a remarkable square form: the colour of the upper part of the body is cinereous, marked with numbers of black spots of different sizes: the belly is white; the skin is without scales, but greatly wrinkled, and mixed with small short spines, dispersed without any order.—These fish are taken chiefly off the north coast of England, and others off the Dutch coast. See *Turbot* FISHERY.

PLEURS, a town in France, which was buried under a mountain in the year 1618. See our article MOUNTAIN, p. 430. Of this fatal circumstance, Bishop Burnet, in his Travels, p. 96. gives the following account. "Having mentioned (says the Bishop) some falls of mountains in these parts (viz. near the Alps), I cannot pass by the extraordinary fate of the town of Pleurs, about a league from Chavennes to the north.—The town was half the bigness of Chavennes, but much more nobly built; for, besides the great palace of the Francken, that cost some millions, there were many other palaces built by rich factors both of Milan and the other parts of Italy, who, liking the situation and air, as well as the freedom of the government, gave themselves all the indulgences that a vast wealth could furnish. By one of the palaces that was a little distant from the town, and was not overwhelmed with it, one may judge of the rest. It was an out-house of the family of the Francken, and yet it may compare with many palaces in Italy. The voluptuousness of this place became

came very crying; and Madam de Salis told me that she heard her mother often relate some passages of a Protestant minister's sermons that preached in a little church there, who warned them often of the terrible judgments of God which were hanging over their heads, and which he believed would suddenly break out upon them.

"On the 25th of August 1628, an inhabitant came and told them to be gone, for he saw the mountains cleaving; but he was laughed at for his pains. He had a daughter whom he persuaded to leave all and go with him; but when she was safe out of town, she called to mind that she had not locked the door of a room in which she had some things of value, and so she went back to do that, and was buried with the rest; for at the hour of supper the hill fell down, and buried the town and all the inhabitants, to the number of 2200, so that not one person escaped. The fall of the mountains did so fill the channel of the river, that the first news those of Chavennes had of it was by the failing of their river; for three or four hours there came not a drop of water, but the river wrought for itself a new course, and returned to them.

"I could hear no particular character of the man who escaped (continues the Bishop); so I must leave the secret reason of so singular a preservation to the great discovery, at the last day, of those steps of Divine Providence that are now so unaccountable. Some of the family of the Francken got some miners to work under ground, to find out the wealth that was buried in their house; for, besides their plate and furniture, there was a great deal of cash and many jewels in the house. The miners pretended they could find nothing; but they went to their country of Tirol and built fine houses, and a great wealth appeared, of which no other visible account could be given but this, that they had found some of that treasure."

PLEXUS, among anatomists, a bundle of small vessels interwoven in the form of net-work: thus a congeries of vessels within the brain is called *plexus choroides*, *reticularis*, or *retiformis*. See ANATOMY, n° 136.

A plexus of nerves is an union of two or more nerves, forming a sort of ganglion or knot.

PLICA POLONICA, or *plaited hair*, is a disease peculiar to Poland; whence the name. See MEDICINE, n° 355. Mr Coxe, who gives a short account of it, attempts likewise to give the physical causes of it. Many causes of this kind, he tells us, have been supposed to concur in rendering the plica more frequent in those regions than in other parts. It would be an endless work to enumerate the various conjectures with which each person has supported his favourite hypothesis.—The most probable are those assigned by Dr Vicat: The first cause is the nature of the Polish air, which is rendered insalubrious by numerous woods and morasses, and occasionally derives an uncommon keenness even in the midst of summer from the position of the Carpathian mountains; for the southern and south-easterly winds, which usually convey warmth in other regions, are in this chilled in their passage over their snowy summits. The second is, unwholesome water; for although Poland is not deficient in good springs, yet the common people usually drink that which is nearest at hand, taken indiscriminately from rivers, lakes, and even stagnant pools. The third cause is the gross inattention of the natives to cleanliness; for experience shows, that those who are not negligent in their persons and habitations, are less liable to be afflicted with the plica than others who are deficient in that particular. Thus persons of higher rank are less subject to this disorder than those of inferior stations; the inhabitants of large towns than those of small villages; the free peasants than those in an absolute state of vassalage; the natives of Poland Proper than those of Lithuania. Whatever we may determine as to the possibility that all or any of these causes, by themselves, or in conjunction with others, originally produced the disorder; we may venture to assert, that they all, and particularly the last, assist its propagation, inflame its symptoms, and protract its cure.

In a word, the plica polonica appears to be a contagious distemper; which, like the leprosy, still prevails among a people ignorant in medicine, and inattentive to check its progress, but is rarely known in those countries where proper precautions are taken to prevent its spreading.

PLIMPTON, a town of Devonshire, in England, with a market on Saturdays. It is seated on a branch of the river Plime, and had once a castle, now in ruins. It sends two members to parliament; is seven miles E. of Plymouth, and 218 W. by S. of London. W. Long. 4. 0. N. Lat. 50. 22.

PLINIA, in botany; a genus of plants of the polyandria monogynia class, described by Plumier and Linnæus. The empalement is divided into five segments; the flower consists of five petals; the stamina are numerous filaments, slender, and as long as the flower; the antheræ are small, and so is the germen of the pistil; the style is subulated, and of the length of the stamina; the stigma is simple; the fruit is a large globose berry, of a striated or sulcated surface, containing only one cell, in which is a very large, smooth, and globose seed. There is only one species.

PLINTH, ORLE, or *Orlo*, in architecture, a flat square member, in the form of a brick. It is used as the foundation of columns, being that flat square table under the moulding of the base and pedestal at the bottom of the whole order. It seems to have been originally intended to keep the bottom of the original wooden pillars from rotting. Vitruvius also calls the Tuscan abacus *plinth*.

PLINTH of a Statue, &c. is a base, either flat, round, or square, that serves to support it.

PLINTH of a Wall, denotes two or three rows of bricks advancing out from a wall; or, in general, any flat high moulding, that serves in a front-wall to mark the floors, to sustain the eaves of a wall, or the larmier of a chimney.

PLINY the ELDER, or *Cæcilius Plinius Secundus*, one of the most learned men of ancient Rome, was descended from an illustrious family, and born at Verona. He bore arms in a distinguished post; was one of the college of Augurs; became intendant of Spain; and was employed in several important affairs by Vespasian and Titus, who honoured him with their esteem. The eruption of Mount Vesuvius, which happened in the year 79, proved fatal to him. His nephew, Pliny the Younger, relates the circumstances of that dreadful eruption, and the death of his uncle, in a letter to Tacitus.

Pliny. citus. Pliny the Elder wrote a Natural History in 37 books, which is still extant, and has had many editions; the most esteemed of which is that of Father Hardouin, printed at Paris in 1723, in two volumes folio.

Pliny the Younger, nephew of the former, was born in the ninth year of Nero, and the 62d of Christ, at Novocomum, a town upon the lake Larius, near which he had several beautiful villas. Cæcilius was the name of his father, and Plinius Secundus that of his mother's brother, who adopted him. He brought into the world with him fine parts and an elegant taste, which he did not fail to cultivate early; for, as he tells us himself, he wrote a Greek tragedy at 14 years of age. He lost his father when he was young; and had the famous Virginius for his tutor or guardian, whom he has set in a glorious light. He frequented the schools of the rhetoricians, and heard Quintilian; for whom he ever after entertained so high an esteem, that he bestowed a considerable portion upon his daughter at her marriage. He was in his 18th year when his uncle died; and it was then that he began to plead in the forum, which was the usual road to dignities. About a year after, he assumed the military character, and went into Syria with the commission of tribune: but this did not suit his taste any more than it had done Tully's; and therefore we find him returning after a campaign or two. He tells us, that in his passage homewards he was detained by contrary winds at the island Icaria, and how he employed himself in making verses: he enlarges in the same place upon his poetical exercitations; yet poetry was not the shining part of his character any more than it had been of Tully's.

Upon his return from Syria, he married a wife, and settled at Rome: it was in the reign of Domitian. During this most perilous time, he continued to plead in the forum, where he was distinguished not more by his uncommon abilities and eloquence, than by his great resolution and courage, which enabled him to speak boldly, when scarcely one else durst speak at all. On these accounts he was often singled out by the senate to defend the plundered provinces against their oppressive governors, and to manage other causes of a like important and dangerous nature. One of these was for the province of Bœtica, in their prosecution of Bæbius Massa; in which he acquired so general an applause, that the emperor Nerva, then a private man, and in banishment at Tarentum, wrote to him a letter, in which he congratulated not only Pliny, but the age which had produced an example so much in the spirit of the ancients. Pliny relates this affair in a letter to Cornelius Tacitus; and he was so pleased with it himself, that he could not help intreating this friend to record it in his history. He intreats him, however, with infinitely more modesty than Tully had intreated Lucceius upon the same occasion: and though he might imitate Cicero in the request, as he professes to have constantly set that great man before him for a model, yet he took care not to transgress the bounds of decency in his manner of making it. He obtained the offices of questor and tribune, and luckily went unhurt through the reign of Domitian: there is, however, reason to suppose, if that emperor had not died just as he did, that Pliny would have shared the fate of many other great men; for he tells us himself, that his name was afterwards found in Domitian's tablets, among the number of those who were destined to destruction.

He lost his wife in the beginning of Nerva's reign, and soon after married his beloved Calphurnia, of whom we read so much in his Epistles. He had not, however, any children by any of his wives: and hence we find him thanking Trajan for the *jus trium liberorum*, which he afterwards obtained of that emperor for his friend Suetonius Tranquillus. He hints also, in his letter of thanks to Trajan, that he had been twice married in the reign of Domitian. He was promoted to the consulate by Trajan in the year 100, when he was 38 years of age; and in this office pronounced that famous panegyric, which has ever since been admired, as well for the copiousness of the topics as the elegance of address. Then he was elected augur, and afterwards made proconsul of Bithynia; whence he wrote to Trajan that curious letter concerning the primitive Christians; which, with Trajan's rescript, is happily extant among his Epistles. Pliny's letter, as Mr Melmoth observes in a note upon the passage, is esteemed as almost the only genuine monument of ecclesiastical antiquity relating to the times immediately succeeding the apostles, it being written at most not above 40 years after the death of St Paul. It was preserved by the Christians themselves, as a clear and unsuspicious evidence of the purity of their doctrines, and is frequently appealed to by the early writers of the church against the calumnies of their adversaries. It is not known what became of Pliny after his return from Bithynia; whether he lived at Rome, or what time he spent at his country-houses. Antiquity is also silent as to the time of his death: but it is conjectured that he died either a little before or soon after that excellent prince, his admired Trajan; that is, about the year of Christ 116.

Pliny was one of the greatest wits, and one of the worthiest men, among the ancients. He had fine parts, which he cultivated to the utmost; and he accomplished himself with all the various kinds of knowledge which could serve to make him either useful or agreeable. He wrote and published a great number of things; but nothing has escaped the wreck of time except the books of Letters, and the panegyric upon Trajan. This has ever been considered as a masterpiece: and if he has, as some think, almost exhausted all the ideas of perfection in a prince, and gone perhaps a little beyond the truth, yet it is allowed that no panegyrist was ever possessed of a finer subject, and on which he might better indulge in all the flow of eloquence, without incurring the suspicion of flattery and lies. His letters seem to have been intended for the public; and in them he may be considered as writing his own memoirs. Every epistle is a kind of historical sketch, wherein we have a view of him in some striking attitude, either of active or contemplative life. In them are preserved anecdotes of many eminent persons, whose works are come down to us, as Suetonius, Silius Italicus, Martial, Tacitus, and Quintilian; and of curious things, which throw great light upon the history of those times. They are written with great politeness and spirit; and if they abound too much in turn and metaphor, we must impute it to that degeneracy of taste which was then accompanying the degenerate manners of Rome. Pliny, however, seems to have

preserved

preserved himself in this latter respect from the general contagion: whatever the manners of the Romans were, his were pure and incorrupt. His writings breathe a spirit of transcendent goodness and humanity: his only imperfection is, he was too desirous that the public and posterity should know how humane and good he was. We have two elegant English translations of his Epistles; the one by Mr Melmoth, and the other by Lord Orrery.

PLOCAMA, in botany; a genus of the monogynia order, belonging to the pentandria class of plants. The calyx is quinquedentate; the fruit a berry and trilocular, with solitary seeds. Of this there is only one species, viz. the *pendula*, a native of the Canaries.

PLOCE. See Oratory, p. 433.

PLOCKSKO, a town of Poland, and capital of a palatinate of the same name, with a castle and a bishop's see. The churches are very magnificent; and it is built upon a hill, whence there is a fine prospect every way, near the river Vistula. It is 25 miles south-east of Uladislaw, and 65 west of Warsaw. E. Long. 19. 29. N. Lat. 52. 46.

Plocksko, a palatinate of Poland, bounded on the north by Regal Prussia, on the east by the palatinate of Mazovia, on the south by the Vistula, and on the west by the palatinate of Inovladislaw. The capital town is of the same name.

PLOEN is a town of Germany, in the circle of Lower Saxony, and capital of Holstein. It stands on the banks of a lake of the same name, and gave title to a duke, till by the death of the last duke Charles without male issue it escheated to the king of Denmark in 1761. The ducal palace, rising in the midst of the town, on an elevated spot of ground, and overlooking the lake, is a very picturesque object. The town stands 22 miles north-west of Lubeck, and 10 south-east of Kiell. E. Long. 10. 30. N. Lat. 54. 11.

PLOMO, in metallurgy, is a name given by the Spaniards, who have the care of the silver-mines, to the silver ore, when found adhering to the surface of stones, and when it incrusts their cracks and cavities like small and loose grains of gun-powder. Though these grains be few in number, and the rest of the stone have no silver in it, yet they are always very happy when they find it, as it is a certain token that there is a rich vein somewhere in the neighbourhood. And if in digging forwards they still meet with these grains, or the plomo in greater quantity, it is a certain sign that they are getting more and more near the good vein.

PLOT (Dr Robert), a learned antiquarian and philosopher, was born at Sutton-barn, in the parish of Borden in Kent, in the year 1641, and studied in Magdalen-hall, and afterwards in University-college, Oxford. In 1682 he was elected secretary of the Royal Society, and published the Philosophical Transactions from nº 143 to nº 166 inclusive. The next year Elias Ashmole, Esq; appointed him first keeper of his museum, and about the same time the vice-chancellor nominated him first professor of chemistry in the university of Oxford. In 1687 he was made secretary to the Earl Marshal, and the following year received the title of *Historiographer* to King James II. In 1690 he resigned his professorship of chemistry, and likewise his place of keeper of the museum, to which he presented a very large collection of natural curiosities; which were those he had described in his histories of Oxfordshire and Staffordshire: the former published at Oxford in 1677, folio, and reprinted with additions and corrections in 1705; and the latter was printed in the same size in 1686. In January 1694-5, Henry Howard, Earl Marshal, nominated him Mobray-herald extraordinary; two days after which he was constituted register of the court of honour; and, on the 30th of April 1696, he died of the stone at his house in Borden.

As Dr Plot delighted in natural history, the above works were designed as essays towards a Natural History of England; and he had actually formed a design of travelling through England and Wales for that purpose. He accordingly drew up a plan of his scheme in a letter to the learned Bishop Fell; which is inserted at the end of the second volume of Leland's Itinerary, of the edition of 1744. Amongst several MSS. which he left behind him were large materials for the "Natural History of Kent, Middlesex, and the city of London." Besides the above works, he published *De origine fontium tentamen philosophicum*, 8vo, and nine papers in the Philosophical Transactions.

Plot, in dramatic poetry, is sometimes used for the fable of a tragedy or comedy; but more properly for the knot or intrigue, which makes the *embarras* of any piece. See Poetry.

Plot, in surveying, the plan or draught of any field, farm, or manor, surveyed with an instrument, and laid down in the proper figure and dimensions.

PLOTINUS, a Platonic philosopher in the third century. He was born at Lycopolis, a city of Egypt, in 204; and began very early to show a great singularity both in his taste and manners: for, at eight years of age, when he went to school, he used to run to his nurse, and uncover her breast to suck; and would have continued that practice longer, if he had not been discouraged by her. At 28 years of age he had a strong desire to study philosophy, on which occasion he was recommended to the most famous professors of Alexandria. He was not satisfied with their lectures; but, upon hearing those of Ammonius, he confessed that this was the man he wanted. He studied for 11 years under that excellent master, and then went to hear the Persian and Indian philosophers: for in 243, when the emperor Gordianus intended to wage war against the Persians, he followed the Roman army, but probably repented of it; for it was with difficulty he could save his life by flight, after the emperor had been slain. He was then 39; and the year following he went to Rome, and read philosophical lectures in that city; but avoided following the example of Erennius and Origen, his fellow-pupils, who, having promised with him not to reveal some hidden and excellent doctrines they had received from Ammonius, had nevertheless forfeited their word. Plotinus continued ten years in Rome, without writing any thing; but, in his 50th year, Porphyry became his scholar; who, being of an exquisitely fine genius, was not satisfied with superficial answers, but required to have all difficulties thoroughly explained; and therefore Plotinus, to treat things with greater accuracy, was obliged to write more books. He had before written 21 books, and during the six years of Porphyry's stay with him he wrote 24, and 9 after Porphyry's leaving Rome, in all 54. The Romans had a high veneration for him; and he passed for a man of such judgment

Plotinus. ment and virtue, that many persons of both sexes, when they found themselves dying, intrusted him, as a kind of guardian angel, with the care of their estates and children. He was the arbiter of numberless law-suits; and constantly behaved with such humanity and rectitude of mind, that he did not create himself one enemy during the 26 years he resided in Rome. He, however, did not meet with the same justice from all of his own profession; for Olympias a philosopher of Alexandria, being envious of his glory, used his utmost endeavours, though in vain, to ruin him. The emperor Gallienus, and the empress Salonina, had a very high regard for him; and, had it not been for the opposition of some jealous courtiers, they would have had the city of Campania rebuilt, and given to him with the territory belonging to it, to establish a colony of philosophers, and to have it governed by the ideal laws of Plato's commonwealth. He laboured under various disorders during the last year of his life, which obliged him to leave Rome, when he was carried to Campania to the heirs of one of his friends, who furnished him with every thing necessary; and he died there in the year 270, at the age of 66, and in the noblest manner that an heathen philosopher could do, these being his words as he breathed his last: "I am labouring with all my might to return the divine part of me to that Divine Whole which fills the universe."

We have already remarked that the ideas of Plotinus were singular and extraordinary; and we shall now show that they were so. He was ashamed of being lodged in a body, for which reason he did not care to tell the place of his birth or family. The contempt he had for all earthly things, was the reason why he would not permit his picture to be drawn: and when his disciple Amelius was urgent with him upon this head, "Is it not enough (said he) to drag after us, whithersoever we go, that image in which nature has shut us up? Do you think that we should likewise transmit to future ages an image of that image, as a sight worthy of their attention?" From the same principle, he refused to attend to his health; for he never made use of preservatives or baths, and did not even eat the flesh of tame animals. He eat but little, and abstained very often from bread; which, joined to his intense meditation, kept him very much from sleeping. In short, he thought the body altogether below his notice; and had so little respect for it, that he considered it as a prison, from which it would be his supreme happiness to be freed. When Amelius, after his death, inquired about the state of his soul of the oracle of Apollo, he was told, "that it was gone to the assembly of the blessed, where charity, joy, and a love of the union with God prevail;" and the reason given for it, as related by Porphyry, is, "that Plotinus had been peaceable, gracious, and vigilant; that he had perpetually elevated his spotless soul to God; that he had loved God with his whole heart; that he had disengaged himself, to the utmost of his abilities, from this wretched life; that, elevating himself with all the powers of his soul, and by the several gradations taught by Plato, towards that Supreme Being which fills the universe, he had been enlightened by him; had enjoyed the vision of him without the help or interposition of ideas; had, in short, been often united to him." This is the account of Porphyry, who tells us also, that he himself had once been favoured with the vision. To this account, however, we need scarcely add, that little credit is due: it agrees pretty much with modern enthusiasm and the reveries of Behmenists. Plotinus had also his familiar spirit, as well as Socrates; but, according to Porphyry, it was not one of those called *demons*, but of the order of those who are called *gods*; so that he was under the protection of a genius superior to that of other men. The superiority of his genius puffed him up not a little: for when Amelius desired him to share in the sacrifices, which he used to offer up on solemn festivals, "It is their business (replied Plotinus) to come to me, not mine to go to them:" "which lofty answer (says Porphyry) no one could guess the reason of, or dared to ask."

Plotinus, Plotus. Porphyry put the 54 books of Plotinus in order, and divided them into six enneases. The greater part of them turn on the most high-flown ideas in metaphysics; and this philosopher seems, in certain points, not to differ much from Spinoza. He wrote two books to prove, that "all being is one and the same;" which is the very doctrine of Spinoza. He inquires, in another book, "Whether there are many souls, or only one?" His manner of composing partook of the singularity of his nature: he never read over his compositions after he had written them; he wrote a bad hand; and was not exact in his orthography: he stood in need, therefore, of a faithful friend to revise and correct his writings; and he chose Porphyry for this purpose before Amelius, who had, however, been his disciple 24 years, and was very much esteemed by him. Some have accused Plotinus of plagiarism, with regard to Numenius; a slander which Amelius refuted. Longinus was once much prejudiced against our great philosopher, and wrote against his Treatise of Ideas, and against Porphyry's answer in defence of that treatise. He afterwards conceived a high esteem for him; sought industriously for all his books; and, in order to have them very correct, desired Porphyry to lend him his copy; but at the same time wrote to him in the following manner: "I always observed to you, when we were together, when we were at a distance from one another, as well as when you lived at Tyre, that I did not comprehend many of the subjects treated of by Plotinus; but that I was extremely fond of his manner of writing, the variety of his knowledge, and the order and disposition of his questions, which are altogether philosophical." "This single passage (says Bayle) shows the exalted genius, the exquisite discernment, and judicious penetration of Longinus. It cannot be denied, that most subjects which this philosopher examines are incomprehensible; nevertheless, we discover in his works a very elevated, fruitful, and capacious genius, and a close way of reasoning. Had Longinus been an injudicious critic, had he not possessed an exalted and beautiful genius, he would not have been so sensible of Plotinus's obscurity: for no persons complain less of the obscurity of a book, than those whose thoughts are confused and understanding is shallow." Marsilius Ficinus, at the request of Cosmo de Medicis, made a Latin version of the works of Plotinus, with a summary and analysis of each book; which was printed at Basil, first by itself, in 1559, and afterwards with the Greek in 1580, folio. His life was written by Porphyry, the most illustrious of his disciples.

PLOTUS, or Darter, in ornithology, a genus of birds

Plotus. birds belonging to the order palmipedes. The bill is long and sharp-pointed; the nostrils are merely a long slit placed near the base; the face and chin are bare of feathers; the neck is very long; and the legs are short. They have four toes webbed together. There are three species of this genus, and three varieties of the second of these.

1. The plotus anhinga, or white-bellied darter, is not quite so big as a mallard; but its length from the point of the bill to the end of the tail is 10 inches. The bill, which is three inches long, is straight and pointed: the colour is greyish, with a yellowish base: the irides are of a gold colour: the head is small: the neck long and slender: the upper part of the back and scapulars are of a dusky black colour; the middle of the feathers are dashed with white: the lower part of the back, &c. are of a fine black colour: the under parts from the breasts are silvery white: the smaller wing coverts, and those in the middle, are dusky black; the larger ones are spotted with white, and the outer ones are plain black: the tail feathers are 12 in number, broad, long, and glossy black: the legs and toes are of a yellowish grey. This species is an inhabitant of Brasil, and is exceedingly expert and cunning in catching fish. Like the corvorant, it builds nests on trees, and roosts in them at night. It is scarcely ever seen on the ground, being always on the highest branches of trees on the water, or such as grow in the moist savannas or river sides. When at rest, it generally sits with the neck drawn in between the shoulders like the heron. The flesh is in general very fat; but has an oily, rank, and disagreeable taste like that of a gull.

2. The anhinga of Cayenne, or black-bellied anhinga, is as large as a common duck, with a very long neck, and a long sharp-pointed straight bill. The upper part of the bill is of a pale blue, and the lower is reddish: the eyes are very piercing: the head, neck, and upper part of the breast are light brown: both sides of the head, and the upper part of the neck, are marked with a broad white line: the back, scapulars, and wing coverts, are marked with black and white stripes lengthwise in equal portions: the quill-feathers, the belly, thighs, and tail, are of a deep black colour; the tail is very long and slender: the legs and feet are of a pale green colour; and the four toes, like those of the corvorant, are united by webs. This species is found in the islands of Ceylon and Java. They generally sit on the shrubs that hang over the water; and, when they shoot out their long slender necks, are often taken for serpents at first sight.

Mr Latham describes three varieties of this species, which are all equal in size to the common birds of the species. The first and the second variety, which last Mr Latham calls the black darter, inhabit Cayenne; and third, or rufous darter, inhabits Africa, particularly Senegal, where it is called *kandar*.

3. The Surinam darter is about 13 inches long, being about the size of a teal. The bill is of a pale colour, and about 1¼ inch in length: the irides are red: the crown of the head is black, and the feathers behind form a sort of crest: the neck, as in the other species, is long and slender: the cheeks are of a bright bay colour: from the corner of each eye there comes a line of white: the sides and back part of the neck are marked with longitudinal lines of black and white: the wings are black, and the tail is dusky brown: it is also tipped with white and shaped like a wedge: the breast and belly are white: the legs short, but very strong, and of a pale dusky colour: the four toes are joined by a membrane, and barred with black. This species inhabits Surinam; frequenting the sides of rivers and creeks, where it feeds on small fish and insects, especially on flies, which it catches with great dexterity. When domesticated, which often happens, the inhabitants call it the *sun bird*. Authors have differed exceedingly concerning the genus to which this species belongs, since it is found to differ from the others in some pretty essential characters: it agrees, however, in so many, and those the most essential, as sufficiently to excuse those naturalists who class it with the plotus genus. See *Latham's Synopsis of Birds*, vol. iii. part 2. p. 627.

Plough.

1 The plough. PLOUGH, in agriculture: A machine for turning up the soil by the action of cattle, contrived to save the time, labour, and expence, which, without this instrument, must have been employed in digging the ground, and fitting it for receiving all sorts of seed. See AGRICULTURE, n° 83—95.

Amidst all the varieties which can occur in the manner of ploughing the ground, arising from difference of soil, local habits, and other causes, there is still a sameness in the task which gives a certain uniformity to the chief parts of the instrument; and should therefore furnish principles for its construction. There is not, perhaps, any invention of man that more highly merits our utmost endeavours to bring it to perfection; but it has been too much neglected by those persons who study machines, and has been considered as a rude tool, unworthy of their attention. 2 An instrument of the greatest value. Any thing appears to them sufficient for the clumsy task of turning up the ground; and they cannot imagine that there can be any nicety in a business which is successfully performed by the ignorant peasant. Others acknowledge the value of the machine, and the difficulty of the subject; but they think that difficulty insuperable, because the operation is so complicated, and the resistances to be overcome so uncertain, or so little understood, that we cannot discover any unequivocal principle, and must look for improvement only from experience or chance.

But these opinions are ill founded. The difficulty is indeed great, and it is neither from the ignorant farmer nor the rude artist that we can expect improvement. It requires the serious consideration of the most accomplished mechanician; but from him we *may* expect improvement. 3 And may be improved. We have many data: we know pretty distinctly what preparation will fit the ground for being the proper receptacle for the seed, and for supporting and nourishing the plants; and though it is, perhaps, impossible to bring it into this state by the operation of any instrument of the plough kind, we know that some ploughs prodigiously excel others in reducing the stiff ground to that uniform crumbling state in which it can be left by the spade. The imperfections of their performance, or what yet remains to be done to bring the ground into this state, is distinctly understood. It seems, then, a determinate problem (to use the language of mathematicians), because the operation depends on the invariable laws of mechanical nature.

4 The task it performs. It will therefore be very proper, under this article, to ascertain, if possible, what a plough in general ought to be, by describing distinctly its task. This will sure-

Plough. ly point out a general form, the chief features of which must be found under every variety that can arise from particular circumstances.

The plough performs its task, not by digging, but by being pulled along. We do not aim at immediately reducing the ground to that friable and uniform state into which we can bring it by the spade; but we wish to bring it into such a state that the ordinary operations of the season will complete the task.

For this purpose, a slice or sod must be cut off from the firm land. This must be shoved to one side, that the plough and the ploughman may proceed in their labour; and the sod must be turned over, so that the grass and stubble may be buried and rot, and that fresh soil may be brought to the surface; and all must be left in such a loose and open condition, that it may quickly crumble down by the influence of the weather, without baking into lumps, or retaining water. The first office is performed by the coulter, which makes a perpendicular cut in the ground. The point of the sock follows this, and its edge gets under the sod, and lifts it up. While lifting it up, it also heels it over, away from the firm land. The mould-board comes last, and pushes it aside, and gradually turns it over as far as is required.

Plate cccxcviii.

5 General form of the plough.

The general form of the body of a plough is that of a wedge, or very blunt chissel, AFEDBC, (fig. 1.), having the lower corner D of its edge considerably more advanced than the upper corner B; the edge BD and the whole back AFDB is in the same perpendicular plane; the bottom FDB approaches to a triangular form, acute at D, and square at F; the surface BCED is of a complicated shape, generally hollow, because the angle ABC is always greater than FDE: this consequence will be easily seen by the mathematician. The back is usually called the LAND SIDE by the ploughmen, and the base FDE is called the SOLE, and FE the HEEL, and BCED the mould-board. Lastly, the angle AFE is generally square, or a right angle, so that the sole has level both as to length and breadth.

6 Advantages of this form.

By comparing this form with attention, the reader will perceive that if this wedge is pulled or pushed along in the direction FD, keeping the edge BD always in the perpendicular cut which has been previously made by the coulter, the point D will both raise the earth and shove it to one side and twist it over; and, when the point has advanced from F to D, the sod, which formerly rested on the triangle DFE, will be forced up along the surface BCED, the line DF rising into the position D*f*, and the line EF into the position E*f*.—Had the bottom of this furrow been covered with a bit of cloth, this cloth would be lying on the mould-board, in the position D*f*E: the slice, thus deranged from its former situation, will have a shape something like that represented in fig. 2.

In as much as the wedge raises the earth, the earth presses down the wedge; and as the wedge pushes the earth to the right hand, the earth presses the wedge to the left; and in this manner the plough is strongly pressed, both to the bottom of the furrow by its sole, and also to the firm land by its back or land-side. In short, it is strongly squeezed into the angle formed along the line FD (fig. 1.) by the perpendicular plane *a b* DF and the horizontal plane FDE; and in this manner the furrow becomes a firm groove, directing the motion of the plough, and giving it a resisting support, by which it can perform all parts of its task. We beg our readers to keep this circumstance constantly in mind. It evidently suggests a fundamental maxim in the construction, namely, to make the land-side of the plough an exact plane, and to make the sole, if not plane, at least straight from point to heel. Any projection would tear up the supporting planes, destroy the directing groove, and expend force in doing mischief.

7 A fundamental maxim in the construction of a plough.

This wedge is seldom made of one piece. To give it the necessary width for removing the earth would require a huge block of timber. It is therefore usually framed of several pieces, which we shall only mention in order to have the language of the art. Fig. 3. represents the land-side of a plough, such as are made by James Small at Rosebank, near Foord, Mid Lothian. The base of it, CM, is a piece of hard wood, pointed before at C to receive a hollow shoeing of iron CO, called the SOCK, and tapering a little towards the hinder end, M, called the HEEL. This piece is called the HEAD of the plough. Into its fore part, just behind the sock, is mortised a sloping post, AL, called the SHEATH, the front of which is worked sharp, forming the edge of the wedge. Nearer the heel there is mortised another piece, PQ, sloping far back, called the STILT, serving for a handle to the ploughman. The upper end of the sheath is mortised into the long BEAM RH, which projects forward, almost horizontally, and is mortised behind into the stilt. To the fore end of the beam are the cattle attached. The whole of this side of the wedge is fashioned into one plain surface, and the intervals between the pieces are filled up with boards, and commonly covered with iron plates. The COULTER, WFE, is firmly fixed by its shank, W, into the beam, rakes forward at an angle of 45° with the horizon, and has its point E about six inches before the point of the sock. It is brought into the same vertical plane with the land-side of the plough, by giving it a knee outward immediately below the beam, and then kneeing it again downward. It is further supported on this side by an iron stay FH, which turns on a pin at F, passes through an eye-bolt I on the side of the beam, and has a nut screwed on it immediately above. When screwed to its proper slope, it is firmly wedged behind and before the shank.—Fig. 3. N° 2. represents the same plough viewed from above. ST is the right hand or small stilt fixed to the inside of the mould-board LV.

8 The several parts of the plough.

Fig. 4. represents the bottom of the wedge. CM is the head, covered at the point by the sock. Just behind the sock there is mortised into the side of the head a smaller piece DE, called the wrest, making an angle of 16° with the land-side of the head, and its outside edge is in the same straight line with the side of the sock. From the point to the heel of the head is about 33 inches, and the extreme breadth of the heel is about nine. The side of the wedge, called the furrow side, is formed by the mould-board, which is either made of a block or plank of wood, or of a thick iron plate.

9 Socks.

The sock drawn in this figure is called a SPEAR SOCK, and is chiefly used in coarse or stony ground, which requires great force to break it up. Another form of the sock is represented in the next figure 4. N° 2. This is called a FEATHER SOCK, and has a cutting edge CF on its furrow side, extending back about ten inches, and to the right hand or furrow side about six. The use of this is to cut the sod below, and detach it from the ground, as the coulter detaches it from the unploughed land. This is of great use when the ground is bound together by knotted roots, but it is evident that it cannot be used to advantage in very stony ground. In general, the feather sock is only fit for ground which has been under tolerable culture; but it greatly facilitates the labour of separating the sod. It may reasonably be asked, why the feather is not much broader, so as to cut the whole breadth of the furrow? This is sometimes done. But we must recollect that the sod is not only to be pushed aside, but also to be turned over. If it were completely detached by the feather, and chanced at any time to break on the back of the sock, it would only be pushed aside; but by leaving a little of the sod uncut, it is held fast below while it is shoved aside above, which cannot fail to twist it round. As the wrest advances, it easily destroys the remaining connection, which in general is very slight and crumbling.

10 Proper breadth of the sole.

The breadth of the sole at the heel determines the width of the furrow. Nine inches will give enough of room for a horse or man to walk in. A greater breadth is of no use, and it expends force in pushing the earth aside. It is a mistake to suppose that a broad sole gives more room for the turned slice to stand on; for whatever is the breadth of the furrow, the successive slices will be left at their former distances, because each is shoved aside to the same distance. When the breadth of a slice exceeds its depth, and it is turned on its side, it will now stand on a narrow base, but higher than before, and therefore will stand looser, which the farmers desire. But in this case it generally falls on its back before it has been far enough removed, and is then pushed aside, and left with the grassy side down, which is not approved of. On the other hand, when the depth considerably exceeds the breadth, the sods, now turned on their sides, must be squeezed home to the ploughed land, which breaks them and tosses them up, making rough work. In wet clay soil, this is also apt to knead them together. On the whole, it is best to have the breadth and depth nearly equal. But all this is workmanship, and has no dependence on the width of the sole behind.

11 It should be level.

We have already said that the sole is generally level from right to left at the heel. This was not the case formerly, but the wrest was considerably raised behind. It resulted from this form, that the furrow was always shallower on the right side, or there was left a low ridge of unstirred earth between the furrows. This circumstance alone was a bad practice; for one great aim of ploughing is the renewal of the superficial soil. In this way of ribbing the furrows, the sod tumbles over as soon as it is pushed to the top of the rib on the right of the *rut* made by the plough; the firmest parts of it fall undermost, and the rest crumbles above it, making the work appear neat; whereas it is extremely unequal, and what most needs the influence of the weather to crumble it down is sheltered from it. Add to these circumstances, that the hollow is a receptacle for water, with a surface which can retain it, having been consolidated by the pressure of the plough. For all these reasons, therefore, it seems advisable to form the furrow with a flat or level bottom, and therefore to keep the heel of the wrest as low as the heel of the head. For the same reason it is proper to hold the plough with the land-side perpendicular, and not to heel it over to that side, as is frequently done, producing the same ribbed furrow as an ill-formed sole.

12 Length of the plough.

There is great variety of opinions about the length of the plough. If considered merely as a pointed instrument, or even as a cutting instrument acting obliquely on a given length of sod, there can be no doubt but that it will be more powerful as it is longer: that is, it will require less force to pull it through the ground. But it must also shove the earth aside, and if we double its length we cause it to act on twice as much earth at once; for when the plough has entered as far as the heel, the whole furrow side is acting together in pushing the earth to the side. Now it is found, that the force necessary for pushing a mass of earth horizontally along the rough ground is nearly equal to its weight. It would seem, therefore, that nothing is to be gained by making the base of the plough of a great length, except a greater facility in making the first penetration, and this is chiefly performed by the coulter and sock; and a great length renders the plough heavy and cumbersome; and, by causing it to act long on the sod, tends to knead and cake it.

Nothing very precise can be offered on this subject. Some sensible advantage is derived by making the plough taper, especially forward, where it acts as a boring and cutting instrument; and for this purpose it is convenient to give the coulter a slope of 45 degrees. (This has also the advantage of throwing up the stones and roots, which it would otherwise drive before it through the firm ground.) And for the same reason the edge of the feather has a great slope, it being ten inches long and only six inches broad. But if we pursue this advantage too far we expose ourselves to another risk. It is sometimes necessary to heel over the plough to the right in order to get over some obstruction. In doing this, the coulter is necessarily raised for a moment, and the slanting cut now made by the feather becomes the directing groove for the plough. When the feather has a very long slope, this groove has force enough to guide the whole plough; and it is almost impossible for the ploughman to prevent it from running out of the ground to the land-side (A). The feather, therefore, should not exceed 10 or 12 inches in length.

13 Slope of the coulter and of the feather.

But to return to the length of the plough, from which this observation has diverted us a little, we must add, that a long plough has a great advantage in the steadiness of its motion, having a much more extensive support both on the land-side and below, and being therefore less affected by its inequalities. Accordingly they are now made considerably longer than formerly; and 33 inches has been assumed as a proportion to 9 inches of breadth, in conformity to the most approved ploughs now in use.

14 The mould-board

We come now to treat of the mould-board. This is

(A) This is often felt with the excellent plough described by Mr Arbuthnot of Surry, in the Transactions of the Society for the Encouragement of Arts, &c. London.

Plough. is the most delicate part of the plough, and is to be seen in the greatest variety in the works of different artists, each of whom has a nostrum of great value in his own opinion. It is here indeed that the chief resistances are exerted and must be overcome; and a judicious form of this part of the plough may diminish them considerably, while it performs the work in the best manner. Without pretending to say that the different resistances are susceptible of an accurate determination, we can still draw sufficient information from palpable rules of mechanics to direct us to what would be nearly the best possible form for a mould-board. The task to be performed is to raise, push aside, and turn over to a certain degree, a slice already cut off from the firm ground. As we cannot provide for every inequality of the cohesion or tenacity of the earth, our safest way is to consider it as uniform: the weight of it is always so. As we cannot provide for every *proportion* between the tenacity and the weight, we must take an average or medium proportion which is not far from that of equality. Conceiving the slice at first as only tenacious, and without weight, it is an easy problem to determine the form which shall give it the intended twist and removal with the smallest force. In like manner we can proceed with a slice that has weight without tenacity. It is equally easy to combine both in any proportion; and it is easiest of all to make this combination on the supposition of equality of weight and cohesion. Supposing the slice like a brick, we know that it requires the greatest force to *begin* to raise it on one edge, and that the strain becomes less as it rises, till its centre of gravity is perpendicularly above the supporting angle. It requires no force to raise it further; for on pushing it beyond this position, it would fall over of itself, unless withheld by the tenacity of what is not yet raised. But on considering the form or plan of the sock, we find that while the weight of the sod resists most strongly, there is less of it in this situation actually rising, and this nearly in the same proportion with the labour of raising it; and we see that after the sod has attained that position in which it is ready to fall over, it has reached the wider part of the wrest, and is now pushed aside, which requires nearly the same force as to raise it: and this continues to the end of the operation.

When we take all these circumstances into consideration, it appears probable, that the compound resistance does not change much from first to last. If this be really the case, it is an undoubted maxim that the whole operation should proceed equably: if it does not, there must be some part of the sod that makes a resistance greater than the medium; and as the resistances in all this class of motions increase nearly as the squares of the velocities with which they are overcome, it is demonstrable that we shall lose power if we render them unequal.

15
How to be formed.

Hence we deduce this maxim, *That as the plough advances through equal spaces, the twist and the lateral sliding of the sod should increase by equal degrees.* And this determines *à priori* the form of the mould-board. This principle occurred to Mr James Small a ploughmaker in Berwickshire, and he published a treatise on the subject in 1784. He has given several methods for constructing mould-boards, which he supposes are in conformity to his principle; but being merely a country artist, and unacquainted with science, his rules do not produce mouldboards having this property of equable operation, altho' they do not deviate far from it. His book is a very useful and instructive performance, and level to the capacity of those for whom it is intended; and we have here availed ourselves of the author's information on many points.

The high character which Small's ploughs have maintained for 25 years is a strong argument for the truth of the maxim. We shall therefore give such instructions as will enable any intelligent workman to construct such a mould-board without any risk of failure; and if future theory or experience should discover any error in the principles from which this maxim is deduced, by showing that either the weight, the tenacity, or the lateral resistance, is exerted according to a different law from what has been assumed, the directions to be given are of such a nature that they adapt themselves with precision to these changes of principle, and will still produce a perfect and efficacious plough. Our readers will readily acknowledge that this is gaining a great point; because at present the instrument is constructed very much at random, and by a guess of the eye.

Let us now return to the wedge formerly made use of for illustrating the action of the plough. Suppose it placed in a furrow already ploughed, and that the space before the line FE (fig. 1.), which is square from the line of motion FD, is covered with a piece of cloth or carpet, and that the point of the wedge enters upon it at F, and advances to D. It will evidently raise the cloth, which will now cover the side of the wedge, forming the triangle *f*DE. The line *f*D is what formerly lay in the angle along the line FD, and *f*E formerly lay on FE. It is this line FE therefore that we are to raise, shove aside, and twist round, by equal degrees, while the plough advances through equal spaces.

Now, if the length DF of the plough-wedge, reckoned from the point of the sock to the heel, be 33 inches, and the breadth FE behind be 9 inches, the angle DEF or DE*f* will be nearly 74°. The construction of the furrow side of the plough is therefore reduced to this very simple problem, "To make the angle DE*f* turn equably round the axis DE, while the angular point E advances equably from D to E."

16
Description of an instrument for this purpose.

This will be done by means of the following very simple tool or instrument. Let IHFK (fig. 5.) be a piece of hard wood, such as oak, a foot long, three inches broad, and an inch thick. Plant on this another piece BHFC of the same breadth, four inches long, and half an inch thick. This will leave beyond it a flat 8 inches long. We shall call this the *stock* of the instrument. Let ABC be a piece of clean oak half an inch thick, 20 inches long, and three inches broad at the end BC. Let this be fashioned like the stile of a sun-dial, having its angle ABC 74°. Let it have a part BCE square, to the extent of four inches from C, and the rest EA worked into the form of a straight slender rod. Let EFG be a semicircle of clean plane-tree or of metal four inches radius: fasten this by small screws to the square part of the stile CE, so that its centre may be at C. Let this semicircle be divided into 180 degrees, and numbered from G along the arch GFE, so that 0° may be at G, and 180° at E. Let this stile and semicircle turn round the line BC by means of small hinges. This instrument may be called the mould-board, gage, or protractor. When the stile is folded down on the stock

Plough.

stock BIK, the point G will be at F; and when it is raised up to any angle, the degrees will be pointed out on the semicircle by the straight edge CF.

Nothing can be more obvious than the manner of employing this instrument once we have determined the most proper position for the sod when the work is completed. Now it seems to be the opinion of the most intelligent farmers, that the best position of the sod is that represented in fig. 6.

17 Proper position of the sod.

Fig. 6. represents a section of the ground and the working parts of the plough, as viewed by a person standing straight before it. ABDC is the unploughed ground, and WB the coulter, kneed in Small's manner. FGKB is the section of the plough (or rather of the whole space through which the plough has passed, for no part of the plough has this section). HOFE is the section of a slice, pushed aside and turned over, so as to lean on the next. HE is that side of the slice which formerly lay on KB. EF is the side cut off by the coulter; and FO is the upper or grassy side. The lower corners are supposed to be a little bruised inwards, as must generally happen.

The sod is pushed 9 inches to the right hand, and it leans with its grassy side on the preceding furrow, in an angle of about 50 degrees. In this position the grass is turned down so as to rot; and there is a hollow left below to allow the rain water to run freely off, and to receive the earth as it crumbles down by the weather: and if the harrow is dragged across these ridges, it distributes along the surface the mould which was formerly at the bottom. The sod has got a twist of 130 degrees: but it is evident, that after it has been turned 90 degrees, or even a little before this, it is ready to fall over of itself. It is sufficient therefore that it be turned 90 degrees when the heel of the wrest has reached it, and the remainder of the twist is given to it by the wing or flap of the mould-board. This, then, dictates to us the manner of applying the instrument.

Divide the edge DE (fig. 7.) of the wrest, or of a lath nailed on it, into 90 equal parts, and continue the divisions backwards to G in the same line to 130. Number the divisions backwards from the point of the sock; then place the protractor on the edge of the wrest, with the point B of fig. 5. at the 90th division (fig. 7.); that is, just at the heel, with the stock under the wrest, and the stile raised to 90°, and press it home to the joint, so that the stock may be square to the edge, and then the stile will be in the position suiting that part of the mould-board. In like manner slide the stock forward to the 80th division, and lower the style to 80°, and it will have the position which suits that part of the mould-board. In the same way slide it forward to 70, 60, 50, &c. and lower the stile to 70°, 60°, 50°, &c. and we shall have the position for these several parts of the mould board; and thus it may be formed to the very point of the sock, because the straight edge of the wrest may be continued so far. A block of wood may be hewed to fit these several positions of the protractor stile; and this, when placed with its straight edge on the outer line of the wrest, and cut away behind in the land-side plane, will be the exact shape of the plough-wedge. It would rise up indeed into a tall piece of singular shape, gradually tapering down to the point of the sock; but when cut off parallel to the ground, at the height of about 12 inches, it will form the mould-board, the front or edge of the sheath, and the whole back of the sock except the feather, which is an extraneous piece. The wing or flap of the mould-board is formed in the same manner, by sliding the stock of the protractor to 100, 110, 120, 130, and opening the stile to 100°, 110°, 120°, 130°. This will extend the top of the mould-board to about 22 or 23 inches; but the lower part of the wing must be cut away, because it would push the sod too far aside after it has got the proper twist. The form of this part should be such as would exactly apply itself to a plank set at the heel of the wrest, parallel to the land-side of the head, and leaning outward 40 degrees. This will be very nearly the case if it be made a sweep similar to the edge of the sheath. Fig. 8. is a resemblance of the surface of the mould-board; AD being the edge of the sheath, E the heel of the wrest, and EBC the wing or flap. When cut through in a perpendicular direction, the section is hollow; if cut horizontally it is convex; and if in the direction CE, making an angle of 74° with ED, it is straight. If the protractor be set on it at D, and gradually slidden backwards, the mould-board will gradually open the stile, and the stile will skim its whole surface without any vacuity between them.

18 How to form the mould-board.

This form is given to the mould-board on the authority of the supposition that the sum of the resistances arising from weight and tenacity remains pretty constant in its whole length. This cannot be affirmed with confidence in any case, and is by no means true in all. In stiff clay soils the effects of tenacity prevail, and in light or crumbling soils the weight is the chief resistance. The advantage of this mode of construction is, that it can be adapted to any soil. If the difficulty of cutting and raising the sod is much greater than that of shoving it aside and turning it over, we have only to make the rise and twist more gentle towards the point of the sock, and more rapid as we advance; and it is easy to do this according to any law of acceleration that we please. Thus, instead of dividing the edge of the wrest DE (fig. 9.) continued to G into 130 parts, draw a line Gg perpendicular to it, and draw some curve line Dg convex toward DG, and divide this into equal parts in the points 10, 20, 30, 40, &c.; and then draw perpendiculars to the wrest edge, cutting it in 10, 20, 30, 40, &c. and apply the protractor to these points. It is evident that the divisions of the wrest line are bigger at D, and grow gradually less towards G; and therefore, because each has 10° more twist than the preceding, the twist will be more rapid as it approaches the end of the mould-board. This curve may be chosen so as to produce any law of acceleration. On the contrary, we produce a retarded or diminished twist by making the curve concave towards DG, as represented by the dotted curve.

The mathematical reader will observe, that this construction aims at regulating the twist round the line of the wrest ED. This does not produce precisely the same regulation round the line FD, which is the line of the plough's motion, and of the sod's position before it is ploughed over. The difference, however, is not worth attending to in a matter so little susceptible of precision. But the twist round the line FD may be regulated according to any law by this instrument with equal facility. Instead of placing the stock of the protractor square with the edge of the wrest, it may be placed square

square with the land-side of the plough. To do this, draw a line BL (fig. 5. n° 2.) across the stock from the point B, making the angle LBC 16°, and put a brass pin at L, making a hole in the style that it may not be prevented from folding down. Then in using the instrument let the points B and L rest against the edge of the wrest, and proceed as directed.

A still greater variety of forms, and accommodation to particular views, with the same general dependence on principle, will be procured by giving the rod BA a motion round B in the plane of the stile, so as to form a stile of a variable angle.

A tool may even be constructed in which the rod BA might be a cutting knife: and the whole may be led along by a screw, while this knife turns round according to any law, and would gradually pare away the mould-board to the proper form.

Thus have we reduced the fashioning the operative part of the plough to a rule which is certain. We do not mean by this, that a mould-board made according to the maxim now given will make the best possible plough; but we have given a rule by which this part of the plough can be made unequivocally of a certain quality by every workman, whatever this quality may be, and this without being obliged to copy. No description of any curve mould-board to be met with in books has this advantage; and we say that this rule is capable of any systematic variation, either with respect to the width of furrow, or the quantity or variation of its twist. We have therefore put it in the power of any intelligent person to make such gradual and progressive changes as may serve to bring this most useful of all instruments to perfection. The angle of the head and wrest, and the curve for dividing the wrest line, can always be expressed in writing, and the improvements communicated to the public at large.

19 Mode of the plough's action.

After this description of the working parts of a plough, and directions for giving it the most effective form, it will not be improper to consider a little its mode of action, with the view of attaining a more distinct conception of what is done by the ploughman and the cattle, and to direct him in his procedure.

Returning again to the wedge (fig. 1.), we see that it is pressed down at the point D, and as far back along the mould-board as its surface continues to look upward, that is, all the way to the heel of the wrest. Behind this, the perpendicular sections of the mould-board overhang, and look downward; and here, while pressing down the sod, the plough is pressed upwards. These two pressures tend to twist the plough round a transverse line somewhere between the heel and the point. The plough therefore tends to rise at the heel, and to run its point deeper into the ground. Upon the whole, the pressure downwards is much greater than the upward pressure. It is exerted over a much greater space, and is greater in most parts of that space. Behind, very little downward pressure is necessary, the sod being ready to fall down of itself, and only requiring a gentle touch to lay it in a proper position.

In like manner the plough is pressed backward by the resistance made to the coulter and sock, and part of the resistance made to the sloping side of the mould-board: and it is pressed to the left by the other part of the pressure on the sock and mould-board.

All these pressures must be balanced by the joint action of the cattle, the resistance of the bottom, and the resistance of the firm ground on the left hand or land-side.

It is the action of the cattle, exerted on that point to which they are attached, which produces all these pressures. It is demonstrated by the principles of mechanics, that this force must not only be equal to the mean or compound force of these resisting pressures, but must also be in the opposite direction.

It is further demonstrated, that if a body be dragged through any resisting substance by a force acting on any point G, and in any direction whatever GH, and really moves uniformly in that direction, the force exerted exactly balances the resistances which it excites, both as to quantity and direction: And if the body advances without turning round the point by which it is dragged, the resistances on one side of this point are in equilibrio with those on the opposite side.

And, lastly, it is demonstrated, that when this equilibrium is obtained, it is indifferent to what point in the line GH the force is applied. Therefore, in fig. 3. n° 1. the force acting in the direction HO may either be applied to the point of the beam H, or to the point N of the coulter, or to the point O of the sock.

When therefore a plough advances steadily, requiring no effort of the ploughman to direct it, if the line of draught OM (fig. 10.) be produced backwards to the point G of the mould-board, that point is the place round which all the resistances balance each other. This point may be called the *centre of resistance* and the *centre of action*.

It would be of importance to determine this point by principle; but this can hardly be done with precision even in a plough of a known form: and it is impossible to do it in general for all ploughs, because it is different in each. It even varies in any plough by every variation of the proportion between the weight and the cohesion of the sod. We see how it can be found experimentally in any given uniform sod, viz. by producing backwards the line of draught. Then, if the draught-rope, instead of being fixed to the muzzle of the beam, were fixed to this point, and if it were pulled in the same direction, the plough would continue to perform its work without any assistance from the ploughman, while the sod continued uniform. But the smallest inequality of sod would derange the plough so as to make it go entirely out of its path. Should the resistances between G and D prevail, the plough would go deeper, which would increase the resistances on that side where they already exceed, and the plough would run still deeper. Should the resistances behind G prevail, the heel would be pressed down, and the point would rise, which would still farther destroy the equilibrium, and, producing a greater deviation from the right path, would quickly throw the plough out of the ground.

For these reasons we must not think of attaching the draught to the centre of resistance; but must contrive a point of draught such as shall restore the plough to its proper position when it has been driven out of it by any obstruction.

The muzzle or end of the beam is a point which will completely suit our purpose. For suppose that the re- 20 Muzzle of the beam.

sistance

Plough.

stance on the back of the sock has prevailed, and the plough MNFD (fig. 10.) has taken the position *mnfd* represented by the dotted lines, the draught line GMO is brought down into the position *gmo*, diverging a little from GMO, and meeting the mould-board in a point *g* considerably before G. By this means the resistances on the hinder side of *g* are increased, and those before it are diminished, and the plough quickly regains its former position.

21 The point of draught. From these observations it is plain, that whatever is the situation of the centre of resistance, the point of draught may be so chosen that the action of the cattle shall be directly opposed to the resistance of the ground, and that moreover the plough shall have no tendency either to go deeper or to run out. This is the use of the apparatus at the point of the beam called the muzzle, represented at H (fig. 3.) It turns round a bolt *i* through the beam, and can be stopped at any height by another pin *k* put through the holes in the arch *lm*. A figure is given of the muzzle immediately below, as it appears when looking down on it. The eye to which the draught-rope is hooked is spread out horizontally, as shown by HK, and has several notches O in it, to either of which the hook can be applied. This serves to counteract any occasional tendency which the plough may have to the right or left.

When the plough goes on steadily, without any effort of the ploughman, it is said to be in trim, and to swim fair; the pressure before and behind the centre of action being in equilibrio with each other. In order to learn whether a plough will be in this manner under management, hook the draught-rope as high as possible.

22 Of the plough in trim. In this state the plough should have a continual tendency to rise at the heel, and even to run a little into the ground. Then hook the rope as low as possible. The plough should now press hard on the furrow with the heel, and have some tendency to run out of the ground. If both these are observed, the plough is properly constructed in this respect; if not, it must be altered, either by changing the position of the sock or that of the beam. Lowering the end of the beam will correct the tendency of the plough to go deeper; the raising the point of the sock will also have the same effect. But it is of considerable importance not to take the point of the sock out of the plane of the sod, and it is much better to make the alteration by the beam. The slope of the coulter has a considerable effect, but it cannot be placed very far from the inclination of 45° without the risk of choaking the plough by driving the roots and stones before it. It is of great consequence to have the coulter sit exactly in the direction of the plough's motion: if it is in any other direction, it will powerfully twist the plough into its own track. As it must be fixed in the middle of the beam's thickness to have strength, it is removed a little from the plane of the land-side, and it was the usual practice to point it to the left below to compensate for this; but this by no means removes the disposition to twist, and it exposes to the risk of catching a stone between its point and that of the sock, which must now be driven forward through the firm ground at a great expence of labour to the cattle. Mr Small has very ingeniously remedied this by giving the coulter a short knee to the left immediately below the beam, and thus pointing it downwards in the plumb of the land-side. See fig. 6.

It is not without its use to know the absolute force necessary for tilling the ground. This has been frequently measured with a spring steel-yard. One of Small's ploughs, worked by two horses, and employed in breaking up stiff land which had been ploughed before winter, and much consolidated by the rains, required a force of 360 lbs. avoirdupois; and we may state this as the ordinary rate of such work; but moderately firm sod, under good culture, requires at a medium 320 lbs.

As we wish to embrace every opportunity of rendering this work useful to the public, we shall conclude this article with an account of a plough which has just now been recommended to public notice by the Scots Highland Society as extremely proper for a hilly country. The inventor, the Rev. Alexander Campbell minister at Kilcalmonell in Argyleshire, was honoured with the Society's gold medal, value L. 25.

A, the sock (fig. 11.); the land-side of which supplies the place of the coulter, and the sole of it serves for a feather; it is 18 inches long, and is made of a plate of iron 12 inches broad when finished, and somewhat under half an inch thick.—B, the head; to be made of iron in a triangular form, 4 inches broad by 2 inches at the thickest part. There are 5 inches of the head fixed in the sock.—C, the beam, 4 inches thick by 5 inches deep, gradually tapered thinner; the length 6 feet.—E, the sheath, must be of the same thickness with the beam above and the head below, and is five inches broad. An iron screw-bolt connects the beam and head behind the sheath.—F, the handles are so made that the slope of the mould-board, which is fixed to one of them, may be the longer and more gradual. They are 5 feet 8 inches long, and 2 feet 4 inches asunder at the ends.—G, the mould-board, consists of 7 rounded sticks 2 inches in diameter; the covert of them is in the plane of the sole, the rest in succession close to each other above it. This makes the mould-board 14 inches broad. To prevent any earth from getting over the mould-board, a thin dale 4 or 5 inches broad is fixed above it. The mould-board, land-side, and sole of the plough, are clad with iron.—The length is 20 inches: this added to 18 inches, the length of the sock, makes the length from point to heel 3 feet 2 inches.—The muzzle or bridle OPH is also of a more convenient and better construction than those commonly in use. By means of the screw-pins at L and M different degrees of land may be given to the plough; the iron rod LH being thereby moved sidewise in the socket LN, and up and down by OP. The rod is 30 inches long, one broad, and half an inch thick. It is hooked into a screw-bolt at H. Two inches of the rod project at N, in the form of an eye, before the muzzle, to receive the hook of the cross-tree.

23 The Argyleshire plough.

The advantages of this plough are said to be: It is not so liable to be interrupted or turned out of its course by stones, roots, &c. as other ploughs are; nor does it dip so deep as to be liable to be broken by large stones or flags. The motion of the muzzle is also thought an improvement. Another advantage it has over other ploughs is, its not being so liable to be choaked up by stubble, &c. This we understand to be its chief excellency, and an object much desired in the construction of the plough. Upon the whole, we are informed that this plough is lighter, less expensive, and less liable to go out of trim than the ordinary plough, and that with it two horses can plough land which require four with any other plough.

Objections to its construction.

Such are said to be the advantages of this construction; but we cannot help expressing our apprehension that the uniting the coulter and feather at the point of the sock will expose the plough to great risks of being put out of order. When the upright edge strikes a stone obliquely, especially on the land-side, it must be violently twisted round the point of the head; and, having but a moderate thickness at this part, may be broken or permanently twisted. The plough will then be continually running out of its direction: and we apprehend that this defect cannot be amended without taking off the sock and putting it in the fire. When a coulter is bent by the same cause, the ploughman can either rectify it by altering the wedging, or he can straighten it in the field; and it must be observed, that the plough opposes much less resistance to the derangement of this sort of coulter than of the common one. In the common coulter the strain does not so much tend to twist the plough round the line of its motion, as to press it wholly to landward. The resistance to this is great; but a very moderate force will twist it round its line of motion. In either case, if the blow be given in that point of the coulter where the draught line crosses it, there will be no twist of the whole plough, but the point of the plough will be forced horizontally to or from the land. When the blow is out of this line, the strain tends to twist the beam or the plough. Experience will determine which of the two is the most hazardous. These ploughs are made by Thomas Lindsay, Abbeyhill, Edinburgh, and models are to be seen in the hall of the Highland Society.

Plough-drill. See *Drill sowing*, and Agriculture, p. 318; and Plate VII. and 2d Plate VII. In the Gentleman's Magazine for July 1793, p. 602, Mr Wickins of Pondhead Lodge, New Forest, gives an account of a simplified drill-plough invented by himself. Its importance is increased, he thinks, by the cheapness and easy construction of it, because it can be used upon a small scale by a single man, and upon a larger scale by two men, or a man and boy; so that the inconvenience suffered by horses trampling the ground, &c. is hereby avoided. To the drill for sowing is occasionally annexed a blade for hoeing between the rows: "the good effects of which (says Mr Wickins) are no less obvious from its nurturing the growth of the corn, and producing collateral shoots from the application of fresh soil, but also from its affording the means of extirpating the weeds which are so obnoxious to it." He informs us likewise, that his single hand-drill hath been seen and approved by the Bath Society; and they have in consequence been pleased to vote him an honorary and corresponding member. Since that time, however, he says, he has very materially improved and simplified it. Mr Wickins's description of his invention is far from being accurate; and the drawing, of which there is an engraving in the same magazine, was taken when his machine was in its infant and less improved state. He promises, however, further information in the Gentleman's Magazine, and he offers more particulars to such agricultural people as shall desire it. We are far from decidedly thinking that this plough-drill is a real improvement, or that it ever will come to be really and generally useful. We have seen so many of these and such like improvements make a great noise for a while, and then fall into neglect, without having ever come into use, as makes us shy in forming opinions respecting the utility of those instruments which are so often and so boldly obtruded on the world as the *ne plus ultra* of improvements in their several spheres. We think it our duty, however, to give every attempt at improvement, especially in the useful arts, all the justice in our power; and, on this account, it has always been our custom to lay before our readers such claims to it as have occurred in the course of our work, whether those claims appeared to ourselves to be just or not.

PLOUGHMAN, the person who guides the plough in the operation of tilling.

PLOUGHING, in agriculture, the turning up the earth with a plough. See Agriculture, Part II. *passim.*

PLOVER, in ornithology, a species of Charadrius.

These birds usually fly in exceedingly large flocks in the places they frequent; people talk of 20,000 or 30,000 being seen in a flock. They generally come to us in September, and leave us about the end of March. In cold weather they are found very commonly on lands lying near the sea in quest of food; but in thaws and open seasons they go higher up in the country.

They love to feed on ploughed lands, but never remain long at a time on them, for they are very cleanly in their nature; and the dirt which lodges on their beaks and feet give them so much uneasiness, that they fly to the nearest water to wash themselves. When they roost, they do not go to trees or hedges; but sit squatting on the ground like ducks or geese, far from trees or hedges, when the weather is calm; but when it is stormy, they often get under shelter. In wet weather they do not sleep in the night at all, but run about picking up the worms as they crawl out of the ground; during this feeding they are continually making a small cry, that serves to keep them together; and in the morning they take flight. If in their flight they spy any others on the ground, they call them up; and if they refuse to come, the whole body descends to see what food there is in the place that detains them.

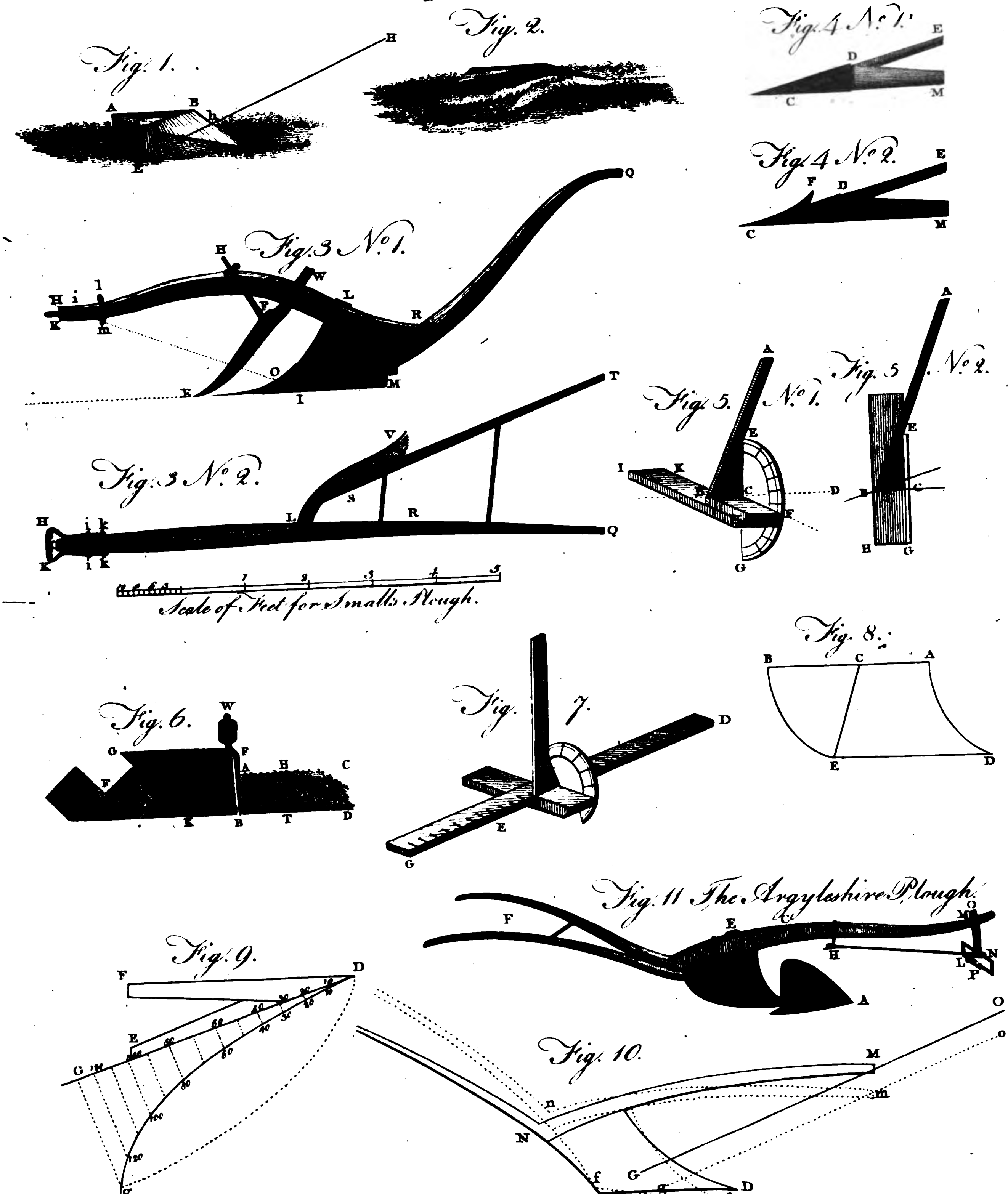
Plovers are very easily taken at the time of their first coming over, when they have not got any other birds mixed among them; but when they afterwards pick up the teal and other shy birds among them, it becomes more difficult. The best season for taking them is in October, especially in the beginning of that month: after this they grow timorous, and are not easily taken again till March, which is the time of their coupling. The severest frosts are not the best season for taking them in nest, but variable weather does better. The north-west wind is found disadvantageous to the taking of them; and in general, great regard is to be paid to the course of the wind in the setting of the nets. All sea-fowl fly against the wind when the land lies that way; and the nets for taking them are therefore to be placed in a proper direction accordingly.

PLOWDEN (Edmund), serjeant at law, was the son of Humphrey Plowden of Plowden in Shropshire, of an ancient and genteel family. He was first a student of the university of Cambridge, where he spent three years in the study of philosophy and medicine.

He

PLOUGH.

Plate CCCXCVIII.



A. Bell Prin. Wal. Sculptor fecit.

He then removed to Oxford, where, having continued his former studies about four years more, in 1552 he was admitted to the practice of physic and surgery: but probably finding the practice of the art of healing less agreeable than the study, he entered himself of the Middle Temple, and began to read law. Wood says, that in 1557 he was summer reader to that society, and Lent-reader three years after, being then serjeant and oracle of the law. He died in the year 1584, aged 67; and was buried in the Temple-church, near the north-wall, at the east end of the choir. He married the daughter of William Sheldon of Boley in Worcestershire; by whom he had a son, who died soon after his father. He wrote, 1. Commentaries or Reports of divers Cases, &c. in the reigns of King Edw. VI. Queen Mary, and Queen Elizabeth; London, 1571, 78, 99, 1613, &c. Written in the old Norman language. 2. Queries, or a Moot-book of cases, &c. translated, methodized, and enlarged, by H. B. of Lincoln's-Inn; Lond. 1662, 8vo.

PLUCHE (Antony), born at Rheims in 1688, merited by his engaging manners and proficiency in the belles-lettres the appointment of humanist in the university of that city. Two years after he obtained the professor of rhetoric's chair, and was admitted into holy orders. The bishop of Laon (Clermont) informed of his talents, offered him the direction of the college of his episcopal city. By his industry and superior knowledge, a proper order and subordination soon took place in it; but some particular opinions respecting the affairs of the time disturbed his tranquillity, and obliged him to quit his office. The intendant of Rouen, at the request of the celebrated Rollin, entrusted him with the education of his son. Abbé Pluche having filled that place with success and great honour to himself, left Rouen and went to Paris, where, by the patronage of some literary friends and his own excellent writings, he acquired a very distinguished reputation for learning. He published, 1. *Le Spectacle de la Nature* (Nature Displayed), in 9 vols in 12mo. This work, which is equally instructive and entertaining, is written with perspicuity and elegance; but the form of dialogue which he adopted has drawn him into the fault of being rather too prolix. The speakers, who are the Prior, the Count, and Countess, are not distinguished by any striking feature; but they have all the common character, which is tolerably pleasing, not excepting even that of the little chevalier De Breuil, who is, however, a mere scholar. This is the opinion which Abbé Desfontaines has formed of this work. Though the author has given the conversations a pretty ingenious turn, and even some vivacity, yet they now and then fall into the tone of the college. 2. *Histoire du Ciel*, or History of the Heavens, in 2 vols in 12mo. In this performance we find two parts almost independent of one another. The first contains some learned inquiries into the origin of the poetic heavens. It is nearly a complete mythology, founded upon ideas which are new and ingenious. The second is the history of the opinions given by philosophers respecting the formation of the world. The author shows the inutility, the inconstancy, and uncertainty, of the most esteemed systems; and concludes with pointing out the excellence and sublime simplicity of the Mosaic account. Besides a noble and well-turned expression, we find in it an erudition which does not fatigue the mind. As to the foundation of the system explained in the first part, though it appears extremely plausible, we will not take upon us to say how far it is true: Voltaire called it *Fable du Ciel*, or a Fable of the Heavens. 3. *De Linguarum artificio;* a work which he translated with this title, *La Mecanique des Langues*, in 12mo. In this treatise he proposes a short and easy method of learning languages, which is by the use of translations instead of themes or exercises; and we must admit his reflections on that subject are both judicious and well expressed. 4. Harmony of the Psalms and the Gospel, or a Translation of the Psalms and Hymns of the Church, with Notes relative to the Vulgate, the Septuagint, and Hebrew Text, printed at Paris in 1764, in 12mo. In 1749, Abbé Pluche retired to Varenne St Maure, where he gave himself up entirely to devotion and study. Having become so deaf that he could not hear without the help of a trumpet, the capital afforded him very little entertainment. It was in this retreat that he died of an apoplexy on the 20th of November 1761, at the age of 73 years. He possessed those qualities which form the scholar, the honest man, and the Christian: temperate in his meals, true to his word, an affectionate parent, a sensible friend, and a humane philosopher; he gave lessons of virtue in his life as well as in his writings. His submission to all the dogmas of religion was very great. Some Deists having been surprised that, in matters of faith, he should think and speak like the vulgar, his answer was, "I glory in doing so: It is infinitely more rational to believe the word of God, than to follow the glimmering lights of a reason which is limited and subject to error."

PLUG, certain pieces of timber, formed like the frustum of a cone, and used to stop the hause-holes and the breaches made in the body of a ship by cannon-balls; the former of which are called *hause-plugs*, and the latter *shot plugs*, which are formed of various sizes in proportion to the holes made by the different sizes of shot, which may penetrate the ship's sides or bottom in battle; accordingly they are always ready for this purpose.

PLUKENET (Leonard), a physician who flourished in the reign of King Charles II. was one of the most excellent and laborious botanists of that or any other age. He was author of the *Phytographia Pluceneliana*, the *Almagesticum Britannicum*, and other works of the like kind, on which he spent the greatest part of his life and fortune. His Phytography is mentioned with the highest encomiums in the Philosophical Transactions for February 1696-7. His *Opera Botannica*, with cuts, were printed at London in 6 vols folio, in 1720.

PLUM-TREE, in botany. See PRUNUS.

PLUMAGE, the feathers which serve birds for a covering. See ORNITHOLOGY, p. 506.

PLUMB-LINE, among artificers, denotes a perpendicular to the horizon; so called, as being commonly erected by means of a plummet.

PLUMBAGO, LEAD-WORT; a genus of the monogynia order, belonging to the pentandria class of plants. There are four species; the most remarkable of which are the Europæa and Zeylonica. The first grows naturally in the southern parts of Europe, and has a perennial root striking deep in the ground. There are many slender channelled stalks, about three feet high, terminated by tufts of small funnel-shaped flowers, of a blue or white colour. The second grows naturally in both the Indies. The upper part of the stalk and empalement are covered with a glutinous juice, which catches the small flies that light upon it. The former species is propagated by parting the roots, and by seeds; but the latter is too tender to thrive in the open air in this country.

PLUMBAGO. See *Black-Lead*.

PLUMBERY, the art of casting and working lead, and using it in building.

As this metal melts soon and with little heat, it is easy to cast it into figures of any kind, by running it into moulds of brass, clay, plaster, &c. But the chief article in plumbery is sheets and pipes of lead; and as these make the basis of the plumber's work, we shall here give the process of making them.

In casting *sheet-lead*, a table or mould is made use of, which consists of large pieces of wood well jointed, and bound with bars of iron at the ends; on the sides of which runs a frame consisting of a ledge or border of wood, three inches thick and four inches high from the mould, called the *sharps*: The ordinary width of the mould, within these sharps, is from four to five feet; and its length is 16, 17, or 18 feet. This should be something longer than the sheets are intended to be, in order that the end where the metal runs off from the mould may be cut off, because it is commonly thin or uneven, or ragged at the end. It must stand very even or level in breadth, and something falling from the end in which the metal is poured in, viz. about an inch or an inch and a half in the length of 16 or 17 feet or more, according to the thinness of the sheets wanted; for the thinner the sheet, the more declivity the mould should have. At the upper end of the mould stands the pan, which is a concave triangular prism, composed of two planks nailed together at right angles, and two triangular pieces fitted in between them at the ends. The length of this pan is the whole breadth of the mould in which the sheets are cast; it stands with its bottom, which is a sharp edge, on a form at the end of the mould, leaning with one side against it; and on the opposite side is a handle to lift it up by, to pour out the melted lead; and on that side of the pan next the mould are two iron-hooks to take hold of the mould, and prevent the pan from slipping while the melted lead is pouring out of it into the mould. This pan is lined on the inside with moistened sand, to prevent it from being fired by the hot metal. The mould is also spread over, about two inches thick, with sand sifted and moistened, which is rendered perfectly level by moving over it a piece of wood called a *strike*, and smoothing it over with a smoothing plane, which is a plate of polished brass, about one-fourth of an inch thick and nine inches square, turned up on all the four edges, and with a handle fitted on to the upper or concave side. The sand being thus smoothed, it is fit for casting sheets of lead: but if they would cast a cistern, they measure out the bigness of the four sides; and having taken the dimensions of the front or fore-part, make mouldings by pressing long slips of wood, which contain the same mouldings, into the level sand; and form the figures of birds, beasts, &c. by pressing in the same manner leaden figures upon it, and then taking them off, and at the same time smoothing the surface where any of the sand is raised up by making these impressions upon it. The rest of the operation is the same in casting either cisterns or plain sheets of lead. But before we proceed to mention the manner in which that is performed, it will be necessary to give a more particular description of the *strike*. The strike, then, is a piece of board about five inches broad, and something longer than the breadth of the mould on the inside; and at each end is cut a notch about two inches deep, so that when it is used it rides upon the sharps with those notches. Before they begin to cast, the strike is made ready by tacking on two pieces of an old hat on the notches, or by slipping a case of leather over each end, in order to raise the under side about one-eighth of an inch or something more above the sand, according as they would have the sheet to be in thickness; then they tallow the under edge of the strike, and lay it across the mould. The lead being melted, it is put into the pan with ladles, in which, when there is a sufficient quantity for the present purpose, the scum of the metal is swept off with a piece of board to the edge of the pan, letting it settle on the sand, which is by this means prevented from falling into the mould at the pouring out of the metal. When the lead is cool enough, which must be regulated according to the thickness of the sheets wanted, and is known by its beginning to stand with a shell or wall on the sand round the pan, two men take the pan by the handle, or else one of them lifts it by the bar and chain fixed to a beam in the ceiling, and pour it into the mould, while another man stands ready with the strike, and, as soon as they have done pouring in the metal, puts on the mould, sweeps the lead forward, and draws the overplus into a trough prepared to receive it. The sheets being thus cast, nothing remains but to roll them up or cut them into any measure wanted: but if it be a cistern, it is bent into four sides, so that the two ends may join the back, where they are soldered together; after which the bottom is soldered up.

The method of casting pipes without soldering. To make these pipes they have a kind of little mill, with arms or levers to turn it withal. The moulds are of brass, and consist of two pieces, which open and shut by means of hooks and hinges, their inward caliber or diameter being according to the size of the pipe, usually two feet and a half. In the middle is placed a core or round piece of brass or iron, somewhat longer than the mould, and of the thickness of the inward diameter of the pipe. This core is passed through two copper rundles, one at each end of the mould, which they serve to close; and to these is joined a little copper tube about two inches long, and of the thickness the leaden pipe is intended to be of. By means of these tubes, the core is retained in the middle of the cavity of the mould. The core being in the mould, with the rundles at its two ends, and the lead melted in the furnace, they take it up in a ladle, and pour it into the mould by a little aperture at one end, made in the form of a funnel. When the mould is full, they pass a hook into the end of the core, and, turning the mill, draw it out; and then opening the mould, take out the pipe. If they desire to have the pipe lengthened, they put one end of it in the lower end of the mould, and pass the end of the core into it; then shut the mould again, and apply its rundle and tube as before, the pipe just cast serving for a rundle, &c. at the other end. Things being thus replaced, they pour in fresh metal, and repeat the operation till they have got a pipe of the length required.

For

For making pipes of sheet-lead, the plumbers have wooden cylinders, of the length and thickness required; and on these they form their pipes by wrapping the sheet around them, and soldering up the edges all along them.

The lead which lines the Chinese tea-boxes is reduced to a thinness which we are informed European plumbers cannot imitate. The following account of the process by which the plates are formed was communicated to a writer in the Gentleman's Magazine by an intelligent mate of an East Indiaman. The caster sits by a pot containing the melted metal; and has two large stones, the under one fixed, the upper moveable, directly before him. He raises the upper stone by pressing his foot upon the side of it, and with an iron ladle pours into the opening a proper quantity of the fluid metal. He then immediately lets fall the upper stone, and by that means forms the lead into a thin irregular plate, which is afterwards cut into a proper shape. The surfaces of the stones, where they touch each other, are exactly ground together.

PLUMBUM, LEAD. See LEAD.

Plumbum Corneum, a combination of lead with the marine acid. See CHEMISTRY, n° 812.

PLUME, in botany, the bud or germ. See GEMMA.

PLUMIER (Charles), a learned Minim, born at Marseilles, and one of the most able botanists of the 17th century. He was instructed by the famous Maignan, who taught him mathematics, turnery, the art of making spectacles, burning-glasses, microscopes, and other works. He at length went to Rome to perfect himself in his studies, and there applied himself entirely to botany under a skilful Italian. At his return to Provence, he settled in the convent at Bornes, a maritime place near Hieres, where he had the conveniency of making discoveries in the fields with respect to simples. He was some time after sent by the French king to America, to bring from thence such plants as might be of service in medicine. He made three different voyages to the Antilles, and stopped at the island of St Domingo. The king honoured him with a pension; and he at last settled at Paris. However, at the desire of M. Fagon, he prepared to go a fourth time to America, to examine the tree which produces the Jesuits bark; but died at the port of Santa Maria, near Cadiz, in 1706. He wrote several excellent works; the principal of which are, 1. A volume of the Plants in the American Islands. 2. A Treatise on the American Fern. 3. The Art of Turnery; a curious work embellished with plates.

PLUMMET, PLUMB-*Rule*, or *Plumb line*, an instrument used by carpenters, masons, &c. in order to judge whether walls, &c. be upright planes, horizontal, or the like. It is thus called from a piece of lead, fastened to the end of a chord, which usually constitutes this instrument. Sometimes the string descends along a wooden ruler, &c. raised perpendicularly on another; in which case it becomes a level.

PLUMMING, among miners, is the method of using a mine-dial, in order to know the exact place of the work where to sink down an air-shaft, or to bring an adit to the work, or to know which way the load inclines when any flexure happens in it.

It is performed in this manner: A skilful person with an assistant, and with pen, ink, and paper, and a long line, and a sun-dial, after his guess of the place above ground, descends into the adit or work, and there fastens one end of the line to some fixed thing in it; then the incited needle is let to rest, and the exact point where it rests is marked with a pen: he then goes on farther in the line still fastened, and at the next flexure of the adit he makes a mark on the line by a knot or otherwise: and then letting down the dial again, he there likewise notes down that point at which the needle stands in this second position. In this manner he proceeds, from turning to turning, marking down the points, and marking the line, till he comes to the intended place: this done, he ascends and begins to work on the surface of the earth what he did in the adit, bringing the first knot in the line to such a place where the mark of the place of the needle will again answer its pointing, and continues this till he come to the desired place above ground, which is certain to be perpendicular over the part of the mine into which the air-shaft is to be sunk.

PLUMOSE, something formed in the manner of a feather, with a stem and fibres issuing from it on each side; such are the antennæ of certain moths, butterflies, &c.

PLURAL, in grammar, an epithet applied to that number of nouns and verbs which is used when we speak of more than one thing. See GRAMMAR.

PLURALITY, a discrete quantity, consisting of two or a greater number of the same kind: thus we say, a plurality of gods, &c. See the article ASTRONOMY, n° 157. for the arguments both for and against a plurality of worlds.

Plurality of Benefices, or *Livings*, is where the same clerk is possessed of two or more spiritual preferments, with cure of souls. See BENEFICE.

The smallness of some benefices first gave rise to pluralities; for an ecclesiastic, unable to subsist on a single one, was allowed to hold two; and at length the number increased without bounds. A remedy was attempted for this abuse at the council of Lateran under Alexander III. and Innocent III. in the year 1215, when the holding more than one benefice was forbid by a canon under the penalty of deprivation; but the same canon granting the pope a power to dispense with it in favour of persons of distinguished merit, the prohibition became almost useless. They were also restrained by statute 21 Hen. VIII. cap. 13. which enacts, that if any person having one benefice with cure of souls, of the yearly value of 8 l. or above (in the king's books), accept any other with cure of souls, the first shall be adjudged in law to be void, &c. though the same statute provides for dispensation in certain cases.

In England, in order to procure a dispensation, the presentee must obtain of the bishop, in whose diocese the livings are, two certificates of the values in the king's books, and the reputed values and distance; one for the archbishop, and the other for the lord-chancellor. And if the livings lie in two dioceses, then two certificates of the same kind are to be obtained from each bishop. He must also show the archbishop his presentation to the second living; and bring with him two testimonials from the neighbouring clergy concerning his behaviour and conversation, one for the archbishop and the other for the lord-chancellor; and he must also show the archbishop his letters of orders, and a certificate of his having taken the degree of master of arts at the least, in one of the universities of this realm, under the hand of the register. And if he be not doctor or bachelor of divinity, nor doctor nor bachelor of law, he is to procure a qualification of a chaplain, which is to be duly registered in the faculty office, in order to be tendered to the archbishop, according to the statute. And if he hath taken any of the aforesaid degrees, which the statute allows as qualifications, he is to procure a certificate thereof as already mentioned, and to show the same to the archbishop; after which his dispensation is made out at the faculty office, where he gives security according to the direction of the canon. He must then repair to the lord-chancellor for confirmation under the broad seal; and he must apply to the bishop of the diocese where the living lies for his admission and institution. By the several stamp acts, for every skin, or paper, or parchment, &c. on which any dispensation to hold two ecclesiastical dignities or benefices, or a dignity and a benefice, shall be engrossed or written, there shall be paid a treble 40s. stamp duty.

We have also a regulation in regard to pluralities; but it is often dispensed with: for, by the faculty of dispensation, a pluralist is required, in that benefice from which he shall happen to be most absent, to preach 13 sermons every year, and to exercise hospitality for two months yearly.

In Germany the pope grants dispensations for possessing a plurality of benefices, on pretence that the ecclesiastical princes there need large revenues to bear up against the Protestant princes.

PLUS, in algebra, a character marked thus +, used for the sign of addition. See Algebra, p. 400, and *Negative Sine*.

PLUSH, in commerce, &c. a kind of stuff, having a sort of velvet knap or shag on one side, composed regularly of a woof of a single woollen thread and a double warp; the one wool, of two threads twisted; the other goats or camels hair; though there are some plushes entirely of worsted, and others composed wholly of hair.

PLUTARCH, a great philosopher and historian of antiquity, who lived from the reign of Claudius to that of Hadrian, was born at Chæronea, a small city of Bœotia in Greece. Plutarch's family was ancient in Chæronea: his grandfather Lamprias was eminent for his learning and a philosopher; and is often mentioned by Plutarch in his writings, as is also his father. Plutarch was initiated early in study, to which he was naturally inclined; and was placed under the care of Ammonius, an Egyptian, who, having taught philosophy with great reputation at Alexandria, from thence travelled into Greece, and settled at Athens. Under this master he made great advances in knowledge; and like a thorough philosopher, more apt to regard things than words, he pursued this knowledge to the neglect of languages. The Roman language at that time was not only the language of Rome, but of Greece also: and much more used there than the French is now in England. Yet he was so far from regarding it then, that, as we learn from himself, he became not conversant in it till the declension of his life: and, though he is supposed to have resided in Rome near 40 years at different times, yet he never seems to have acquired a competent skill in it. But this was not the worst: he did not cultivate his mother-tongue with any great exactness; and hence that harshness, inequality, and obscurity in his style, which has so frequently and so justly been complained of.

After he was principled and grounded by Ammonius, having an insatiable thirst for knowledge, he resolved to travel. Egypt was at that time, as formerly it had been, famous for learning; and probably the mysteriousness of their doctrine might tempt him, as it had tempted Pythagoras and others, to go and converse with the priesthood of that country. This appears to have been particularly his business, by his treatise *Of Isis and Osiris*: in which he shows himself versed in the ancient theology and philosophy of the wise men. From Egypt he returned into Greece; and visiting in his way all the academies and schools of the philosophers, gathered from them many of those observations with which he has abundantly enriched posterity. He does not seem to have been attached to any particular sect, but culled from each of them whatever he thought excellent and worthy to be regarded. He could not bear the paradoxes of the Stoics, but yet was more averse from the impiety of the Epicureans: in many things he followed Aristotle; but his favourites were Socrates and Plato, whose memory he revered so highly, that he annually celebrated their birth-days with much solemnity. Besides this, he applied himself with extreme diligence to collect not only all books that were excellent in their kind, but also all the sayings and observations of wise men which he had heard in conversation or had received from others by tradition; and likewise to consult the records and public instruments preserved in cities which he had visited in his travels. He took a particular journey to Sparta, to search the archives of that famous commonwealth, to understand thoroughly the model of their ancient government, the history of their legislators, their kings, and their ephori; and digested all their memorable deeds and sayings with much care. He took the same methods with regard to many other commonwealths; and thus was enabled to leave us in his works such a rich cabinet of observation upon men and manners, as, in the opinion of Montaigne and Bayle, have rendered him the most valuable author of antiquity.

The circumstances of Plutarch's life are not known, and therefore cannot be related with any exactness. According to the learned Fabricius, he was born under Claudius, 50 years after the Christian era. He was married to a most amiable woman of his own native town, whose name, according to the probable conjecture of Rualdus, was Timoxena, and to whose sense and virtue he has borne the most affectionate testimony in his moral works. He had several children, and among them two sons; one called *Plutarch* after himself, the other *Lamprias* in memory of his grandfather. Lamprias was he, of all his children, who seems to have inherited his father's philosophy; and to him we owe the table or catalogue of Plutarch's writings, and perhaps also his apophthegms. He had a nephew, Sextus Chæroneus, who taught the learned emperor Marcus Aurelius the Greek tongue, and was much honoured by him. Some think, that the critic Longinus was of his family; and Apuleius, in the first book of his Metamorphoses, affirms himself to be descended from him.

On what occasion, and at what time of his life, he went

went to Rome, how long he lived there, and when he finally returned to his own country, are all uncertain. It is probable, that the fame of him went thither before him, not only because he had published several of his works, but because immediately upon his arrival, as there is reason to believe, he had a great resort of the Roman nobility to hear him: for he tells us himself, that he was so taken up in giving lectures of philosophy to the great men of Rome, that he had not time to make himself master of the Latin tongue, which is one of the first things that would naturally have engaged his attention. It appears that he was several times at Rome; and perhaps one motive to his inhabiting there was the intimacy he had contracted in some of these journeys with Sossius Senecio, a great and worthy man, who had been four times consul, and to whom Plutarch has dedicated many of his lives. But the great inducement which carried him first to Rome, was undoubtedly that which had carried him into so many other parts of the world; namely, to make observations upon men and manners, and to collect materials for writing the lives of the Roman worthies, in the same manner as he had already written those of the Grecian: and accordingly he not only conversed with all the living, but searched the records of the Capitol, and of all the libraries. Not but, as we learn from Suidas, he was intrusted also with the management of public affairs in the empire, during his residence in the metropolis. "Plutarch (says he) lived in the time of Trajan, who bestowed on him the consular ornaments, and also caused an edict to be passed, that the magistrates or officers of Illyria should do nothing in that province without his knowledge and approbation."

When and how he was made known to Trajan is likewise uncertain: but it is generally supposed that Trajan, a private man when Plutarch first came to Rome, was, among other nobility, one of his auditors. It is also supposed, that this wise emperor made use of him in his councils; at least, much of the happiness of his reign has been imputed to Plutarch. Fabricius asserts that he was Trajan's preceptor, and that he was raised to the consular dignity by him, and made procurator of Greece in his old age by the emperor Adrian. We are equally at a loss concerning the time of his abode in the imperial city; which, however, at different times, is not imagined to fall much short of 40 years. The desire of visiting his native country, so natural to all men, and especially when growing old, prevailed with him at length to leave Italy: and at his return he was unanimously chosen archon or chief magistrate of Cheronea, and not long after admitted into the number of the Delphic Apollo's priests. We have no particular account of his death, either as to the manner of it or the year; only it is evident that he lived, and continued his studies, to a good old age. The most probable conjecture is that of Fabricius, who says he died in the fifth year of Adrian at the age of 70.

His works have been divided, and they admit of a pretty equal division, into Lives and Morals: the former of which, in his own estimation, were to be preferred as more noble than the latter. His style, as we have already observed, has been excepted to with some reason: he has also been criticised for some mistakes in Roman antiquities, and for a little partiality to the Greeks. On the other hand, he has been justly praised for the copiousness of his fine sense and learning, for his integrity, and for a certain air of goodness which appears in all he wrote. His business was not to please the ear, but to instruct and charm the mind; and in this none ever went beyond him. Of his moral writings it is to be regretted that we have no elegant English translation. Even his Lives were chiefly known to the English reader by a motley and miserable version, till a new one executed with fidelity and spirit was presented to the public by the Langhornes in 1770. On the whole, it is to be wished that this most amiable moralist and biographer had added a life of himself to those which he has given to the world of others, as the particulars which other writers have preserved of his personal history are very doubtful and imperfect.

PLUTO, in Pagan worship, the king of the infernal regions, was the son of Saturn and Ops, and the brother of Jupiter and Neptune. This deity finding himself childless and unmarried, mounted his chariot to visit the world; and arriving in Sicily, fell in love with Proserpine, whom he saw gathering flowers with her companions in the valley of Enna, near mount Ætna; when, forcing her into his chariot, he drove her to the river Chemarus, through which he opened himself a passage back to the realms of night. See CERES and PROSERPINE.

Pluto is usually represented in an ebony chariot drawn by four black horses; sometimes holding a sceptre, to denote his power; at others, a wand, with which he drives away the ghosts; and at others, some keys, to signify that he had the keys of death. Homer observes, that his helmet had the quality of rendering the wearer invisible, and that Minerva borrowed it in order to be concealed from Mars when she fought against the Trojans. Pluto was greatly revered both by the Greeks and Romans, who erected temples and altars to him. To this god sacrifices were offered in the night, and it was not lawful to offer them by day.

PLUTUS, in Pagan worship, the god of riches, is frequently confounded with Pluto. He was represented as appearing lame when he approached, and with wings at his departure; to show the difficulty of amassing wealth, and the uncertainty of its enjoyment. He was also frequently represented blind, to show that he often bestowed his favours on the most unworthy, and left in necessity those who had the greatest merit.

PLUVIALIS. See CHARADRIUS, n° 7.

PLUVIUS, a surname of Jupiter. He was invoked by that name among the Romans whenever the earth was parched up by continual heat, and was in want of refreshing rains. He had an altar in the temple on the capitol.

PLYERS, in fortification, denote a kind of balance used in raising or letting down a draw-bridge. They consist of two timber levers, twice as long as the bridge they lift, joined together by other timbers framed in the form of a St Andrew's cross to counterpoise them. They are supported by two upright jambs, on which they swing; and the bridge is raised or let down by means of chains joining the ends of the plyers and bridge.

PLYING, in the sea language, the act of making, or endeavouring to make, a progress against the direction of the wind. Hence a ship that advances well in her course in this manner of sailing, is said to be a good plyer.

Plymouth. plyer. See the articles BEATING, PITCHING, and TACKING.

PLYMOUTH, a town of Devonshire, in England, about 215 miles from London, stands between the rivers Plym and Tamar, just before they fall into the British Channel. Erom a mere fishing village it has become one of the largest towns in the county; and is one of the chief magazines in the kingdom, on account of its port, which is one of the safest in England, and which is so large as to be able to contain 1000 sail. It is defended by several different forts, mounting altogether nearly 300 guns; of which the chief is the Royal Citadel, erected in the reign of Charles II. opposite to St Nicholas Island, which is within the circuit of its walls, and contains a large store-house and five regular bastions. In time of war the outward-bound convoys generally rendezvous at Plymouth, and homeward-bound ships generally put in to provide pilots up the Channel. It is also a great place of resort for men of war that are wind-bound.

The mouth of the Tamar is called Ham-Ooze, and that of Plym Catwater, which are both commanded by the castle on St Nicholas Island. About two miles up the mouth of the Tamar there are four docks, two of which were built in the reign of William III. one wet and the other dry, and two which have been built since. They have every conveniency for building or repairing ships, and one of them is hewn out of a mine of slate and lined with Portland stone. This town enjoys a pilchard fishery of considerable importance, and carries on an extensive trade with Newfoundland and the Straits. There is a customhouse in it; and though there are two churches (and besides several meeting-houses), yet each church has so large a cure of souls, that the parish clerks were till very lately in deacon's orders, to enable them to perform all the occasional and other offices. The seat-rents are given to the poor. The lecturers are chosen every three years by the corporation, which was constituted by Henry VI. and consists of a mayor, 12 aldermen, and 24 common-council men. The mayor is elected by a jury of 36 persons, chosen by four others, two of whom are appointed by the mayor and aldermen, and the other two by the common-council. There is also a recorder, and a town-clerk, whose place is very profitable. The town consists of four divisions, which were anciently governed by four captains, each of whom had three constables under him. It is well supplied with fresh water, which was brought from the distance of seven miles, by Sir Francis Drake a native of the town. The toll of the markets, and of the cotton, yarn, &c. with the profit of the mill, which is very considerable, belongs to the corporation, as do the revenues of the shambles, which are farmed out for the mayor's kitchen. There is a charity-school in Plymouth, four hospitals, and a workhouse, in all which 100 poor children are clothed, fed, and taught; and there are two printing-houses. To one of the hospitals Colonel Jory gave a charity for 12 poor widows, as he did a mace worth 120l. to be carried before the mayor, and six good bells, valued at 500l. to Charles-Church, so called from our kings in whose reigns it was begun and finished. In the entrance of the bay lies the famous Edystone-rock, which is covered at high-water, and on which the ingenious Mr Winstanley built a light-house, that was blown down in the terrible hurricane of Nov. 27th 1703, and himself, with others that were with him in it, never more heard of. However, another was erected in the room of it, by the corporation of the Trinity-house, in pursuance of an act of the 5th of Queen Anne, which was destroyed by an accidental fire Dec. 4th 1755, but rebuilt in 1759: which also was burnt down, and rebuilt in the year 1770. In the reign of Edward III. the French landed, and burnt part of the town, but were soon repulsed by Hugh Courtenay earl of Devon. In the reign of Henry IV. the French landed here again, and burnt 600 houses. Between this town and the sea is a hill called the Haw, which has a delightful plain on the top, having a pleasant prospect all round it, and a good landmark for the use of mariners. The list of parliament-men for this borough, formerly divided into two parts, by the names of Sutton-Valtort and Sutton-Prior, commences the 26th of Edward I. and continues to the 14th of Edward III. after which we find no return made for it till the 20th of Henry VI. when the privilege was renewed. On the Haw is a fort, which at once awes the town and defends the harbour. Here is a ferry over the Tamar, called Crumwell or Crimble Passage, the west side of which is called Westone-House, and is in Devonshire, though most of the parish wherein it stands is in Cornwall. In April 1759 the parliament granted 25,159l. for the better fortifying the town and dock of Plymouth; which was visited by George III. with the Queen, &c. in August 1789. N. Lat. 50. 26. W. Long. 4. 15.

Plymouth, Plynteria.

PLYMOUTH, in New England, a sea-port town, and capital of the county of the same name, in the province of Massachusets Bay, in North America. It is remarkable for having been the first settlement in New England, and for having had the first place of worship. It is seated at the south end of Plymouth Bay. W. Long. 70. 10. N. Lat. 41. 58.

PLYNTERIA, a Grecian festival in honour of Aglauros, or rather of Minerva, who received from the daughter of Cecrops the name of Aglauros. The word is derived from πλυνειν, *lavare*, because during the solemnity they undressed the statue of the goddess and washed it. The day on which it was observed was looked upon as unfortunate and inauspicious; and therefore no person was permitted to appear in the temples, as they were purposely surrounded with ropes. The arrival of Alcibiades in Athens that day was thought very unfortunate, but the success that ever after attended him proved it to be otherwise. It was customary at this festival to bear in procession a cluster of figs; which intimated the progress of civilization among the first inhabitants of the earth, as figs served them for food after they had found a dislike for acorns.

PNEUMATICS.

PNEUMATICS.

1 Definition of the term. THIS term is restricted, in the present habits of our language, to that part of natural philosophy which treats of the mechanical properties of elastic fluids. The word, in its original meaning, expresses a quality of air, or more properly of breath. Under the article PHYSICS we observed, that in a great number of languages the term used to express breath was also one of the terms used to express the animating principle, nay, the intellectual substance, the soul. It has been perhaps owing to some attention to this chance of confusion that our philosophers have appropriated the term PNEUMATICS to the science of the mechanical properties of air, and PNEUMATOLOGY to the science of the intellectual phenomena consequent on the operations or affections of our thinking principle.

2 Extent of the science. We have extended (on the authority of present custom) the term PNEUMATICS to the study of the mechanical properties of all elastic or sensibly compressible fluids, that is, of fluids whose elasticity and compressibility become an interesting object of our attention; as the term HYDROSTATICS is applied to the study of the mechanical properties of such bodies as interest us by their fluidity or liquidity only, or whose elasticity and compressibility are not familiar or interesting, though not less real or general than in the case of air and all vapours.

3 No precise limit to the different classes of bodies. We may be indulged in the observation by the bye, that there is no precise limit to the different classes of natural bodies with respect to their mechanical properties. There is no such thing as a body perfectly hard, perfectly soft, perfectly elastic, or perfectly incompressible. All bodies have some degree of elasticity intermixed with some degree of ductility. Water, mercury, oil, are compressible; but their compressibility need not be attended to in order perfectly to understand the phenomena consequent on their materiality, fluidity, and gravity. But if we neglect the compressibility of air, we remain ignorant of the cause and nature of its most interesting phenomena, and but imperfectly informed with respect to those in which its elasticity has no share; and it is convenient to attend to this distinction in our researches, in order to understand those phenomena which depend solely or chiefly on compressibility and elasticity. This observation is important; for here elasticity appears in its most simple form, unaccompanied with any other mechanical affection of matter (if we except gravity), and lies most open to our observation, whether employed for investigating the nature of this very property of bodies, or for explaining its mode of action. We shall even find that the constitution of an avowedly elastic fluid, whose compressibility is so very sensible, will give us the distinctest notions of fluidity in general, and enable us to understand its *characteristic appearances*, by which it is distinguished from solidity, namely, the *equable* distribution of pressure thro' all its parts in every direction, and the horizontality which its surface assumes by the action of gravity: phenomena which have been assumed as equivalent to the definition of a perfect fluid, and from which all the laws of hydrostatics and hydraulics have been derived. And these laws have been applied to the explanation of the phenomena around us; and water, mercury, oil, &c. have been denominated fluid only because their appearances have been found to tally exactly with these consequences of this definition, while the definition itself remains in the form of an assumption, unsupported by any other proof of its obtaining in nature. A real mechanical philosopher will therefore attach himself with great eagerness to this property, and consider it as an introduction to much natural science.

4 Air the most familiar compressible fluid. Of all the sensibly compressible fluids air is the most familiar, was the first studied, and the most minutely examined. It has therefore been generally taken as the example of their mechanical properties, while those mechanical properties which are peculiar to any of them, and therefore characteristic, have usually been treated as an appendix to the general science of pneumatics. No objection occurs to us against this method, which will therefore be adopted in treating this article.

5 Different properties of it. But although the mechanical properties are the proper subjects of our consideration, it will be impossible to avoid considering occasionally properties which are more of a chemical nature; because they occasion such modifications of the mechanical properties as would frequently be unintelligible without considering them in conjunction with the other; and, on the other hand, the mechanical properties produce such modifications of the properties merely chemical, and of very interesting phenomena consequent on them, that these would often pass unexplained unless we give an account of them in this place.

6 Mechanical properties. By *mechanical properties* we would be understood to mean such as produce, or are connected with, sensible changes of motion, and which indicate the presence and agency of moving or mechanical powers. They are therefore the subject of mathematical discussion; admitting of measure, number, and direction, notions purely mathematical.

We shall therefore begin with the consideration of air.

7 What is air? It is by no means an idle question, "*What is this* air of which so much is said and written?" We see nothing, we feel nothing. We find ourselves at liberty to move about in any direction without any let or hinderance. Whence, then, the assertion, that we are surrounded with a *matter* called air? A few very simple observations and experiments will show us that this assertion is well founded.

8 Proofs that it is matter. We are accustomed to say, that a vessel is empty when we have poured out of it the water which it contained. Take a cylindrical glass jar (fig. 1.), having a small hole in its bottom; and having stopped this hole, fill the jar with water, and then pour out the water, leaving the glass empty, in the common acceptation of the word. Now, throw a bit of cork, or any light body, on the surface of water in a cistern: cover this with the glass jar held in the hand with its bottom upwards, and move it downwards, keeping it all the while in an upright position. The cork will continue to float on the surface of the water in the inside of the glass, Plate CCXCIX.

and will most distinctly show whereabouts that surface is. It will thus be seen, that the water within the glass has its surface considerably lower than that of the surrounding water; and however deep we immerge the glass, we shall find that the water will never rise in the inside of it so as to fill it. If plunged to the depth of 32 feet, the water will only half fill it; and yet the acknowledged laws of hydrostatics tell us, that the water would fill the glass if there were nothing to hinder it. There is therefore something already within the glass which prevents the water from getting into it; manifesting in this manner the most distinctive property of matter, viz. the hindering other matter from occupying the same place at the same time.

9 Possessed of impulsive force, While things are in this condition, pull the stopper out of the hole in the bottom of the jar, and the water will instantly rise in the inside of the jar, and stand at an equal height within and without. This is justly ascribed to the escape through the hole of the *matter* which formerly obstructed the entry of the water: for if the hand be held before the hole, a puff will be distinctly felt, or a feather held there will be blown aside; indicating in this manner that what prevented the entry of the water, and now escapes, possesses another characteristic property of matter, *impulsive force*. The materiality is concluded from this appearance in the same manner that the materiality of water is concluded from the impulse of a jet from a pipe. We also see the mobility of the formerly pent up, and now liberated, substance, in consequence of external pressure, viz. the pressure of the surrounding water.

10 Impenetrability, Also, if we take a smooth cylindrical tube, shut at one end, and fit a plug or cork to its open end, so as to slide along it, but so tightly as to prevent all passage by its sides; and if the plug be well soaked in grease, we shall find that no force whatever can push it to the bottom of the tube. There is therefore *something* within the tube preventing by its impenetrability the entry of the plug, and therefore possessing this characteristic of matter.

11 Elasticity, In like manner, if, after having opened a pair of common bellows, we shut up the nozzle and valve hole, and try to bring the boards together, we find it impossible. There is something included which prevents this, in the same manner as if the bellows were filled with wool; but on opening the nozzle we can easily shut them, viz. by expelling this something; and if the compression is forcible, the something will issue with considerable force, and very sensibly impel any thing in its way.

12 Inertia, and mobility. It is not accurate to say, that we move about without *any* obstruction; for we find, that if we endeavour to move a large fan with rapidity, a very sensible hinderance is perceived, and that a very sensible force must be exerted; and a sensible wind is produced, which will agitate the neighbouring bodies. It is therefore justly concluded that the motion is possible only in consequence of having driven this obstructing substance out of the way; and that this impenetrable, resisting, moveable, impelling substance, is *matter*. We perceive the perseverance of this matter in its state of rest when we wave a fan, in the same manner that we perceive the *inertia* of water when we move a paddle through it. The effects of wind in impelling our ships and mills, in tearing up trees, and overturning buildings, are equal indications of its perseverance in a state of motion.

To this matter, when at rest, we give the name Air; and when it is in motion we call it Wind.

Air, therefore, is a material fluid: a fluid, because its parts are easily moved, and yield to the smallest inequality of pressure. 13 It is therefore a material fluid,

Air possesses some others of the very general, though not essential, properties of matter. It is heavy. This appears from the following facts. 14 Heavy, and

1. It always accompanies this globe in its orbit round the sun, surrounding it to a certain distance, under the name of the Atmosphere, which indicates the being connected with the earth by its general force of gravity. It is chiefly in consequence of this that it is continually moving round the earth from east to west; forming what is called the trade-wind, to be more particularly considered afterwards. All that is to be observed on this subject at present is, that, in consequence of the disturbing force of the sun and moon, there is an accumulation of the air of the atmosphere, in the same manner as of the waters of the ocean, in those parts of the globe which have the moon near their zenith or nadir: and as this happens successively, going from the east to the west (by the rotation of the earth round its axis in the opposite direction), the accumulated air must gradually flow along to form the elevation. This is chiefly to be observed in the torrid zone; and the generality and regularity of this motion are greatly disturbed by the changes which are continually taking place in different parts of the atmosphere from causes which are not mechanical.

2. It is in like manner owing to the gravity of the air that it supports the clouds and vapours which we see constantly floating in it. We have even seen bodies of no inconsiderable weight float, and even rise, in the air. Soap bubbles, and balloons filled with inflammable gas, rise and float in the same manner as a cork rises in water. This phenomenon proves the weight of the air in the same manner that the swimming of a piece of wood indicates the weight of the water which supports it. 15 Supports the clouds.

3. But we are not left to these refined observations for the proof of the air's gravity. We may observe familiar phenomena, which would be immediate consequences of the supposition that air is a heavy fluid, and, like other heavy fluids, presses on the outsides of all bodies immersed in or surrounded by it. Thus, for instance, if we shut the nozzle and valve hole of a pair of bellows after having squeezed the air out of them, we shall find that a very great force, even some hundred pounds, is necessary for separating the boards. They are kept together by the pressure of the heavy air which surrounds them in the same manner as if they were immersed in water. In like manner, if we stop the end of a syringe after its piston has been pressed down to the bottom, and then attempt to draw up the piston, we shall find a considerable force necessary, viz. about 15 or 16 pounds for every square inch of the section of the syringe. Exerting this force, we can draw up the piston to the top, and we can hold it there; but the moment we cease acting, the piston rushes down and strikes the bottom. It is called a suction, as we feel something as it were drawing in the piston; but it is really the weight of 16 Familiar proofs of its weight.

of the incumbent air pressing it in. And this obtains in every position of the syringe; because the air is a fluid, and presses in every direction. Nay, it presses on the syringe as well as on the piston; and if the piston be hung by its ring on a nail, the syringe requires force to draw it down (just as much as to draw the piston up); and if it be let go, it will spring up, unless loaded with at least 15 pounds for every square inch of its transverse section (see fig. 2.)

Plate CCCXCIX

17 It may even be weighed.

4. But the most direct proof of the weight of the air is had by weighing a vessel empty of air, and then weighing it again when the air has been admitted; and this, as it is the most obvious consequence of its weight, has been asserted as long ago as the days of Aristotle. He says (περὶ οὐρανου, iv. 4.), That all bodies are heavy in their place except fire: even air is heavy; for a blown bladder is heavier than when it is empty. It is somewhat surprising that his followers should have gone into the opposite opinion, while professing to maintain the doctrine of their leader. If we take a very large and limber bladder, and squeeze out the air very carefully, and weigh it, and then fill it till the wrinkles just begin to disappear, and weigh it again, we shall find no difference in the weight. But this is not Aristotle's meaning; because the bladder, considered as a vessel, is equally full in both cases, its dimensions being changed. We cannot take the air out of a bladder without its immediately collapsing. But what would be true of a bladder would be equally true of any vessel. Therefore, take a round vessel A (fig. 3.), fitted with a stopcock B, and syringe C. Fill the whole with water, and press the piston to the bottom of the syringe. Then keeping the cock open, and holding the vessel upright, with the syringe undermost, draw down the piston. The water will follow it by its weight, and leave part of the vessel empty. Now shut the cock, and again push up the piston to the bottom of the syringe; the water escapes through the piston valve, as will be explained afterward: then opening the cock, and again drawing down the piston, more water will come out of the vessel. Repeat this operation till all the water have come out. Shut the cock, unscrew the syringe, and weigh the vessel very accurately. Now open the cock, and admit the air, and weigh the vessel again, it will be found heavier than before, and this additional weight is the weight of the air which fills it; and it will be found to be 523 grains, about an ounce and a fifth avoirdupoise, for every cubic foot that the vessel contains. Now since a cubic foot of water would weigh 1000 ounces, this experiment would show that water is about 840 times heavier than air. The most accurate judgment of this kind of which we have met with an account is that recorded by Sir George Shuckbourgh, which is in the 67th vol. of the Philosophical Transactions, p. 560. From this it follows, that when the air is of the temperature 53, and the barometer stands at 29¾ inches, the air is 836 times lighter than water. But the experiment is not susceptible of sufficient accuracy for determining the exact weight of a cubic foot of air. Its weight is very small; and the vessel must be strong and heavy, so as to overload any balance that is sufficiently nice for the experiment.

18 The most convenient method of doing this.

To avoid this inconvenience, the whole may be weighed in water, first loading the vessel so as to make it preponderate an ounce or two in the water. By this means the balance will be loaded only with this small preponderancy. But even in this case there are considerable sources of error, arising from changes in the specific gravity of the water and other causes. The experiment has often been repeated with this view, and the air has been found at a medium to be about 840 times as light as water, but with great variations, as may be expected from its very heterogeneous nature, in consequence of its being the menstruum of almost every fluid, of all vapours, and even of most solid bodies; all which it holds in solution, forming a fluid perfectly transparent, and of very different density according to its composition. It is found, for instance, that perfectly pure air of the temperature of our ordinary summer is considerably denser than when it has dissolved about half as much water as it can hold in that temperature; and that with this quantity of water the difference of density increases in proportion as the mass grows warmer, for damp air is more expansible by heat than dry air. We shall have occasion to consider this subject again, when we treat of the connection of the mechanical properties of air with the state of the weather. See Weather.

Such is the result of the experiment suggested by Aristotle, evidently proving the weight of the air; and yet, as has been observed, the Peripatetics, who profess to follow the *dictates* of Aristotle, uniformly refused it this property. It was a matter long debated among the philosophers of the last century. The reason was, that Aristotle, with that indistinctness and inconsistency which is observed in all his writings which relate to matters of fact and experience, assigns a different cause to many phenomena which any man led by common observation would ascribe to the weight of the air. Of this kind is the rise of water in pumps and syphons, which all the Peripatetics had for ages ascribed to something which they called *nature's abhorrence of a void*. Aristotle had asserted (for reasons not our business to adduce at present), that all nature was full of being, and that nature abhorred a void. He adduces many facts, in which it appears, that if not absolutely impossible, it is very difficult, and requires great force, to produce a space void of matter. When the operation of pumps and syphons came to be known, the philosophers of Europe (who had all embraced the Peripatetic doctrines) found in this fancied horror of a fancied mind (what else is this that nature abhors?) a ready solution of the phenomena. We shall state the facts, that every reader may see what kinds of reasoning were received among the learned not two centuries ago. 19 This property of air denied by the Peripatetics, though acknowledged by their master.

Pumps were then constructed in the following manner: A long pipe GB (fig. 4.) was set in the water of the well A. This was fitted with a sucker or piston C, having a long rod CF, and was furnished with a valve B at the bottom, and a lateral pipe DE at the place of delivery, also furnished with a valve. The fact is, that if the piston be thrust down to the bottom, and then drawn up, the water will follow it; and upon the piston being again pushed down, the water shuts the valve B by its weight, and escapes or is expelled at the valve E; and on drawing up the piston again the valve E is shut, the water again rises after the piston, and is again expelled at its next descent. 20 Construction of pumps in the last century.

The Peripatetics explain all this by saying, that if the water did *not follow the piston* there would be a void between

21 Their operation accounted for by the Peripatetics. between them. But nature abhors a void; or a void is impossible: therefore the water follows the piston.—It is not worth while to criticise the wretched reasoning in this pretence to explanation. It is all overturned by one observation. Suppose the pipe shut at the bottom, the piston *can* be drawn up, and thus a void produced. No, say the Peripatetics; and they speak of certain spirits, effluvia, &c. which occupy the place. But if so, why needs the water rise? This therefore is not the cause of its ascent. It is a curious and important phenomenon.

22 Galileo first accounted for it rationally. The sagacious Galileo seems to have been the first who seriously ascribed this to the weight of the air. Many before him had supposed air heavy; and thus explained the difficulty of raising the board of bellows, or the piston of a syringe, &c. But he distinctly applies to this allowed weight of the air all the consequences of hydrostatical laws; and he reasons as follows.

23 By the weight of the atmosphere, The heavy air rests on the water in the cistern, and presses it with its weight. It does the same with the water in the pipe, and therefore both are on a level: but if the piston, after being in contact with the surface of the water, be drawn up, there is no longer any pressure on the surface of the water within the pipe; for the air now rests on the piston only, and thus occasions a difficulty in drawing it up. The water in the pipe, therefore, is in the same situation as if more water were poured into the cistern, that is, as much as would exert the same pressure on its surface as the air does. In this case we are certain that the water will be pressed into the pipe, and will raise up the water already in it, and follow it till it is equally high within and without. The same pressure of the air shuts the valve E during the descent of the piston. (See *Gal. Discourses.*)

24 And predicted the height to which water would rise in them. He did not wait for the very obvious objection, that if the rise of the water was the effect of the air's pressure, it would also be its measure, and would be raised and supported only to a certain height. He directly said so, and adduced this as a decisive experiment. If the horror of a void be the cause, says he, the water must rise to any height however great; but if it be owing to the pressure of the air, it will only rise till the weight of the water in the pipe is in equilibrio with the pressure of the air, according to the common laws of hydrostatics. And he adds, that this is well known; for it is a fact, that pumps will not *draw* water much above forty palms, although they may be made to *propel* it, or to *lift it* to any height. He then makes an assertion, which, if true, will be decisive. Let a very long pipe, shut at one end, be filled with water, and let it be erected perpendicularly with the close end uppermost, and a stopper in the other end, and then its lower orifice immersed into a vessel of water; the water will subside in the pipe upon removing the stopper, till the remaining column is in equilibrio with the pressure of the external air. This experiment he proposes to the curious; saying, however, that he thought it unnecessary, there being already such abundant proofs of the air's pressure.

25 His prediction verified by Toricelli's experiment. It is probable that the cumbersomeness of the necessary apparatus protracted the making of this experiment. Another equally conclusive, and much easier, was made in 1642 after Galileo's death, by his zealous and learned disciple Toricelli. He filled a glass tube, close at one end, with mercury; judging, that if the support of the water was owing to the pressure of the air, and was the measure of this pressure, mercury would in like manner be supported by it, and this at a height which was also the measure of the air's pressure, and therefore 13 times less than water. He had the pleasure of seeing his expectation verified in the completest manner; the mercury descending in the tube AB (fig. 5.), and finally settling at the height *f*B of 29½ Roman inches: and he found, that when the tube was inclined, the point *f* was in the same horizontal plane with *f* in the upright tube, according to the received laws of hydrostatical pressure. The experiment was often repeated, and soon became famous, exciting great controversies among the philosophers about the possibility of a vacuum. About three years afterwards the same experiment was published, at Warsaw in Poland, by Valerianus Magnus as his own suggestion and discovery: but it appears plain from the letters of Roberval, not only that Toricelli was prior, and that his experiment was the general topic of discussion among the curious; but also highly probable that Valerianus Magnus was informed of it when at Rome, and daily conversant with those who had seen it. He denies, however, even having heard of the name of Toricelli. Plate CCCXCIX

This was the era of philosophical ardour; and we think that it was Galileo's invention and immediate application of the telescope which gave it vigour. Discoveries of the most wonderful kind in the heavens, and which required no extent of previous knowledge to understand them, were thus put into the hands of every person who could purchase a spy-glass; while the high degree of credibility which some of the discoveries, such as the phases of Venus and the rotation and satellites of Jupiter, gave to the Copernican system, immediately set the whole body of the learned in motion. Galileo joined to his ardour a great extent of learning, particularly of mathematical knowledge and sound logic, and was even the first who formally united mathematics with physics; and his treatise on accelerated motion was the first, and a precious fruit of this union. About the years 1642 and 1644, we find clubs of gentlemen associated in Oxford and London for the cultivation of knowledge by experiment; and before 1655 all the doctrines of hydrostatics and pneumatics were familiar there, established upon experiment. Mr Boyle procured a coalition and correspondence of these clubs under the name of the Invisible and Philosophical Society. In May 1658 Mr Hooke finished for Mr Boyle an air-pump, which had employed him a long time, and occasioned him several journeys to London for things which the workmen of Oxford could not execute. He speaks of this as a great improvement on Mr Boyle's own pump, which he had been using some time before. Boyle therefore must have invented his air-pump, and was not indebted for it to Schottus's account of Otto Guerick's, published in his (Schottus) *Mechanica Hydraulo-pneumatica* in 1657, as he asserts (*Techna Curiosa*). The Royal Society of London arose in 1656 from the coalition of these clubs, after 15 years co-operation and correspondence. The Montmorine Society at Paris had subsisted nearly about the same time; for we find Paschal in 1648 speaking of the meetings in the Sorbonne College, from which we know that society originated.—Nuremberg, in Germany, was also a distinguished seminary of experimental philosophy. The magistrates, 26 Origin of the Royal Society, &c. 27 Invention of the air-pump.

magistrates, sensible of its valuable influence in manufactures, the source of the opulence and prosperity of their city, and many of them philosophers, gave philosophy a professed and munificent patronage, furnishing the philosophers with a copious apparatus, a place of assembly, and a fund for the expence of their experiments; so that this was the first academy of sciences out of Italy under the patronage of government. In Italy, indeed, there had long existed institutions of this kind. Rome was the centre of church-government, and the resort of all expectants for preferment. The clergy were the majority of the learned in all Christian nations, and particularly of the systematic philosophers. Each, eager to recommend himself to notice, brought forward every thing that was curious; and they were the willing vehicles of philosophical communication. Thus the experiments of Galileo and Toricelli were rapidly diffused by persons of rank, the dignitaries of the church, or by the monks their obsequious servants. Perhaps the recent defection of England, and the want of a residing embassy at Rome, made her sometimes late in receiving or spreading philosophical researches, and was the cause that more was done there *proprio Marte*.

18 The experiments of Galileo and Toricelli rapidly diffused.

We hope to be excused for this digression. We were naturally led into it by the pretensions of Valerianus Magnus to originality in the experiment of the mercury supported by the pressure of the air. Such is the strength of national attachment, that there were not wanting some who found that Toricelli had borrowed his experiment from Honoratus Fabri, who had proposed and explained it in 1641; but whoever knows the writings of Toricelli, and Galileo's high opinion of him, will never think that he could need such helps. (See this surmise of Mounier in *Schott. Tech. Cur.* III. at the end.

19 The merit of Toricelli's claimed by others

Galileo must be considered as the author of the experiment when he proposes it to be made. Valerianus Magnus owns himself indebted to him for the principle and the contrivance of the experiment. It is neither wonderful that many ingenious men, of one opinion, and instructed by Galileo, should separately hit on so obvious a thing; nor that Toricelli, his immediate disciple, his enthusiastic admirer, and who was in the habits of corresponding with him till his death in 1642, should be the first to put it in practice. It became the subject of dispute from the national arrogance and self-conceit of some Frenchmen, who have always shown themselves disposed to consider their nation as at the head of the republic of letters, and cannot brook the concurrence of any foreigners. Roberval was in this instance, however, the champion of Toricelli; but those who know his controversies with the mathematicians of France at this time will easily account for this exception.

30 Unjustly.

All now agree in giving Toricelli the honour of the *first* invention; and it universally passes by the name of the Toricellian Experiment. The tube is called the Toricellian Tube; and the space left by the mercury is called the Toricellian Vacuum, to distinguish it from the Boylean-Vacuum, which is only an extreme rarefaction.

31 It was repeated in various forms.

The experiment was repeated in various forms, and with apparatus which enabled philosophers to examine several effects which the vacuum produced on bodies exposed in it. This was done by making the upper part of the tube terminate in a vessel of some capacity, or communicate with such a vessel, in which were included along with the mercury bodies on which the experiments were to be made. When the mercury had run out, the phenomena of these bodies were carefully observed.

32 An objection to the conclusion drawn from it obviated.

An objection was made to the conclusion drawn from Toricelli's experiment, which appears formidable. If the Toricellian tube be suspended on the arm of a balance, it is found that the counterpoise must be equal to the weight both of the tube and of the mercury it contains. This could not be, say the objectors, if the mercury were supported by the air. It is evidently supported by the balance; and this gave rise to another notion of the cause different from the peripatetic *fuga vacui*: a suspensive force, or rather attraction, was assigned to the upper part of the tube.

But the true explanation of the phenomenon is most easy and satisfactory. Suppose the mercury in the cistern and tube to freeze, but without adhering to the tube, so that the tube could be freely drawn up and down. In this case the mercury is supported by the base, without any dependence on the pressure of the air; and the tube is in the same condition as before, and the solid mercury performs the office of a piston to this kind of syringe. Suppose the tube thrust down till the top of it touches the top of the mercury. It is evident that it must be drawn up in opposition to the pressure of the external air, and it is precisely similar to the syringe mentioned in n° 16. The weight sustained therefore by this arm of the balance is the weight of the tube and the downward pressure of the atmosphere on its top.

33 Galileo's original experiment performed.

The curiosity of philosophers being thus excited by this very manageable experiment, it was natural now to try the original experiment proposed by Galileo. Accordingly Berti in Italy, Paschal in France, and many others in different places, made the experiment with a tube filled with water, wine, oil, &c. and all with the success which might be expected in so simple a matter: and the doctrine of the weight and pressure of the air was established beyond contradiction or doubt. All was done before the year 1648.—A very beautiful experiment was exhibited by Auzout, which completely satisfied all who had any remaining doubts.

34 An experiment by Auzout Plate CCCXCIX.

A small box or phial EFGH (fig. 6.) had two glass tubes, AB, CD, three feet long, inserted into it in such a manner as to be firmly fixed in one end, and to reach nearly to the other end. AB was open at both ends, and CD was close at D. This apparatus was completely filled with mercury, by unscrewing the tube AB, filling the box, and the hole CD; then screwing in the tube AB, and filling it: then holding a finger on the orifice A, the whole was inverted and set upright in the position represented in figure 8, immersing the orifice A (now *a*) in a small vessel of quicksilver. The result was, that the mercury ran out at the orifice *a*, till its surface *m n* within the phial descended to the top of the tube *b a*. The mercury also began to descend in the tube *d c* (formerly DC) and run over into the tube *b a*, and ran out at *a*, till the mercury in *d c* was very near equal in a level with *m n*. The mercury descending in *b a* till it stood at *k*, $29\frac{1}{2}$ inches above the surface *o p* of the mercury in the cistern, just as in the Toricellian tube.

The rationale of this experiment is very easy. The whole apparatus may first be considered as a Toricellian tube of an uncommon shape, and the mercury would flow out at *a*. But as soon as a drop of mercury comes out, leaving a space above *m n*, there is nothing to keep up the mercury in the tube *d c*. Its mercury therefore descends also; and running over into *b a*, continues to supply its expence till the tube *d c* is almost empty, or can no longer supply the waste of *b a*. The inner surface therefore falls as low as it can, till it is level with *b*. No more mercury can enter *b a*, yet its column is too heavy to be supported by the pressure of the air on the mercury in the cistern below; it therefore descends in *b a*, and finally settles at the height *k o*, equal to that of the mercury in the Toricellian tube.

35 Decisive of the question.

The prettiest circumstance of the experiment remains. Make a small hole *g* in the upper cap of the box. The external air immediately rushes in by its weight, and now presses on the mercury in the box. This immediately raises the mercury in the tube *d c* to *l*, 29½ inches above *m n*. It presses on the mercury at *k* in the tube *b a*, balancing the pressure of the air in the cistern. The mercury in the tube therefore is left to the influence of its own weight, and it descends to the bottom. Nothing can be more apposite or decisive.

36 The gravity of the air therefore a statical principle from which we obtain

And thus the doctrine of the gravity and pressure of the air is established by the most unexceptionable evidence: and we are intitled to assume it as a statical principle, and to affirm *à priori* all its legitimate consequences.

And in the first place, we obtain an exact measure of the pressure of the atmosphere. It is precisely equal to the weight of the column of mercury, of water, of oil, &c. which it can support; and the Toricellian tube, or others fitted up upon the same principle, are justly termed *baroscopes* and *barometers* with respect to the air. Now it is observed that water is supported at the height of 32 feet nearly: The weight of the column is exactly 2000 avoirdupois pounds on every square foot of base, or 13$\frac{8}{10}$ on every square inch. The same conclusion very nearly may be drawn from the column of mercury, which is nearly 29½ inches high when in equilibrium with the pressure of the air. We may here observe, that the measure taken from the height of a column of water, wine, spirits, and the other fluids of considerable volatility, as chemists term it, is not so exact as that taken from mercury, oil, and the like. For it is observed, that the volatile fluids are converted by the ordinary heat of our climates into vapour when the confining pressure of the air is removed; and this vapour, by its elasticity, exerts a small pressure on the surface of the water, &c. in the pipe, and thus counteracts a small part of the external pressure; and therefore the column supported by the remaining pressure must be lighter, that is, shorter. Thus it is found, that rectified spirits will not stand much higher than is competent to a weight of 13 pounds on an inch, the elasticity of its vapour balancing about $\frac{1}{15}$ of the pressure of the air. We shall afterwards have occasion to consider this matter more particularly.

37 An exact measure of the pressure of the atmosphere

As the medium height of the mercury in the barometer is 29½ inches, we see that the whole globe sustains a pressure equal to the whole weight of a body of mercury of this height; and that all bodies on its surface sustain a part of this in proportion to their surfaces. An ordinary sized man sustains a pressure of several thousand pounds. How comes it then that we are not sensible of a pressure which one should think enough to crush us together? This has been considered as a strong objection to the pressure of the air; for when a man is plunged a few feet under water, he is very sensible of the pressure. The answer is by no means so easy as is commonly imagined. We feel very distinctly the effects of removing this pressure from any part of the body. If any one will apply the open end of a syringe to his hand, and then draw up the piston, he will find his hand sucked into the syringe with great force, and it will give pain; and the soft part of the hand will swell into it, being pressed in by the neighbouring parts, which are subject to the action of the external air. If one lays his hand on the top of a long perpendicular pipe, such as a pump filled to the brim with water, which is at first prevented from running out by the valve below; and if the valve be then opened, so that the water descends, he will then find his hand so hard pressed to the top of the pipe that he cannot draw it away. But why do we only feel the *inequality* of pressure? There is a similar instance wherein we do not feel it, although we cannot doubt of its existence. When a man goes slowly to a great depth under water in a diving-bell, we know unquestionably that he is exposed to a new and very great pressure, yet he does not feel it. But those facts are not sufficiently familiar for general argument. The human body is a bundle of solids, hard or soft, filled or mixed with fluids, and there are few or no parts of it which are empty. All communicate either by vessels or pores; and the whole surface is a sieve through which the insensible perspiration is performed. The whole extended surface of the lungs is open to the pressure of the atmosphere; every thing is therefore in equilibrio: and if free or speedy access be given to every part, the body will not be damaged by the pressure, however great, any more than a wet sponge would be deranged by plunging it any depth in water. The pressure is instantaneously diffused by means of the incompressible fluids with which the parts are filled; and if any parts are filled with air or other compressible fluids, these are compressed till their elasticity again balances the pressure. Besides, all our fluids are acquired slowly, and gradually mixed with that proportion of air which they can dissolve or contain. The whole animal has grown up in this manner from the first vital atom of the embryo. For such reasons the pressure can occasion no change of shape by squeezing together the flexible parts; nor any obstruction by compressing the vessels or pores. We cannot say what would be felt by a man, were it possible that he could have been produced and grown up *in vacuo*, and then subjected to the compression. We even know that any sudden and considerable change of general pressure is very severely felt. Persons in a diving-bell have been almost killed by letting them down or drawing them up too suddenly. In drawing up, the elastic matters within have suddenly swelled, and not finding an immediate escape have burst the vessels. Dr Halley experienced this, the blood gushing out from his ears by the expansion of air contained in the internal cavities of this organ, from which there are but very slender passages.

38 A difficulty solved.

39 **The weather-glass.**

A very important observation recurs here: the pressure of the atmosphere is variable. This was observed almost as soon as philosophers began to attend to the barometer. Paschal observed it in France, and Descartes observed it in Sweden in 1650. Mr Boyle and others observed it in England in 1656. And before this, observers, who took notice of the concomitancy of these changes of aerial pressure with the state of the atmosphere, remarked, that it was generally greatest in winter and in the night; and certainly most variable during winter and in the northern regions. Familiar now with the weight of the air, and considering it as the vehicle of the clouds and vapours, they noted with care the connection between the weather and the pressure of the air, and found that a great pressure of the air was generally accompanied with fair weather, and a diminution of it with rain and mists. Hence the barometer came to be considered as an index not only of the present state of the air's weight, but also as indicating by its variations changes of weather. It became a WEATHER-GLASS, and continued to be anxiously observed with this view. This is an important subject, and will afterwards be treated in some detail.

40 **The pressure of the air in proportion to the elevation**

In the next place, we may conclude that the pressure of the air will be different in different places, according to their elevation above the surface of the ocean: for if air be an heavy fluid, it must press in some proportion according to its perpendicular height. If it be a homogeneous fluid of equal density and weight in all its parts, the mercury in the cistern of a barometer must be pressed precisely in proportion to the depth to which that cistern is immersed in it; and as this pressure is exactly measured by the height of the mercury in the tube, the height of the mercury in the Toricellian tube must be exactly proportional to the depth of the place of observation under the surface of the atmosphere.

41 **First supposed by Descartes and Paschal, and proved by experiments,**

The celebrated Descartes first entertained this thought (Epist. 67. of Pr. III.), and soon after him Paschal. His occupation in Paris not permitting him to try the justness of his conjecture, he requested Mr Perrier, a gentleman of Clermont in Auvergne, to make the experiment, by observing the height of the mercury at one and the same time at Clermont and on the top of a very high mountain in the neighbourhood. His letters to Mr Perrier in 1647 are still extant. Accordingly Mr Perrier, in September 1648, filled two equal tubes with mercury, and observed the heights of both to be the same, viz. $26\frac{7}{12}$ inches, in the garden of the convent of the Friars Minims, situated in the lowest part of Clermont. Leaving one of them there, and one of the fathers to observe it, he took the other to the top of Puy de Domme, which was elevated nearly 500 French fathoms above the garden. He found its height to be $23\frac{2}{12}$ inches. On his return to the town, in a place called *Font de l'Arbre*, 150 fathoms above the garden, he found it 25 inches; when he returned to the garden it was again $26\frac{7}{12}$, and the person set to watch the tube which had been left said that it had not varied the whole day. Thus a difference of elevation of 3000 French feet had occasioned a depression of $3\frac{1}{8}$ inches; from which it may be concluded, that $3\frac{1}{8}$ inches of mercury weighs as much as 3000 feet of air, and one-tenth of an inch of mercury as much as 96 feet of air. The next day he found, that taking the tube to the top of a steeple 120 feet high made a fall of one-sixth of an inch. This gives 72 feet of air for one-tenth of an inch of mercury; but ill agreeing with the former experiment. But it is to be observed, that a very small error of observation of the barometer would correspond to a great difference of elevation, and also that the height of the mountain had not been measured with any precision. This has been since done (Mem. Acad. par. 1703), and found to be 529 French toises.

42 **Which were repeated by others.**

Paschal published an account of this great experiment (*Grande Exp. sur. la Pesanteur de l'Air*), and it was quickly repeated in many places of the world. In 1653 it was repeated in England by Dr Power (Power's Exper. Phil.); and in Scotland, in 1661, by Mr Sinclair professor of philosophy in the university of Glasgow, who observed the barometer at Lanark, on the top of mount Tintock in Clydsdale, and on the top of Arthur's Seat at Edinburgh. He found a depression of two inches between Glasgow and the top of Tintock, three quarters of an inch between the bottom and top of Arthur's Seat, and $\frac{5}{12}$ of an inch at the cathedral of Glasgow on a height of 126 feet. See Sinclair's *Ars Nova et Magna Gravitatis et Levitatis; Sturmii Collegium Experimentale*, and *Schotti Technica Curiosa*.

43 **Hence a method of measuring heights,**

Hence we may derive a method of measuring the heights of mountains. Having ascertained with great precision the elevation corresponding to a fall of one-tenth of an inch of mercury, which is nearly 90 feet, we have only to observe the length of the mercurial column at the top and bottom of the mountain, and to allow 90 feet for every tenth of an inch. Accordingly this method has been practised with great success: but it requires an attention to many things not yet considered; such as the change of density of the mercury by heat and cold; the changes of density of air, which are much more remarkable from the same causes; and above all, the changes of the density of air from its compressibility; a change immediately connected with or dependent on the very elevation we wish to measure. Of all these afterwards.

44 **Also a measure of the density of the air,**

These observations give us the most accurate measure of the density of the air and its specific gravity. This is but vaguely though directly measured by weighing air in a bladder or vessel. The weight of a manageable quantity is so small, that a balance sufficiently ticklish to indicate even very sensible fractions of it is overloaded by the weight of the vessel which contains it, and ceases to be exact: and when we take Bernoulli's ingenious method of suspending it in water, we expose ourselves to great risk of error by the variation of the water's density. Also it must necessarily be humid air which we can examine in this way: but the proportion of an elevation in the atmosphere to the depression of the column of mercury or other fluid, by which we measure its pressure, gives us at once the proportion of this weight or their specific gravity. Thus since it is found that in such a state of pressure that the barometer stands at 30 inches, and the thermometer at 32°, 87 feet of rise produces one-tenth of an inch of fall in the barometer, the air and the mercury being both of the freezing temperature, we must conclude that mercury is 10,440 times heavier or denser than air. Then, by comparing mercury and water, we get $\frac{1}{850}$ nearly for the density of air relative to water: but this varies so much by heat and moisture, that it is useless to retain any thing more than a general notion of it; nor is it easy to determine whether

whether this method or that by actual weighing is preferable. It is extremely difficult to observe the height of the mercury in the barometer nearer than $\frac{1}{100}$ of an inch; and this will produce a difference of even five feet, or $\frac{1}{18}$ of the whole. Perhaps this is a greater proportion than the error in weighing.

45
And some knowledge of the height of the atmosphere.

From the same experiments we also derive some knowledge of the height of the aerial covering which surrounds our globe. When we raise our barometer 87 feet above the surface of the sea, the mercury falls about one-tenth of an inch in the barometer: therefore if the barometer shows 30 inches at the sea-shore, we may expect that, by raising it 300 times 87 feet or 5 miles, the mercury in the tube will descend to the level of the cistern, and that this is the height of our atmosphere. But other appearances lead us to suppose a much greater height. Meteors are seen with us much higher than this, and which yet give undoubted indication of being supported by our air. There can be little doubt, too, that the visibility of the expanse above us is owing to the reflection of the sun's light by our air. Were the heavenly spaces perfectly transparent, we should no more see them than the purest water through which we see other objects; and we see *them* as we see water tinged with milk or other fæculæ. Now it is easy to show, that the light which gives us what is called twilight must be reflected from the height of at least 50 miles; for we have it when the sun is depressed 18 degrees below our horizon.

46
Why this knowledge is not accurate.

A little attention to the constitution of our air will convince us, that the atmosphere must extend to a much greater height than 300 times 87 feet. We see from the most familiar facts that it is compressible; we can squeeze it in an ox-bladder. It is also heavy; pressing on the air in this bladder with a very great force, not less than 1500 pounds. We must therefore consider it as in a state of compression, existing in smaller room than it would assume if it were not compressed by the incumbent air. It must therefore be in a condition something resembling that of a quantity of fine carded wool thrown loosely into a deep pit; the lower strata carrying the weight of the upper strata, and being compressed by them; and so much the more compressed as they are further down, and only the upper stratum in its unconstrained and most expanded state. If we shall suppose this wool thrown in by a hundred weight at a time, it will be divided into strata of equal weights, but of unequal thickness; the lowest being the thinnest, and the superior strata gradually increasing in thickness. Now, suppose the pit filled with air, and reaching to the top of the atmosphere, the *weights* of all the strata above any horizontal plane in it is measured by the height of the mercury in the Toricellian tube placed in that plane; and one-tenth of an inch of mercury is just equal to the weight of the lowest stratum 87 feet thick: for on raising the tube 87 feet from the sea, the surface of the mercury will descend one-tenth of an inch. Raise the tube till the mercury fall another tenth: This stratum must be more than 87 feet thick; how much more we cannot tell, being ignorant of the law of the air's expansion. In order to make it fall a third tenth, we must raise it through a stratum still thicker; and so on continually.

All this is abundantly confirmed by the very first experiment made by the order and directions of Paschal: For by carrying the tube from the garden of the convent to a place 150 fathoms higher, the mercury fell 1 $\frac{7}{24}$ inches, or 1,2917; which gives about 69 feet 8 inches of aerial stratum for $\frac{1}{10}$ of an inch of mercury; and by carrying it from thence to a place 350 fathoms higher, the mercury fell 1 $\frac{11}{12}$, or 1,9167 inches, which gives 109 feet 7 inches for $\frac{1}{10}$ of an inch of mercury. These experiments were not accurately made; for at that time the philosophers, though zealous, were but *scholars* in the *science* of experimenting, and *novices* in the art. But the results abundantly show this general truth, and they are completely confirmed by thousands of subsequent observations. It is evident from the whole tenor of them, that the strata of air decrease in density as we ascend through the atmosphere; but it remained to be discovered what is the force of this decrease, that is, the law of the air's expansion. Till this be done we can say nothing about the constitution of our atmosphere: we cannot tell in what manner it is fittest for raising and supporting the exhalations and vapours which are continually arising from the inhabited regions; not as an excrementitious waste, but to be supported, perhaps manufactured, in that vast laboratory of nature, and to be returned to us in beneficent showers. We cannot use our knowledge for the curious, and frequently useful, purpose of measuring the heights of mountains and taking the levels of extensive regions; in short, without an accurate knowledge of this, we can hardly acquire any acquaintance with those mechanical properties which distinguish air from those liquids which circulate here below.

47
Compressibility of the air

Having therefore considered at some length the leading consequences of the air's fluidity and gravity, let us consider its compressibility with the same care; and then, combining the agency of both, we shall answer all the purposes of philosophy, discover the laws, explain the phenomena of nature, and improve art. We proceed therefore to consider a little the phenomena which indicate and characterise this other property of the air. All fluids are elastic and compressible as well as air; but in them the compressibility makes no figure, or does not interest us while we are considering their pressures, motions, and impulsions. But in air the compressibility and expansion draw our chief attention, and make it a proper representative of this class of fluids.

48
A familiar phenomenon, which

Nothing is more familiar than the compressibility of air. It is seen in a bladder filled with it, which we can forcibly squeeze into less room; it is seen in a syringe, of which we can push the plug farther and farther as we increase the pressure.

49
Shews its elasticity,

But these appearances bring into view another, and the most interesting, property of air, *viz.* its *elasticity*. When we have squeezed the air in the bladder or syringe into less room, we find that the force with which we *compressed* it is necessary to *keep it in this bulk*; and that if we cease to press it together, it will swell out and regain its natural dimensions. This distinguishes it essentially from such a body as a mass of flour, salt, or such like, which remain in the compressed state to which we reduce them.

50
Resisting force, and producing motion.

There is therefore something which opposes the compression different from the simple impenetrability of the air: there is something that opposes mechanical force: there is something too which produces motion, not only resisting compression, but pushing back the compressing body, and communicating motion to it. As an an arrow is gradually accelerated by the bow-string pressing it forward, and at the moment of its discharge is brought to a state of rapid motion; so the ball from a pop-gun or wind-gun is gradually accelerated along the barrel by the pressure of the air during its expansion from its compressed state, and finally quits it with an accumulated velocity. These two motions are indications perfectly similar of the elasticity of the bow and of the air.

51 Fluidity of the air

Thus it appears that air is heavy and elastic. It needs little consideration to convince us in a vague manner that it is fluid. The ease with which it is penetrated, and driven about in every direction, and the motion of it in pipes and channels, however crooked and intricate, intitle it to this character. But before we can proceed to deduce consequences from its fluidity, and to offer them as a true account of what will happen in these circumstances, it is necessary to exhibit some distinct and simple case, in which the characteristic mechanical property of a fluid is clearly and unequivocally observed in it. That property of fluids from which all the laws of hydrostatics and hydraulics are derived with strictest evidence is, that any pressure applied to any part of them is propagated through the whole mass in every direction; and that in consequence of this diffusion of pressure, any two external forces can be put in equilibrio by the interposition of a fluid, in the same way as they can be put in equilibrio by the intervention of any mechanical engine.

52 Experimentally

Let a close vessel ABC (fig. 7.), of any form, have two upright pipes EDC, GFB, inserted into any parts of its top, sides, or bottom, and let water be poured into them, so as to stand in equilibrio with the horizontal surfaces at E, D, G, F, and let D*d*, F*f*, be horizontal lines, *it will be found* that the height of the column E*d* is sensibly equal to that of the column G*f*. This is a fact universally observed in whatever way the pipes are inserted.

53 Proved.

Now the surface of the water at D is undoubtedly pressed upwards with a force equal to a column of water, having its surface for its base, and E*d* for its height; it is therefore prevented from rising by some opposite force. This can be nothing but the elasticity of the confined air pressing it down. The very same thing must be said of the surface at F; and thus there are two external pressures at D and F set in equilibrio by the interposition of air. The force exerted on the surface D, by the pressure of the column E*d*, is therefore propagated to the surface at F; and thus air has this characteristic mark of fluidity.

In this experiment the *weight* of the air is insensible when the vessel is of small size, and has no sensible share in the pressure reaching at D and F. But if the elevation of the point F above D is very great, the column E*d* *will be observed* sensibly to exceed the column G*f*. Thus if F be 70 feet higher than D, E*d* will be an inch longer than the column G*f*: for in this case there is reacting at D, not only the pressure propagated from F; but also the weight of a column of air, having the surface at D for its base and 70 feet high. This is equal to the weight of a column of water one inch high.

It is by this propagation of pressure, this *fluidity*, that the pellet is discharged from a child's pop-gun. It sticks fast in the muzzle; and he forces in another pellet at the other end, which he presses forward with the rammer, condensing the air between them, and thus propagating to the other pellet the pressure which he exerts, till the friction is overcome, and the pellet is discharged by the air expanding and following it.

There is a pretty philosophical plaything which illustrates this property of air in a very perspicuous manner, and which we shall afterwards have occasion to consider as converted into a most useful hydraulic machine. This is what is usually called *Hero's fountain*, having been invented by a Syracusan of that name. It consists of two vessels KLMN (fig. 8.), OPQR, which are close on all sides. A tube AB, having a funnel a-top, passes through the uppermost vessel without communicating with it, being soldered into its top and bottom. It also passes through the top of the under-vessel, where it is also soldered, and reaches almost to its bottom. This tube is open at both ends. There is another open tube ST, which is soldered into the top of the under-vessel and the bottom of the upper vessel, and reaches almost to its top. These two tubes serve also to support the upper vessel. A third tube GF is soldered into the top of the upper vessel, and reaches almost to its bottom. This tube is open at both ends, but the orifice G is very small. Now suppose the uppermost vessel filled with water to the height EN, E*e* being its surface a little below T. Stop the orifice G with the finger, and pour in water at A. This will descend through AB, and compress the air in OQRP into less room. Suppose the water in the under vessel to have acquired the surface C*c*, the air which formerly occupied the whole of the spaces OPQR and KL*e*E will now be contained in the spaces *o*P*c*C and KL*e*E; and its elasticity will be in equilibrio with the weight of the column of water, whose base is the surface E*e*, and whose height is A*c*. As this pressure is exerted in every part of the air, it will be exerted on the surface E*e* of the water of the upper vessel; and if the pipe FG were continued upwards, the water would be supported in it to an height *e*H above E*e*, equal to A*c*. Therefore if the finger be now taken from off the orifice G, the water will spout up to the same height as if it had been immediately forced out by a column of water A*c* without the intervention of the air, that is, nearly to H. If instead of the funnel at A, the vessel have a brim which will cause the water discharged at G to run down the pipe AB, this fountain will play till all the water in the upper vessel is expended. The operation of this second fountain will be better understood from fig. 9. which an intelligent reader will see is perfectly equivalent to fig. 8. A very powerful engine for raising water upon this principle has long been employed in the Hungarian mines; where the pipe AB is about 200 feet high, and the pipe FG about 120; and the condensation is made in the upper vessel, and communicated to the lower, at the bottom of the mine, by a long pipe. See WATER-Works.

54 Hero's fountain.

55 Laws of hydrostatics applicable to air.

We may now apply to air all the laws of hydrostatics and hydraulics, in perfect confidence that their legitimate consequences will be observed in all its situations. We shall in future substitute, in place of any force acting on a surface of air, a column of water, mercury, or any other fluid whose weight is equal to this force: and as we know distinctly from theory what will be the consequences of this hydrostatic pressure, we shall determine *à priori* the phenomena in air, and in cases where

where theory does not enable us to say with precision what is the effect of this pressure, experience informs us in the case of water, and analogy enables us to transfer this to air. We shall find this of great service in some cases, which otherwise are almost desperate in the present state of our knowledge.

56 More refined experiments, such as

From such familiar and simple observations and experiments, the fluidity, the heaviness, and elasticity, are discovered of the substance with which we are surrounded, and which we call *air*. But to understand these properties, and completely to explain their numerous and important consequences, we must call in the aid of more refined observations and experiments which even this scanty knowledge of them enables us to make; we must contrive some methods of producing with precision any degree of condensation or rarefaction, of employing or excluding the gravitating pressure of air, and of modifying at pleasure the action of all its mechanical properties.

57 A method of compressing the air by

Nothing can be more obvious than a method of compressing a quantity of air to any degree. Take a cylinder or prismatic tube AB (fig. 10.) shut at one end, and fit it with a piston or plug C, so nicely that no air can pass by its sides. This will be best done in a cylindric tube by a turned stopper, covered with oiled leather, and fitted with a long handle CD. When this is thrust down, the air which formerly occupied the whole capacity of the tube is *condensed* into less room. The force necessary to produce any degree of compression may be concluded from the weight necessary for pushing down the plug to any depth. But this instrument leaves us little opportunity of making interesting experiments on or in this condensed air; and the force required to make any degree of compression cannot be measured with much accuracy; because the piston must be very close, and have great friction, in order to be sufficiently tight: And as the compression is increased, the leather is more squeezed to the side of the tube; and the proportion of the external force, which is employed merely to overcome this variable and uncertain friction, cannot be ascertained with any tolerable precision. To get rid of these imperfections, the following addition may be made to the instrument, which then becomes what is called the *condensing syringe*.

58 The condensing syringe with

The end of the syringe is perforated with a very small hole *e f*; and being externally turned to a small cylinder, a narrow slip of bladder, or of thin leather, soaked in a mixture of oil and tallow, must be tied over the hole. Now let us suppose the piston pushed down to the bottom of the barrel to which it applies close; when it is drawn up to the top, it leaves a void behind, and the weight of the external air presses on the slip of bladder, which therefore claps close to the brass, and thus performs the part of a valve, and keeps it close so that no air can enter. But the piston having reached the top of the barrel, a hole F in the side of it is just below the piston, and the air rushes through this hole and fills the barrel. Now push the piston down again, it immediately passes the hole F, and no air escapes through it; it therefore forces open the valve at *f*, and escapes while the piston moves to the bottom.

59 Its vessel or receiver.

Now let E be any vessel, such as a glass bottle, having its mouth furnished with a brass cap firmly cemented to it, having a hollow screw which fits a solid screw *p q*, turned on the cylindric nozzle of the syringe. Screw the syringe into this cap, and it is evident that the air forced out of the syringe will be accumulated in this vessel: for upon drawing up the piston the valve *f* always shuts by the elasticity or expanding force of the air in E; and on pushing it down again, the valve will open as soon as the piston has got so far down that the air in the lower part of the barrel is more powerful than the air already in the vessel. Thus at every stroke an additional barrelful of air will be forced into the vessel E; and it will be found, that after every stroke the piston must be farther pushed down before the valve will open. It cannot open till the pressure arising from the elasticity of the air condensed in the barrel is superior to the elasticity of the air condensed in the vessel; that is, till the condensation of the first, or its density, is *somewhat* greater than that of the last, in order to overcome the straining of the valve on the hole and the sticking occasioned by the clammy matter employed to make it air-tight.

Sometimes the syringe is constructed with a valve in the piston. This piston, instead of being of one piece and solid, consists of two pieces perforated. The upper part *i k n m* is connected with the rod or handle, and has its lower part turned down to a small cylinder, which is screwed into the lower part *k l o n*; and has a perforation *g h* going up in the axis, and terminating in a hole *h* in one side of the rod, a piece of oiled leather is strained across the hole *g*. When the piston is drawn up and a void left below it, the weight of the external air forces it through the hole *h g*, opens the valve *g*, and fills the barrel. Then, on pushing down the piston, the air being squeezed into less room, presses on the valve *g*, shuts it; and none escaping through the piston, it is gradually condensed as the piston descends till it opens the valve *f*, and is added to that already accumulated in the vessel E. 60 A different construction of this syringe.

Having in this manner forced a quantity of air into the vessel E, we can make many experiments in it in this state of condensation. We are chiefly concerned at present with the effect which this produces on its elasticity. We see this to be greatly increased; for we find more and more force required for introducing every successive barrelful. When the syringe is unscrewed, we see the air rush out with great violence, and every indication of great expanding force. If the syringe be connected with the vessel E in the same manner as the syringe in n° 17, viz. by interposing a stopcock B between them (see fig. 3.), and if this stopcock have a pipe at its extremity, reaching near to the bottom of the vessel, which is previously half filled with water, we can observe distinctly when the elasticity of the air in the syringe exceeds that of the air in the receiver: for the piston must be pushed down a certain length before the air from the syringe bubbles up thro' the water, and the piston must be farther down at each successive stroke before this appearance is observed. When the air has thus been accumulated in the receiver, it presses the sides of it outward, and will burst it if not strong enough. It also presses on the surface of the water; and if we now shut the cock, unscrew the syringe, and open the cock again, the air will force the water through the pipe with great velocity, causing it to rise in a beautiful jet. When a metal-receiver is used, the condensation may be pushed to a great length, and the jet will then rise to a great height; which gradually 61 Elasticity of the air increased by condensation.

dually diminishes as the water is expended and room given to the air to expand itself. See the figure.

62 A method of judging of the condensation, &c.

We judge of the condensation of air in the vessel E by the number of strokes and the proportion of the capacity of the syringe to that of the vessel. Suppose the first to be one-tenth of the last; then we know, that after 10 strokes the quantity of air in the vessel is doubled, and therefore its density double, and so on after any number of strokes. Let the capacity of the syringe (when the piston is drawn to the top) be a, and that of the vessel be b, and the number of strokes be n, the density of air in the vessel will be $\frac{b+na}{b}$, or $1+\frac{na}{b}$.

63 Not perfectly accurate.

But this is on the supposition that the piston accurately fills the barrel, the bottom of the one applying close to that of the other, and that no force is necessary for opening either of the valves: but the first cannot be insured, and the last is very far from being true. In the construction now described, it will require at least one twentieth-part of the ordinary pressure of the air to open the piston valve: therefore the air which gets in will want at least this proportion of its complete elasticity; and there is always a similar part of the elasticity employed in opening the nozzle valve. The condensation therefore is never nearly equal to what is here determined.

64 A better method.

It is accurately enough measured by a gage fitted to the instrument. A glass tube GH of a cylindric bore, and close at the end, is screwed into the side of the cap on the mouth of the vessel E. A small drop of water or mercury is taken into this tube by warming it a little in the hand, which expands the contained air, so that when the open end is dipped into water, and the whole allowed to cool, the water advances a little into the tube. The tube is furnished with a scale divided into small equal parts, numbered from the close end of the tube. Since this tube communicates with the vessel, it is evident that the condensation will force the water along the tube, acting like a piston on the air beyond it, and the air in the tube and vessel will always be of one density. Suppose the number at which the drop stands before the condensation is made to be c, and that it stands at d when the condensation has attained the degree required, the density of the air in the remote end of the gage, and consequently in the vessel, will be $\frac{c}{d}$.

65 A variation of it.

Sometimes there is used any bit of tube close at one end, having a drop of water in it, simply laid into the vessel E, and furnished or not with a scale: but this can only be used with glass vessels, and these are too weak to resist the pressure arising from great condensation. In such experiments metalline vessels are used, fitted with a variety of apparatus for different experiments. Some of these will be occasionally mentioned afterwards.

66 Syringes for great condensations.

It must be observed in this place, that very great condensations require great force, and therefore small syringes. It is therefore convenient to have them of various sizes, and to begin with those of a larger diameter, which operate more quickly; and when the condensation becomes fatiguing, to change the syringe for a smaller.

67 A stop-cock between the syringe and receiver.

For this reason, and in general to make the condensing apparatus more convenient, it is proper to have a stop-cock interposed between the syringe and the vessel, or as it is usually called the receiver. This consists of a brass pipe, which has a well-ground cock in its middle, and has a hollow screw at one end, which receives the nozzle screw of the syringe, and a solid screw at the other end, which fits the screw of the receiver. See fig. 3.

68 Instances of great condensation prove

By these gages, or contrivances similar to them, we have been able to ascertain very great degrees of condensation in the course of some experiments. Dr Hales found, that when dry wood was put into a strong vessel, which it almost filled, and the remainder was filled with water, the swelling of the wood, occasioned by its imbibition of water, condensed the air of his gage into the thousandth of its original bulk. He found that pease treated in the same way generated elastic air, which pressing on the air in the gage condensed it into the fifteen hundredth part of its bulk. This is the greatest condensation that has been ascertained with precision; although in other experiments it has certainly been carried much farther; but the precise degree could not be ascertained.

69 Air and water to be essentially different;

The only use to be made of this observation at present is, that since we have been able to exhibit air in a density a thousand times greater than the ordinary density of the air we breathe, it cannot, as some imagine, be only a different form of water; for in this state it it is as dense or denser than water, and yet retains its great expansibility.

70 And show the error of some opinions respecting elasticity, &c.

Another important observation is, that in every state of density in which we find it, it retains its perfect fluidity, transmitting all pressures which are applied to it with undiminished force, as appears by the equality constantly observed between the opposing columns of water or other fluid by which it is compressed, and by the facility with which all motions are performed in it in the most compressed states in which we can make observations of this kind. This fact is totally incompatible with the opinion of those who ascribe the elasticity of air to the springy ramified structure of its particles, touching each other like so many pieces of sponge or foot-balls. A collection of such particles might indeed be pervaded by solid bodies with considerable ease, if they were merely touching each other, and not subjected to any external pressure. But the moment such pressure is exerted, and the assemblage squeezed into a smaller space, each presses on its adjoining particles: they are individually compressed, flattened in their touching surfaces, and *before the density is doubled* they are squeezed into the form of perfect cubes, and compose a mass, which may indeed propagate pressure from one place to another in an imperfect manner, and with great diminution of its intensity, but will no more be fluid than a mass of soft clay. It will be of use to keep this observation in mind.

71 Consequences of the air's elasticity.

We have seen that air is heavy and compressible, and might now proceed to deduce in order the explanation of the appearances consequent on each of these properties. But, as has been already observed, the elasticity of air modifies the effects of its gravity so remarkably, that they would be imperfectly understood if both qualities were not combined in our consideration of either. At any rate, some farther consequences of its elasticity

ticity must be considered, before we understand the means of varying at pleasure the effects of its gravity.

72 Its great expansibility

Since air is heavy, the lower strata of a mass of air must support the upper; and, being compressible, they must be condensed by their weight. In this state of compression the elasticity of the lower strata of air acts in opposition to the weight of the incumbent air, and balances it. There is no reason which should make us suppose that its expanding force belongs to it only when in such a state of compression. It is more probable, that, if we could free it from this pressure, the air would expand itself into still greater bulk. This is most distinctly seen in the following experiment.

73 Proved by experiment.

Into the cylindric jar ABCD (fig. 11.), which has a small hole in its bottom, and is furnished with an air-tight piston E, put a small flaccid bladder, having its mouth tied tight with a string. Having pushed the piston near to the bottom, and noticed the state of the bladder, stop up the hole in the bottom of the jar with the finger, and draw up the piston, which will require a considerable force. You will observe the bladder swell out, as if air had been blown into it; and it will again collapse on allowing the piston to descend. Nothing can be more unexceptionable than the conclusion from this experiment, that ordinary air is in a state of compression, and that its elasticity is not limited to this state. The bladder being flaccid, shows that the included air is in the same state with the air which surrounds it; and the same must be affirmed of it while it swells but still remains flaccid. We must conclude, that the whole air within the vessel expands, and continues to fill it, when its capacity has been enlarged. And since this is observed to go on as long as we give it more room, we conclude, that by such experiments we have not yet given it so much room as it can occupy.

74 Attempts to discover the limits of this expansion by

It was a natural object of curiosity to discover the limits of this expansion; to know what was the natural unconstrained bulk of a quantity of air, beyond which it would not expand though all external compressing force were removed. Accordingly philosophers constructed instruments for *rarefying* the air. The common water-pump had been long familiar, and appeared very proper for this purpose. The most obvious is the following.

75 A syringe;

Let the barrel of the syringe AB (fig. 12.) communicate with the vessel V, with a stopcock C between them. Let it communicate with the external air by another orifice D, in any convenient situation, also furnished with a stopcock. Let this syringe have a piston very accurately fitted to it so as to touch the bottom all over when pushed down, and have no vacancy about the sides.

76 From the operation of which

Now suppose the piston at the bottom, the cock C open, and the cock D shut, draw the piston to the top. The air which filled the vessel V will expand so as to fill both that vessel and the barrel AB; and as no reason can be given to the contrary, we must suppose that the air will be uniformly diffused through both. Calling V and B the capacity of the vessel and barrel, it is plain that the bulk of the air will now be $V+B$; and since the quantity of matter remains the same, and the density of a fluid is as its quantity of matter directly and its bulk inversely, the density of the expanded air will be $\frac{V}{V+B}$, the density of common air being 1: for $V+B : V = 1 : \frac{V}{V+B}$.

77 We infer the diminution of the elasticity of expanded air,

The piston requires force to raise it, and it is raised in opposition to the pressure of the incumbent atmosphere; for this had formerly been balanced by the elasticity of the common air: and we conclude from the fact, *that force is required to raise the piston*, that the elasticity of the expanded air is less than that of air in its ordinary state; and an accurate observation of the force necessary to raise it would show how much the elasticity is diminished. When therefore the piston is let go, it will descend as long as the pressure of the atmosphere exceeds the elasticity of the air in the barrel; that is, till the air in the barrel is in a state of ordinary density. To put it further down will require force, because the air must be compressed in the barrel; but if we now open the cock D, the air will be expelled through it, and the piston will reach the bottom.

78 And calculate its density.

Now shut the *discharging cock* D, and open the cock C, and draw up the piston. The air which occupied the space V, with the density $\frac{V}{V+B}$, will now occupy the space $V+B$, if it expands so far. To have its density D, say, As its present bulk $V+B$ is to its former bulk V, so is its former density $\frac{V}{V+B}$ to its new density; which will therefore be $\frac{V \times V}{V+B \times V+B}$, or $\overline{\frac{V}{V+B}}\Big|^2$.

It is evident, that if the air continues to expand, the density of the air in the vessel after the third drawing up of the piston will be $\overline{\frac{V}{V+B}}\Big|^3$, after the fourth it will be $\overline{\frac{V}{V+B}}\Big|^4$, and after any number of strokes *n* will be $\overline{\frac{V}{V+B}}\Big|^n$. Thus, if the vessel is four times as large as the barrel, the density after the fifth stroke will be $\frac{1024}{3125}$, nearly $\frac{1}{3}$ of its ordinary density. 79

On the other hand, the number *n* of strokes necessary for reducing air to the density D is $\frac{\text{Log } D}{\text{Log } V - \text{Log } (V+B)}$. 80

81 Some inconveniences of this instrument

Thus we see that this instrument can never abstract the whole air in consequence of its expansion, but only rarefy it continually as long as it continues to expand; nay, there is a limit beyond which the rarefaction cannot go. When the piston has reached the bottom, there remains a small space between it and the cock C filled with common air. When the piston is drawn up, this small quantity of air expands, and also a similar quantity in the neck of the other cock; and no air will come out of the receiver V till the expanded air in the barrel is of a smaller density than the air in the receiver. This circumstance evidently directs us to make these two spaces as small as possible, or by some contrivance

contrivance to fill them up altogether. Perhaps this may be done effectually in the following manner.

82 Remedied by another.

Let BE (fig. 13.) represent the bottom of the barrel, and let the circle HKI be the section of the key of the cock, of a large diameter, and place it as near to the barrel as can be. Let this communicate with the barrel by means of an hole FG widening upwards, as the frustum of a hollow obtuse cone. Let the bottom of the piston *bfbgc* be shaped so as to fit the bottom of the barrel and this hole exactly. Let the cock be pierced with two holes. One of them, HI, passes perpendicularly through its axis, and forms the communication between the receiver and barrel. The other hole, KL, has one extremity K on the same circumference with H, so that when the key is turned a fourth part round, K will come into the place of H: but this hole is pierced obliquely into the key, and thus keeps clear of the hole HI. It goes no further than the axis, where it communicates with a hole bored along the axis and terminating at its extremity. This hole forms the communication with the external air, and serves for discharging the air in the barrel. (A side view of the key is seen in fig. 14.) Fig. 12. shows the position of the cock while the piston is moving upwards, and fig. 14. shows its position while the piston is moving downwards. When the piston has reached the bottom, the conical piece *fbg* of the piston, which may be of firm leather, fills the hole FHG, and therefore completely expels the air from the barrel. The canal KL*l* of the cock contains air of the common density; but this is turned aside into the position KL (fig. 13.), while the piston is still touching the cock. It cannot expand into the barrel during the ascent of the piston. In place of it the perforation HLI comes under the piston, filled with air that had been turned aside with it when the piston was at the top of the barrel, and therefore of the same density with the air of the receiver. It appears therefore that there is no limit to the rarefaction as long as the air will expand.

83 Called an *exhausting syringe.*

This instrument is called an EXHAUSTING SYRINGE. It is more generally made in another form, which is much less expensive, and more convenient in its use. Instead of being furnished with *cocks* for establishing the communications and shutting them, as is necessary, it has *valves* like those of the condensing syringe, but opening in the opposite direction. It is thus made:

84 Its construction and

The pipe of communication or conduit MN (fig. 15.), has a male screw in its extremity, and over this is tied a slip of bladder or leather M. The lower half of the piston has also a male screw on it, covered at the end with a slip of bladder O. This is screwed into the upper half of the piston, which is pierced with a hole H coming out of the side of the rod.

85 Operation.

Now suppose the syringe screwed to the conducting pipe, and that screwed into the receiver V, and the piston at the bottom of the barrel. When the piston is drawn up, the pressure of the external air shuts the valve O, and a void is left below the piston: there is therefore no pressure on the upper side of the valve M to balance the elasticity of the air in the receiver which formerly balanced the weight of the atmosphere. The air therefore in the receiver lifts this valve, and distributes itself between the vessel and the barrel; so that when the piston has reached the top the density of the air in both receiver and barrel is as before $\frac{V}{V+B}$.

When the piston is let go it descends, because the elasticity of the expanded air is not a balance for the pressure of the atmosphere, which therefore presses down the piston with the difference, keeping the piston-valve shut all the while. At the same time the valve M also shuts: for it was opened by the prevailing elasticity of the air in the receiver, and while it is open the two airs have equal density and elasticity; but the moment the piston descends, the capacity of the barrel is diminished, the elasticity of its air increases by collapsing, and now prevailing over that of the air in the receiver shuts the valve M. 86

When it has arrived at such a part of the barrel that the air in it is of the density of the external air, there is no force to push it farther down; the hand must therefore press it. This attempts to condense the air in the barrel, and therefore increases its elasticity; so that it lifts the valve O and escapes, and the piston gets to the bottom. When drawn up again, greater force is required than the last time, because the elasticity of the included air is less than in the former stroke. The piston rises further before the valve M is lifted up, and when it has reached the top of the barrel the density of the included air is $\left(\frac{V}{V+B}\right)^2$. The piston, when let go, will descend further than it did before ere the piston-valve open, and the pressure of the hand will again push it to the bottom, all the air escaping through O. The rarefaction will go on at every successive stroke in the same manner as with the other syringe. 87

This syringe is evidently more easy in its use, requiring no attendance to the cocks to open and shut them at the proper times. On this account this construction of an exhausting syringe is much more generally used. 88 Advantages of this syringe over the former, and

But it is greatly inferior to the syringe with cocks with respect to its power of rarefaction. Its operation is greatly limited. It is evident that no air will come out of the receiver unless its elasticity *exceed* that of the air in the barrel by a difference able to lift up the valve M. A piece of oiled leather tied across this hole can hardly be made tight and certain of clapping to the hole without some small straining, which must therefore be overcome. It must be very gentle indeed not to require a force equal to the weight of two inches of water, and this is equal to about the 200th part of the whole elasticity of the ordinary air; and therefore this syringe, for this reason alone, cannot rarefy air above 200 times, even though air were capable of an indefinite expansion. In like manner the valve O cannot be raised without a similar prevalence of the elasticity of the air in the barrel above the weight of the atmosphere. These causes united, make it difficult to rarefy the air more than 100 times, and very few such syringes will rarefy it more than 50 times; whereas the syringe with cocks, when new and in good order, will rarefy it 1000 times. 89 Its inferiority.

But, on the other hand, syringes with cocks are much more expensive, especially when furnished with apparatus for opening and shutting the cocks. They are more difficult to make equally tight, and (which is the 90 The former syringe, however, more liable to go out of order.

Air-pump.

the greatest objection) do not remain long in good order. The cocks, by so frequently opening and shutting, grow loose, and allow the air to escape. No method has been found of preventing this. They must be ground tight by means of emery or other cutting powders. Some of these unavoidably stick in the metal, and continue to wear it down. For this reason philosophers, and the makers of philosophical instruments, have turned their chief attention to the improvement of the syringe with valves. We have been thus minute in the account of the operation of rarefaction, that the reader may better understand the value of these improvements, and in general the operation of the principal pneumatic engines.

Of the Air-Pump.

91 Invention of the air-pump by Guericke.

An Air-Pump is nothing but an exhausting syringe accommodated to a variety of experiments. It was first invented by Otto Guericke, a gentleman of Magdeburgh in Germany, about the year 1654. We trust that it will not be unacceptable to our readers to see this instrument, which now makes a principal article in a philosophical apparatus, in its first form, and to trace it through its successive steps to its present state of improvement.

Guericke, indifferent about the solitary possession of an invention which gave entertainment to numbers who came to see his wonderful experiments, gave a minute description of all his pneumatic apparatus to Gaspar Schottus professor of mathematics at Wirtemberg, who immediately published it with the author's consent, with an account of some of its performances, first in 1657, in his *Mechanica Hydraulico-pneumatica;* and then in his *Technica Curiosa*, in 1664, a curious collection of all the wonderful performances of art which he collected by a correspondence over all Europe.

92 Construction of his pump.

Otto Guericke's air-pump consists of a glass receiver A (fig. 16.), of a form nearly spherical, fitted up with a brass cap and cock B. The nozzle of the cap was fixed to a syringe CDE, also of brass, bent at D into half a right angle. This had a valve at D, opening from the receiver into the syringe, and shutting when pressed in the opposite direction. In the upper side of the syringe there is another valve F, opening from the syringe into the external air, and shutting when pressed inwards. The piston had no valve. The syringe, the cock B, and the joint of the tube, were immersed in a cistern filled with water. From this description it is easy to understand the operation of the instrument. When the piston was drawn up from the bottom of the syringe, the valve F was kept shut by the pressure of the external air, and the valve D opened by the elasticity of the air in the receiver. When it was pushed down again, the valve D immediately shut by the superior elasticity of the air in the syringe; and when this was sufficiently compressed, it opened the valve F, and was discharged. It was immersed in water, that no air might find its way through the joints or cocks.

93 Its imperfections.

It would seem that this machine was not very perfect, for Guericke says that it took several hours to produce an evacuation of a moderate-sized vessel; but he says, that when it was in good order, the rarefaction (for he acknowledges that it was not, nor could be, a complete evacuation) was so great, that when the cock was opened, and water admitted, it filled the receiver so as sometimes to leave no more than the bulk of a pea filled with air. This is a little surprising; for if the valve F be placed as far from the bottom of the syringe as in Schottus's figure, it would appear that the rarefaction could not be greater than what must arise from the air in DF expanding till it filled the whole syringe: because as soon as the piston in its descent passes F it can discharge no more air, but must compress it between F and the bottom, to be expanded again when the piston is drawn up. It is probable that the piston was not very tight, but that on pressing it down it allowed the air to pass it; and the water in which the whole was immersed prevented the return of the air when it was drawn up again: and this accounts for the great time necessary for producing the desired rarefaction.

94 His improvement of it.

Guericke, being a gentleman of fortune, spared no expence, and added a part to the machine, which saved his numerous visitants the trouble of hours attendance before they could see the curious experiments with the rarefied air. He made a large copper vessel G (fig. 17.), having a pipe and cock below, which passed through the floor of the chamber into an under apartment, where it was joined to the syringe immersed in the cistern of water, and worked by a lever. The upper part of the vessel terminated in a pipe, furnished with a stopcock H, surrounded with a small brim to hold water for preventing the ingress of air. On the top was another cap I, also filled with water, to protect the junction of the pipes with the receiver K. This great vessel was always kept exhausted, and workmen attended below. When experiments were to be performed in the receiver K, it was set on the top of the great vessel, and the cock H was opened. The air in K immediately diffused itself equally between the two vessels, and was so much more rarefied as the receiver K was smaller than the vessel G. When this rarefaction was not sufficient, the attendants below immediately worked the pump.

These particulars deserve to be recorded, as they show the inventive genius of this celebrated philosopher, and because they are useful even in the present advanced state of the study. Guericke's method of excluding air from all the joints of his apparatus, by immersing these joints in water, is the only method that has to this day been found effectual; and there frequently occur experiments where this exclusion for a long time is absolutely necessary. In such cases it is necessary to construct little cups or cisterns at every joint, and to fill them with water or oil. In a letter to Schottus, 1662-3, he describes very ingenious contrivances for producing complete rarefaction after the elasticity of the remaining air has been so far diminished that it is not able to open the valves. He opens the exhausting valves by a plug, which is pushed in by the hand; and the discharging valve is opened by a small pump placed on its outside, so that it opens into a void instead of opening against the pressure of the atmosphere. (See *Schotti Technica Curiosa*, p. 68, 70.) These contrivances have been lately added to air-pumps by Haas and Hurter as new inventions.

It must be acknowledged, that the application of the pump or syringe to the exhaustion of air was a very obvious thought on the principle exhibited in n° 17. and in this way it was also employed by Guericke, who first filled the receiver with water, and then applied the syringe. But this was by no means either his object or

2 his

his principle. His object was not solely to procure a vessel void of air, but to exhaust the air which was already in it; and his principle was the power which he suspected to be in air of expanding itself into a greater space when the force was removed which he supposed to compress it. He expressly says (*Tract. de Experimentis Magdeburgicis, et in Epist. ad Schottum*), that the contrivance occurred to him accidentally when occupied with experiments in the Toricellian tube, in which he found that the air would really expand, and completely fill a much larger space than what it usually occupied, and that he had found no limits to the expansion, evincing this by facts which we shall perfectly understand by and by. This was a doctrine quite new, and required a philosophical mind to view it in a general and systematic manner; and it must be owned that his manner of treating the subject is equally remarkable for ingenuity and for modesty. (*Epist. ad Schottum.*)

95 Merits of Guericke.

96 Progress of experimental philosophy.

His doctrine and his machine were soon spread over Europe. It was the age of literary ardour and philosophical curiosity; and it is most pleasant to us, who, standing on the shoulders of our predecessors, can see far around us, to observe the eagerness with which every new, and to us frivolous, experiment was repeated and canvassed. The worshippers of Aristotle were daily receiving severe mortifications from the experimenters, or empirics as they affected to call them, and they exerted themselves strenuously in support of his now tottering cause. This contributed to the rapid propagation of every discovery; and it was a most profitable and respectable business to go through the chief cities of Germany and France exhibiting philosophical experiments.

97 Ardour of Mr Boyle.

About this time the foundations of the Royal Society of London were laid. Mr Boyle, Mr Wren, Lord Brounker, Dr Wallis, and other curious gentlemen, held meetings at Oxford, in which were received accounts of whatever was doing in the study of nature; and many experiments were exhibited. The researches of Galileo, Toricelli, and Paschal concerning the pressure of the air, greatly engaged their attention, and many additions were made to their discoveries. Mr Boyle, the most ardent and successful studier of nature, had the principal share in these improvements, his inquisitive mind being aided by an opulent fortune. In a letter to his nephew Lord Dungarvon, he says that he had made many attempts to see the appearances exhibited by bodies freed from the pressure of the air. He had made Toricellian tubes, having a small vessel a-top, into which he put some bodies before filling the tubes with mercury; so that when the tube was set upright, and the mercury run out, the bodies were *in vacuo*. He had also abstracted the water from a vessel, by a small pump, by means of its weight, in the manner described in n° 17, having previously put bodies into the vessel along with the water. But all these ways were very troublesome and imperfect. He was delighted when he learned from Schottus's first publication, that Counsellor Guericke had effected this by the expansive power of the air; and immediately set about constructing a machine from his own ideas, no description of Guericke's being then published.

Plate CCCCI.

It consisted of a receiver A (fig. 18.), furnished with a stopcock B, and syringe CD placed in a vertical position below the receiver. Its valve C was in its bottom, close adjoining to the entry of the pipe of communication; and the hole by which the air issued was farther secured by a plug which could be removed. The piston was moved by a wheel and rackwork. The receiver of Guericke's pump was but ill adapted for any considerable variety of experiments; and accordingly very few were made in it. Mr Boyle's receiver had a large opening EF, with a strong glass margin. To this was fitted a strong brass cap, pierced with a hole G in its middle, to which was fitted a plug ground into it, and shaped like the key of a cock. The extremity of this key was furnished with a screw, to which could be affixed a hook, or a variety of pieces for supporting what was to be examined in the receiver, or for producing various motions within it, without admitting the air. This was farther guarded against by means of oil poured round the key, where it was retained by the hollow cup-like form of the cover. With all these precautions, however, Mr Boyle ingenuously confesses, that it was but seldom, and with great difficulty, that he could produce an extreme degree of rarefaction; and it appears by Guericke's letter to Schottus, that in this respect the Magdeburgh machine had the advantage. But most of Boyle's very interesting experiments did not require this extreme rarefaction; and the variety of them, and their philosophic importance, compensated for this defect, and soon eclipsed the fame of the inventor to such a degree, that the state of air in the receiver was generally denominated the *vacuum Boyleanum*, and the air-pump was called *machina Boyleana*. It does not appear that Guericke was at all solicitous to maintain his claim to priority or invention. He appears to have been of a truly noble and philosophical mind, aiming at nothing but the advancement of science.

98 His air-pump.

99 His contrivances to make air-vessels tight.

Mr Boyle found, that to make a vessel air-tight, it was sufficient to place a piece of wet or oiled leather on its brim, and to lay a flat plate of metal upon this. The pressure of the external air squeezed the two solid bodies so hard together, that the soft leather effectually excluded it. This enabled him to render the whole machine incomparably more convenient for a variety of experiments. He caused the conduit-pipe to terminate in a flat plate which he covered with leather, and on this he set the glass ball or receiver, which had both its upper and lower brim ground flat. He covered the upper orifice in like manner with a piece of oiled leather and a flat plate, having cocks and a variety of other perforations and contrivances suited to his purposes. This he found infinitely more expeditious, and also tighter, than the clammy cements which he had formerly used for securing the joints.

100 Dr Hooke's improvement of Boyle's air-pump

He was now assisted by Dr Hooke, the most ingenious and inventive mechanic that the world has ever seen. This person made a great improvement on the air-pump, by applying two syringes whose piston-rods were worked by the same wheel, as in fig. 20, n° 1, and putting valves in the pistons in the same manner as in the piston of a common pump. This evidently doubled the expedition of the pump's operation: but it also greatly diminished the labour of pumping; for it must be observed, that the piston H, must be drawn up against the pressure of the external air, and when the rarefaction is nearly perfect this requires a force of nearly 15 pounds for every inch of the area of the piston. Now when one piston H is at the bottom of the barrel, the other K is at the

the top of the barrel, and the air below K is equally rare with that in the receiver. Therefore the pressure of the external air on the piston K is *nearly* equal to that on the piston H. Both, therefore, are acting in opposite directions on the wheel which gave them motion; and the force necessary for raising H is only the difference between the elasticity of the air in the barrel H and that of the air in the barrel K. This is very small in the beginning of the stroke, but gradually increases as the piston K descends, and becomes equal to the whole excess of the air's pressure above the elasticity of the remaining air of the receiver when the air at K of the natural density begins to open the piston valves. An accurate attention to the circumstances will show us that the force requisite for working the pump is greatest at first, and gradually diminishes as the rarefaction advances; and when this is nearly complete, hardly any more force is required than what is necessary for overcoming the friction of the pistons, except during the discharge of the air at the end of each stroke.

101 Generally adopted.

This is therefore the form of the air-pump which is most generally used all over Europe. Some traces of national prepossession remain. In Germany, air-pumps are frequently made after the original model of Guericke's (Wolff Cyclomathesis); and the French generally use the pump made by Papin, though extremely aukward. We shall give a description of Boyle's air-pump as finally improved by Hawkesbee, which, with some small accommodations to particular views, still remains the most approved form.

102 Hawkesbee's improvements Plate CCCCI.

Here follows the description from Desaguliers.

It consists of two brass barrels *aa*, *aa* (fig. 19.), 12 inches high and 2 wide. The pistons are raised and depressed by turning the winch *bb*. This is fastened to an axis passing through a strong toothed wheel, which lays hold of the teeth of the racks *cccc*. Then the one is raised while the other is depressed; by which means the valves, which are made of limber bladder, fixed in the upper part of each piston, as well as in the openings into the bottom of the barrels, perform their office of discharging the air from the barrels, and admitting into them the air from the receiver to be afterwards discharged; and when the receiver comes to be pretty well exhausted of its air, the pressure of the atmosphere in the descending piston is nearly so great, that the power required to raise the other is little more than is necessary for overcoming the friction of the piston, which renders this pump preferable to all others, which require more force to work them as the rarefaction of the air in the receiver advances.

103 Barrels.

The barrels are set in a brass dish about two inches deep, filled with water or oil to prevent the insinuation of air. The barrels are screwed tight down by the nuts *ee*, *ee*, which force the frontispiece *ff* down on them, through which the two pillars *gg*, *gg* pass.

104 Brass pipe, &c.

From between the barrels rises a slender brass pipe *bb*, communicating with each by a perforation in the transverse piece of brass on which they stand. The upper end of this pipe communicates with another perforated piece of brass, which screws on underneath the plate *iiii*, of ten inches diameter, and surrounded with a brass rim to prevent the shedding of water used in some experiments. This piece of brass has three branches: 1st, An horizontal one communicating with the conduit-pipe *bb*. 2. An upright one screwed into the middle of the pump-plate, and terminating in a small pipe *k*, rising about an inch above it. 3d, Is a perpendicular one, looking downwards in the continuation of the pipe *k*, and having a hollow screw in its end receiving the brass cap of the gage-pipe *llll*, which is of glass, 34 inches long, and immersed in a glass cistern *m m* filled with mercury. This is covered a-top with a cork float, carrying the weight of a light wooden scale divided into inches, which are numbered from the surface of the mercury in the cistern. This scale will therefore rise and fall with the mercury in the cistern, and indicate the true elevation of that in the tube.

There is a stopcock immediately above the insertion of the gage-pipe, by which its communication may be cut off. There is another at *n*, by which a communication is opened with the external air for allowing its readmission; and there is sometimes another immediately within the insertion of the conduct-pipe for cutting off the communication between the receiver and the pump. This is particularly useful when the rarefaction is to be continued long, as there are by these means fewer chances of the insinuation of air by the many joints. 105 Stopcock.

The receivers are made tight by simply setting them on the pump-plate with a piece of wet or oiled leather between; and the receivers, which are open a-top, have a brass cover set on them in the same manner. In these covers there are various perforations and contrivances for various purposes. The one in the figure has a slip wire passing through a collar of oiled leather, having a hook or a screw in its lower end for hanging any thing on or producing a variety of motions. 106 Receivers.

Sometimes the receivers are set on another plate, which has a pipe screwed into its middle, furnished with a stopcock and a screw, which fits the middle pipe *k*. When the rarefaction has been made in it, the cock is shut, and then the whole may be unscrewed from the pump, and removed to any convenient place. This is called a *transporter plate*. 107 Contrivance for removing them.

It only remains to explain the gage *llll*. In the ordinary state of the air its elasticity balances the pressure of the incumbent atmosphere. We find this from the force that is necessary to squeeze it into less bulk, in opposition to this elasticity. Therefore the elasticity of the air increases with the vicinity of its particles. It is therefore reasonable to expect, that when we allow it to occupy more room, and its particles are farther asunder, its elasticity will be diminished though not annihilated; that is, it will no longer balance the WHOLE pressure of the atmosphere, though it may still balance part of it. If therefore an upright pipe have its lower end immersed in a vessel of mercury, and communicate by its upper end with a vessel containing rarefied, therefore less elastic, air, we should expect that the pressure of the air will prevail, and force the mercury into the tube, and cause it to rise to such an height that the weight of the mercury, joined to the elasticity of the rarefied air acting on its upper surface, shall be exactly equal to the whole pressure of the atmosphere. The height of the mercury is the exact measure of that part of the whole pressure which is not balanced by the elasticity of the rarefied air, and its deficiency from the height of the mercury in the Torricellian tube is the exact measure of this remaining elasticity. 108 Principle upon which the gage is constructed.

It

It is evident therefore, that the pipe will be a scale of the elasticity of the remaining air, and will indicate in some sort the degree of rarefaction: for there must be some analogy between the density of the air and its elasticity; and we have no reason to imagine that they do not increase and diminish together, although we may be ignorant of the law, that is, of the change of elasticity corresponding to a known change of density. This is to be discovered by experiment; and the air-pump itself furnishes us with the best experiments for this purpose. After rarefying till the mercury in the gage has attained half the height of that in the Toricellian tube, shut the communication with the barrels and gage, and admit the water into the receiver. It will go in till all is again in equilibrio with the pressure of the atmosphere; that is, till the air in the receiver has collapsed into its natural bulk. This we can accurately measure, and compare with the whole capacity of the receiver; and thus obtain the precise degree of rarefaction corresponding to half the natural elasticity. We can do the same thing with the elasticity reduced to one third, one fourth, &c. and thus discover the whole law.

109 So as to indicate the degree of rarefaction.

110 Inconveniences of this gage

This gage must be considered as one of the most ingenious and convenient parts of Hawkesbee's pump; and it is well disposed, being in a situation protected against accidents: but it necessarily increases greatly the size of the machine, and cannot be applied to the table-pump, represented in fig. 20, n°1. When it is wanted here, a small plate is added behind, or between the barrels and receiver; and on this is set a small tubulated (as it is termed) receiver, covering a common weather-glass tube.—This receiver being rarefied along with the other, the pressure on the mercury in the cistern arising from the elasticity of the remaining air is diminished so as to be no longer able to support the mercury at its full height; and it therefore descends till the height at which it stands puts it in equilibrio with the elasticity. In this form, therefore, the height of the mercury is directly a measure of the remaining elasticity; while in the other it measures the remaining unbalanced pressure of the atmosphere. But this gage is extremely cumbersome, and liable to accidents. We are seldom much interested in the rarefaction till it is great: a contracted form of this gage is therefore very useful, and was early used. A syphon ABCD (fig. 20, n° 2.), each branch of which is about four inches long, close at A and open at D, is filled with boiling mercury till it occupies the branch AB and a very small part of CD, having its surface at O. This is fixed to a small stand, and fixed into the receiver, along with the things that are to be exhibited in the rarefied air. When the air has been rarefied till its remaining elasticity is not able to support the column BA, the mercury descends in AB, and rises in CD, and the remaining elasticity will always be measured by the elevation of the mercury in AB above that in the leg CD. Could the exhaustion be perfected, the surfaces in both legs would be on a level. Another gage might be put into the same foot, having a small bubble of air at A. This would move from the beginning of the rarefaction; but our ignorance of the analogy between the density and elasticity hinders us from using it as a measure of either.

Plate CCCCI.

111 Remedied.

It is enough for our present purpose to observe, that the barometer or syphon gage is a perfect indication and measure of the performance of an air-pump, and that a pump is (*cæteris paribus*) so much the more perfect, as it is able to raise the mercury higher in the gage. It is in this way that we discover that none can produce a complete exhaustion, and that their operation is only a very great rarefaction: for none can raise the mercury to that height at which it stands in the Toricellian tube, well purged of air. Few pumps will bring it within $\frac{1}{10}$ of an inch. Hawkesbee's, fitted up according to his instructions, will seldom bring it within $\frac{1}{5}$. Pumps with cocks, when constructed according to the principles mentioned when speaking of the exhausting syringe, and new and in fine order, will in favourable circumstances bring it within $\frac{1}{20}$. None with valves fitted up with wet leather, or when water or volatile fluids are allowed access into any part, will bring it nearer than $\frac{1}{4}$. Nay, a pump of the best kind, and in the finest order, will have its rarefying power reduced to the lowest standard, as measured by this gage, if we put into the receiver the tenth part of a square inch of white sheep-skin, fresh from the shops, or of any substance equally damp. This is a discovery made by means of the improved air-pump, and leads to very extensive and important consequences in general physics; some of which will be treated of under this article: and the observation is made thus early, that our readers may better understand the improvements which have been made on this celebrated machine.

112 A complete exhaustion not effected by the air-pump.

It would require a volume to describe all the changes which have been made on it. An instrument of such multifarious use, and in the hands of curious men, each diving into the secrets of nature in his favourite line, must have received many alterations and real improvements in many particular respects. But these are beside our present purpose; which is to consider it merely as a machine for rarefying elastic or expansive fluids. We must therefore confine ourselves to this view of it; and shall carefully state to our readers every improvement founded on principle, and on pneumatical laws.

113 Various improvements of this machine.

All who used it perceived the limit set to the rarefaction by the resistance of the valves, and tried to perfect the construction of the cocks. The Abbé Nollet and Gravesande, two of the most eminent experimental philosophers in Europe, were the most successful.

114 By attempting to perfect the construction of the cocks.

Mr Gravesande justly preferred Hooke's plan of a double pump, and contrived an apparatus for turning the cocks by the motion of the pump's handle. This is far from either being simple or easy in working; and occasions great jerks and concussions in the whole machine. This, however, is not necessarily connected with the truly pneumatical improvement. His piston has no valve, and the rod is connected with it by a stirrup D (fig. 21), as in a common pump. The rod has a cylindric part *c p*, which passes through the stirrup, and has a stiff motion in it up and down of about half an inch; being stopped by the shoulder *c* above and the nut below. The round plate supported by this stirrup has a short square tube *n d*, which fits tight into the hole of a piece of cork F. The round plate E has a square shank *g*, which goes into the square tube *n d*. A piece of thin leather *f*, soaked in oil, is put between the cork and the plate E, and another between the cork and the plate which forms the sole of the stirrup. All these pieces are screwed together by the nail *e*, whose flat head covers the hole *n*. Suppose, therefore, the piston

115 Gravesande's improvement,

Air-pump.

touching the bottom of the barrel, and the winch turning to raise it again, the friction of the piston on the barrel keeps it in its place, and the rod is drawn up through the stirrup D. Thus the wheel has liberty to turn about an inch; and this is sufficient for turning the cock, so as to cut off the communication with the external air, and to open the communication with the receiver. This being done, and the motion of the winch continued, the piston is raised to the top of the barrel. When the winch is turned in the opposite direction, the piston remains fixed till the cock is turned, so as to shut the communication with the receiver, and open that with the external air.

116 And manner of using it.

117 A useful contrivance.

This is a pretty contrivance, and does not at first appear necessary; because the cocks might be made to turn at the beginning and end of the stroke without it. But this is just possible; and the smallest error of adjustment, or wearing of the apparatus, will cause them to be open at improper times. Besides, the cocks are not turned in an instant, and are improperly open during some very small time; but this contrivance completely obviates this difficulty.

118. The cock is precisely similar to that formerly described, having one perforation diametrically through it and another entering at right angles to this, and after reaching the centre, it passes along the axis of the cock, and comes out to the open air.

119 Its inconveniences

It is evident, that by this construction of the cock, the ingenious improvement of Dr Hooke, by which the pressure of the atmosphere on one piston is made to balance (in great part) the pressure on the other, is given up: for, whenever the communication with the air is opened, it rushes in, and immediately balances the pressure on the upper side of the piston in this barrel; so that the whole pressure in the other must be overcome by the person working the pump. Gravesande, aware of this, put a valve on the orifice of the cock; that is, tied a slip of wet bladder or oiled leather across it; and now the piston is pressed down, as long as the air in the barrel is rarer than the outward air, in the same manner as when the valve is in the piston itself.

120 Remedied.

121 Highly extolled, but

This is all that is necessary to be described in Mr Gravesande's air-pump. Its performance is highly extolled by him, as far exceeding his former pumps with valves. The same preference was given to it by his successor Muschenbroek. But, while they both prepared the pistons and valves and leathers of the pump, by steeping them in oil, and then in a mixture of water and spirits of wine, we are certain that no just estimate could be made of its performance. For with this preparation it could not bring the gage within $\frac{1}{5}$ of an inch of the barometer. We even see other limits to its rarefaction: from its construction, it is plain that a very considerable space is left between the piston and cock, not less than an inch, from which the air is never expelled; and if this be made extremely small, it is plain that the pump must be worked very slow, otherwise there will not be time for the air to diffuse itself from the receiver into the barrel, especially towards the end, when the expelling force, viz. the elasticity of the remaining air, is very small. There is also the same limit to the rarefaction, as in Hooke's or Hawkesbee's pump, opposed by the valve E, which will not open till the air below the piston is considerably denser than the external air: and this pump soon lost any advantages it possessed when fresh from the workman's hands, by the cock's growing loose and admitting air. It is surprising that Gravesande omitted Hawkesbee's security against this, by placing the barrels in a dish filled with oil; which would effectually have prevented this inconvenience.

122 Limited in its operation.

123 In one respect inferior to Hawkesbee's.

124 Advantage of short barrels.

We must not omit a seemingly paradoxical observation of Gravesande, that in a pump constructed with valves, and worked with a determined uniform velocity, the required degree of rarefaction is sooner produced by short barrels than by long ones. It would require too much time to give a general demonstration of this, but it will easily be seen by an example. Suppose the long barrel to have equal capacity with the receiver, then at the end of the first stroke the air in the receiver will have $\frac{1}{2}$ its natural density. Now, let the short barrels have half this capacity: at the end of the first stroke the density of the air in the receiver is $\frac{2}{3}$, and at the end of the second stroke it is $\frac{4}{9}$, which is less than $\frac{1}{2}$, and the two strokes of the short barrel are supposed to be made in the same time with one of the longest, &c.

125 Smeaton improves the valve-pump

Hawkesbee's pump maintained its pre-eminence without rival in Britain, and generally too on the continent, except in France, where every thing took the *ton* of the Academy, which abhorred being indebted to foreigners for any thing in science, till about the year 1750, when it engaged the attention of Mr John Smeaton, a person of uncommon knowledge, and second to none but Dr Hooke in sagacity and mechanical resource. He was then a maker of philosophical instruments, and made many attempts to perfect the pumps with cocks, but found, that whatever perfection he could bring them to, he could not enable them to preserve it; and he never would sell one of this construction. He therefore attached himself solely to the valve pumps.

126 By enlarging the valve-hole,

The first thing was to diminish the resistance to the entry of the air from the receiver into the barrels: this he rendered almost nothing, by enlarging the surface on which this feebly elastic air was to press. Instead of making these valves to open by its pressure on a circle of $\frac{1}{20}$ of an inch in diameter, he made the valve-hole one inch in diameter, enlarging the surface 400 times; and, to prevent this piece of thin leather from being burst by the great pressure on it, when the piston in its descent was approaching the bottom of the barrel, he supported it by a delicate but strong grating, dividing the valve-hole like the section of a honey-comb, as represented in fig. 22, n° 3; and the ribs of this grating are seen edgewise in fig. 22, n° 1, at *abc*.

Plate CCCCI.

127 Changing the structure of the valve, and

The valve was a piece of thin membrane or oiled silk, gently strained over the mouth of the valve-hole, and tied on by a fine silk thread wound round it in the same manner that the narrow slips had been tied on formerly. This done, he cut with a pointed knife the leather round the edge, nearly four quadrantal arcs, leaving a small tongue between each, as in fig. 22, n° 3. The strained valve immediately shrinks inwards, as represented by the shaded parts; and the strain by which it is kept down is now greatly diminished, taking place only at the corners. The gratings being reduced nearly to an edge (but not quite, lest they should cut), there is very little pressure to produce adhesion by the clammy oil. Thus it appears, that a very small elasticity of the air in the receiver will be sufficient to raise the valve; and Mr Smeaton found, that

Air-pump. that when it was not able to do this at first, when only about $\frac{1}{600}$ of the natural elasticity, it would do it after keeping the piston up eight or ten seconds, the air having been all the while undermining the valve, and gradually detaching it from the grating.

Unfortunately he could not follow this method with the piston valve. There was not room round the rod for such an expanded valve; and it would have obliged him to have a great space below the valve, from which he could not expel the air by the descent of the piston.

128 Increasing the expelling force. His ingenuity hit on a way of increasing the expelling force through the common valve: he inclosed the rod of the piston in a collar of leather *l*, through which it moved freely without allowing any air to get past its sides. For greater security, the collar of leather was contained in a box terminating in a cup filled with oil. As this makes a material change in the principle of construction of the air-pump (and indeed of pneumatic engines in general), and as it has been adopted in all the subsequent attempts to improve them, it merits a particular consideration.

129 Structure of his piston for this purpose. Plate CCCCI. The piston itself consists of two pieces of brass fastened by screws from below. The uppermost, which is of one solid piece with the rod GH (fig. 22, n° 1.), is of a diameter somewhat less than the barrel; so that when they are screwed together, a piece of leather soaked in a mixture of boiled oil and tallow, is put between them; and when the piston is thrust into the barrel from above, the leather comes up around the side of the piston, and fills the barrel, making the piston perfectly air-tight. The lower half of the piston projects upwards into the upper, which has a hollow *gbcg* to receive it. There is a small hole through the lower half at *a* to admit the air; and a hole *cd* in the upper half to let it through, and there is a slip of oiled silk strained across the hole *a* by way of valve, and there is room enough left at *bc* for this valve to rise a little when pressed from below. The rod GH passes through the piece of brass which forms the top of the barrel so as to move freely, but without any sensible shake: this top is formed into a hollow box, consisting of two pieces ECDF and CNOD, which screw together at CD. This box is filled with rings of oiled leather exactly fitted to its diameter, each having a hole in it for the rod to pass through. When the piece ECDF is screwed down, it compresses the leathers; squeezing them to the rod, so that no air can pass between them; and, to secure us against all ingress of air, the upper part is formed into a cup EF, which is kept filled with oil.

The top of the barrel is also pierced with a hole LK, which rises above the flat surface NO, and has a slip of oiled silk tied over it to act as a valve; opening when pressed from below, but shutting when pressed from above.

The communication between the barrel and receiver is made by means of the pipe ABPQ; and there goes from the hole K in the top of the barrel a pipe KRST, which either communicates with the open air or with the receiver, by means of the cock at its extremity T. The conduit pipe ABPQ has also a cock at Q, by which it is made to communicate either with the receiver or with the open air. These channels of communication are variously conducted and terminated, according to the views of the maker: the sketch in this figure is sufficient for explaining the principle, and is suited to the general form of the pump, as it has been frequently made by Nairne and other artists in London.

130 Superiority of this construction. Let us now suppose the piston at the top of the barrel, and that it applies to it all over, and that the air in the barrel is very much rarefied: in the common pump the piston valve is pressed hard down by the atmosphere, and continues shut till the piston gets far down, condenses the air below it beyond its natural state, and enables it to force up the valves. But here, as soon as the piston quits the top of the barrel, it leaves a void behind it; for no air gets in round the piston rod, and the valve at K is shut by the pressure of the atmosphere. There is nothing now to oppose the elasticity of the air below but the stiffness of the valve *bc*; and thus the expelling (or more accurately the liberating) force is prodigiously increased.

131 Shown by an example. The superiority of this construction will be best seen by an example. Suppose the stiffness of the valve equal to the weight of $\frac{1}{10}$ of an inch of mercury, when the barometer stands at 30 inches, and that the the pump gage stands at 29.9; then, in an ordinary pump, the valve in the piston will not rise till the piston has got within the 300th part of the bottom of the barrel, and it will leave the valve-hole filled with air of the ordinary density. But in this pump the valve will rise as soon as the piston quits the top of the barrel; and when it is quite down, the valve-hole *a* will contain only the 300th part of the air which it would have contained in a pump of the ordinary form. Suppose further, that the barrel is of equal capacity with the receiver, and that both pumps are so badly constructed, that the space left below the piston is the 300th part of the barrel. In the common pump the piston valve will rise no more, and the rarefaction can be carried no farther, however delicate the barrel valve may be; but in this pump the next stroke will raise the gage to 29.95, and the piston valve will again rise as soon as the piston gets half way down the barrel.

The limit to the rarefaction by this pump depends chiefly on the space contained in the hole LK; and in the space *bcd* of the piston. When the piston is brought up to the top, and applied close to it, those spaces remain filled with air of the ordinary density, which will expand as the piston descends, and thus will retard the opening of the piston valve. The rarefaction will stop when the elasticity of this small quantity of air, expanded so as to fill the whole barrel (by the descent of the piston to the bottom), is just equal to the force requisite for opening the piston valve.

132 It is easily worked. Another advantage attending this construction is, that in drawing up the piston, we are not resisted by the whole pressure of the air; because the air is rarefied above this piston as well as below it, and the piston is in precisely the same state of pressure as if connected with another piston in a double pump. The resistance to the ascent of the piston is the excess of the elasticity of the air above it over the elasticity of the air below: this, toward the end of the rarefaction, is very small, while the piston is near the bottom of the barrel, but gradually increases as the piston rises, and reduces the air above it into smaller dimensions, and becomes equal to the pressure of the atmosphere, when the air above the piston is of the common density. If we should raise the piston still farther, we must condense the air above it: but Mr Smeaton has here made an issue for the air by a small hole in the top of the barrel, covered with a delicate

Air pump. delicate valve. This allows the air to escape, and shuts again as soon as the piston begins to descend, leaving almost a perfect void behind it as before.

This pump has another advantage. It may be changed in a moment from a rarefying to a condensing engine, by simply turning the cocks at Q and T. While T communicates with the open air and Q with the receiver, it is a rarefying engine or air-pump: but when T communicates with the receiver, and Q with the open air, it is a condensing engine.

Plate CCCCII. 133 Description of Smeaton's pump.

Fig. 23. represents Mr Smeaton's air-pump as it is usually made by Nairne. Upon a solid base or table are set up three pillars F, H, H: the pillar F supports the pump-plate A; and the pillars H, H, support the front or head, containing a brass cog-wheel, which is turned by the handle B, and works in the rack C fastened to the upper end of the piston rod. The whole is still farther steadyed by two pieces of brass *c b* and *o k*, which connect the pump-plate with the front, and have perforations communicating between the hole *a* in the middle of the plate and the barrel, as will be described immediately. DE is the barrel of the pump, firmly fixed to the table by screws thro' its upper flanch: *e f d c* is a slender brass tube screwed to the bottom of the barrel, and to the under hole of the horizontal canal *c b*. In this canal there is a cock which opens a communication between the barrel and the receiver, when the key is in the position represented here: but when the key is at right angles with this position, this communication is cut off. If that side of the key which is here drawn next to the pump-plate be turned outward, the external air is admitted into the receiver; but if turned inwards, the air is admitted into the barrel.

g h is another slender brass pipe, leading from the discharging valve at *g* to the horizontal canal *h k*, to the under side of which it is screwed fast. In this horizontal canal there is a cock *n* which opens a passage from the barrel to the receiver when the key is in the position here drawn; but opens a passage from the barrel to the external air when the key is turned outwards, and from the receiver to the external air when the key is turned inwards. This communication with the external air is not immediate but through a sort of box *i*; the use of this box is to receive the oil which is discharged through the top valve *g*. In order to keep the pump tight, and in working order, it is proper sometimes to pour a table-spoonful of olive-oil into the hole *a* of the pump-plate, and then to work the pump. The oil goes along the conduit *b c d f e*, gets into the barrel and through the piston-valve, when the piston is pressed to the bottom of the barrel, and is then drawn up, and forced through the discharging valve *g* along the pipe *g h*, the horizontal passage *h n*, and finally into the box *i*. This box has a small hole in its side near the top, through which the air escapes.

From the upper side of the canal *c b* there rises a slender pipe which bends outward and then turns downwards, and is joined to a small box, which cannot be seen in this view. From the bottom of this box proceeds downwards the gage-pipe of glass, which enters the cistern of mercury G fixed below.

On the upper side of the other canal at *o* is seen a small stud, having a short pipe of glass projecting horizontally from it, close by and parallel to the front piece of the pump, and reaching to the other canal. This pipe is close at the farther end, and has a small drop of mercury or oil in it at the end *o*. This serves as a gage in condensing, indicating the degree of condensation by the place of the drop: For this drop is forced along the pipe, condensing the air before it in the same degree that it is condensed in the barrel and receiver.

134 Method of joining together the different pipes, &c.

In constructing this pump, Mr Smeaton introduced a method of joining together the different pipes and other pieces, which has great advantages over the usual manner of screwing them together with leather between, and which is now much used in hydraulic and pneumatic engines. We shall explain this to our readers by a description of the manner in which the exhausting gage is joined to the horizontal duct *c b*.

Plate CCCCI. Plate CCCCII.

The piece *h i p*, in fig. 22, n° 2. is the same with the little cylinder observable on the upper side of the horizontal canal *c d*, in fig. 23. The upper part *h i* is formed into an outside screw, to fit the hollow screw of the piece *d e e d*. The top of this last piece has a hole in its middle, giving an easy passage to the bent tube *c b a*, so as to slip along it with freedom. To the end *c* of this bent tube is soldered a piece of brass *c f g*, perforated in continuation of the tube, and having its end ground flat on the top of the piece *h i p*, and also covered with a slip of thin leather strained across it and pierced with a hole in the middle.

It is plain from this form, that if the surface *f g* be applied to the top of *h i*, and the cover *d e e d* be screwed down on it, it will draw or press them together, so that no air can escape by the joint, and this without turning the whole tube *c b a* round, as is necessary in the usual way. This method is now adopted for joining together the conducting pipes of the machines for extinguishing fires, an operation which was extremely troublesome before this improvement.

The conduit pipe E *e f c* (fig. 23.) is fastened to the bottom of the barrel, and the discharging pipe *g h* to its top, in the same manner. But to return to the gage; the bent pipe *c b a* enters the box *s t* near one side, and obliquely, and the gage pipe *q r* is inserted through its bottom towards the opposite side. The use of this box is to catch any drops of mercury which may sometimes be dashed up through the gage pipe by an accidental oscillation. This, by going through the passages of the pump, would corrode them, and would act particularly on the joints, which are generally soldered with tin. When this happens to an air-pump, it must be cleaned with the most scrupulous attention, otherwise it will be quickly destroyed.

135 Great powers of this pump.

This account of Smeaton's pump is sufficient for enabling the reader to understand its operation and to see its superiority. It is reckoned a very fine pump of the ordinary construction which will rarefy 200 times, or raise the gage to 29.85, the barometer standing at 30. But Mr Smeaton found, that his pump, even after long using, raised it to 29.95, which we consider as equivalent to rarefying 600 times. When in fine order, he found no bounds to its rarefaction, frequently raising the gage as high as the barometer; and he thought its performance so perfect, that the barometer-gage was not sufficiently delicate for measuring the rarefaction. He therefore substituted the syphon gage already described, which he gives some reasons for preferring; but even this he found not sufficiently sensible.

He contrived another, which could be carried to any

Air-pump.

any degree of sensibility. It consisted of a glass body A (fig. 24.), of a pear shape, and was therefore called the pear-gage. This had a small projecting orifice at B, and at the other end a tube CD, whose capacity was the hundredth part of the capacity of the whole vessel. This was suspended at the slip-wire of the receiver, and there was set below it a small cup with mercury. When the pump was worked, the air in the pear-gage was rarefied along with the rest. When the rarefaction was brought to the degree intended, the gage was let down till B reached the bottom of the mercury. The external air being now let in, the mercury was raised into the pear, and stood at some height E in the tube CD. The length of this tube being divided into 100 parts, and those numbered from D, it is evident that $\frac{DE}{DB}$ will express the degree of rarefaction which had been produced when the gage was immersed into the mercury: or if DC be $\frac{1}{100}$ of the whole capacity, and be divided into 100 parts by a scale annexed to it, each unit of the scale will be $\frac{1}{10000}$ of the whole.

136 Another contrivance of Smeaton's Plate CCCCII.

137 Very ingenious.

This was a very ingenious contrivance, and has been the means of making some very curious and important discoveries which at present engage the attention of philosophers. By this gage Mr Smeaton found, that his pump frequently rarefied a thousand, ten thousand, nay an hundred thousand, times. But though he in every instance saw the great superiority of his pump above all others, he frequently found irregularities which he could not explain, and a want of correspondence between the pear and the barometer gages which puzzled him. The pear-gage frequently indicated a prodigious rarefaction, when the barometer-gage would not show more than 600.

138 It excited the attention of the literary world.

These unaccountable phenomena excited the curiosity of philosophers, who by this time were making continual use of the air-pump in their meteorological researches, and much interested in every thing connected with the state or constitution of elastic fluids. Mr Nairne, a most ingenious and accurate maker of philosophical instruments, made many curious experiments in the examination and comparison of Mr Smeaton's pump with those of the usual construction, attending to every circumstance which could contribute to the inferiority of the common pumps or to their improvement, so as to bring them nearer to this rival machine. This rigorous comparison brought into view several circumstances in the constitution of the atmospheric air, and its relation to other bodies, which are of the most extensive and important influence in the operations of nature. We shall notice at present such only as have a relation to the operation of the air-pump in extracting AIR from the receiver.

139. Experiments with it by Mr Nairne

Mr Nairne found, that when a little water, or even a bit of paper damped with water, was exposed under the receiver of Mr Smeaton's air-pump, when in the most perfect condition, raising the mercury in the barometer-gage to 29.95, he could not make it rise above 29.8 if Fahrenheit's thermometer indicated the temperature 47°, nor above 29.7 if the thermometer stood at 55°; and that to bring the gage to this height and keep it there, the operation of the pump must be continued for a long time after the water had disappeared or the paper become perfectly dry. He found that a drop of spirits, or paper moistened with spirits, could not in those circumstances allow the mercury in the gage to rise to near that height; and that similar effects followed from admitting any volatile body whatever into the receiver or any part of the apparatus.

140 Show the impropriety of soaking the leather with water,

This showed him at once how improper the directions were which had been given by Gueriche, Boyle, Gravesande, and others, for fitting up the air-pump for experiment, by soaking the leather in water, covering the joints with water, or in short, admitting water or any other volatile body near it.

141 And the utility of using olive oil and tallow.

He therefore took his pumps to pieces, cleared them of all the moisture which he could drive from them by heat, and then leathered them anew with leather soaked in a mixture of olive oil and tallow, from which he had expelled all the water it usually contains, by boiling it till the first frothing was over. When the pumps were fitted up in this manner, he uniformly found that Mr Smeaton's pump rarefied the gage to 29.95, and the best common pump to 29.87, the first of which he computed to indicate a rarefaction to 600, and the other to 230. But in this state he again found that a piece of damp paper, leather, wood, &c. in the receiver, reduced the performance in the same manner as before.

142 A remarkable phenomenon

But the most remarkable phenomenon was, that when he made use of the pear-gage with the pump cleared from all moisture, it indicated the same degree of rarefaction with the barometer-gage: but when he exposed a bit of paper moistened with spirits, and thus reduced the rarefaction of the pump to what he called 50, the barometer-gage standing at 29.4, the pear-gage indicated a rarefaction exceeding 100,000; in short, it was not measurable; and this phenomenon was almost constant. Whenever he exposed any substance susceptible of evaporation, he found the rarefaction indicated by the barometer-gage greatly reduced, while that indicated by the pear-gage was prodigiously increased; and both these effects were more remarkable as the subject was of easier evaporation, or the temperament of the air of the chamber was warmer.

143 Accounted for.

This uniform result suggested the true cause. Water boils at the temperature 212, that is, it then converted into a vapour which is permanently elastic while of that temperature, and its elasticity balances the pressure of the atmosphere. If this pressure be diminished by rarefying the air above it, a lower temperature will now allow it to be converted into elastic vapour, and keep it in that state. Water will boil in the receiver of an air-pump at the temperament 96, or even under it. Philosophers did not think of examining the state of the vapour in temperatures lower than what produced ebullition. But it now appears, that in much lower heats than this the superficial water is converted into elastic vapour, which continues to exhale from it as long as the water lasts, and, supplying the place of air in the receiver, exerts the same elasticity, and hinders the mercury from rising in the gage in the same manner as so much air of equal elasticity would have done.

144. Experiments illustrating this account.

When Mr Nairne was exhibiting these experiments to the Honourable Henry Cavendish in 1776, this gentleman informed him that it appeared from a series of experiments of his father Lord Charles Cavendish, that when water is of the temperature 72°, it is converted into vapour, under any pressure less than three-fourths of an inch of mercury, and at 41° it becomes vapour when the pressure is less than one-fourth of an inch:

Even

Even mercury evaporates in this manner when all pressure is removed. A dewy appearance is frequently observed covering the inside of the tube of a barometer, where we usually suppose a vacuum. This dew, when viewed through a microscope, appears to be a set of detached globules of mercury, and upon inclining the tube so that the mercury may ascend along it, these globules will be all licked up, and the tube become clear. The dew which lined it was the vapour of the mercury condensed by the side of the tube; and it is never observed but when one side is exposed to a stream of cold air from a window, &c.

To return to the vapour in the air-pump receiver, it must be observed, that as long as the water continues to yield it, we may continue to work the pump; and it will be continually abstracted by the barrels, and discharged in the form of water, because it collapses as soon as exposed to the external pressure. All this while the gage will not indicate any more rarefaction, because the thing immediately indicated by the barometer-gage is *diminished elasticity*, which does not happen here. When all the water which the temperature of the room can keep elastic has evaporated under a certain pressure, suppose $\frac{1}{2}$ an inch of mercury, the gage standing at 29.5, the vapour which now fills the receiver expands, and by its diminished elasticity the gage rises, and now some more water which had been attached to bodies by chemical or corpuscular attraction is detached, and a new supply continues to support the gage at a greater height; and this goes on continually till *almost* all has been abstracted: but there will remain some which no art take can away; for as it passes through the barrels, and gets between the piston and the top, it successively collapses into water during the ascent of the piston, and again expands into vapour when we push the piston down again. Whenever this happens there is an end of the rarefaction.

145 **Air and vapour not uniformly mixed together.**

While this operation is going on, the air comes out along with the vapour; but we cannot say in what proportion. If it were always uniformly mixed with the vapour, it would diminish rapidly; but this does not appear to be the case. There is a certain period of rarefaction in which a transient cloudiness is perceived in the receiver. This is watery vapour formed at that degree of rarefaction, mingled with, but not dissolved in or united with, the air, otherwise it would be transparent. A similar cloud will appear if damp air be admitted suddenly into an exhausted receiver. The vapour, which formed an uniform transparent mass with the air, is either suddenly expanded and thus detached from the other ingredient, or is suddenly let go by the air, which expands more than it does. We cannot affirm with probability which of these is the case: different compositions of air, that is, air loaded with vapours from different substances, exhibit remarkable differences in this respect. But we see from this and other phenomena, which shall be mentioned in their proper places, that the air and vapour are not always intimately united; and therefore will not always be drawn out together by the air-pump. But let them be ever so confusedly blended, we see that the air must come out along with the vapour, and its quantity remaining in the receiver must be prodigiously diminished by this association, probably much more than could be, had the receiver only contained pure air.

146 **Consequences of this different in the pear and barometer gages.**

Let us now consider what must happen in the pear-gage. As the air and vapour are continually drawn off from the receiver, the air in the pear expands and goes off with it. We shall suppose that the generated vapour hinders the gage from rising beyond 29.5. During the continued working of the pump, the air in the pear, whose elasticity is 0.5, slowly mixes with the vapour at the mouth of the pear, and the mixture even advances into its inside, so that if the pumping be long enough continued, what is in the pear is nearly of the same composition with what is in the receiver, consisting perhaps of 20 parts of vapour and one part of air, all of the elasticity of 0.5. When the pear is plunged into the mercury, and the external air allowed to get into the receiver, the mercury rises in the pear-gage, and leaves not $\frac{1}{60}$, but $\frac{1}{60 \times 20}$ or $\frac{1}{1200}$ of it filled with common air, the vapour having collapsed into an invisible atom of water. Thus the pear-gage will indicate a rarefaction of 1200, while the barometer-gage only showed 60, that is, showed the elasticity of the included substance diminished 60 times. The conclusion to be drawn from these two measures (the one of the rarefaction of air, and the other of the diminution of elasticity) is, that the matter with which the receiver was filled, immediately before the readmission of the air, consisted of one part of incondensible air, and $\frac{1200}{60}$, or 20 parts of watery vapour.

147 **Difficulty in accounting for some of these consequences.**

The only obscure part of this account is what relates to the composition of the matter which filled the pear-gage before the admission of the mercury. It is not easy to see how the vapour of the receiver comes in by a narrow mouth while the air is coming out by the same passage. Accordingly it requires a *very long time* to produce this extreme rarefaction in the pear-gage; and there are great irregularities in any two succeeding experiments, as may be seen by looking at Mr Nairne's account of them in Philosophical Transactions, Vol. LXVII. Some vapours appear to have mixed much more readily with the air than others; and there are some unaccountable cases where vitriolic acid and sulphureous bodies were included, in which the diminution of density indicated by the pear-gage was uniformly less than the diminution of elasticity indicated by the barometer-gage. It is enough for us at present to have established, by unquestionable facts, this production of elastic vapour, and the necessity of attending to it, both in the construction of the air-pump and in drawing results from experiments exhibited in it.

148 **The superiority of this pump excites to new improvements.**

Mr Smeaton's pump, when in good order, and perfectly free from all moisture, will in dry weather rarefy air about 600 times, raising the barometer-gage to within $\frac{1}{10}$ of an inch of a fine barometer. This was a performance so much superior to that of all others, and by means of Mr Nairne's experiments opened so new a field of observation, that the air-pump once more became a capital instrument among the experimental philosophers. The causes of its superiority were also so distinct, that artists were immediately excited to a farther improvement of the machine; so that this becomes a new epoch in its history.

This is one imperfection which Mr Smeaton has not attempted to remove. The discharging valve is still opened

Air-pump. ed against the pressure of the atmosphere. An author of the Swedish academy adds a subsidiary pump to this valve, which exhausts the air from above it, and thus puts it in the situation of the piston valve. We do not find that this improvement has been adopted so as to become general. Indeed the quantity of air which remains in the passage to this valve is so exceedingly little, that it does not seem to merit attention. Supposing the valve-hole $\frac{1}{10}$ of an inch wide and as deep (and it need not be more), it will not occupy more than $\frac{1}{5000}$ part of a barrel twelve inches long and two inches wide.

149 Improvements in this pump attempted

150 Mr Smeaton, by his ingenious construction, has greatly diminished, but has not annihilated, the obstructions to the passage of the air from the receiver into the barrel. His success encouraged farther attempts. One of the first and most ingenious was that of Professor Russel of the university of Edinburgh, who about the year 1770 constructed a pump in which both cocks and valves were avoided.

151 By Russel, The piston is solid, as represented in fig. 25. and its rod passes through a collar of leather on the top of the barrel. This collar is divided into three portions by two brass rings *a*, *b*, which leave a very small space round the piston rod. The upper ring *a* communicates by means of a lateral perforation with the bent tube *l m n*, which enters the barrel at its middle *n*. The lower ring *b* communicates with the bent tube *c d*, which communicates with the horizontal passage *d e*, going to the middle *e* of the pump plate. By the way, however, it communicates also with a barometer gage *p o*, standing in a cistern of mercury *o*, and covered with a glass tube close at the top. Beyond *e*, on the opposite circumference of the receiver plate, there is a cock or plug *f* communicating with the atmosphere.

The piston rod is closely embraced by the three collars of leather; but, as already said, has a free space round it in the two brass rings. To produce this pressure of the leathers to the rod, the brass rings which separate them are turned thinner on the inner side, so that their cross section along a diameter would be a taper wedge. In the side of the piston rod are two cavities *q r*, *t s*, about one-tenth of an inch wide and deep, and of a length equal to the thickness of the two rings *a*, *b*, and the intermediate collar of leathers. These cavities are so placed on the piston-rod, that when the piston is applied to the bottom of the barrel, the cavity *t s* in the upper end of the rod has its upper end opposite to the ring *a*, and its lower end opposite to the ring *b*, or to the mouth of the pipe *c d*. Therefore, if there be a void in the barrel, the air from the receiver will come from the pipe *c d* into the cavity in the piston rod, and by it will get past the collar of leather between the rings, and thus will get into the small interstice between the rod and the upper ring, and then into the pipe *l m n*, and into the empty barrel. When the piston is drawn up, the solid rod immediately shuts up this passage, and the piston drives the air through the discharging valve *k*. When it has reached the top of the barrel, and is closely applied to it, the cavity *q r* is in the situation in which *t s* formerly was, and the communication is again opened between the receiver and the empty barrel, and the air is again diffused between them. Pushing down the piston expels the air by the lower discharging pipe and valve *b i*; and thus the operation may be continued.

This must be acknowledged to be a most simple and ingenious construction, and can neither be called a cock nor a valve. It seems to oppose no obstruction whatever: and it has the superior advantage of rarefying both during the ascent and the descent of the piston, doubling the expedition of the performance, and the operator is not opposed by the pressure of the atmosphere except towards the end of each stroke. The expedition, however, is not so great as one should expect; for nothing is going on while the piston is in motion, and the operator must stop a while at the end of each stroke, that the air may have time to come through this long, narrow, and crooked passage, to fill the barrel. But the chief difficulty which occurred in the execution arose from the clammy oil with which it was necessary to impregnate the collar of leathers. These were always in a state of strong compression, that they might closely grasp the piston rod, and prevent all passage of air during the motion of the piston. Whenever therefore the cavities in the piston rod come into the situations necessary for connecting the receiver and barrel, this oil is squeezed into them, and choaks them up. Hence it always happened that it was some time after the stroke before the air could force its way round the piston rod, carrying with it the clammy oil which choaked up the tube *l m n*; and when the rarefaction had proceeded a certain length, the diminished elasticity of the air was not able to make its way through these obstructions. The death of the ingenious author put a stop to the improvements by which he hoped to remedy this defect, and we have not heard that any other person has since attempted it. We have inserted it here, because its principle of construction is not only very ingenious, but entirely different from all others, and may furnish very useful hints to those who are much engaged in the construction of pneumatic engines.

152 By Haas and Hurter, In the 73d volume of the Philosophical Transactions, Mr Tiberius Cavallo has given the description of an air-pump contrived and executed by Messrs Haas and Hurter, instrument-makers in London, where these artists have revived Guericke's method of opening the barrel-valve during the last strokes of the pump by a force acting from without. We shall insert so much of this description as relates to this distinguishing circumstance of its construction.

Fig. 26. represents a section of the bottom of the barrel, where AA is the barrel and BB the bottom, which has in its middle a hollow cylinder CCFF, projecting about half an inch into the barrel at CC, and extending a good way downwards to FF. The space between this projection and the sides of the barrel is filled up by a brass ring DD, over the top of which is strained a piece of oiled silk EE, which performs the office of a valve, covering the hole CC. But this hole is filled up by a piece of brass, or rather an assemblage of pieces screwed together GGHHII. It consists of three projecting fillets or shoulders GG, HH, II, which form two hollows between them, and which are filled with rings of oiled leather OO, PP, firmly screwed together. The extreme fillets GG, II, are of equal diameter with the inside of the cylinder, so as to fill it exactly, and the whole stuffed with oiled leather, slide up and down without allowing any air to pass. The middle fillet HH is not so broad, but thicker. In the upper fillet GG there is formed a shallow dish about $\frac{1}{7}$ of an inch deep

 deep and ½ wide. This dish is covered with a thin plate, pierced with a grating like Mr Smeaton's valve-plate. There is a perforation VX along the axis of this piece, which has a passage out at one side H, through the middle fillet. Opposite to this passage, and in the side of the cylinder CCFF, is a hole M, communicating with the conduit pipe MN, which leads to the receiver. Into the lower end of the perforation is screwed the pin KL, whose tail L passes through the cap FF. The tail L is connected with a lever RQ, moveable round the joint Q. This lever is pushed upwards by a spring, and thus the whole piece which we have been describing is kept in contact with the slip of oiled silk or valve EE. This is the usual situation of things.

153 Now suppose a void formed in the barrel by drawing up the piston; the elasticity of the air in the receiver, in the pipe NM, and in the passage XV, will press on the great surface of the valve exposed through the grating, will raise it, and the pump will perform precisely as Mr Smeaton's does. But suppose the rarefaction to have been so long continued, that the air is no longer able to raise the valve; this will be seen by the mercury rising no more in the pump-gage. When this is perceived, the operator must press with his foot on the end R of the lever RQ. This draws down the pin KL, and with it the whole hollow plug with its grated top. And thus, instead of raising the valve from its plate, the plate is here drawn down from the valve. The air now gets in without any obstruction whatever, and the rarefaction proceeds as long as the piston rises. When it is at the top of the barrel, the operator takes his foot from the lever, and the spring presses up the plug again and shuts the valve. The piston rod passes through a collar of leather, as in Mr Smeaton's pump, and the air is finally discharged through an outward valve in the top of the barrel. These parts have nothing peculiar in them.

This is an ingenious contrivance, similar to what was adapted by Guericke himself; and we have no doubt of these pumps performing extremely well if carefully made: and it seems not difficult to keep the plug perfectly air-tight by supplying plenty of oil to the leathers. We cannot say, however, with precision what may be expected from it, as no account has been given of its effects besides what Mr Cavallo published in Philosophical Transactions 1783, where he only says, that when it had been long used, it had, in the course of some experiments, rarefied 600 times.

154 By Prince, Aiming still at the removing the obstructions to the entry of the air from the receiver into the barrels, Mr Prince, an American, has constructed a pump in which there is no valve or cock whatever between them. In this pump the piston rod passes through a collar of leathers, and the air is finally discharged through a valve, as in the two last. But we are chiefly to attend, in this place, to the communication between the barrel and the receiver. The barrel widens below into a sort of cistern ABCD (fig. 27.), communicating with the receiver by the pipe EF. As soon, therefore, as the piston gets into this wider part, where there is a vacancy all round it, the air of the receiver expands freely through the passage FEE into the barrel, in which the descent of the piston had made a void. When the piston is again drawn up, as soon as it gets into the cylindric part of the barrel, which it exactly fills, it carries up the air before it, and expels it by the top valve; and, that this may be done more completely, this valve opens into a second barrel or air-pump whose piston is rising at the same time, and therefore the valve of communication (which is the discharging valve of the primary pump) opens with the same facility as Mr Smeaton's piston valve. While the piston is rising, the air in the receiver expands into the barrel; and when the piston descends, the air in the barrel again collapses till the piston gets again into the cistern, when the air passes out, and fills the evacuated barrel, to be expelled by the piston as before.

Plate CCCCII.

No distinct account has as yet been given of the performance of this pump. We only learn that great inconveniences were experienced from the oscillations of the mercury in the gage. As soon as the piston comes into the cistern, the air from the receiver immediately rushes into the barrel, and the mercury shoots up in the gage, and gets into a state of oscillation. The subsequent rise of the piston will frequently keep time with the second oscillation, and increase it. The descent of the piston produces a downward oscillation, by allowing the air below it to collapse; and, by improperly timing the strokes, this oscillation becomes so great as to make the mercury enter the pump. To prevent this, and a greater irregularity of working as a condenser, valves were put in the piston: but as these require force to open them, the addition seemed rather to increase the evil, by rendering the oscillations more simultaneous with the ordinary rate of working. If this could be got over, the construction seems very promising.

It appears, however, of very difficult execution. It has many long, slender, and crooked passages, which must be drilled through broad plates of brass, some of them appearing scarcely practicable. It is rare to find plates and other pieces of brass without air-holes, which it would be very difficult to find out and to close; and it must be very difficult to clear it of obstructions: so that it appears rather a suggestion of theory than a thing warranted by its actual performance.

155 By Lavoisier. Mr Lavoisier, or some of the naturalists who were occupied in concert with him in the investigation of the different species of gas which are disengaged from bodies in the course of chemical operations, has contrived an air-pump which has great appearance of simplicity, and, being very different from all others, deserves to be taken notice of.

It consists of two barrels l, m, fig. 28. with solid pistons $k\,k$. The pump-plate $a\,b$ is pierced at its centre e with a hole which branches towards each of the barrels, as represented by $c\,d$, $c\,e$. Between the plate and the barrels slides another plate $b\,i$, pierced in the middle with a branched hole $f\,d\,g$, and near the ends with two holes $b\,b$, $i\,i$, which go from its underside to the ends. The holes in these two plates are so adjusted, that when the plate $b\,i$ is drawn so far towards b that the hole i comes within the barrel m, the branch $d\,f$ of the hole in the middle plate coincides with the branch $c\,d$ of the upper plate, and the holes e, g are shut. Thus a communication is established between the barrel l and the receiver on the pump-plate, and between the barrel m and the external air. In this situation the barrel l will exhaust, and m will discharge. When the piston of l is at its mouth, and that of m touches its bottom, the sliding plate is shifted over to the other side, so that m com-

Air-pump. *a* communicates with the receiver through the passage *gd*, *ee*, and *l* communicates with the air by the passages *bb*.

It is evident that this sliding plate performs the office of four cocks in a very beautiful and simple manner, and that if the pistons apply close to the ends of the barrels, so as to expel the whole air, the pump will be perfect. It works, indeed, against the whole pressure of the external air. But this may be avoided by putting valves on the holes *h*, *i*; and these can do no harm, because the air remaining in them never gets back into the barrel till the piston be at the farther end, and the exhaustion of that stroke completed. But the best workmen of London think that it will be incomparably more difficult to execute this cock (for it is a cock of an unusual form), in such a manner that it shall be air-tight and yet move with tolerable ease, and that it is much more liable to wearing loose than common cocks. No accurate accounts have been received of its performance. It must be acknowledged to be ingenious, and it may suggest to an intelligent artist a method of combining common conical cocks upon one axis so as to answer the same purposes much more effectually; for which reason we have inserted it here.

156 And by Cuthbertson. The last improvement which we shall mention is that published by Mr Cuthbertson philosophical instrument-maker in Amsterdam. His pump has given such evidences of its perfection, that we can hardly expect or wish for any thing more complete. But we must be allowed to observe, beforehand, that the same construction was invented, and, in part, executed before the end of 1779, by Dr Daniel Rutherford, now professor of botany in the university of Edinburgh, who was at that time engaged in experiments on the production of air during the combustion of bodies in contact with nitre, and who was vastly desirous of procuring a more complete abstraction of pure aerial matter than could be effected by Mr Smeaton's pump. The compiler of this article had then an opportunity of perusing the Doctor's dissertation on this subject, which was read in the Philosophical Society of Edinburgh. In this dissertation the Doctor appears fully apprised of the existence of pure vital air in the nitrous acid as its chief ingredient, and as the cause of its most remarkable phenomena, and to want but a step to the discoveries which have ennobled the name of Mr Lavoisier. He was particularly anxious to obtain *apart* this distinguishing ingredient in its composition, and, for this purpose, to abstract completely from the vessel in which he subjected it to examination, every particle of elastic matter. The writer of this article proposed to him to cover the bottom of Mr Smeaton's piston with some clammy matter, which should take hold of the bottom valve, and *start it* when the piston was drawn up. A few days after, the Doctor showed him a drawing of a pump, having a conical metal valve in the bottom, furnished with a long slender wire, sliding in the inside of the piston-rod with a gentle friction, sufficient for lifting the valve, and secured against all chance of failure by a spring a-top, which took hold of a notch in the inside of the piston-rod about a quarter of an inch from the lower end, so as certainly to lift the valve during the last quarter of an inch of the piston's motion. Being an excellent mechanic, he had executed a valve on this principle, and was fully satisfied with its performance. But having already confirmed his doctrines respecting the nitrous acid by incontrovertible experiments, his wishes to improve the air-pump lost their incitement, and he thought no more of it; and not long after this, the ardour of the philosophers of the Teylerian Society at Haerlem and Amsterdam excited the efforts of Mr Cuthbertson, their instrument-maker, to the same purpose, and produced the most perfect air-pump that has yet appeared. We shall give a description of it, and an account of its performance, in the inventor's own words.

Cuthbertson's Air-Pump.

Plate CCCCVIII. is a perspective view of this pump, with its two principal gages screwed into their places. These need not be used together, except in cases where the utmost exactness is required. In common experiments one of them is removed, and a stop-screw put in its place. When the pear-gage is used, a small round plate, on which the receiver may stand, must be first screwed into the hole at A; but this hole is stopped on other occasions with a screw. When all the three gages are used, and the receiver is exhausted, the stop-screw B, at the bottom of the pump, must be unscrewed, to admit the air into the receiver; but when they are not all used, either of the other stop-screws will answer this purpose. 157

Fig. 2. represents a cross-bar for preventing the barrels from being shaken by working the pump or by any accident. Its place in fig. 1. is represented by the dotted lines. It is confined in its place, and kept close down on the barrels by two slips of wood NN, which must be drawn out, as well as the screws OO, when the pump is to be taken asunder.

Plate CCCCIX. is a section of all the working parts of the pump, except the wheel and rack, in which there is nothing uncommon.

Fig. 1. is a section of one of the barrels, with all its internal parts; and fig. 2, 3, 4, and 5, are different parts of the piston, proportioned to the size of the barrel (A) and to one another.

In fig. 1. CD represents the barrel, F the collar of leathers, G a hollow cylindrical vessel to contain oil, R is also an oil-vessel to receive the oil which is drawn, along with the air, through the hole *aa*, when the piston is drawn upwards; and, when this is full, the oil is carried over with the air, along the tube T, into the oil-vessel G. *cc* is a wire which is driven upwards from the hole *aa* by the passage of the air; and as soon as this has escaped, it falls down again by its own weight, shuts up the hole, and prevents all return of the air into the barrel. At *dd* are fixed two pieces of brass, to keep the wire *cc* in a vertical direction, that it may accurately shut the hole. H is a cylindrical

(A) The piston and barrel are 1,65 inches in diameter, in proportion to which the scale is drawn. Figures 2, 3, 4, 5. are, however, of double size.

Air-pump. cal wire or rod which carries the piston I, and is made hollow to receive a long wire $g\,g$, which opens and shuts the hole L; and on the other end of the wire O is screwed a nut, which, by stopping in the narrowest part of the hole, prevents the wire from being driven up too far. This wire and screw are more clearly seen in fig. 2. and 6; they slide in a collar of leather $r\,r$, fig. 2. and 5. in the middle piece of the piston. Fig. 4. and 5. are the two mean parts which compose the piston, and, when the pieces 3. and 6. are added to it, the whole is represented by fig. 2. Fig. 5. is a piece of brass of a conical form, with a shoulder at the bottom. A long hollow screw is cut in it, about $\frac{1}{7}$ of its length, and the remainder of the hole, in which there is no screw, is of about the same diameter with the screwed part, except a thin plate at the end, which is of a width exactly equal to the thickness of $g\,g$. That part of the inside of the conical brass in which no thread is cut, is filled with oiled leathers with holes through which $g\,g$ can slide stiffly. There is also a male screw with a hole in it, fitted to $g\,g$, serving to compress the leathers $r\,r$. In fig. 4. $a\,a\,a\,a$ is the outside of the piston, the inside of which is turned so as exactly to fit the outside of fig. 5. $b\,b$ are round leathers about 60 in number, $c\,c$ is a circular piece of brass of the size of the leathers, and $d\,d$ is a screw serving to compress them. The screw at the end of fig. 3. is made to fit the screw in fig. 5. Now if fig. 6. be pushed into fig. 5, this into fig. 4, and fig. 3. be screwed into the end of fig. 5, these will compose the whole of the piston, as represented in fig. 2. H in fig. 1. represents the same part as H in fig. 2, and is that to which the rack is fixed. If, therefore, this be drawn upwards, it will cause fig. 5. to shut close into fig. 4, and drive out the air above it; and when it is pushed downward, it will open as far as the shoulder $a\,a$ will permit, and suffer air to pass through. AA fig. 7. is the receiver plate, BB is a long square piece of brass, screwed into the under side of the plate, through which a hole is drilled corresponding to that in the centre of the receiver-plates and with three female screws b, b, c.

Plate CCCCIX.

The rarefaction of the air in the receiver is effected as follows. Suppose the piston at the bottom of the barrel. The inside of the barrel, from the top of the piston to a, contains common air. When the rod is drawn up, the upper part of the piston sticks fast in the barrel till the conical part connected with the rod shuts the conical hole, and its shoulder applies close to its bottom. The piston is now shut, and therefore the *whole* is drawn up by the rack-work, driving the air before it through the hole $a\,o$, into the oil-vessel at R, and out into the room by the tube T. The piston will then be at the top of the barrel at a, and the wire $g\,g$ will stand nearly as represented in the figure just raised from the hole L, and prevented from rising higher by the nut O. During this motion the air will expand in the receiver, and come along the bent tube m into the barrel. Thus the barrel will be filled with air, which, as the piston rises, will be rarefied in proportion as the capacity of the receiver, pipes, and barrel is to the barrel alone. When the piston is moved down again by the rack-work, it will force the conical part fig. 5. out of the hollow part fig. 4. as far as the shoulders $a\,a$; fig. 2. will rest on $a\,a$ fig. 4, which will then be so far open as to permit the air to pass freely through it, while at the same time the end of $g\,g$ is forced against the top of the hole, and shuts it in order to prevent any air from returning into the receiver. Thus the piston, moving downwards, suffers the air to pass out between the sides of fig. 4. and 5.; and, when it is at the bottom of the barrel, will have the column of air above it; and, consequently, when drawn upwards it will shut, and drive out this air, and, by opening the hole L at the same time, will give a free passage to more air from the receiver. This process being continued, the air of the receiver will be rarefied *as far as its expansive power will permit*. For in this machine there are no valves to be forced open by the elasticity of the air in the receiver, which at last it is unable to effect. There is therefore nothing to prevent the air from expanding to its utmost degree.

It may be suspected here, that as the air must escape thro' the discharging passage $a\,c$, Plate CCCCIX. fig. 1. against the pressure of a column of oil and the weight of the wire, there will remain in this passage a quantity of air of considerable density, which will expand again into the barrel during the descent of the piston, and thus put a stop to the progress of rarefaction. This is the case in Mr Smeaton's pump, and all which have valves in the piston. But it is the peculiar excellency of this pump, that whatever be the density of the air remaining in $a\,c$, the rarefaction will still go on. It is worth while to be perfectly convinced of this. Let us suppose that the air contained in $a\,c$ is $\frac{1}{100}$ part of the common air which would fill the barrel, and that the capacity of the barrel is equal to that of the receiver and passages, and that the air in the receiver and barrel is of the same density, the piston being at the bottom of the barrel: The barrel will therefore contain $\frac{10}{1000}$ parts of its natural quantity, and the receiver $\frac{10}{1000}$. Now let the piston be drawn up. No air will be discharged at $a\,c$, because it will contain the whole air which was in the barrel, and which has now collapsed into its ordinary bulk. But this does not in the least hinder the air of the receiver from expanding into the barrel, and diffusing itself equally between both. Each will now contain $\frac{5}{1000}$ of their ordinary quantity when the piston is at the top, and $a\,c$ will contain $\frac{1}{100}$ as before, or $\frac{10}{1000}$. Now push down the piston. The hole L is instantly shut, and the air in $a\,c$ expands into the barrel, and the barrel now contains $\frac{15}{1000}$. When the piston has reached the bottom, let it be again drawn up. There will be $\frac{5}{1000}$ discharged through c, and the air in the receiver will again be equally distributed between it and the barrel. Therefore the receiver will now contain $\frac{2\frac{1}{2}}{1000}$. When the piston reaches the bottom, there will be $\frac{12\frac{1}{2}}{1000}$ in the barrel. When again drawn up to the top, there will be $\frac{2\frac{1}{2}}{1000}$ discharged, and the receiver will contain $\frac{1\frac{1}{4}}{1000}$; and when the piston reaches the bottom, there will be $\frac{11\frac{1}{4}}{1000}$. At the next stroke the receiver will contain only $\frac{0\frac{5}{8}}{1000}$, &c. &c.

Thus it appears, that notwithstanding the $\frac{10}{1000}$ which always

always expands back again out of the hole *a c* into the barrel, the rarity of the air in the receiver will be doubled at every stroke. There is therefore no need of a subsidiary air-pump at *c*, as in the American air-pump, and in the Swedish attempt to improve Smeaton's.

In using this air-pump no particular directions are necessary, nor is any peculiar care necessary for keeping it in order, except that the oil-vessel A be always kept about half full of oil. When the pump has stood long without being used, it will be proper to draw a table-spoonful of olive-oil through it, by pouring it into the hole in the middle of the receiver-plate when the piston is at the bottom of the barrel. Then by working the piston, the oil will be drawn through all the parts of the pump, and the surplus will be driven through the tube T into the oil-vessel G. Near the top of the piston-rod at H there is a hole which lets some oil into the inside of the rod, which gets at the collar of leathers *r r*, and keeps the wire *g g* air-tight.

When the pump is used for condensation at the same time that it rarefies, or separately, the piece containing the bent tube T must be removed, and fig. 8. put into its place, and fixed by its screws. Fig. 8. as drawn in the plate, is intended for a double barreled pump. But for a single barrel only one piece is used, represented by *b a a*, the double piece being cut off at the dotted line *a a*. In this piece is a female screw to receive the end of a long brass tube, to which a bladder (if sufficient for the experiment of condensation), or a glass, properly secured for this purpose, must be screwed. Then the air which is abstracted from the receiver on the pump-plate will be forced into the bladder or glass. But if the pump be double, the apparatus fig. 8. is used, and the long brass tube screwed on at *c*.

Plate CCCCIX.

Fig. 9. and 10. represent the two gages, which will be sufficiently explained afterwards. Fig. 9. is screwed into *c b*, or into the screw at the other end of *c* fig. 7. and fig. 10. into the screw *a b* fig. 7.

If it be used as a single pump, either to rarefy or condense, the screw K, which fastens the rack to the piston-rod H, must be taken out. Then turning the winch till H is depressed as low as possible, the machine will be fitted to exhaust as a single pump; and if it be required to condense, the direction in n° 8. must be observed with regard to the tube T, and fig. 8.

"I took (says Mr Cuthbertson) two barometer-tubes of an equal bore with that fixed to the pump. These were filled with mercury four times boiled. They were then compared, and stood exactly at the same height. The mercury in one of them was boiled in it four times more, without making any change in their height; they were therefore judged very perfect. One of these was immersed in the cistern of the pump-gage, and fastened in a position parallel to it, and a sliding scale of one inch was attached to it. This scale, when the gage is used, must have its upper edge set equal with the surface of the mercury in the boiled tube after exhaustion, and the difference between the height of the mercury in this and in the other barometer tube may be observed to the $\frac{1}{100}$ of an inch; and being close together, no error arises from their not being exactly vertical, if they are only parallel. This gage will be better understood by inspecting fig. 10.

"I used a second gage, which I shall call a double syphon. See Plate CCCCIX. fig. 9. This was also prepared with the utmost care. I had a scale for measuring the difference between the height of the columns in the two legs. It was an inch long, and divided as the former, and kept in a truly vertical position by suspending it from a point with a weight hung to it, as represented in the figure. Upon comparing these two gages, I always found them to indicate the same degree of rarefaction. I also used a pear-gage, though the most imperfect of all, in order to repeat the curious experiments of Mr Nairne and others."

When experiments require the utmost rarefying power of the pump, the receiver must not be placed on leather, either oiled or soaked in water, as is usually done. The pump-plate and the edge of the receiver must be ground very flat and true, and this with very fine emery, that no roughness may remain. The plate of the pump must then be wiped very clean and very dry, and the receiver rubbed with a warm cloth till it become electrical. The receiver being now set on the plate, hog's lard, either alone or mixed with a little oil, which has been cleared of water by boiling, must be smeared round its outside edge. In this condition the pump will rarefy its utmost, and what still remains in the receiver will be permanent air. Or a little of this composition may be thinly smeared on the pump-plate; this will prevent all risk of scratching it with the edge of the receiver. Leather of very uniform thickness, long dried before a fire, and well soaked in this composition, which must be cleared of all water by the first boiling, will answer very well, and is expeditious, when receivers are to be frequently shifted. Other leathers should be at hand soaked in a composition containing a little rosin. This gives it a clamminess which renders it impermeable to air, and is very proper at all joints of the pump, and all apparatus for pneumatic experiments. As it is impossible to render the pear-gage as dry as other parts of the apparatus, there will be generally some variation between this and the other gages.

When it is only intended to show the utmost power of the pump, without intending to ascertain the quality of the residuum, the receiver may be set on wet leather. If, in this condition, the air be rarefied as far as possible, the syphon and barometer gage will indicate a less degree of rarefaction than in the former experiments. But when the air is let in again, the pear-gage will point out a rarefaction some thousands of times greater than it did before. If the true quality of permanent air after exhaustion be required, the pear-gage will be nearest the truth: for when the air is rarefied to a certain degree, the moistened leather emits an expansible fluid, which, filling the receiver, forces out the permanent air; and the two first gages indicate a degree of exhaustion which relates to the whole elastic matter remaining in the receiver, *viz.* to the expansible fluid together with the permanent air; whereas the pear-gage points out the degree of exhaustion, with relation to the permanent air alone, which remains in the receiver; for by the pressure of the air admitted into the receiver, the elastic vapour is reduced to its former bulk, which is imperceptible.

Many bodies emit this elastic fluid when the pressure of the air is much diminished; a piece of leather, in its ordinary

Air-pump. ordinary damp state, about an inch square, or a bit of green or dry wood, will supply this for a great while.

When such fluids have been generated in any experiments, the pump must be carefully cleared of them, for they remain not only in the receiver, but in the barrels and passages, and will again expand when the exhaustion has been carried far.

The best method of clearing the pump is to take a very large receiver, and, using every precaution to exhaust it as far as possible. Then the expansible matter lurking in the barrels and passes will be diffused through the receiver also, or will be carried off along with its air. It will be as much rarer than it was before, as the aggregate capacity of the receiver barrels and passes is larger than that of the two last.

The performance of the pump may be judged of from the four following experiments.

The two gages being screwed into their places, and the hole in the receiver-plate shut up, the pump was made to exhaust as far as it could. The mercury in the legs of the syphon was only $\frac{1}{20}$ of an inch out of the level, and that in the boiled barometer-tube $\frac{1}{40}$ of an inch higher than in the one screwed to the pump. A standard barometer then stood at 30 inches, and therefore the pump rarefied the permanent air 1200 times. This is twice as much as Mr Nairne found Mr Smeaton's do in its best state. Mr Cavallo seems disposed to give a favourable (while we must suppose it a just) account of Haas and Hurter's pump, and it appears never to have exceeded 600 times. Mr Cuthbertson has often found the mercury within $\frac{1}{100}$ of an inch of the level in the syphon-gage, indicating a rarefaction of 3000.

To one end of a glass tube, 2 inches diameter and 30 inches long, was fitted a brass cap and collar of leather, through which a wire was inserted, reaching about two inches within the tube. This was connected with the conductor of an electric machine. The other end was ground flat and set on the pump plate. When the gages indicated a rarefaction of 300, the light became steady and uniform, of a pale colour, though a little tinged with purple; at 600 the light was of a pale dusky white; when 1200 it disappeared in the middle of the tube, and the tube conducted so well that the prime conductor only gave sparks so faint and short as to be scarcely perceptible. After taking off the tube, and making it as dry as possible, it was again connected with the conductor, which was giving sparks two inches long. When the air in it was rarefied ten times, the sparks were of the same length. Sometimes a pencil of light darted along the tube. When the rarefaction was 20, the spark did not exceed an inch, and light streamed the whole length of the tube. When the rarefaction was 30, the sparks were half an inch, and the light rushed along the tube in great streams. When the rarefaction was 100, the sparks were about $\frac{1}{8}$ long, and the light filled the tube in an uninterrupted body. When 300, the appearances were as before. When 600, the sparks were $\frac{1}{16}$, and the light was of a faint white colour in the middle, but tinged with purple toward the ends. When 1200, the light was hardly perceptible in the middle, and was much fainter at the ends than before, but still ruddy. When 1400, which was the most the pump could produce, six inches of the middle of the tube were quite dark, and the ends free of any tinge of red, and the sparks did not exceed $\frac{1}{20}$ of an inch. Air-pump.

158 The best improvements of the air-pump have been made in Britain.

We trust that our readers will not be displeased with the preceding history of the air-pump. The occasional information which it gives will be of great use to every person much engaged in pneumatic experiments, and help him in the contrivance and construction of the necessary apparatus.

We may be indulged in one remark, that although this noble instrument originated in Germany, all its improvements were made in this kingdom. Both the mechanical and pneumatical principles of Mr Boyle's construction were extremely different from the German, and, in respect of expedition and conveniency, much superior. The double barrel and gage by Hawkesbee were capital improvements, and on principle; and Mr Smeaton's method of making the piston work in rarefied air made a complete change in the whole process.

159 Utility of the air-pump.

Aided by this machine, we can make experiments establishing and illustrating the gravity and elasticity of the air in a much more perspicuous manner than could be done by the spontaneous phenomena of nature.

160 Experiments to show this utility.

It allows us in the first place to show the materiality of air in a very distinct manner. Bodies cannot move about in the atmosphere without displacing it. This requires force; and the resistance of the air always diminishes the velocity of bodies moving in it. A heavy body therefore has the velocity of its fall diminished; and if the quantity of air displaced be very great, the diminution will be very considerable. This is the reason why light bodies, such as feathers, fall very slowly. Their moving force is very small, and can therefore displace a great quantity of air only with a very small velocity. But if the same body be dropped *in vacuo*, when there is no air to be displaced, it falls with the whole velocity competent to its gravity. Fig. 29. Plate CCCCII. represents an apparatus by which a guinea and a downy feather are dropped at the same instant, by opening the forceps which holds them by means of the slip-wire in the top of the receiver. If this be done after the air has been pumped out, the guinea and the feather will be observed to reach the bottom at the same instant.

161 Fig. 30. represents another apparatus for showing the same thing. It consists of two sets of brass vanes put in separate axles, in the manner of windmill sails. One set has their edges placed in the direction of their whirling motion, that is, in a plane to which the axis is perpendicular. The planes of the other set pass through the axis, and they are therefore trimmed so as directly to front the air through which they move. Two springs act upon pins projecting from the axis; and their strength or tensions are so adjusted, that when they are disengaged *in vacuo*, the two sets continue in motion equally long. If they are disengaged in the air, the vanes which beat the air with their planes will stop long before those which cut it edgewise.

162 We can now abstract the air almost completely from a dry vessel, so as to know the precise weight of the air which filled it. The first experiment we have of this kind, done with accuracy, is that of Dr Hooke, Feb. 10. 1664, when he found 114 pints of air to weigh

Air-pump. weigh 945 grains. One pint of water was $8\frac{7}{11}$ ounces. This gives for the specific gravity of air $\frac{1}{850}$ very nearly.

163 The effect of air on the weight of bodies immersed in it. Since we are thus immersed in a gravitating fluid, it follows, that every body preponderates only with the excess of its own weight above that of the air which it displaces; for every body loses by this immersion the weight of the displaced air. A cubic foot loses about 521 grains in frosty weather. We see balloons even rise in the air, as a piece of cork rises in water. A mass of water which really contains 850 pounds will load the scale of a balance with 849 only, and will be balanced by about $849\frac{1}{8}$ pounds of brass. This is evinced by a very pretty experiment, represented in fig. 31. A small beam is suspended within a receiver. To one end of the beam is appended a thin glass or copper ball, close in every part. This is balanced by a small piece of lead hung on the other arm. As the air is pumped out of the receiver, the ball will gradually preponderate, and will regain its equilibrium when the air is re-admitted.

Plate CCCCII.

164 Some naturalists have proposed, and actually used, a large globe of light make, suspended at a beam, for a barometer. If its capacity is a cubic foot, $1\frac{7}{10}$ grains will indicate the same change that is indicated by $\frac{1}{10}$ of an inch of an ordinary barometer. But a vessel of this size will load a balance too much to leave it sufficiently sensible to small changes of density. Besides, it is affected by heat and cold, and would require a very troublesome equation to correct their effects.

165 It may perhaps be worth while to attend to this in buying and selling precious commodities; such as pearls, diamonds, silk, and some drugs. As they are generally sold by brass or leaden weights, the buyer will have some advantage when the air is heavy and the barometer high. On the other hand, he will have the advantage in buying gold and mercury when the air is light. It is needless to confine this observation to precious commodities, for the advantage is the same in all in proportion to their levity.

166 There is a case in which this observation is of consequence to the philosopher: we mean the measuring of time by pendulums. As the accelerating force on a pendulum is not its whole weight, but the excess of its weight over that of the displaced air, it follows that a pendulum will vibrate more slowly in the air than *in vacuo*. A pendulum composed of lead, iron, and brass, may be about 8400 times heavier than the air which it displaces when the barometer is at 30 inches and the thermometer at 32°, and the accelerating force will be diminished about $\frac{1}{8400}$. This will cause a second pendulum to make about five vibrations less in a day than it would do *in vacuo*. In order therefore to deduce the accelerative power of gravity from the length of a pendulum vibrating in the air, we must make an allowance of 0″,17, or $\frac{17}{100}$ of a second, per day for every inch that the barometer stands lower than 30 inches. But we must also note the temperature of the air; because when the air is warm it is less dense when supporting by its elasticity the same weight of atmosphere, and we must know how much its density is diminished by an increase of temperature. The correction is still more complicated; for the change of density affects the resistance of the air, and this affects the time of the vibration, and this by a law that is not yet well ascertained. As far as we can determine from any experiments that have been made, it appears that the change arising from the altered resistance takes off about $\frac{2}{7}$ of the change produced by the altered density, and that a second pendulum makes but three vibrations a-day more *in vacuo* than in the open air. This is a very unexpected result; but it must be owned that the experiments have neither been numerous nor very nicely made.

The air-pump also allows us to show the effects of the air's pressure in a great number of amusing and instructive phenomena.

167 Experiments to show the effects of the air's pressure. When the air is abstracted from the receiver, it is strongly pressed to the pump-plate by the incumbent atmosphere, and it supports this great pressure in consequence of its circular form. Being equally compressed on all sides, there is no place where it should give way rather than another; but if it be thin, and not very round, which is sometimes the case, it will be crushed to pieces. If we take a square thin phial, and apply an exhausting syringe to its mouth, it will not fail being crushed.

As the operation of pumping is something like sucking, many of these phenomena are in common discourse ascribed to suction, a word much abused; and this abuse misleads the mind exceedingly in its contemplation of natural phenomena. Nothing is more usual than to speak of the suction of a syringe, the suction and draught of a chimney, &c. The following experiment puts the true cause of the strong adhesion of the receiver beyond a doubt.

Place a small receiver or cupping-glass on the pump-plate without covering the central hole, as represented in fig. 32. and cover it with a larger receiver. Exhaust the air from it; then admit it as suddenly as possible. The outer receiver, which after the rarefaction adhered strongly to the plate, is now loose, and the cupping-glass will be found sticking fast to it. While the rarefaction was going on, the air in the small receiver also expanded, escaped from it, and was abstracted by the pump. When the external air was suddenly admitted, it pressed on the small receiver, and forced it down to the plate, and thus shut up all entry. The small receiver must now adhere; and there can be no suction, for the pipe of the pump was on the outside of the cupping-glass.

Plate CCCCIII.

This experiment sometimes does not succeed, because the air sometimes finds a passage under the brim of the cupping-glass. But if the cupping-glass be pressed down by the hand on the greasy leather or plate, every thing will be made smooth, and the glass will be so little raised by the expansion of its air during the pumping, that it will instantly clap close when the air is re-admitted.

In like manner, if a thin square phial be furnished with a valve, opening from within, but shutting when pressed from without, and if this phial be put under a receiver, and the air be abstracted from the receiver, the air in the phial will expand during the rarefaction, will escape through the valve, and be at last in a very rarefied state within the phial. If the air be now admitted into the receiver, it will press on the flat sides of the included phial and crush it to pieces. See fig. 33. 168

If a piece of wet ox-bladder be laid over the top of a receiver whose orifice is about four inches wide, and the 169

Air-pump the air be exhausted from within it, the incumbent atmosphere will press down the bladder into a hollow form, and then burst it inward with a prodigious noise.

Plate CCCCIII. See fig. 34. Or if a piece of thin flat glass be laid over the receiver, with an oiled leather between them to make the juncture air-tight, the glass will be broken downwards. This must be done with caution, because the pieces of glass sometimes fly about with great force.

170 If there be formed two hemispherical cups of brass, with very flat thick brims, and one of them be fitted with a neck and stopcock, as represented by fig. 35. the air may be abstracted from them by screwing the neck into the hole in the pump-plate. To prevent the insinuation of air, a ring of oiled leather may be put between the rims. Now unscrew the sphere from the pump, and fix hooks to each, and suspend them from a strong nail, and hang a scale to the lowest. It will require a considerable weight to separate them; namely, about 15 pounds for every square inch of the great circle of the sphere. If this be four inches diameter, it will require near 190 pounds. This pretty experiment was first made by Otto Guericke, and on a very great scale. His sphere was of a large size, and, when exhausted, the hemispheres could not be drawn asunder by 20 horses. It was exhibited, along with many others equally curious and magnificent, to the Emperor of Germany and his court, at the breaking up of the diet of Ratisbon in 1654.

171 If the loaded syringe mentioned in n° 16. be suspended by its piston from the hook in the top plate of the receiver, as in fig. 36. and the air be abstracted by the pump, the syringe will gradually descend (because the elasticity of the air, which formerly balanced the pressure of the atmosphere, is now diminished by its expansion, and is therefore no longer able to press the syringe to the piston), and it will at last drop off. If the air be admitted before this happens, the syringe will immediately rise again.

172 Screw a short brass pipe into the neck of a transporter, n° 107. on which is set a tall receiver, and immerse it into a cistern of water. On opening the cork the pressure of the air on the surface of the water in the cistern will force it up through the pipe, and cause it to spout into the receiver with a strong jet, because there is no air within to balance by its elasticity the pressure of the atmosphere. See fig. 37.

173 By means of this pressure the gage of an air-pump acts. It is in the same way that the gage of the air-pump performs its office. The pressure of the atmosphere raises the mercury in the gage till the weight of the mercury, together with the remaining elasticity of the air in the receiver, are in equilibrio with the whole pressure of the atmosphere: therefore the height and weight of the mercury in the gage is the excess of the weight of the atmosphere above the elasticity of the included air; and the deficiency of this height from that of the mercury in the Toricellian tube is the measure of this remaining elasticity.

174 If a Toricellian tube be put under a tall receiver, as shown in fig. 38. and the air be exhausted, the mercury in the tube will descend while that in the gage will rise; and the sum of their heights will always be the same, that is, equal to the height in an ordinary barometer. The height of the mercury in the receiver is the effect and measure of the remaining elasticity of the included air, and the height in the pump-gage is the unbalanced pressure of the atmosphere. This is a very instructive experiment, perfectly similar to Mr Auzout's, mentioned in n° 34. and completely establishes and illustrates the whole doctrine of atmospheric pressure.

175 Water rises in pumps, We get a similar illustration and confirmation (if such a thing be now needed) of the cause of the rise of water in pumps, by screwing a syringe into the top plate of a receiver, which syringe has a short glass pipe plunging into a small cup of water. See fig. 39. When the piston-rod is drawn up, the water rises in the glass pipe, as in any other pump, of which this is a miniature representation. But if the air has been previously exhausted from the receiver, there is nothing to press on the water in the little jar; and it will not rise in the glass pipe though the piston of the syringe be drawn to the top.

176 and moves in syphons. Analagous to the rise of water in pumps is its rise and motion in syphons. Suppose a pipe ABCD, fig. 40. bent at right angles at B and C, and having its two ends immersed in the cisterns of water A and D. Let the leg CD be longer than the leg BA, and let the whole be full of water. The water is pressed upwards at A with a force equal to the weight of the column of air EA reaching to the top of the atmosphere; but it is pressed downwards by the weight of the column of water BA. The water at E is pressed downwards by the weight of the column CD, and upwards by the weight of the column of air FD reaching to the top of the atmosphere. The two columns of air differ very little in their weight, and may without any sensible error be considered as equal. Therefore there is a superiority of pressure downwards at D, and the water will flow out there. The pressure of the air will raise the water in the leg AB, and thus the stream will be kept up till the vessel A is emptied as low as the orifice of the leg BA, provided the height of AB is not greater than what the pressure of the atmosphere can balance, that is, does not exceed 32 or 33 feet for water, 30 inches for mercury, &c.

A syphon then will always run from that vessel whose surface is highest; the form of the pipe is indifferent, because the hydrostatical pressures depend on the vertical height only. It must be filled with water by some other contrivance, such as a funnel, or a pump applied a-top; and the funnel must be stopped up, otherwise the air would get in, and the water would fall in both legs.

If the syphon have equal legs, as in fig. 41. and be turned up at the ends, it will remain full of water, and be ready for use. It need only be dipped into any vessel of water, and the water will then flow out at the other end of the syphon. This is call the *Wirtinberg syphon*, and is represented in fig. 41. Syphons will afterwards be considered more minutely under the title of PNEUMATICAL *Engines*, at the end of this article. 177

178 The syphon fountain. What is called the *syphon fountain*, constructed on this principle, is shown in fig. 42. where AB is a tall receiver, standing in a wide bason DE, which is supported on the pedestal H by the hollow pillar FG. In the centre of the receiver is a jet pipe C, and in the top a ground stopper A. Near the base of the pillar is a cock N, and in the pedestal is another cock O.

Fill the bason DE with water within half an inch of the brim. Then pour in water at the top of the receiver (the cock N being shut) till it is about half full, and

Experiments on Air, &c.

and then put in the stopper. A little water will run out into the vessel DE. But before it runs over, open the cock N, and the water will run into the cistern H; and by the time that the pipe C appears above water, a jet will rise from it, and continue as long as water is supplied from the bason DE. The passage into the base cistern may be so tempered by the cock N that the water within the receiver shall keep at the same height, and what runs into the base may be received from the cock O into another vessel, and returned into DE, to keep up the stream.

179 Manner of its construction and operation. Plate CCCCIII.

This pretty philosophical toy may be constructed in the following manner. BB, fig. 42. n° 2. is the ferril or cap into which the receiver is cemented. From its centre descends the jet pipe C*a*, sloping outwards, to give room for the discharging pipe *b d* of larger diameter, whose lower extremity *d* fits tightly into the top of the hollow pillar FG.

The operation of the toy is easily understood. Suppose the distance from C to H (n° 1.) three feet, which is about $\frac{1}{11}$ of the height at which the atmosphere would support a column of water. The water poured into AB would descend through FG (the hole A being shut) till the air has expanded $\frac{1}{10}$, and then it would stop. If the pipe C*a* be now opened, the pressure of the air on the surface of the water in the cistern DE will cause it to spout through C to the height of three feet nearly, and the water will continue to descend through the pipe FG. By tempering the cock N so as to allow the water to pass through it as fast as it is supplied by the jet, the amusement may be continued a long time. It will stop at last, however; because, as the jet is made into rarefied air, a little air will be extricated from the water, which will gradually accumulate in the receiver, and diminish its rarefaction, which is the moving cause of the jet. This indeed is an inconvenience felt in every employment of syphons, so much the more remarkably as their top is higher than the surface of the water in the cistern of supply.

180 Syphons are often used thus.

Cases of this employment of a syphon are not unfrequent. When water collected at A (fig. 43.) is to be conducted in a pipe to C, situated in a lower part of the country, it sometimes happens, as between Lochend and Leith, that the intervening ground is higher than the fountain-head as at B. A forcing pump is erected at A, and the water forced along the pipe. Once it runs out at C, the pump may be removed, and the water will continue to run on the syphon principle, provided BD do not exceed 33 feet. But the water in that part of the conduit which is above the horizontal plane AD, is in the same state as in a receiver of rarefied air, and gives out some of the air which is chemically united with it. This gradually accumulates in the elevated part of the conduit, and at last choaks it entirely. When this happens, the forcing pump must again be worked. Although the elevation in the Leith conduit is only about eight or ten feet, it will seldom run for 12 hours. N. B. This air cannot be discharged by the usual air-cocks; for if there were an opening at B, the air would rush in, and immediately stop the motion.

181 The air-pump discovers the combination of air with water,

This combination of air with water is very distinctly seen by means of the air-pump. If a small glass containing cold water, fresh drawn from the spring, be exposed, as in fig. 44. under the receiver, and the air rarefied, small bubbles will be observed to form on the inner surface of the glass, or on the surface of any body immersed in it, which will increase in size, and then detach themselves from the glass and reach the top; as the rarefaction advances, the whole water begins to show very minute air-bubbles rising to the top; and this appearance will continue for a very long time, till it be completely disengaged. Warming the water will occasion a still farther separation of air, and a boiling heat will separate all that can be disengaged. The reason assigned for these air-bubbles first appearing on the surface of the glass, &c. is, that air is attracted by bodies, and adheres to their surface. This may be so. But it is more probably owing to the attraction of the water for the glass, which causes it to quit the air which it held in solution, in the same manner as we see it happen when it is mixed with spirits-of-wine, with vitriolic acid, &c. or when salts or sugar are dissolved in it. For if we pour out the water which has been purged of air by boiling *in vacuo*, and fill the glass with fresh water, we shall observe the same thing, although a film of the purified water was left adhering to the glass. In this case there can be no air adhering to the glass.

Elasticity, &c. Plate CCCCIV.

Water thus purged of air by boiling (or even without boiling) *in vacuo*, will again absorb air when exposed to the atmosphere. The best demonstration of this is to fill with this water a phial, leaving about the size of a pea not filled. Immerse this in a vessel of water, with the mouth undermost, by which means the air-bubble will mount up to the bottom of the phial. After some days standing in this condition, the air-bubble will be completely absorbed, and the vessel quite filled with water. 182

The air in this state of chemical solution has lost its elasticity, for the water is not more compressible than common water. It is also found that water brought up from a great depth under ground contains much more air than water at the surface. Indeed fountain waters differ exceedingly in this respect. The water which now comes into the city of Edinburgh by pipes contains so much as to throw it into a considerable ebullition *in vacuo*. Other liquors contain much greater quantities of elastic fluids in this loosely combined state. A glass of beer treated in the same way will be almost wholly converted into froth by the escape of its fixed air, and will have lost entirely the prickling smartness which is so agreeable, and it become quite vapid.

183 And illustrates the air's elasticity and expansibility.

The air-pump gives us, in the next place, a great variety of experiments illustrative of the air's elasticity and expansibility. The very operation of exhaustion, as it is called, is an instance of its great, and hitherto unlimited, expansibility. But this is not palpably exhibited to view. The following experiments show it most distinctly.

184 Experiments showing these properties.

1st, Put a flaccid bladder, of which the neck is firmly tied with a thread, under a receiver, and work the pump. The bladder will gradually swell, and will even be fully distended. Upon readmitting the air into the receiver, the bladder gradually collapses again into its former dimensions: while the bladder is flaccid, the air within it is of the same density and elasticity with the surrounding air, and its elasticity balances the pressure of the atmosphere. When part of the air of the receiver is abstracted, the remainder expands so as

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as still to fill the receiver: but by expanding, its elasticity is plainly diminished; for we see by the fact, that the elasticity of the air of the receiver no longer balances the elasticity of that in the bladder, as it no longer keeps it in its dimensions. The air in the bladder expands also: it expands till its diminished elasticity is again in equilibrio with the diminished elasticity of the air in the receiver; that is, till its density is the same. When all the wrinkles of the bladder have disappeared, its air can expand no more, although we continue to diminish the elasticity of the air of the receiver by further rarefaction. The bladder now tends to burst; and if it be pierced by a point or knife fastened to the slip-wire, the air will rush out, and the mercury descend rapidly in the gage.

185 If a phial or tube be partly filled with water, and immersed in a vessel of water with the mouth downwards, the air will occupy the upper part of the phial. If this apparatus be put under a receiver, and the air be abstracted, the air in the phial will gradually expand, allowing the water to run out by its weight till the surface of the water be on a level within and without. When this is the case, we must grant that the density and elasticity of the air in the phial is the same with that in the receiver. When we work the pump again, we shall observe the air in the phial expand still more, and come out of the water in bubbles. Continuing the operation, we shall see the air continually escaping from the phial: when this is over, it shows that the pump can rarefy no more. If we now admit the air into the receiver, we shall see the water rise into the phial, and at last almost completely fill it, leaving only a very small bubble of air at top. This bubble had expanded so as to fill the whole phial. See this represented in fig. 45.

Plate CCCCIV.

186 Every one must have observed a cavity at the big end of an egg between the shell and the white. The white and yolk are contained in a thin membrane or bladder which adheres loosely to the shell, but is detached from it at that part; and this cavity increases by keeping the egg in a dry place. One may form a judgment of its size, and therefore of the freshness of the egg, by touching it with the tongue; for the shell, where it is not in contact with the contents, will presently feel warm, being quickly heated by the tongue, while the rest of the egg will feel cold.

If a hole be made in the opposite end of the egg, and it be set on a little tripod, and put under a receiver, the expansion of the air in the cavity of the egg will force the contents through the hole till the egg be quite emptied: or, if nearly one half of the egg be taken away at the other end, and the white and yolk taken out, and the shell be put under a receiver, and the air abstracted, the air in the cavity of the egg will expand, gradually detaching the membrane from the shell, till it causes it to swell out, and gives the whole the appearance of an entire egg. — In like manner shrivelled apples and other fruits will swell in vacuo by the expansion of the air confined in their cavities.

187 If a piece of wood, a twig with green leaves, charcoal, plaster of Paris, &c. be kept under water in vacuo, a prodigious quantity of air will be extracted; and if we readmit the air into the receiver, it will force the water into the pores of the body. In this case the body will not swim in water as it did before, showing that the vegetable fibres are specifically heavier than water. It is found, however, that the air contained in the pith and bark, such as cork, is not all extricated in this way; and that much of it is contained in vesicles which have no outlet: being secreted into them in the process of vegetation, as it is secreted into the air-bladder of fishes, where it is generally found in a pretty compressed state, considerably denser than the surrounding air. The air-bladder of a fish is surrounded by circular and longitudinal muscles, by which the fish can compress the air still further; and, by ceasing to act with them, allow it to swell out again. It is in this manner that the fish can suit its specific gravity to its situation in the water, so as to have no tendency either to rise or sink: but if the fish be put into the receiver of an air-pump, the rarefaction of the air obliges the fish to act more strongly with these contracting muscles, in order to adjust its specific gravity; and if too much air has been abstracted from the receiver, the fish is no longer able to keep its air-bladder in the proper degree of compression. It becomes therefore too buoyant, and comes to the top of the water, and is obliged to struggle with its tail and fins in order to get down; frequently in vain. The air-bladder sometimes bursts, and the fish goes to the bottom, and can no longer keep above without the continual action of its tail and fins. When fishes die, they commonly float at top, their contractive action being now at an end. All this may be illustrated (but very imperfectly) by a small half-blown bladder, to which is appended a bit of lead, just so heavy as to make it sink in water: when this is put under a receiver, and the air abstracted, the bubble will rise to the top; and, by nicely adjusting the rarefaction, it may be kept at any height. See fig. 46.

Compressibility, &c.

The play-things called *Cartesian devils* are similar to this: they are hollow glass figures, having a small aperture in the lower part of the figures, as at the point of the foot; their weight is adjusted so that they swim upright in water. When put into a tall jar filled to the top, and having a piece of leather tied over it, they will sink in the water, by pressing on the leather with the ball of the hand: this, by compressing the water, forces some of it to enter into the figure and makes it heavier than the water; for which reason it sinks, but rises again on removing the pressure of the hand. See fig. 47, n° 1. and 2. 188

If a half-blown ox-bladder be put into a box, and great weights laid on it, and the whole be put under a receiver, and the air abstracted; the air will, by expanding, lift up the weights, though above an hundred pounds. See fig. 48.

189

Compressibility and expansibility are in no state of the air very dissimilar.

By such experiments the great expansibility of the air is abundantly illustrated, as its compressibility was formerly by means of the condensing syringe. We now see that the two sets of experiments form an uninterrupted chain; and that there is no particular state of the air's density where the compressibility and expansibility is remarkably dissimilar. Air in its ordinary state expands; because its ordinary state is a state of compression by the weight of the atmosphere: and if there were a pit about 33 miles deep, the air at the bottom would probably be as dense as water; and if it were 50 miles deep, it would be as dense as gold, if it did not become a liquid before this depth: nay, if a bottle with its mouth undermost were immersed six miles under water, it would probably be as dense as water; we say probably, for this depends on the nature of its compressibility

sibility; that is, on the relation which subsists between the compression and the force which produces it.

190 Relation between compression and the force producing it.

This is the circumstance of its constitution, which we now proceed to examine; and it is evidently a very important circumstance. We have long ago observed, that the great compressibility and permanent fluidity of air, observed in a vast variety of phenomena, is totally inexplicable, on the supposition that the particles of air are like so many balls of sponge or so many foot-balls. Give to those what compressibility you please, common air could no more be fluid than a mass of clay; it could no more be fluid than a mass of such balls pressed into a box. It can be demonstrated (and indeed hardly needs a demonstration), that before a parcel of such balls, just touching each other, can be squeezed into half their present dimensions, their globular shape will be entirely gone, and each will have become a perfect cube, touching six other cubes with its whole surface; and these cubes will be strongly compressed together, so that motion could never be performed through among them by any solid body without a very great force. Whereas we know that in this state air is just as permeable to every body as the common air that we breathe. There is no way in which we can represent this fluidity to our imagination but by conceiving air to consist of particles, not only discrete, but distant from each other, and actuated by repulsive forces, or something analogous to them. It is an idle subterfuge, to which some naturalists have recourse, saying, that they are kept asunder by an intervening ether, or elastic fluid of any other name. This is only removing the difficulty a step farther off: for the elasticity of this fluid requires the same explanation; and therefore it is necessary, in obedience to the rules of just reasoning, to begin the inquiry here; that is, to determine from the phenomena what is the analogy between the distances of the particles and the repulsive forces exerted at these distances, proceeding in the same way as in the examination of planetary gravitation. We shall learn the analogy by attending to the analogy between the compressing force and the density.

291 Density explained as applied to air.

For the density depends on the distance between the particles; the nearer they are to each other, the denser is the air. Suppose a square pipe one inch wide and eight inches long, shut at one end, and filled with common air; then suppose a plug so nicely fitted to this pipe that no air can pass by it sides; suppose this piston thrust down to within an inch of the bottom: it is evident that the air which formerly filled the whole pipe now occupies the space of one cubic inch, which contains the same number of particles as were formerly diffused over eight cubic inches.

The condensation would have been the same if the air which fills a cube whose side is two inches had been squeezed into a cube of one inch, for the cube of two inches also contains eight inches. Now, in this case it is evident that the distance between the particles would be reduced to its half in every direction. In like manner, if a cube whose side is three inches, and which therefore contains 27 inches, be squeezed into one inch, the distance of the particles will be one third of what it was: in general the distance of the particles will be as the cube-root of the space into which they are compressed. If the space be $\frac{1}{8}$, $\frac{1}{27}$, $\frac{1}{64}$ $\frac{1}{125}$, &c. of its former dimensions, the distance of the particles will be $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, &c. Now the term *density*, in its strict sense, expresses the vicinity of the particles; *densi arbores* are trees growing near each other. The measure of this vicinity therefore is the true measure of the density; and when 27 inches of air are compressed into one, we should say that it is three times as dense; but we say, that it is 27 times denser.

191 Further explanation.

Density is therefore used in a sense different from its strictest acceptation: it expresses the comparative number of equidistant particles contained in the same bulk. This is also abundantly precise, when we compare bodies of the same kind, differing in density only; but we also say, that gold is 19 times denser than water, because the same bulk of it is 19 times heavier. This assertion proceeds on the assumption, or the fact, that every ultimate atom of terrestrial matter is equally heavy: a particle of gold may contain more or fewer atoms of matter than a particle of water. In such a case, therefore, the term density has little or no reference to the vicinity of the particles; and is only a term of comparison of other qualities or accidents.

But when we speak of the respective densities of the same substance in its different states of compression, the word *density* is strictly connected with vicinity of particles, and we may safely take either of the measures. We shall abide by the common acceptation, and call that air eight times as dense which has eight times as many particles in the same bulk, although the particles are only twice as near to each other.

193 The analogy between the compressing force and the distance of the particles, &c.

Thus then we see, that by observing the analogy between the compressing force and the density, we shall discover the analogy between the compressing force and the distance of the particles. Now the force which is necessary for compressing two particles of air to a certain vicinity is a proper measure of the elasticity of the particles corresponding to that vicinity or distance; for it balances it, and forces which balance must be esteemed equal. Elasticity is a distinctive name for that corpuscular force which keeps the particles at that distance: therefore observations made on the analogy between the compressing force and the density of air will give us the law of its corpuscular force, in the same way that observations on the simultaneous deflections of the planets towards the sun give us the law of celestial gravitation.

But the sensible compressing forces which we are able to apply is at once exerted on unknown thousands of particles, while it is the law of action of a single particle that we want to discover. We must therefore know the *proportion* of the numbers of particles on which the compressing force is exerted. It is easy to see, that since the distance of the particles is as the cube root of the density inversely, the number of particles in physical contact with the compressing surface must be as the square of this root. Thus when a cube of 8 inches is compressed into one inch, and the particles are twice as near each other as they were before, there must be four times the number of particles in contact with each of the sides of this cubical inch; or, when we have pushed down the square piston of the pipe spoken of above to within an inch of the bottom, there will be four times the number of particles *immediately* contiguous to the piston, and resisting the compression; and in order to obtain the force really exerted on one particle, and the elasticity of that particle, we must divide the whole compressing force by 4. In like manner, if we have com- 194

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pressed air into $\frac{1}{27}$ of its former bulk, and brought the particles to $\frac{1}{3}$ of their former distance, we must divide the compressing force by 9. In general if d express the density, $\frac{1}{\sqrt[3]{d}}$ will express the distance x of the particles; $\sqrt[3]{d}$, or $d^{\frac{1}{3}}$, will express the vicinity or real density; and $d^{\frac{2}{3}}$ will express the number of particles acting on the compressing surface: and if f express the accumulated external compressing force, $\frac{f}{d^{\frac{2}{3}}}$ will express the force acting on one particle; and therefore the elasticity of that particle corresponding to the distance x.

195 Experiments establishing the law of compression.

We may now proceed to consider the experiments by which the law of compression is to be established.

The first experiments to this purpose were those made by Mr Boyle, published in 1661 in his *Defensio Doctrinæ de Aeris Elatere contra Linum*, and exhibited before the Royal Society the year before. Mariotte made experiments of the same kind, which were published in 1676 in his *Essai sur la Nature de l'Air* and *Traité des Mouvemens des Eaux*. The most copious experiments are those by Sulzer (*Mem. Berlin.* ix.), those by Fontana (*Opusc. Physico-Math.*), and those by Sir George Shuckbourgh and Gen. Roy.

196 Compressibility of air not rarer than the atmosphere at the earth's surface. Plate CCCCIV.

In order to examine the compressibility of air that is not rarer than the atmosphere at the surface of the earth, we employ a bent tube or syphon ABCD (fig. 49.), hermetically sealed at A and open at D. The short leg AB must be very accurately divided in the proportion of its solid contents, and fitted with a scale whose units denote equal increments, not of length, but of capacity. There are various ways of doing this; but it requires the most scrupulous attention, and without this the experiments are of no value. In particular, the arched form at A must be noticed. A small quantity of mercury must then be poured into the tube, and passed backwards and forwards till it stands (the tube being held in a vertical position) on a level at B and C. Then we are certain that the included air is of the same density with that of the contiguous atmosphere. Mercury is now poured into the leg DC, which will fill it, suppose to G, and will compress the air into a smaller space AE. Draw the horizontal line EF: the new bulk of the compressed air is evidently AE, measured by the adjacent scale, and the addition made to the compressing force of the atmosphere is the weight of the column GF. Produce GF downwards to H, till FH is equal to the height shown by a Toricellian tube filled with the *same mercury*; then the whole compressing force is HG. This is evidently the measure of the elasticity of the compressed air in AE, for it balances it. Now pour in more mercury, and let it rise to g, compressing the air into A e. Draw the horizontal line ef, and make fh equal to FH; then A e will be the new bulk of the compressed air, $\frac{AB}{Ae}$ will be its new density, and hg will be the measure of the new elasticity. This operation may be extended as far as we please, by lengthening the tube CD, and taking care that it be strong enough to resist the great pressure. Great care must be taken to keep the whole in a constant temperature, because the elasticity of air is greatly affected by heat, and the change by any increase of temperature is different according to its density or compression.

197 Experiments of Boyle, &c. neither nicely made nor extended to very great compressions.

The experiments of Boyle, Mariotte, Amontons, and others, were not extended to very great compressions, the density of the air not having been quadrupled in any of them; nor do they seem to have been made with very great nicety. It may be collected from them in general, that the elasticity of the air is very nearly proportioned to its density; and accordingly this law was almost immediately acquiesced in, and was called the *Boylean law*: it is accordingly assumed by almost all writers on the subject as exact. Of late years, however, there occurred questions in which it was of importance that this point should be more scrupulously settled, and the former experiments were repeated and extended. Sulzer and Fontana have carried them farther than any other. Sulzer compressed air into $\frac{1}{8}$ of its former dimensions.

198 Varieties, &c. in these experiments.

Considerable varieties and irregularities are to be observed in these experiments. It is extremely difficult to preserve the temperature of the apparatus, particularly of the leg AB, which is most handled. A great quantity of mercury must be employed; and it does not appear that philosophers have been careful to have it precisely similar to that in the barometer, which gives us the unit of compressing force and of elasticity. The mercury in the barometer should be pure and boiled. If the mercury in the syphon is adulterated with bismuth and tin, which it commonly is to a considerable degree, the compressing force, and consequently the elasticity, will appear greater than the truth. If the barometer has not been nicely fitted, it will be lower than it should be, and the compressing force will appear too great, because the unit is too small; and this error will be most remarkable in the smaller compressions.

199 Heterogeneous nature of the air the greatest source of error.

The greatest source of error and irregularity in the experiments is the very heterogeneous nature of the air itself. Air is a solvent of all fluids, all vapours, and perhaps of many solid bodies. It is highly improbable that the different compounds shall have the same elasticity, or even the same law of elasticity: and it is well known, that air, loaded with water or other volatile bodies, is much more expansible by heat than pure air; nay, it would appear from many experiments, that certain determinate changes both of density and of temperature, cause air to let go the vapours which it holds in solution. Cold causes it to precipitate water, as appears in dew; so does rarefaction, as is seen in the receiver of an air-pump.

200 The air's elasticity does not increase so fast as its density.

In general, it appears that the elasticity of air does not increase quite so fast as its density. This will be best seen by the following tables, calculated from the experiments of Mr Sulzer. The column E in each set of experiments expresses the length of the column GH, the unit being FH, while the column D expresses $\frac{AB}{AE}$.

Experiments on Air.

1st Set.		2d Set.		3d Set.	
D	E	D	E	D	E
1,000	1,000	1,000	1,000	1,000	1,000
1,100	1,093	1,236	1,224	1,091	1,076
1,222	1,211	1,294	1,288	1,200	1,183
1,375	1,284	1,375	1,332	1,333	1,303
1,571	1,559	1,466	1,414	1,500	1,472
1,692	1,669	1,571	1,515	1,714	1,659
1,833	1,796	1,692	1,647		
2,000	1,958	2,000	1,964	2,000	1,900
2,288	2,130				
2 444	2,375	2,444	2,392	2,400	2,241
3,143	2,936	3,143	3,078	3,000	2,793
3,666	3,391	3,666	3,575		
4,000	3,706			4,000	3,631
4,444	4.035	4,444	4,320		
4,888	4,438				
5,500	4,922	5,500	5,096		
5,882	5,522			6,000	5,297
		7,333	6,694		
				8,000	6,835

201 There appears in these experiments sufficient grounds for calling in question the Boylean law; and the writer of this article thought it incumbent on him to repeat them with some precautions, which probably had not been attended to by Mr Sulzer. He was particularly anxious to have the air as free as possible from moisture. For this purpose, having detached the short leg of the syphon, which was 34 inches long, he boiled mercury in it, and filled it with mercury boiling hot. He took a tinplate vessel of sufficient capacity, and put into it a quantity of powdered quicklime just taken from the kiln; and having closed the mouth, he agitated the lime through the air in the vessel, and allowed it to remain there all night. He then emptied the mercury out of the syphon into this vessel, keeping the open end far within it. By this means the short leg of the syphon was filled with very dry air. The other part was now joined, and boiled mercury put into the bend of the syphon; and the experiment was then prosecuted with mercury which had been recently boiled, and was the same with which the barometer had been carefully filled.

202 The results of the experiments are expressed in the following table.

Dry Air.		Moist Air.		Camp. Air.	
D	E	D	E	D	E
1,000	1,000	1,000	1,000	1,000	1,000
2,000	1,957	2,000	1,920	2,000	1,909
3,000	2,848	3,000	2,839	3,000	2,845
4,000	3.737	4,000	3,726	4,000	3,718
5,500	4,930	5,500	5,000	5,500	5,104
6,000	5,342	6,000	5,452	6,000	5,463
7,620	6,490	7,620	6,775	7,620	6,812

Here it appears again in the clearest manner that the elasticities do not increase as fast as the densities, and the differences are even greater than in Mr Sulzer's experiments.

203 The second table contains the results of experiments made on very damp air in a warm summer's morning. In these it appears that the elasticities are almost precisely proportional to the densities + a small constant quantity, nearly 0,11 deviating from this rule chiefly between the densities 1 and 1,5, within which limits we have very nearly $D = E^{1,0017}$. As this air is nearer to the constitution of atmospheric air than the former, this rule may be safely followed in cases where atmospheric air is concerned, as in measuring the depths of pits by the barometer.

Elasticity.

The third table shows the compression and elasticity of air strongly impregnated with the vapours of camphire. Here the Boylean law appears pretty exact, or rather the elasticity seems to increase a little faster than the density. 204

Dr Hooke examined the compression of air by immersing a bottle to great depths in the sea, and weighing the water which got into it without any escape of air. But this method was liable to great uncertainty, on account of the unknown temperature of the sea at great depths. 205

206 Mode of examining the elasticity of rarefied air.

Hitherto we have considered only such air as is not rarer than what we breathe; we must take a very different method for examining the elasticity of rarefied air.

Plate CCCCIV.

Let $g\,b$ (fig. 50.) be a long tube, formed a-top into a cup, and of sufficient diameter to receive another smaller tube $a\,f$, open at first at both ends. Let the outer tube and cup be filled with mercury, which will rise in the inner tube to the same level. Let $a\,f$ now be stopped at a. It contains air of the same density and elasticity with the adjoining atmosphere. Note exactly the space $a\,b$ which it occupies. Draw it up into the position of fig. 51. and let the mercury stand in it at the height $d\,e$, while $c\,e$ is the height of the mercury in the barometer. It is evident that the column $d\,e$ is in equilibrio between the pressure of the atmosphere and the elasticity of the air included in the space $a\,d$. And since the weight of $c\,e$ would be in equilibrio with the whole pressure of the atmosphere, the weight of $c\,d$ is equivalent to the elasticity of the included air. While therefore $c\,e$ is the measure of the elasticity of the surrounding atmosphere, $c\,d$ will be the measure of the elasticity of the included air; and since the air originally occupied the space $a\,b$, and has now expanded into $a\,d$, we have $\frac{a\,b}{a\,d}$ for the measure of its density. N. B. $c\,e$ and $c\,d$ are measured by the *perpendicular heights* of the columns, but $a\,b$ and $a\,d$ must be measured by their *solid capacities*.

By raising the inner tube still higher, the mercury will also rise higher, and the included air will expand still farther, and we obtain another $c\,d$, and another $\frac{a\,b}{a\,d}$; and in this manner the relation between the density and elasticity of rarefied air may be discovered. 207

208 An easier method by means of the air-pump.

This examination may be managed more easily by means of the air-pump. Suppose a tube $a\,e$ (fig. 52.) containing a small quantity of air $a\,b$, set up in a cistern of mercury, which is supported in the tube at the height $e\,b$, and let $e\,c$ be the height of the mercury in the barometer. Let this apparatus be set under a tubulated receiver on the pump-plate, and let $g\,n$ be the pump-gage, and $m\,n$ be made equal to $c\,e$.

Then,

Experiments on Air.

Then, as has been already shown, $e b$ is the measure of the elasticity of the air in $a b$, corresponding to the bulk $a b$. Now let some air be abstracted from the receiver. The elasticity of the remainder will be diminished by its expansion; and therefore the mercury in the tube $a e$ will descend to some point d. For the same reason, the mercury in the gage will rise to some point o, and $m o$ will express the elasticity of the air in the receiver. This would support the mercury in the tube $a e$ at the height $e r$, if the space $a r$ were entirely void of air. Therefore $r d$ is the effect and measure of the elasticity of the included air when it has expanded to the bulk $a d$; and thus its elasticity, under a variety of other bulks, may be compared with its elasticity when of the bulk $a b$. When the air has been so far abstracted from the receiver that the mercury in $a e$ descends to e, then $m o$ will be the precise measure of its elasticity.

In all these cases it is necessary to compare its bulk $a b$ with its natural bulk, in which its elasticity balances the pressure of the atmosphere. This may be done by laying the tube $a e$ horizontally, and then the air will collapse into its ordinary bulk.

209 Another easy method Plate CCCCIV.

Another easy method may be taken for this examination. Let an apparatus $a b c d e f$ (fig. 53.) be made, consisting of a horizontal tube $a e$ of even bore, a ball $d g e$ of a large diameter, and a swan-neck tube $b f$. Let the ball and part of the tube $g e b$ be filled with mercury, so that the tube may be in the same horizontal plane with the surface $d e$ of the mercury in the ball. Then seal up the end a, and connect f with an air-pump. When the air is abstracted from the surface $d e$, the air in $a b$ will expand into a larger bulk $a c$, and the mercury in the pump-gage will rise to some distance below the barometric height. It is evident that this distance, without any farther calculation, will be the measure of the elasticity of the air pressing on the surface $d e$, and therefore of the air in $a c$.

210 The most exact mode of examining this elasticity.

The most exact of all methods is to suspend in the receiver of an air-pump a glass vessel, having a very narrow mouth over a cistern of mercury, and then abstract the air till the gage rises to some determined height. The difference e between this height and the barometric height determines the elasticity of the air in the receiver and in the suspended vessel. Now lower down that vessel by the slip-wire till its mouth is immersed into the mercury, and admit the air into the receiver; it will press the mercury into the little vessel. Lower it still farther down, till the mercury within it is level with that without; then stop its mouth, take it out and weigh the mercury, and let its weight be w. Subtract this weight from the weight v of the mercury, which would completely fill the whole vessel; then the natural bulk of the air will be $v-w$, while its bulk, when of the elasticity e in the rarefied receiver, was the bulk or capacity w of the vessel. Its density therefore, corresponding to this elasticity e, was $\frac{v-w}{w}$. And thus may the relation between the density and elasticity in all cases be obtained.

211 Various experiments have been made to this purpose.

A great variety of experiments to this purpose have been made, with different degrees of attention, according to the interest which the philosophers had in the result. Those made by M. de Luc, General Roy, Mr Trembley, and Sir George Shuckbourgh, are by far the most accurate; but they are all confined to very moderate rarefactions. The general result has been, that the elasticity of rarefied air is very nearly proportional to its density. We cannot say with confidence that any regular deviation from this law has been observed, there being as many observations on one side as on the other; but we think that it is not unworthy the attention of philosophers to determine it with precision in the cases of extreme rarefaction, where the irregularities are most remarkable. The great source of error is a certain adhesive sluggishness of the mercury when the impelling forces are very small; and other fluids can hardly be used, because they either smear the inside of the tube and diminish its capacity, or they are converted into vapour, which alters the law of elasticity.

Boylean Law

212 The Boylean law may in general be assumed.

Let us, upon the whole, assume the Boylean law, viz. that the elasticity of the air is proportional to its density. The law deviates not in any sensible degree from the truth in those cases which are of the greatest practical importance, that is, when the density does not much exceed or fall short of that of ordinary air.

213 Investigation of the action of the particles on each other.

Let us now see what information this gives us with respect to the action of the particles on each other.

The investigation is extremely easy. We have seen that a force eight times greater than the pressure of the atmosphere will compress common air into the eighth part of its common bulk, and give it eight times its common density: and in this case we know, that the particles are at half their former distance, and that the number which are now acting on the surface of the piston employed to compress them is quadruple of the number which act on it when it is of the common density. Therefore, when this eightfold compressing force is distributed over a fourfold number of particles, the portion of it which acts on each is double. In like manner, when a compressing force 27 is employed, the air is compressed into $\frac{1}{27}$ of its former bulk, the particles are at $\frac{1}{3}$ of their former distance, and the force is distributed among 9 times the number of particles; the force on each is therefore 3. In short, let $\frac{1}{x}$ be the distance of the particles, the number of them in any given vessel, and therefore the density will be as x^3, and the number pressing by their elasticity on its whole internal surface will be as x^2. Experiment shows, that the compressing force is as x^3, which being distributed over the number as x^2, will give the force on each as x. Now this force is in immediate equilibrium with the elasticity of the particle immediately contiguous to the compressing surface. This elasticity is therefore as x: and it follows from the nature of perfect fluidity, that the particle adjoining to the compressing surface presses with an equal force on its adjoining particles on every side. Hence we must conclude, that the corpuscular repulsions exerted by the adjoining particles are inversely as their distances from each other, or that the adjoining particles tend to recede from each other with forces inversely proportional to their distances.

214 Sir Isaac Newton was the first who reasoned properly on this subject.

Sir Isaac Newton was the first who reasoned in this manner from the phenomena. Indeed he was the first who had the patience to reflect on the phenomena with any precision. His discoveries in gravitation naturally gave his thoughts this turn, and he very early hinted his suspicions that all the characteristic phenomena of

Boylean Law.

tangible matter were produced by forces which were exerted by the particles at small and insensible distances: And he considers the phenomena of air as affording an excellent example of this investigation, and deduces from them the law which we have now demonstrated; and says, that air consists of particles which avoid the adjoining particles with forces inversely proportional to their distances from each other. From this he deduces (in the 2d book of his Principles) several beautiful propositions, determining the mechanical constitution of the atmosphere.

215 Limits the action to adjoining particles.

But it must be noticed that he limits this action to the *adjoining* particles: and this is a remark of immense consequence, though not attended to by the numerous experimenters who adopt the law.

It is plain that the particles are supposed to act at a distance, and that this distance is variable, and that the forces diminish as the distances increase. A very ordinary air-pump will rarefy the air 125 times. The distance of the particles is now 5 times greater than before; and yet they still repel each other: for air of this density will still support the mercury in a syphon-gage at the height of 0,24, or $\frac{24}{100}$ of an inch; and a better pump will allow this air to expand twice as much, and still leave it elastic. Thus we see that whatever is the distance of the particles of common air, they can act five times farther off. The question comes now to be, Whether, in the state of common air, they really do act five times farther than the distance of the adjoining particles? While the particle *a* acts on the particle *b* with the force 5, does it also act on the particle *c* with the force 2,5, on the particle *d* with the force 1,667, on the particle *e* with the force 1,25, on the particle *f* with the force 1, on the particle *g* with the force 0,8333, &c?

216 Sir Isaac Newton shows in the plainest manner, that this is by no means the case; for if this were the case, he makes it appear that the sensible phenomena of condensation would be totally different from what we observe. The force necessary for a quadruple condensation would be eight times greater, and for a nonuple condensation the force must be 27 times greater. Two spheres filled with condensed air must repel each other, and two spheres containing air that is rarer than the surrounding air must attract each other, &c. &c. All this will appear very clearly, by applying to air the reasoning which Sir Isaac Newton has employed in deducing the sensible law of mutual tendency of two spheres, which consist of particles attracting each other with forces proportional to the square of the distance inversely.

217 If we could suppose that the particles of air repelled each other with invariable forces at all distances within some small and insensible limit, this would produce a compressibility and elasticity similar to what we observe. For if we consider a row of particles, within this limit, as compressed by an external force applied to the two extremities, the action of the whole row on the extreme points would be proportional to the number of particles, that is, to their distance inversely and to their density: and a number of such parcels, ranged in a straight line, would constitute a row of any sensible magnitude having the same law of compression. But this law of corpuscular force is unlike every thing we observe in nature, and to the last degree improbable.

Height of the Atmosphere.

218 We must therefore continue the limitation of this mutual repulsion of the particles of air, and be contented for the present with having established it as an experimental fact, that the *adjoining* particles of air are kept asunder by forces inversely proportional to their distances; or perhaps it is better to abide by the sensible law, that *the density of air is proportional to the compressing force.* This law is abundantly sufficient for explaining all the subordinate phenomena, and for giving us a complete knowledge of the mechanical constitution of our atmosphere.

219 The height of the air investigated from considering its compressibility, &c.

And, in the first place, this view of the compressibility of the air must give us a very different notion of the height of the atmosphere from what we deduced on a former occasion from our experiments. It is found, that when the air is of the temperature 32° of Fahrenheit's thermometer, and the mercury in the barometer stands at 30 inches, it will descend one-tenth of an inch if we take it to a place 87 feet higher. Therefore, if the air were equally dense and heavy throughout, the height of the atmosphere would be $30 \times 10 \times 87$ feet, or 5 miles and 100 yards. But the loose reasoning adduced on that occasion was enough to show us that it must be much higher; because every stratum as we ascend must be successively rarer as it is less compressed by incumbent weight. Not knowing to what degree air expanded when the compression was diminished, we could not tell the successive diminutions of density and consequent augmentation of bulk and height; we could only say, that several atmospheric appearances indicated a much greater height. Clouds have been seen much higher; but the phenomenon of the twilight is the most convincing proof of this. There is no doubt that the visibility of the sky or air is owing to its want of perfect transparency, each particle (whether of matter purely aerial or heterogeneous) reflecting a little light.

220 Plate CCCCIV.

Let *b* (fig. 54.) be the last particle of illuminated air which can be seen in the horizon by a spectator at A. This must be illuminated by a ray SD*b*, touching the earth's surface at some point D. Now it is a known fact, that the degree of illumination called *twilight* is perceived when the sun is 18° below the horizon of the spectator, that is, when the angle E*b*S or ACD is 18 degrees; therefore *b*C is the secant of 9 degrees (it is less, viz. about 8¼ degrees, on account of refraction). We know the earth's radius to be about 3970 miles: hence we conclude *b*B to be about 45 miles; nay, a very sensible illumination is perceptible much farther from the sun's place than this, perhaps twice as far, and the air is sufficiently dense for reflecting a sensible light at the height of nearly 200 miles.

221 Experiment fixes no limit to the air's expansibility.

We have now seen that air is prodigiously expansible. None of our experiments have distinctly shown us any limit. But it does not follow that it is expansible without end; nor is this at all likely. It is much more probable that there is a certain distance of the parts in which they no longer repel each other; and this would be the distance at which they would arrange themselves if they were not heavy. But at the very summit of the atmosphere they will be a very small matter nearer to each other, on account of their gravitation to the earth. Till we know precisely the law of this mutual repulsion, we cannot say what is the height of the atmosphere.

But if the air be an elastic fluid whose density is always

Height of the Atmosphere.

ways proportionable to the compressing force, we can tell what is its density at any height above the surface of the earth: and we can compare the density so calculated with the density discovered by observation: for this last is measured by the height at which it supports mercury in the barometer. This is the direct measure of the pressure of the external air; and as we know the law of gravitation, we can tell what would be the pressure of air having the calculated density in all its parts.

222 Farther observations on, and investigation of, the height of the atmosphere.

223 Let us therefore suppose a prismatic or cylindric column of air reaching to the top of the atmosphere. Let this be divided into an indefinite number of strata of very small and equal depths or thickness; and let us, for greater simplicity, suppose at first that a particle of air is of the same weight at all distances from the centre of the earth.

224 The absolute weight of any one of these strata will on these conditions be proportional to the number of particles or the gravity of air contained in it; and since the depth of each stratum is the same, this quantity of air will evidently be as the density of the stratum: but the density of any stratum is as the compressing force; that is, as the pressure of the strata above it; that is, as their weight; that is, as their quantity of matter—therefore the quantity of air in each stratum is proportional to the quantity of air above it; but the quantity in each stratum is the difference between the column incumbent on its bottom and on its top: these differences are therefore proportional to the quantities of which they are the differences. But when there is a series of quantities which are proportional to their own differences, both the quantities and their differences are in continual or geometrical progression: for let a, b, c, be three such quantities that

$b : c = a - b : b - c$, then, by altern.

$b : a - b = c : b - c$ and by compos.

$b : a = c : b$

and $a : b = b : c$

therefore the densities of these strata decrease in a geometrical progression; that is, when the elevations above the centre or surface of the earth increase, or their depths under the top of the atmosphere decrease, in an arithmetical progression, the densities decrease in a geometrical progression.

225 Plate CCCCIV. Let ARQ (fig. 55.) represent the section of the earth by a plane through its centre O, and let m OAM be a vertical line, and AE perpendicular to OA will be a horizontal line through A, a point on the earth's surface. Let AE be taken to represent the density of the air at A; and let DH, parallel to AE, be taken to AE as the density at D is to the density at A: it is evident, that if a logistic or logarithmic curve EHN be drawn, having AN for its axis, and passing through the points E and H, the density of the air at any other point C, in this vertical line, will be represented by CG, the ordinate to the curve in that point: for it is the property of this curve, that if portions AB, AC, AD, of its axis be taken in arithmetical progression, the ordinates AE, BF, CG, DH, will be in geometrical progression.

226 It is another fundamental property of this curve, that if EK or HS touch the curve in E or H, the subtangent AK or DS is a constant quantity.

And a third fundamental property is, that the infinitely extended area MAEN is equal to the rectangle KAEL of the ordinate and subtangent; and, in like manner, the area MDHN is equal to SD×DH, or to KA×DH; consequently the area lying beyond any ordinate is proportional to that ordinate. 227

These geometrical properties of this curve are all analogous to the chief circumstances in the constitution of the atmosphere, on the supposition of equal gravity. The area MCGN represents the whole quantity of aereal matter which is above C: for CG is the density at C, and CD is the thickness of the stratum between C and D; and therefore CGHD will be as the quantity of matter or air in it; and in like manner of all the others, and of their sums, or the whole area MCGN: and as each ordinate is proportional to the area above it, so each density, and the quantity of air in each stratum, is proportional to the quantity of air above it: and as the whole area MAEN is equal to the rectangle KAEL, so the whole air of variable density above A might be contained in a column KA, if, instead of being compressed by its own weight, it were without weight, and compressed by an external force equal to the pressure of the air at the surface of the earth. In this case, it would be of the uniform density AE, which it has at the surface of the earth, making what we have repeatedly called the homogeneous atmosphere. 228

Hence we derive this important circumstance, that the height of the homogeneous atmosphere is the subtangent of that curve whose ordinates are as the densities of the air at different heights, on the supposition of equal gravity. This curve may with propriety be called the ATMOSPHERICAL LOGARITHMIC: and as the different logarithmics are all characterised by their subtangents, it is of importance to determine this one. 229

It may be done by comparing the densities of mercury and air. For a column of air of uniform density, reaching to the top of the homogeneous atmosphere, is in equilibrio with the mercury in the barometer. Now it is found, by the best experiments, that when mercury and air are of the temperature 32° of Fahrenheit's thermometer, and the barometer stands at 30 inches, the mercury is nearly 10440 times denser than air. Therefore the height of the homogeneous atmosphere is 10440 times 30 inches, or 26100 feet, or 8700 yards, or 4350 fathoms, or 5 miles wanting 100 yards.

Or it may be found by observations on the barometer. It is found, that when the mercury and air are of the above temperature, and the barometer on the sea-shore stands at 30 inches, if we carry it to a place 884 feet higher it will fall to 29 inches. Now, in all logarithmic curves having equal ordinates, the portions of the axes intercepted between the corresponding pairs of ordinates are proportional to the subtangents. And the subtangents of the curve belonging to our common tables is 0,4342945, and the difference of the logarithms of 30 and 29 (which is the portion of the axis intercepted between the ordinates 30 and 29), or 0,0147233, is to 0,4342945 as 883 is to 26058 feet, or 8686 yards, or 4343 fathoms, or 5 miles wanting 114 yards. This determination is 14 yards less than the other, and it is uncertain which is the most exact. It is extremely difficult to measure the respective densities of mercury and air; and in measuring the elevation which pro- 230

Height of the Atmosphere duces a fall of one inch in the barometer, an error of $\frac{1}{10}$ of an inch would produce all the difference. We prefer the last, as depending on fewer circumstances.

231 But all this investigation proceeds on the supposition of equal gravity, whereas we know that the weight of a particle of air decreases as the square of its distance from the centre of the earth increases. In order, therefore, that a superior stratum may produce an equal pressure at the surface of the earth, it must be denser, because a particle of it gravitates less. The density, therefore, at equal elevations, must be greater than on the supposition of equal gravity, and the law of diminution of density must be different.

Make $OD : OA = OA : Od$;
$OC : OA = OA : Oc$;
$OB : OA = OA : Ob$, &c;

so that Od, Oc, Ob, OA, may be reciprocals to OD, OC, OB, OA; and through the points A, b, c, d, draw the perpendiculars AE, bf, cg, dh, making them proportional to the densities in A, B, C, D; and let us suppose CD to be exceedingly small, so that the density may be supposed uniform through the whole stratum. Thus we have

$$OD \times Od = OA^2, = OC \times Oc$$
and $Oc : Od = OD : OC$;
and $Oc : Oc - Od = OD : OD - OC$,
or $Oc : cd = OD : DC$;
and $cd : CD = Oc : OD$;

or, because OC and OD are ultimately in the ratio of equality, we have

$$cd : CD = Oc : OC = OA^2 : OC^2,$$

and $cd = CD \times \frac{OA^2}{OC^2}$, and $cd \times cg = CD \times cg \times \frac{OA^2}{OC^2}$;

but $CD \times cg \times \frac{OA^2}{OC^2}$ is as the pressure at C arising from the absolute weight of the stratum CD. For this weight is as the bulk, as the density, and as the gravitation of each particle jointly. Now CD expresses the bulk, cg the density, and $\frac{OA^2}{OC^2}$ the gravitation of each particle. Therefore, $cd \times cg$ is as the pressure on C arising from the weight of the stratum DC; but $cd \times cg$ is evidently the element of the curvilineal area $AmnE$, formed by the curve $Efghn$ and the ordinates AE, bf, cg, dh, &c. mn. Therefore the sum of all the elements, such as $cdhg$, that is, the area $cmng$ below cg, will be as the *whole* pressure on C, arising from the gravitation of all the air above it; but, by the nature of air, this whole pressure is as the density which it produces, that is, as cg. Therefore the curve Egn is of such a nature that the area lying below or beyond any ordinate cg is proportional to that ordinate. This is the property of the logarithmic curve, and Egn is a logarithmic curve.

232 But farther, this curve is the same with EGN. For let B continually approach to A, and ultimately coincide with it. It is evident that the ultimate ratio of BA to Ab, and of BF to bf, is that of equality; and if EFK, Efk, be drawn, they will contain equal angles with the ordinate AE, and will cut off equal subtangents AK, Ak. The curves EGN, Egn are therefore the same, but in opposite positions.

233 Lastly, if OA, Ob, Oc, Od, &c. be taken in arithmetical progression decreasing, their reciprocals OA, OB, OC, OD, &c. will be in harmonical progression increasing, as is well known: but, from the nature of the logarithmic curve, when OA, Ob, Oc, Od, &c. are in arithmetical progression, the ordinates AE, bf, cg, dh, &c. are in geometrical progression. Therefore when OA, OB, OC, OD, &c. are in harmonical progression, the densities of the air at A, B, C, D, &c. are in geometrical progression; and thus may the density of the air at all elevations be discovered. Thus to find the density of the air at K the top of the homogeneous atmosphere, make $OK : OA = OA : OL$, and draw the ordinate LT, LT is the density at K.

The celebrated Dr Halley was the first who observed the relation between the density of the air and the ordinates of the logarithmic curve, or common logarithms. This he did on the supposition of equal gravity; and his discovery is acknowledged by Sir Isaac Newton in *Princip.* ii. *prop.* 22. *schol.* Halley's dissertation on the subject is in n° 185 of the Phil. Trans. Newton, with his usual sagacity, extended the same relation to the true state of the case, where gravity is as the square of the distance inversely; and showed that when the distances from the earth's centre are in harmonic progression, the densities are in geometric progression. He shows indeed, in general, what progression of the distance, on any supposition of gravity, will produce a geometrical progression of the densities, so as to obtain a set of lines OA, Ob, Oc, Od, &c. which will be logarithms of the densities. The subject was afterwards treated in a more familiar manner by Cotes in his *Hydrost. Lect.* and in his *Harmonia Mensurarum*; also by Dr Brooke Taylor, *Meth. Increment*; Wolf in his *Aerometria*; Herman in his *Phoronomia*; &c. &c. and lately by Horsley, Phil. Trans. tom. lxiv.

234 The air has a finite density at an infinite distance from the centre of the earth.

An important corollary is deducible from these principles, viz. that the air has a finite density at an infinite distance from the centre of the earth, namely, such as will be represented by the ordinate OP drawn through the centre. It may be objected to this conclusion, that it would infer an infinity of matter in the universe, and that it is inconsistent with the phenomena of the planetary motions, which appear to be performed in a space void of all resistance, and therefore of all matter. But this fluid must be so rare at great distances, that the resistance will be insensible, even though the retardation occasioned by it has been accumulated for ages. Even at the very moderate distance of 500 miles, the rarity is so great that a cubic inch of common air expanded to that degree would occupy a sphere equal to the orbit of Saturn; and the whole retardation which this planet would sustain after some millions of years would not exceed what would be occasioned by its meeting one bit of matter of half a grain weight.

This being the case, it is not unreasonable to suppose the visible universe occupied by air, which, by its gravitation, will accumulate itself round every body in it, in a proportion depending on their quantities of matter, the larger bodies attracting more of it than the smaller ones, and thus forming an atmosphere about each. And many appearances warrant this supposition. Jupiter, Mars, Saturn, and Venus, are evidently surrounded by atmospheres. The constitution of these atmospheres may differ exceedingly from other causes. If the planet has nothing on its surface which can be dissolved by

Atmospheres of the other Planets, &c.

by the air or volatilised by heat, the atmosphere will be continually clear and transparent, like that of the moon.

Mars has an atmosphere which appears precisely like our own, carrying clouds, or depositing snows: for
235 The atmosphere of Mars, when, by the obliquity of his axis to the plane of his ecliptic, he turns his north pole towards the sun, it is observed to be occupied by a broad white spot. As the summer of that region advances, this spot gradually wastes, and sometimes vanishes, and then the south pole comes in sight, surrounded in like manner with a white spot, which undergoes similar changes. This is precisely the appearance which the snowy circumpolar regions of this earth will exhibit to an astronomer on Mars. It may not, however, be snow that we see; thick clouds will have the same appearances.

236 Of Jupiter, The atmosphere of the planet Jupiter is also very similar to our own. It is diversified by streaks or belts parallel to his equator, which frequently change their appearance and dimensions, in the same manner as those tracks of similar sky which belong to different regions of this globe. There is a certain kind of weather that more properly belongs to a particular climate than to any other. This is nothing but a certain general state of the atmosphere which is prevalent there, though with considerable variations. This must appear to a spectator in the moon like a streak spread over that climate, distinguishing it from others. But the most remarkable similarity is in the motion of the clouds on Jupiter. They have plainly a motion from east to west relative to the body of the planet; for there is a remarkable spot on the surface of the planet, which is observed to turn round the axis in 9h. 51′ 16″; and there frequently appear variable and perishing spots in the belts, which sometimes last for several revolutions. These are observed to circulate in 9. 55. 05. These numbers are the results of a long series of observations by Dr Herschel. This plainly indicates a general current of the clouds westward, precisely similar to what a spectator in the moon must observe in our atmosphere arising from the trade-winds. Mr Schroeter has made the atmosphere of Jupiter a study for many years; and deduces from his observations that the motion of the variable spots is subject to great variations, but is always from east to west. This indicates variable winds.

237 Of Venus, The atmosphere of Venus appears also to be like ours, loaded with vapours, and in a state of continual change of absorption and precipitation. About the middle of last century the surface of Venus was pretty distinctly seen for many years chequered with irregular spots, which are described by Campani, Bianchini, and other astronomers in the south of Europe, and also by Cassini at Paris, and Hooke and Townley in England. But the spots became gradually more faint and indistinct; and, for near a century, have disappeared. The whole surface appears now of one uniform brilliant white. The atmosphere is probably filled with a reflecting vapour, thinly diffused through it, like water faintly tinged with milk. A great depth of this must appear as white as a small depth of milk itself; and it appears to be of a *very great* depth, and to be refractive like our air. For Dr Herschel has observed, by the help of his fine telescopes, that the illuminated part of Venus is considerably more than a hemisphere, and that the light dies gradually away to the bounding margin. This is the very appearance that the earth would make if furnished with such an atmosphere. The boundary of illumination would have a penumbra reaching about nine degrees beyond it. If this be the constitution of the atmosphere of Venus, she may be inhabited by beings like ourselves. They would not be dazzled by the intolerable splendor of a sun four times as big and as bright, and sixteen times more glaring, than ours; for they would seldom or never see him, but instead of him an uniformly bright and white sky. They would probably never see a star or planet, unless the dog-star and Mercury; and perhaps the earth might pierce through the bright haze which surrounds their planet. For the same reason the inhabitants would not perhaps be incommoded by the sun's heat. It is indeed a very questionable thing, whether the sun would cause any heat, even here, if it were not for the chemical action of his rays on our air. This is rendered not improbable by the intense cold felt on the tops of the highest mountains, in the clearest air, and even under a vertical sun in the torrid zone.

The atmosphere of comets seems of a nature totally different. This seems to be of inconceivable rarity, 238 And of comets.
even when it reflects a very sensible light. The tail is always turned nearly away from the sun. It is thought that this is by the impulse of the solar rays. If this be the case, we think it might be discovered by the aberration and the refraction of the light by which we see the tail: for this light must come to our eye with a much smaller velocity than the sun's light, if it be reflected by repulsive or elastic forces, which there is every reason in the world to believe; and therefore the velocity of the reflected light will be diminished by all the velocity communicated to the reflecting particles. This is almost inconceivably great. The comet of 1680 went half round the sun in ten hours, and had a tail at least a hundred millions of miles long, which turned round at the same time, keeping nearly in the direction opposite to the sun. The velocity necessary for this is prodigious, approaching to that of light. And perhaps the tail extends much farther than we see it, but is visible only as far as the velocity with which its particles recede from the sun is less than a certain quantity, namely, what would leave a sufficient velocity for the reflected light to enable it to affect our eyes. And it may be demonstrated, that although the real form of the visible tail is concave on the anterior side to which the comet is moving, it may appear convex on that side, in consequence of the very great aberration of the light by which the remote parts are seen. All this may be discovered by properly contrived observations; and the conjecture merits attention. But of this digression there is enough; and we return to our subject, the constitution of our air.

We have shown how to determine *à priori* the density 239 The barometer used in taking heights.
of the air at different elevations above the surface of the earth. But the densities may be discovered in all accessible elevations by experiments; namely, by observing the heights of the mercury in the barometer. This is a direct measure of the pressure of the incumbent atmosphere; and this is proportional to the density which it produces.

Therefore, by means of the relation subsisting between 240
the densities and the elevations, we can discover the elevations by observations made on the densities by means

Barometer.

of the barometer; and thus we may measure elevations by means of the barometer; and, with very little trouble, take the level of any extensive track of country. Of this we have an illustrious example in the section which the Abbé Chappe D'Auteroche has given of the whole country between Brest and Ekaterinenburgh in Siberia. This is a subject which deserves a minute consideration: we shall therefore present it under a very simple and familiar form; and trace the method through its various steps of improvement by De Luc, Roy, Shuckbourgh, &c.

241 Explanation of its use, &c.

We have already observed oftener than once, that if the mercury in the barometer stands at 30 inches, and if the air and mercury be of the temperature 32° in Fahrenheit's thermometer, a column of air 87 feet thick has the same weight with a column of mercury $\frac{1}{10}$ of an inch thick. Therefore, if we carry the barometer to a higher place, so that the mercury sinks to 29.9, we have ascended 87 feet. Now, suppose we carry it still higher, and that the mercury stands at 29.8; it is required to know what height we have now got to? We have evidently ascended through another stratum of equal weight with the former: but it must be of greater thickness, because the air in it is rarer, being less compressed. We may call the density of the first stratum 300, measuring the density by the number of tenths of an inch of mercury which its elasticity proportional to its density enables it to support. For the same reason, the density of the second stratum must be 299: but when the weights are equal, the bulks are inversely as the densities; and when the bases of the strata are equal, the bulks are as the thicknesses. Therefore, to obtain the thickness of this second stratum, say $299:300=87:87,29$; and this fourth term is the thickness of the second stratum, and we have ascended in all 174,29 feet. In like manner we may rise till the barometer shows the density to be 298: then say, $298:30=87:87,584$ for the thickness of the third stratum, and 261,875 or $261\frac{7}{8}$ for the whole ascent; and we may proceed in the same way for any number of mercurial heights, and make a table of the corresponding elements as follows: where the first column is the height of the mercury in the barometer, the second column is the thickness of the stratum, or the elevation above the preceding station; and the third column is the whole elevation above the first station.

Bar.	Strat.	Elev.
30	00,000	00,000
29,9	87,000	87,000
29,8	87,291	174,291
29,7	87,584	261,875
29,6	87,879	349,754
29,5	88,176	437,930
29,4	88,475	526,405
29,3	88,776	615,181
29,2	89,079	704,260
29,1	89,384	793,644
29	89,691	883,335

242 Having done this, we can now measure any elevation within the limits of our table, in this manner.

Observe the barometer at the lower and at the upper stations, and write down the corresponding elevations. Subtract the one from the other, and the remainder is the height required. Thus suppose that at the lower station the mercurial height was 29,8, and that at the upper station it was 29,1.

Taking heights.

29,1	793,644
29,8	174,291
	619,353 = Elevation.

We may do the same thing with tolerable accuracy without the table, by taking the medium m of the mercurial heights, and their difference d in tenths of an inch; and then say, as m to 300, so is $87d$ to the height required h: or $h=\frac{300\times 87d}{m}=\frac{26100d}{m}$. Thus, in the foregoing example, m is 294,5, and d is $=7$; and therefore $h=\frac{7\times 26100}{294,5}=620,4$, differing only one foot from the former value.

Either of these methods is sufficiently accurate for most purposes, and even in very great elevations will not produce any error of consequence: the whole error of the elevation 883 feet 4 inches, which is the extent of the above table, is only $\frac{1}{4}$ of an inch.

But we need not confine ourselves to methods of approximation, when we have an accurate and scientific method that is equally easy. We have seen that, upon the supposition of equal gravity, the densities of the air are as the ordinates of a logarithmic curve, having the line of elevations for its axis. We have also seen that, in the true theory of gravity, if the distances from the centre of the earth increase in a harmonic progression, the logarithm of the densities will decrease in an arithmetical progression; but if the greatest elevation above the surface be but a few miles, this harmonic progression will hardly differ from an arithmetical one. Thus, if Ab, Ac, Ad, are 1, 2, and 3 miles, we shall find that the corresponding elevations AB, AC, AD are sensibly in arithmetical progression also: for the earth's radius AC is nearly 4000 miles. Hence it plainly follows, that BC—AB is $\frac{1}{4000\times 4001}$, or $\frac{1}{16004000}$ of a mile, or $\frac{1}{250}$ of an inch; a quantity quite insignificant. We may therefore affirm without hesitation, that in all accessible places, the elevations increase in an arithmetical progression, while the densities decrease in a geometrical progression. Therefore the ordinates are proportional to the numbers which are taken to measure the densities, and the portions of the axis are proportional to the logarithms of these numbers. It follows, therefore, that we may take such a scale for measuring the densities that the logarithms of the numbers of this scale shall be the very portions of the axis; that is, of the vertical line in feet, yards, fathoms, or what measure we please: and we may, on the other hand, choose such a scale for measuring our elevations, that the logarithms of our scale of densities shall be parts of this scale of elevations; and we may find either of these scales scientifically. For it is a known property of the logarithmic curves, that when the ordinates are the same, the intercepted portions of the abscissæ are proportional to their subtangents. Now we know the subtangent of the atmospherical logarithmic: it is the height of the homogeneous atmosphere in any measure we please, suppose fathoms: we find this height by comparing the gravities of air and mercury, when both

243

Barometer. both are of some determined density. Thus, in the temperature of 32° of Fahrenheit's thermometer, when the barometer stands at 30 inches, it is known (by many experiments) that mercury is 10423,068 times heavier than air; therefore the height of the balancing column of homogeneous air will be 10423,068 times 30 inches; that is, 4342,945 English fathoms. Again, it is known that the subtangent of our common logarithmic tables, where 1 is the logarithm of the number 10, is 0,4342945. Therefore the number 0,4342945 is to the difference D of the logarithms of any two barometric heights as 4342,945 fathoms are to the fathoms F contained in the portion of the axis of the atmospherical logarithmic, which is intercepted between the ordinates equal to these barometrical heights; or that 0,4342945 : D = 4342,945 : F, and 0,4342945 : 4342,945 = D : F; but 0,4342945 is the ten-thousandth part of 4342,945, and therefore D is the ten-thousandth part of F.

244 And thus it happens, by mere chance, that the logarithms of the densities, measured by the inches of mercury which their elasticity supports in the barometer, are just the ten-thousandth part of the fathoms contained in the corresponding portions of the axis of the atmospherical logarithmic. Therefore, if we multiply our common logarithms by 10000, they will express the fathoms of the axis of the atmospherical logarithmic; nothing is more easily done. Our logarithms contain what is called the index or characteristic, which is an integer and a number of decimal places. Let us just remove the integer-place four figures to the right hand; thus the logarithm of 60 is 1.7781513, which is one integer and $\frac{7781513}{10000000}$. Multiply this by 10,000, and we obtain $\frac{513}{1001}$ 17781,513, or 17781 $\frac{513}{1000}$.

245 The practical application of all this reasoning is obvious and easy; observe the heights of the mercury in the barometer at the upper and lower stations in inches and decimals; take the logarithms of these, and subtract the one from the other: the difference between them (accounting the four first decimal figures as integers) is the difference of elevation of fathoms.

Example.

Merc. Height at the lower station	29,8	1.4742163
upper station	29,1	1.4638930
Diff. of Log. ×10000		0.0103,233

or 103 fathoms and $\frac{233}{1000}$ of a fathom, which is 619,392 feet, or 619 feet 4¾ inches; differing from the approximated value formerly found about ¼ an inch.

246 This method of measuring heights now much improved. Such is the general nature of the barometric measurement of heights first suggested by Dr Halley; and it has been verified by numberless comparisons of the heights calculated in this way with the same height measured geometrically. It was indeed in this way that the precise specific gravity of air and mercury was most accurately determined; namely, by observing, that when the temperature of air and mercury was 32, the difference of the logarithms of the mercurial heights were precisely the fathoms of elevation. But it requires many corrections to adjust this method to the circumstances of the case; and it was not till very lately that it has been so far adjusted to them as to become useful. We are chiefly indebted to Mr de Luc for the improvements. The great elevations in Switzerland enabled him to make an immense number of observations, in almost every variety of circumstances. Sir George Shuckbourgh also made a great number with most accurate instruments in much greater elevations, in the same country; and he made many chamber experiments for determining the laws of variation in the subordinate circumstances. General Roy also made many to the same purpose. And to these two gentlemen we are chiefly obliged for the corrections which are now generally adopted. Taking heights.

It is easy to perceive that the method, as already expressed, cannot apply to every case: it depends on the specific gravity of air and mercury, combined with the supposition that this is affected *only by a change of pressure*. But since all bodies are expanded by heat, and as there is no reason to suppose that they are equally expanded by it, it follows that a change of temperature will change the relative gravity of mercury and air, even although both suffer the same change of temperature: and since the air may be warmed or cooled when the mercury is not, or may change its temperature independent of it, we may expect still greater variations of specific gravity. 247 It depends on the specific gravity of air and mercury.

The general effect of an augmentation of the specific gravity of the mercury must be to increase the subtangent of the atmospherical logarithmic; in which case the logarithms of the densities, as measured by inches of mercury, will express measures that are greater than fathoms in the same proportion that the subtangent is increased; or, when the air is more expanded than the mercury, it will require a greater height of homogeneous atmosphere to balance 30 inches of mercury, and a given fall of mercury will then correspond to a thicker stratum of air.

In order, therefore, to perfect this method, we must learn by experiment how much mercury expands by an increase of temperature; we must also learn how much the air expands by the same, or any change of temperature; and how much its elasticity is affected by it. Both these circumstances must be considered in the case of air; for it might happen that the elasticity of the air is not so much affected by heat as its bulk is.

It will, therefore, be proper to state in this place the experiments which have been made for ascertaining these two expansions.

The most accurate, and the best adapted experiments for ascertaining the expansion of mercury, are those of General Roy, published in the 67th volume of the Philosophical Transactions. He exposed 30 inches of mercury, actually supported by the atmosphere in a barometer, in a nice apparatus, by which it could be made of one uniform temperature through its whole length; and he noted the expansion of it in decimals of an inch. These are contained in the following table; where the first column expresses the temperature by Fahrenheit's thermometer, the second column expresses the bulk of the mercury, and the third column the expansion of an inch of mercury for an increase of one degree in the adjoining temperatures. 248 General Roy's experiments on the expansion of mercury.

TABLE

Barometer.

Taking heights.

Table A.

Temp.	Bulk of ☿.	Expan. for 1°
212°	30,5117	0,0000763
202	30,4888	0,0000787
192	30,4652	0,0000810
182	30,4409	0,0000833
172	30,4159	0,0000857
162	30,3902	0,0000880
152	30,3638	0,0000903
142	30,3367	0,0000923
132	30,3090	0,0000943
122	30.2807	0,0000963
112	30,2518	0,0000983
102	30,2223	0,0001003
92	30,1922	0,0001023
82	30,1615	0,0001043
72	30,1302	0,0001063
62	30,0984	0,0001077
52	30,0661	0,0001093
42	30,0333	0,0001110
32	30,0000	0,0001127
22	29,9662	0,0001143
12	29,9319	0,0001160
2	29,8971	0,0000177
0	29,8901	

249 This table gives rise to some reflections. The scale of the thermometer is constructed on the supposition that the successive degrees of heat are measured by equal increments of bulk in the mercury of the thermometer. How comes it, therefore, that this is not accompanied by equal increments of bulk in the mercury of the column, but that the corresponding expansions of this column do continually diminish? General Roy attributes this to the gradual detachment of elastic matter from the mercury by heat, which presses on the top of the column, and therefore shortens it. He applied a boiling heat to the vacuum a-top, without producing any farther depression; a proof that the barometer had been carefully filled. It had indeed been boiled through its whole length. He had attempted to measure the mercurial expansion in the usual way, by filling 30 inches of the tube with boiled mercury, and exposing it to the heat with the open end uppermost. But here it is evident that the expansion of the tube, and its solid contents, must be taken into the account. The expansion of the tube was found so exceedingly irregular, and so incapable of being determined with precision for the tubes which were to be employed, that he was obliged to have recourse to the method with the real barometer. In this no regard was necessary to any circumstance but the perpendicular height. There was, besides, a propriety in examining the mercury in the very condition in which it was used for measuring the pressure of the atmosphere; because whatever complication there was in the results, it was the same in the barometer in actual use.

250 The most obvious manner of applying these experiments on the expansion of mercury to our purpose, is to reduce the observed height of the mercury to what it would have been if it were of the temperature 32. Thus, suppose that the observed mercurial height is 29,2, and that the temperature of the mercury is 72° make 30,1302 : 30=29,2 : 29,0738. This will be the true measure of the density of the air of the standard temperature. In order that we may obtain the exact temperature of the mercury, it is proper that the observation be made by means of a thermometer attached to the barometer-frame, so as to warm and cool along with it.

Or, this may be done without the help of a table, and with sufficient accuracy, from the circumstance that the expansion of an inch of mercury for one degree diminishes very nearly $\frac{1}{1000}$th part in each succeeding degree. If therefore we take from the expansion at 32° its thousandth part for each degree of any range above it, we obtain a mean rate of expansion for that range. If the observed temperature of the mercury is below 32°, we must *add* this correction to obtain the mean expansion. This rule will be made more exact if we suppose the expansion at 32° to be =0,0001127. Then multiply the observed mercurial height by this expansion, and we obtain the correction, to be subtracted or added according as the temperature of the mercury was above or below 32°. Thus to abide by the former example of 72°. This exceeds 32° by 40: therefore take 40 from 0,0001127, and we have 0,0001087 for the medium expansion for that range. Multiply this by 40, and we have the whole expansion of one inch of mercury, =0,004348. Multiply the inches of mercurial height, viz. 29,2, by this expansion, and we have for the correction 0,126963; which being subtracted from the observed height leaves 29,07304, differing from the accurate quantity less than the thousandth part of an inch. This rule is very easily kept in the memory, and supersedes the use of a table. 251

This correction may be made with all necessary exactness by a rule still more simple; namely, by multiplying the observed height of the mercury by the difference of its temperature from 32°, and cutting off four cyphers before the decimals of the mercurial height. This will seldom err $\frac{1}{100}$ of an inch. We even believe that it is the most exact method within the range of temperatures that can be expected to occur in measuring heights: for it appears, by comparing many experiments and observations, that General Roy's measure of the mercurial expansion is too great, and that the expansion of an inch of mercury between 20° and 70 of Fahrenheit's thermometer does not exceed 0,000102 *per* degree. Having thus corrected the observed mercurial heights by reducing them to what they would have been if the mercury had been of the standard temperature, the logarithms of the corrected heights are taken, and their difference, multiplied by 10000, will give the difference of elevations in English fathoms. 252

There is another way of applying this correction, fully more expeditious and equally accurate. The difference of the logarithms of the mercurial heights is the measure of the ratio of those heights. In like manner the difference of the logarithms of the observed and corrected heights at any station is the measure of the ratio of those heights. Therefore this last difference of the logarithms is the measure of the correction of this ratio. Now the observed height is to the corrected height nearly as 1 to 1,000102. The logarithm of this ratio, or the difference of the logarithms of 1 and 1,000102, is 0,0000444. This is the correction for each degree that the temperature of the mercury differs from 32. Therefore multiply 0,0000444 by the difference of the mercurial temperatures from 32, and the 253

products

products will be the corrections of the respective logarithms.

254 But there is still an easier way of applying the logarithmic correction. If both the mercurial temperatures are the same, the differences of their logarithms will be the same, although each may be a good deal above or below the standard temperature, if the expansion be very nearly equable. The correction will be necessary only when the temperatures at the two stations are different, and will be proportional to this difference. Therefore, if the difference of the mercurial temperatures be multiplied by 0,0000444, the product will be the correction to be made on the difference of the logarithms of the mercurial heights.

But farther, since the differences of the logarithms of the mercurial heights are also the differences of elevation in English fathoms, it follows that the correction is also a difference of elevation in English fathoms, or that the correction for one degree of difference of mercurial temperature is $\frac{444}{1000}$ of a fathom, or 32 inches, or 2 feet 8 inches.

This correction of 2.8 for every degree of difference of temperature must be subtracted from the elevation found by the general rate, when the mercury at the upper station is colder than that at the lower. For when this is the case, the mercurial column at the upper station will appear too short, the pressure of the atmosphere too small, and therefore the elevation in the atmosphere will appear greater than it really is.

255 Therefore the rule for this correction will be to multiply 0,0000444 by the degrees of difference between the mercurial temperatures at the two stations, and to add or subtract the product from the elevation found by the general rule, according as the mercury at the upper station is hotter or colder than that at the lower.

256 If the experiments of General Roy on the expansion of the mercury in a real barometer be thought most deserving of attention, and the expansion be considered as variable, the logarithmic difference corresponding to this expansion for the *mean* temperature of the two barometers may be taken. These logarithmic differences are contained in the following table, which is carried as far as 112°, beyond which it is not probable that any observations will be made. The number for each temperature is the difference between the logarithms of 30 inches, of the temperature 32, and of 30 inches expanded by that temperature.

TABLE B.

Temp.	Log. diff.	Dec. of Fath.	Ft. In.
112°	0.0000427	,427	2.7
102	0.0000436	,436	2.7
92	0.0000444	,444	2.8
82	0.0000453	,453	2.9
72	0.0000460	,460	2.9
62	0.0000468	,468	2.10
52	0.0000475	,475	2.10
42	0.0000482	,482	2.11
32	0.0000489	,489	2.11
22	0.0000497	,497	3.0
12	0.0000504	,504	3.0
0			

257 The temperature of the air must also be attended to.

It is also necessary to attend to the temperature of the air; and the change that is produced by heat in its density is of much greater consequence than that of the mercury. The relative gravity of the two, on which the subtangent of the logarithmic curve depends, and consequently the unit of our scale of elevations, is much more affected by the heat of the air than by the heat of the mercury.

This adjustment is of incomparably greater difficulty than the former, and we can hardly hope to make it perfect. We shall narrate the chief experiments which have been made on the expansion of air, and deduce from them such rules as appear to be necessary consequences of them, and then notice the circumstances which leave the matter still imperfect.

258 Comparison of a mercurial and air thermometer.

General Roy compared a mercurial and an air thermometer, each of which was graduated arithmetically, that is, the units of the scales were equal bulks of mercury, and equal bulks (perhaps different from the former) of air. He found their progress as in the following table.

TABLE C.

Merc.	Diff.	Air.	Diff.
212	20	212,0	17,6
192	20	194,4	18,2
172	20	176,2	18,8
152	20	157,4	19,4
132	20	138,0	20,0
112	20	118,0	20,8
92	20	97,2	21,6
72	20	75,6	22,6
52	20	53,0	21,6
32	20	31,4	20,0
12		11,4	

It has been established by many experiments that equal increments of heat produce equal increments in the bulk of mercury. The differences of temperature are therefore expressed by the second column, and may be considered as equal; and the numbers of the third column must be allowed to express the same temperatures with those of the first. They *directly* express the *bulks* of the air, and the numbers of the fourth column express the differences of these bulks. These are evidently unequal, and show that common air expands most of all when of the temperature 62 nearly. 259

260 To determine an actual increase of bulk from a known increase of heat.

The next point was to determine what was the *actual* increase of bulk by some known increase of heat. For this purpose he took a tube, having a narrow bore, and a ball at one end. He measured with great care the capacity of both the ball and the tube, and divided the tube into equal spaces which bore a determined proportion to the capacity of the ball. This apparatus was set in a long cylinder filled with frigorific mixtures or with water, which could be uniformly heated up to the boiling temperature, and was accompanied by a nice thermometer. The expansion of the air was measured by means of a column of mercury which rose or sunk in the tube. The tube being of a small bore, the mercury did not drop out of it; and the bore being chosen as equable as possible, this column remained of an uniform length, whatever part of the tube it chanced to occupy. By this contrivance he was able to examine the expansibility of air of various densities. When the column of mercury contained only a single drop or two, the air was nearly of the density of the external air. If he wished to examine the expansion of air twice or thrice as dense, he used a column of 30 or 60 inches long: and to examine the expansion of air that is rarer than

the

the external air, he placed the tube with the ball uppermoft, the open end coming through a hole in the bottom of the veffel containing the mixtures or water. By this pofition the column of mercury was hanging in the tube, fupported by the preffure of the atmofphere; and the elafticity of the included air was meafured by the difference between the fufpended column and the common barometer.

261 The following table contains the expanfion of 1000 parts of air, nearly of the common denfity, by heating it from 0 to 212. The firft column contains the height of the barometer; the fecond contains this height augmented by the fmall column of mercury in the tube of the manometer, and therefore expreffes the denfity of the air examined; the third contains the total expanfion of 1000 parts; and the fourth contains the expanfion for 1°, fuppofing it uniform throughout.

TABLE D.

Barom.	Denfity of Air examined.	Expanfion of 1000 p.ts by 212°.	Expanfion by 1°.
29,95	31,52	483,89	2,2825
30,07	30,77	482,10	2,2741
29,48	29,90	480,74	2,2676
29,90	30,73	485,86	2,2918
29,96	30,92	489,45	2,3087
29,90	30,55	476,04	2,2455
29,95	30,60	487,55	2,2998
30,07	30,60	482,80	2,2774
29,48	30,00	489,47	2,3087
Mean	30,62	484,21	2,2840

Hence it appears, that the mean expanfion of 1000 parts of air of the denfity 30,62 by one degree of Fahrenheit's thermometer is 2,284, or that 1000 becomes 1002,284.

262 If this expanfion be fuppofed to follow the fame rate that was obferved in the comparifon of the mercurial and air thermometer, we fhall find that the expanfion of a thoufand parts of air for one degree of heat at the different intermediate temperatures will be as in the following table.

TABLE E.

Temp.	Total Expanfion	Expanfion for 1°.
212	484,210	2,0099
192	444,011	2,0080
172	402,452	2,1475
152	359,503	2,2155
132	315,193	2,2840
112	269,513	2,3754
92	222,006	2,4211
82	197,795	2,5124
72	172,671	2,5581
62	147,090	2,6037
52	121,053	2,5124
42	95,929	2,4211
32	71,718	2,3297
22	48,421	2,2383
12	26,038	2,1698
0		

If we would have a mean expanfion for any particular range, as between 12° and 92°, which is the moft likely to comprehend all the geodætical obfervations, we need only take the difference of the bulks 26,038 and 222,006 = 195,968, and divide this by the interval of temperature 80°, and we obtain 2,4496, or 2,45 for the mean expanfion for 1°.

It would perhaps be better to adapt the table to a mafs of 1000 parts of air of the ftandard temperature 32°; for in its prefent form it fhows the expanfibility of air originally of the temperature 0. This will be done with fufficient accuracy by faying (for 212°) 1071,718 : 1484,210 = 1000, : 13849, and fo of the reft. Thus we fhall conftruct the following table of the expanfion of 10,000 parts of air. 263

TABLE F.

Temp.	Bulk.	Differ.	Expanf. for 1°.
212	13489	375	18,7
192	13474	387	19,3
172	13087	392	19,6
152	12685	413	20,6
132	12272	426	21,3
112	11846	443	22,1
92	11403	226	22,6
82	11177	235	23,5
72	10942	238	23,8
62	10704	243	24,3
52	10461	235	23,5
42	10226	226	22,6
32	10000	217	21,7
22	9783	209	20,9
12	9574	243	20,2
0	9331		

This will give for the mean expanfion of 1000 parts of air between 12° and 92 = 2,29.

264 General Roy's experiments on air above the common denfity.

Although it cannot happen that in meafuring the differences of elevation near the earth's furface, we fhall have occafion to employ air greatly exceeding the common denfity, we may infert the experiments made by General Roy on fuch airs. They are expreffed in the following table; where column firft contains the denfities meafured by the inches of mercury that they will fupport when of the temperature 32°; column fecond is the expanfion of 1000 parts of fuch air by being heated from 0 to 212; and column third is the mean expanfion for 1°.

TABLE G.

	Denfity.	Expanfion for 212.	Expanf. for 1°.
	101,7	451,54	2,130
	92,3	423,23	1,996
	80,5	412,09	1,944
	54,5	439,87	2,075
	49,7	443,24	2,091
Mean	75,7	434	2,047

265 And on air below that denfity.

We have much more frequent occafion to operate in air that is rarer than the ordinary ftate of the fuperficial atmo-

atmosphere. General Roy accordingly made many experiments on such airs. He found in general, that their expansibility by heat was analogous to that of air in its ordinary density, being greatest about the temperature 60°. He found, too, that its expansibility by heat diminished with its density, but he could not determine the law of gradation. When reduced to about ⅕ of the density of common air, its expansion was as follows.

TABLE H.

Temp.	Bulk.	Difference.	Expans. for 1°.
212	1141,504		
192	1134,429	7,075	0,354
172	1122,165	12,264	0,613
152	1108,015	14,150	0,708
132	1093,864	14,151	0,708
112	1079,636	14,228	0,711
92	1064,699	14,937	0.747
72	1043,788	20,911	1,045
52	1017,845	25,943	1,297
32	1000,000	17,845	0,892
	Mean expansion		0,786

266 Air of ordinary density expands most, &c.

From this very extensive and judicious range of experiments, it is evident that the expansibility of air by heat is greatest when the air is about its ordinary density, and that in small densities it is greatly diminished. It appears also, that the law of compression is altered; for in this specimen of the rare air half of the whole expansion happens about the temperature 99°, but in air of ordinary density at 105°. This being the case, we see that the experiments of Mr Amontons, narrated in the Memoirs of the Academy at Paris 1702, &c. are not inconsistent with those more perspicuous experiments of General Roy. Amontons found, that whatever was the density of the air, at least in cases much denser than ordinary air, the change of 180° of temperature increased its elasticity in the same proportion: for he found, that the column of mercury which it supported when of the temperature 50, was increased ⅓ at the temperature 212. Hence he hastily concluded, that its expansibility was increased in the same proportion; but this by no means follows, unless we are certain that in every temperature the elasticity is proportional to the density. This is a point which still remains undecided; and it merits attention, because if true it establishes a remarkable law concerning the action of heat, which would seem to go to prove that the elasticity of fluids is the property of the matter of fire, which it superinduces on every body with which it combines in the form of vapour.

267 The height which produces a given fall in the barometer, increases with the air's expansion.

After this account of the expansion of air, we see that the height through which we must rise in order to produce a given fall of the mercury in the barometer, or the thickness of the stratum of air equiponderant with a tenth of an inch of mercury, must increase with the expansion of air; and that if $\frac{2,29}{1000}$ be the expansion for one degree, we must multiply the excess of the temperature of the air above 32° by 0,00229, and multiply the product by 87, in order to obtain the thickness of the stratum where the barometer stands at 30 inches; or whatever be the elevation indicated by the difference of the barometrical heights, upon the supposition that the air is of the temperature 32°, we must multiply this by 0,00229 for every degree that the air is warmer or colder than 32. The product must be added to the elevation in the first case, and subtracted in the latter.

Sir George Shuckbourgh deduces 0,0024 from his experiments as the mean expansion of air in the ordinary cases: and this is probably nearer the truth; because General Roy's experiments were made on air which was freer from damp than the ordinary air in the fields; and it appears from his experiments, that a very minute quantity of damp increases its expansibility by heat in a prodigious degree. 268

269 Difficulties in this mode of measuring heights.

The great difficulty is how to apply this correction; or rather, how to determine the temperature of the air in those extensive and deep strata in which the elevations are measured. It seldom or never happens that the stratum is of the same temperature throughout. It is commonly much colder aloft; it is also of different constitutions. Below it is warm, loaded with vapour, and very expansible; above it is cold, much drier, and less expansible, both by its dryness and its rarity. The currents of wind are often disposed in strata, which long retain their places; and as they come from different regions, are of different temperatures and different constitutions. We cannot therefore determine the expansion of the whole stratum with precision, and must content ourselves with an approximation: and the best approximation that we can make is, by supposing the whole stratum of a mean temperature between those of its upper and lower extremity, and employ the expansion corresponding to that mean temperature.

This, however, is founded on a gratuitous supposition, that the whole intermediate stratum expands alike, and that the expansion is equable in the different intermediate temperatures; but neither of these are warranted by experiment. Rare air expands less than what is denser; and therefore the general expansion of the whole stratum renders its density more uniform. Dr Horsley has pointed out some curious consequences of this in Phil. Trans. Vol. LXIV. There is a particular elevation at which the general expansion, instead of diminishing the density of the air, increases it by the superior expansion of what is below; and we know that the expansion is not equable in the intermediate temperatures: but we cannot find out a rule which will give us a more accurate correction than by taking the expansion for the mean temperature.

When we have done this, we have carried the method of measuring heights by the barometer as far as it can go; and this source of remaining error makes it needless to attend to some other very minute equations which theory points out. Such is the diminution of the weight of the mercury by the change of distance from the centre of the earth. This accompanies the diminution of the weight of the air, but neither so as to compensate it, nor to go along with it *pari passu*.

After all, there are found cases where there is a regular deviation from those rules, of which we cannot give any very satisfactory account. Thus it is found, that in the province of Quito in Peru, which is at a great elevation above the surface of the ocean, the heights obtained by these rules fall considerably short of the

the real heights; and at Spitsbergen they considerably exceed them. It appears that the air in the circumpolar regions is denser than the air of the temperate climates when of the same heat and under the same pressure; and the contrary seems to be the case with the air in the torrid zone. It would seem that the specific gravity of air to mercury is at Spitsbergen about 1 to 10224, and in Peru about 1 to 13100. This difference is with great probability ascribed to the greater dryness of the circumpolar air.

This source of error will always remain; and it is combined with another, which should be attended to by all who practise this method of measuring heights, namely, a difference in the specific gravity of the quicksilver. It is thought sufficiently pure for a barometer when it is cleared of all calcinable matter, so as not to drag or sully the tube. In this state it may contain a considerable portion of other metals, particularly of silver, bismuth, and tin, which will diminish its specific gravity. It has been obtained by revivification from cinnabar of the specific gravity 14,229, and it is thought very fine if 13,65. Sir George Shuckbourgh found the quicksilver which agreed precisely with the atmospherical observations on which the rules are founded to have the specific gravity 13,61. It is seldom obtained so heavy. It is evident that these variations will change the whole results; and that it is absolutely necessary, in order to obtain precision, that we know the density of the mercury employed. The subtangent of the atmospherical logarithmic, or the height of the homogeneous atmosphere, will increase in the same proportion with the density of the mercury; and the elevation corresponding to $\frac{1}{10}$ of an inch of barometric height will change in the same proportion.

We must be contented with the remaining imperfections: and we can readily see, that, for any purpose that can be answered by such measurements of great heights, the method is sufficiently exact; but it is quite inadequate to the purpose of taking accurate levels, for directing the construction of canals, aqueducts, and other works of this kind, where extreme precision is absolutely necessary.

We shall now deduce from all that has been said on this subject sets of easy rules for the practice of this mode of measurement, illustrating them by an example.

1. M. de Luc's Method.

270 Mode of measuring heights by the barometer according to De Luc,

I. Subtract the logarithm of the barometrical height at the upper station from the logarithm of that at the lower, and count the index and four first decimal figures of the remainder as fathoms, the rest as a decimal fraction. Call this the *elevation*.

II. Note the different temperatures of the mercury at the two stations, and the mean temperature. Multiply the logarithmic expansion corresponding to this mean temperature (in Table B, p. 126.) by the difference of the two temperatures, and subtract the product from the elevation if the barometer has been coldest at the upper station, otherwise add it. Call the difference or the sum the *approximated elevation*.

III. Note the difference of the temperatures of the air at the two stations by a detached thermometer, and also the mean temperature and its difference from 32°. Multiply this difference by the expansion of air for the mean temperature, and multiply the approximate elevation by 1 ± this product, according as the air is above or below 32°. The product is the correct elevation in fathoms and decimals.

Example.

Suppose that the mercury in the barometer at the lower station was at 29,4 inches, that its temperature was 50°, and the temperature of the air was 45; and let the height of the mercury at the upper station be 25,19 inches, its temperature 46, and the temperature of the air 39. Thus we have

☿al Hts.	Temp. ☿.	Mean.	Temp. Air.	Mean.
29,4	50	48	45	42
25,19	46		39	

I. Log. of 29,4		1.4683473
Log. of 25.19		1.4012282
Elevation in fathoms		671,191
II. Expans. for 48°	,473	
Multiply by	4	
		1,892
Approximated elevation		669,299
III. Expans. of air at 42	0,00238	
×42—32,=10°	10	
	0,0238	
Multiply		669,2990
By		1,0238
Product = the correct elevation		685,228

2. Sir George Shuckbourgh's Method.

I. Reduce the barometric heights to what they would be if they were of the temperature 32°. 271 And according to Shuckbourgh.

II. The difference of the logarithms of the reduced barometrical heights will give the approximate elevation.

III. Correct the approximated elevation as before.

Same Example.

I. Mean expans. for 1° from Tab. A, p. 125. is 0,000111.

18°×0,000111×29,4=	0,059
Subtract this from	29,4
Reduced barometric height	29,341
Expans. from Tab. A, p. 125. is 0,000111.	
14°×0,000111×25,19	0,039
Subtract from	25,190
Reduced barometric height	25,151
II. Log. 29,341	1.4674749
Log. 25,151	1.4005553
Approximated elevation	669,196
III. This multiplied by 1,0238 gives	685,125

Remark 1. If 0,000101 be supposed the mean expansion of mercury for 1°, as Sir George Shuckbourgh determines it, the reduction of the barometric heights will be had sufficiently exact by multiplying the obser- 272 Remarks on this method.

ved

Barometer

ved heights of the mercury by the difference of its temperatures from 32, and cutting off four more decimal places; thus $29,4 \frac{\times 18}{10000}$ gives for the reduced height $29,347$, and $25,19 \times \frac{14}{10000}$ gives 25,155, and the difference of their logarithms gives 669,4 fathoms for the approximated elevation, which differs from the one given above by no more than 15 inches.

273 *Remark* 2. If 0,0024 be taken for the expansion of air for one degree, the correction for this expansion will be had by multiplying the approximated elevation by 12, and this product by the sum of the differences of the temperatures from 32°, counting that difference as negative when the temperature is below 32, and cutting off four places; thus $669,196 \times 12 \times \overline{13+07} \times \frac{1}{10000} =$ 16,061, which added to 669,196 gives 685,257, differing from the former only 9 inches.

274 An easy rule without the help of tables.

From the same premises we may derive a rule, which is abundantly exact for all geodætical purposes, and which requires no tables of any kind, and is easily remembered.

1. The height through which we must rise in order to produce any fall of the mercury in the barometer, is inversely proportional to the density of the air, that is, to the height of the mercury in the barometer.

2. When the barometer stands at 30 inches, and the air and quicksilver are of the temperature 32, we must rise through 87 feet, in order to produce a depression of $\frac{1}{10}$ of an inch.

3. But if the air be of a different temperature, this 87 feet must be increased or diminished by 0,21 of a foot for every degree of difference of the temperature from 32°.

4. Every degree of difference of the temperatures of the mercury at the two stations makes a change of 2,833 feet, or 2 feet 10 inches in the elevation.

Hence the following rule.

275 1. Take the difference of the barometric heights in tenths of an inch. Call this *d*.

2. Multiply the difference *a* between 32, and the mean temperature of the air by 21, and take the sum or difference of this product and 87 feet. This is the height through which we must rise to cause the barometer to fall from 30 inches to 29,9. Call this height *h*.

Let *m* be the mean between the two barometric heights. Then $\frac{30\,d\,h}{m}$ is the approximated elevation very nearly.

Multiply the difference δ of the mercurial temperatures by 2,83 feet, and add this product to the approximated elevation if the upper barometer has been the warmest, otherwise subtract it. The result, that is, the sum or difference, will be the corrected elevation.

Same Example.

$$d = 294 - 251,9 = 42,1$$
$$h = 87 + 10 \times 0,21 = 89,1$$
$$m = \frac{29,4 + 25.19}{2} = 27,29$$

Measuring Heights.

$$\text{Approx. elevation} = \frac{30 \times 42,1 \times 89,1}{27,29} = 4123,24 \text{ feet.}$$

Corr. for temp. of mercury, $-4 \times 2,83$		1132
Corrected elevation in feet	-	4111,92
Ditto in fathoms	- -	685,32

Differing from the former only 15 inches.

This rule may be expressed by the following simple and easily remembered formula, where *a* is the difference between 32° and the mean temperature of the air, *d* is the difference of barometric heights in tenths of an inch, *m* is the mean barometric height, δ the difference between the mercurial temperatures, and E is the correct elevation. $E = \frac{30(87 \pm 0,21a)d}{m} \pm \delta \times 2,83$. 276

277 Heights of the most remarkable mountains.

We shall now conclude this subject by an account of some of the most remarkable mountains, &c. on the earth, above the surface of the ocean, in feet.

Mount Puy de Domme in Auvergne, the first mountain measured by the barometer		5088
Mount Blanc	Alps	15662
Monte Rosa	Alps	15084
Aiguille d'Argenture	Alps	13402
Monastery of St Bernard	Alps	7944
Mount Cenis		9212
Pic de los Reyes	Pyrennees	7620
Pic du Medi	Pyrennees	9300
Pic d'Ossano	Pyrennees	11700
Canegou	Pyrennees	8544
Lake of Geneva		1232
Mount Ætna		10954
Mount Vesuvius		3938
Mount Hekla in Iceland		4887
Snowdown		3555
Ben Moir		3723
Ben Laurs		3858
Ben Gloe		3472
Shihallion		3461
Ben Lomond		3180
Tinto		2342
Table Hill, Cape of Good Hope		3454
Gondar city in Abyssinia		8440
Source of the Nile		8082
Pic of Teneriffe		14026
Chimboraçon		19595
Cayambourow		19391
Antisana		19290
Pichinha (see Peru, n° 56.)		15670
City of Quito (see ditto)		9977
Caspian Sea below the ocean		306

This last is so singular, that it is necessary to give the authority on which this determination is founded. It is deduced from nine years observations with the barometer at Astrachan by Mr Lecre, compared with a series of observations made with the same barometer at St Petersburgh.

278 Improved barometers, with a description of Hooke's.

This employment of the barometer has caused it to become a very interesting instrument to the philosopher and to the traveller; and many attempts have been made of late to improve it, and render it more portable. The improvements have either been directed to the enlargement

Barometer. largement of its range, or to the more accurate measurement of its present scale. Of the first kind are Hooke's wheel barometer, the diagonal barometer, and the horizontal barometer, described in a former volume of this work. See BAROMETER. In that place are also described two very ingenious contrivances of Mr Rownings, which are evidently not portable. Of all the barometers with an enlarged scale the best is that invented by Dr Hooke in 1668, and described in the Phil. Transf. N° 185. The invention was also claimed by Huyghens and by De la Hire; but Hooke's was published long before.

Plate CCCCIV. It consists of a compound tube ABCDEFG (fig. 56.), of which the parts AB and DE are equally wide, and EFG as much narrower as we would amplify the scale. The parts AB and EG must also be as perfectly cylindrical as possible. The part HBCDI is filled with mercury, having a vacuum above in AB. IF is filled with a light fluid, and FG with another light fluid which will not mix with that in IF. The cistern G is of the same diameter as AB. It is easy to see that the range of the separating surface at F must be as much greater than that of the surface I as the area of I is greater than that of F. And this ratio is in our choice. This barometer is free from all the bad qualities of those formerly described, being most delicately moveable; and is by far the fittest for a chamber, for amusement, by observations on the changes of the atmospheric pressure. The slightest breeze causes it to rise and fall, and it is continually in motion.

279 Inferior to the common one for the measurement of heights.

But this, and all other contrivances of the kind, are inferior to the common barometer for measurement of heights, on account of their bulk and cumbersomeness: nay, they are inferior for all philosophical purposes in point of accuracy; and this for a reason that admits of no reply. Their scale must be determined in all its parts by the common barometer; and therefore, notwithstanding their great range, they are susceptible of no greater accuracy than that with which the scale of a common barometer can be observed and measured. This will be evident to any person who will take the trouble of considering how the points of their scale must be ascertained. The most accurate method for graduating such a barometer as we have now described would be to make a mixture of vitriolic acid and water, which should have $\frac{1}{10}$ of the density of mercury. Then, let a long tube stand vertical in this fluid, and connect its upper end with the open end of the barometer by a pipe which has a branch to which we can apply the mouth. Then if we suck through this pipe, the fluid will rise both in the barometer and in the other tube; and 10 inches rise in this tube will correspond to one inch descent in the common barometer. In this manner may every point of the scale be adjusted in due proportion to the rest. But it still remains to determine what particular point of the scale corresponds to some determined inch of the common barometer. This can only be done by an actual comparison; and this being done, the whole becomes equally accurate. Except therefore for the mere purpose of chamber amusement, in which case the barometer last described has a decided preference, the common barometer is to be preferred; and our attention should be entirely directed to its improvement and portability.

280 How the common one might be improved.

For this purpose it should be furnished with two microscopes or magnifying glasses, one of them stationed at the beginning of the scale; which should either be moveable, so that it may always be brought to the surface of the mercury in the cistern, or the cistern should be so contrived that its surface may always be brought to the beginning of the scale. The glass will enable us to see the coincidence with accuracy. The other microscope must be moveable, so as to be set opposite to the surface of the mercury in the tube; and the scale should be furnished with a vernier which divides an inch into 1000 parts, and be made of materials of which we know the expansion with great precision.

Air in Motion.

281 For an account of many ingenious contrivances to the make instrument accurate, portable, and commodious, consult Magellan, *Disser. de diverses Instr. de Phys.*; *Phil. Transf.* lxvii. lxviii.; *Journ. de Phys.* xix. 108. 346. xvi. 392. xviii. 391. xxi. 436. xxii. 390.; Sulzer, *Act. Helvet.* iii. 259.; De Luc, *Recherches sur les Modifications de l'Atmosphere*, i. 401. ii. 459, 490. De Luc's seems the most simple and perfect of them all. Cardinal de Luynes (*Mem. Par.* 1768); Prinf. De Luc, *Recherches*, § 63.; Van Swinden's *Positiones Physicæ*; *Com. Acad. Petrop.* i.; *Com. Acad. Petrop. Nov.* ii. 200. viii.

THUS we have given an elementary account of the distinguishing properties of air as a heavy and compressible fluid, and of the general phenomena which are immediate consequences of these properties. This we have done in a set of propositions analogous to those which form the doctrines of hydrostatics. It remains to consider it in another point of view, namely, as moveable and inert. The phenomena consequent on these properties are exhibited in the velocities which air acquires by pressure, in the resistance which bodies meet with to their motion through the air, and in the impression which air in motion gives to bodies exposed to its action.

We shall first consider the motions of which air is susceptible when the equilibrium of pressure (whether arising from its weight or its elasticity) is removed; and, in the next place, we shall consider its action on solid bodies exposed to its current, and the resistance which it makes to their motion through it.

282 Doctrine of air in accessible situations as acted on by equal and parallel gravity

In this consideration we shall avoid the extreme of generality, which renders the discussion too abstract and difficult, and adapt our investigation to the circumstances in which compressible fluids (of which air is taken for the representative) are most commonly found. We shall consider air therefore as it is commonly found in accessible situations, as acted on by equal and parallel gravity; and we shall consider it in the same order in which water is treated in a system of hydraulics.

283 Analogous to the doctrine of water in hydraulics.

In that science the leading problem is to determine with what velocity the water will move through a given orifice when impelled by some known pressure; and it has been found, that the best form in which this most difficult and intricate proposition can be put, is to determine the velocity of water flowing through this orifice when impelled by its weight alone. Having determined this, we can reduce to this case every question which can be proposed; for, in place of the pressure of any piston or other mover, we can always substitute a perpendicular column of water or air whose weight shall be equal to the given pressure.

284 The velocity with which air rushes into a void by its own weight,

The first problem, therefore, is to determine with what velocity air will rush into a void when impelled by weight,

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by its weight alone. This is evidently analogous to the hydraulic problem of water flowing out of a vessel.

And here we must be contented with referring our readers to the solutions which have been given of that problem, and the demonstration that it flows with the velocity which a heavy body would acquire by falling from a height equal to the depth of the hole under the surface of the water in the vessel. In whatever way we attempt to demonstrate that proposition, every step, nay, every word, of the demonstration applies equally to the air, or to any fluid whatever. Or, if our readers should wish to see the connection or analogy of the cases, we only desire them to recollect an undoubted maxim in the science of motion, that *when the moving force and the matter to be moved vary in the same proportion, the velocity will be the same.* If therefore there be similar vessels of air, water, oil, or any other fluid, all of the height of a homogeneous atmosphere, they will all run through equal and similar holes with the same velocity; for in whatever proportion the quantity of matter moving through the hole be varied by a variation of density, the pressure which forces it out, by acting in circumstances perfectly similar, varies in the same proportion by the same variation of density.

We must therefore assume it as the leading proposition, that *air rushes from the atmosphere into a void with the velocity which a heavy body would acquire by falling from the top of a homogeneous atmosphere.*

It is known that air is about 840 times lighter than water, and that the pressure of the atmosphere supports water at the height of 33 feet nearly. The height therefore of a homogeneous atmosphere is nearly 33×840, or 27720 feet. Moreover, to know the velocity acquired by any fall, recollect that a heavy body by falling one foot acquires the velocity of 8 feet per second; and that the velocities acquired by falling thro' different heights are as the square roots of the heights. Therefore, to find the velocity corresponding to any height, expressed in feet per second, multiply the square root of the height by 8. We have therefore in the present instance $V = 8\sqrt{27220}, = 8 \times 166{,}493, = 1332$ feet per second. This therefore is the velocity with which common air will rush into a void; and this may be taken as a standard number in pneumatics, as 16 and 32 are standard numbers in the general science of mechanics, expressing the action of gravity at the surface of the earth.

It is easy to see that greater precision is not necessary in this matter. The height of a homogeneous atmosphere is a variable thing, depending on the temperature of the air. If this reason seems any objection against the use of the number 1332, we may retain $8\sqrt{H}$ in place of it, where H expresses the height of a homogeneous atmosphere of the given temperature. A variation of the barometer makes no change in the velocity, nor in the height of the homogeneous atmosphere, because it is accompanied by a proportional variation in the density of the air. When it is increased $\frac{1}{10}$, for instance, the density is also increased $\frac{1}{10}$; and thus the expelling force and the matter to be moved are changed in the same proportion, and the velocity remains the same. N. B. We do not here consider the velocity which the air acquires after its issuing into the void by its continual expansion. This may be ascertained by the 39th prop. of Newton's *Principia*, b. i. Nay, which appears very paradoxical, if a cylinder of air, communicating in this manner with a void, be compressed by a piston loaded with a weight, which presses it down as the air flows out, and thus keeps it of the same density, the velocity of efflux will still be the same however great the pressure may chance to be: for the first and immediate effect of the load on the piston is to reduce the air in the cylinder to such a density that its elasticity shall exactly balance the load; and because the elasticity of air is proportional to its density, the density of the air will be increased in the same proportion with the load, that is, with the expelling power (for we are neglecting at present the weight of the included air as too inconsiderable to have any sensible effect.) Therefore, since the matter to be moved is increased in the same proportion with the pressure, the velocity will be the same as before.

285 And the velocity with which it rushes into a space containing rarer air,

It is equally easy to determine the velocity with which the air of the atmosphere will rush into a space containing rarer air. Whatever may be the density of this air, its elasticity, which follows the proportion of its density, will balance a proportional part of the pressure of the atmosphere; and it is the excess of this last only which is the moving force. The matter to be moved is the same as before. Let D be the natural density of the air, and δ the density of the air contained in the vessel into which it is supposed to run, and let P be the pressure of the atmosphere, and therefore equal to the force which impels it into a void; and let π be the force with which this rarer air would run into a void. We have $D : \delta = P : \pi$, and $\pi = \frac{P\delta}{D}$. Now the moving force in the present instance is $P - \pi$, or $P - \frac{P\delta}{D}$. Lastly, let V be the velocity of air rushing into a void, and v the velocity with which it will rush into this rarefied air.

It is a theorem in the motion of fluids, that the pressures are as the squares of the velocities of efflux. Therefore $P : P - \frac{P\delta}{D} = V^2 : v^2$. Hence we derive $v^2 = V^2 \times \overline{1 - \frac{\delta}{D}}$, and $v = V \times \sqrt{1 - \frac{\delta}{D}}$. We do not here consider the resistance which the air of the atmosphere will meet with from the inertia of that in the vessel which it must displace in its motion.

Here we see that there will always be a current into the vessel while δ is less than D.

We also learn the gradual diminution of the velocity as the vessel fills; for δ continually increases, and therefore $1 - \frac{\delta}{D}$ continually diminishes.

It remains to determine the time t expressed in seconds, in which the air of the atmosphere will flow into this vessel from its state of vacuity till the air in the vessel has acquired any proposed density δ.

For this purpose let H, expressed in feet, be the height through which a heavy body must fall in order to acquire the velocity V, expressed also in feet per second. This we shall express more briefly in future, by calling it the height producing the velocity V. Let C represent the capacity of the vessel, expressed in cubic feet,

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feet, and O the area or section of the orifice, expressed in superficial or square feet; and let the natural density of the air be D.

Since the quantity of aerial matter contained in a vessel depends on the capacity of the vessel and the density of the air jointly, we may express the air which would fill this vessel by the symbol CD when the air is in its ordinary state, and by $C\delta$ when it has the density δ. In order to obtain the rate at which it fills, we must take the fluxion of this quantity $C\delta$. This is $C\dot{\delta}$; for C is a constant quantity, and δ is a variable or flowing quantity.

But we also obtain the rate of influx by our knowledge of the velocity, and the area of the orifice, and the density. The velocity is V, or $8\sqrt{H}$, at the first instant; and when the air in the vessel has acquired the density δ, that is, at the end of the time t, the velocity is $8\sqrt{H}\sqrt{1-\frac{\delta}{D}}$, or $8\sqrt{H}\sqrt{\frac{D-\delta}{D}}$, or $8\sqrt{H}\frac{\sqrt{D-\delta}}{\sqrt{D}}$.

The rate of influx therefore (which may be conceived as measured by the little mass of air which will enter during the time $\dot{t}$ with this velocity) will be $\frac{8\sqrt{H}OD\sqrt{D-\delta}\,\dot{t}}{\sqrt{D}}$, or $8\sqrt{H}O\sqrt{D}\sqrt{D-\delta}\,\dot{t}$, multiplying the velocity by the orifice and by the density.

Here then we have two values of the rate of influx. By stating them as equal we have a fluxionary equation, from which we may obtain the fluents, that is, the time t in seconds necessary for bringing the air in the vessel to the density δ, or the density δ which will be produced at the end of any time t. We have the equation $8\sqrt{H}O\sqrt{D}\sqrt{D-\delta}\,\dot{t}=C\dot{\delta}$. Hence we derive $\dot{t}=\frac{C}{8\sqrt{H}O\sqrt{D}}\times\frac{\dot{\delta}}{\sqrt{D-\delta}}$. Of this the fluent is $t=\frac{C}{4\sqrt{H}O\sqrt{D}}\times\sqrt{D-\delta}+A$, in which A is a conditional constant quantity. The condition which determines it is, that t must be nothing when δ is nothing, that is, when $\sqrt{D-\delta}=\sqrt{D}$; for this is evidently the case at the beginning of the motion. Hence it follows, that the constant quantity is $\sqrt{D}$, and the complete fluent, suited to the case, is

$$\frac{C}{4\sqrt{H}O\sqrt{D}}\times\overline{\sqrt{D}-\sqrt{D-\delta}}.$$

The motion ceases when the air in the vessel has acquired the density of the external air; that is, when $\delta=D$, or when $t=\frac{C}{4\sqrt{H}O\sqrt{D}}\times\sqrt{D},=\frac{C}{4\sqrt{H}O}$. Therefore the time of completely filling the vessel is $\frac{C}{4\sqrt{H}O}$.

286 Illustrated by examples in numbers.

Let us illustrate this by an example in numbers.

Supposing then that air is 840 times lighter than water, and the height of the homogeneous atmosphere 27720 feet, we have $4\sqrt{H}=666$. Let us further suppose the vessel to contain 8 cubic feet, which is nearly a wine hogshead, and that the hole by which the air of the ordinary density, which we shall make $=1$, enters is an inch square, or $\frac{1}{144}$ of a square foot. Then the time in seconds of completely filling it will be $\frac{8''}{\frac{1}{144}666}$, or $\frac{1152''}{666}$, or $1{,}7297''$. If the hole is only $\frac{1}{100}$ of a square inch, that is, if its side is $\frac{1}{10}$ of an inch, the time of completely filling the hogshead will be $173''$ very nearly, or something less than three minutes.

If we make the experiment with a hole cut in a thin plate, we shall find the time greater nearly in the proportion of 63 to 100, for reasons obvious to all who have studied hydraulics. In like manner we can tell the time necessary for bringing the air in the vessel to $\frac{3}{4}$ of its ordinary density. The only variable part of our fluent is the coefficient $-\sqrt{D-\delta}$, or $\sqrt{1-\delta}$. Let δ be $=\frac{3}{4}$, then $\sqrt{1-\delta}=\sqrt{\frac{1}{4}}=\frac{1}{2}$, and $1-\sqrt{1-\delta}=\frac{1}{2}$; and the time is $86\frac{1}{2}''$ very nearly when the hole is $\frac{1}{10}$ of an inch wide.

Plate CCCCV. 287 The velocity of air with the additional impulse of a weight moving down the vessel.

Let us now suppose that the air in the vessel ABCD (fig. 64.) is compressed by a weight acting on the cover AD, which is moveable down the vessel, and is thus expelled into the external air.

The immediate effect of this external pressure is to compress the air and give it another density. The density D of the external air corresponds to its pressure P. Let the additional pressure on the cover of the vessel be p, and the density of the air in the vessel be d. We shall have $P:P+p=D:d$; and therefore $p=P\times\frac{d-D}{D}$. Then, because the pressure which expels the air is the difference between the force which compresses the air in the vessel and the force which compresses the external air, the expelling force is p. And because the quantities of motion are as the forces which similarly produce them, we shall have $P:P\times\frac{d-D}{D}=MV:mv$; where M and m express the quantities of matter expelled, V expresses the velocity with which air rushes into a void, and v expresses the velocity sought. But because the quantities of aerial matter which issue from the same orifice in a moment are as the densities and velocities jointly, we shall have $MV:mv=DVV:dvv,=DV^2:dv^2$. Therefore $P:p\frac{d-D}{D}=DV^2:dv$. Hence we deduce $v=V\sqrt{\frac{d-D}{d}}$.

We may have another expression of the velocity without considering the density. We had $P:P+p=D:d$: therefore $d=\frac{D\times\overline{P+p}}{P}$, and $d-D=\frac{D\times\overline{P+p}}{P}-D$, $=\frac{D\times\overline{P+p}-DP}{P}$, and $\frac{d-D}{d}=\frac{D\times\overline{P+p}-DP}{D\times\overline{P+p}}$, $=\frac{P+p-P}{P+p}$, $=\frac{p}{P+p}$: therefore $v=V\times\sqrt{\frac{p}{P+p}}$, which is a very simple and convenient expression.

288 The effect of the air's elasticity considered.

Hitherto we have considered the motion of air as produced by its weight only. Let us now consider the effect of its elasticity.

Let ABCD (fig. 64.) be a vessel containing air of any density D. This air is in a state of compression; and if the compressing force be removed, it will expand, and its elasticity will diminish along with its density.

Its

Its elaſticity in any ſtate is meaſured by the force which keeps it in that ſtate. The force which keeps common air in its ordinary denſity is the weight of the atmoſphere, and is the ſame with the weight of a column of water 33 feet high. If therefore we ſuppoſe that this air, inſtead of being confined by the top of the veſſel, is preſſed down by a moveable piſton carrying a column of water 33 feet high, its elaſticity will balance this preſſure as it balances the preſſure of the atmoſphere; and as it is a fluid, and propagates through every part the preſſure exerted on any one part, it will preſs on any little portion of the veſſel by its elaſticity in the ſame manner as when loaded with this column.

The conſequence of this reaſoning is, that if this ſmall portion of the veſſel be removed, and thus a paſſage be made into a void, the air will begin to flow out with the ſame velocity with which it would flow when impelled by its weight alone, or with the velocity acquired by falling from the top of a homogeneous atmoſphere, or 1332 feet in a ſecond nearly.

But as ſoon as ſome air has come out, the denſity of the remaining air is diminiſhed, and its elaſticity is diminiſhed; therefore the expelling force is diminiſhed. But the matter to be moved is diminiſhed in the very ſame proportion, becauſe the denſity and elaſticity are found to vary according to the ſame law; therefore the velocity will continue the ſame from the beginning to the end of the efflux.

This may be ſeen in another way. Let P be the preſſure of the atmoſphere, which being the counterbalance and meaſure of the initial elaſticity, is equal to the expelling force at the firſt inſtant. Let D be the initial denſity, and V the initial velocity. Let d be its denſity at the end of the time t of efflux, and v the contemporaneous velocity. It is plain that at the end of this time we ſhall have the expelling force $\pi = \frac{Pd}{D}$; for $D : d = P : \pi \left(= \frac{Pd}{D}\right)$.

Theſe forces are proportional to the quantities of motion which they produce; and the quantities of motion are proportional to the quantities of matter M and m and the velocities V and v jointly: therefore we have $P : \frac{Pd}{D} = MV : mv$. But the quantities of matter which eſcape through a given orifice are as the denſities and velocities jointly; that is, $M : m = DV : dv$: therefore $P : \frac{Pd}{D} = DV^2 : dv^2$, and $P \times dv^2 = \frac{PdDV^2}{D} = PdV^2$, and $V^2 = v^2$, and $V = v$, and the velocity of efflux is conſtant. Hence follows, what appears very unlikely at firſt ſight, that however much the air in the veſſel is condenſed, it will always iſſue into a void with the ſame velocity.

289 Quantity of air iſſuing into a void in a given time, and the denſity at the end of that time.

In order to find the quantity of aerial matter which will iſſue during any time t, and conſequently the denſity of the remaining air at the end of this time, we muſt get the rate of efflux. In the element of time $\dot{t}$ there iſſues (by what has been ſaid above) the bulk $8\sqrt{HO}\,\dot{t}$ (for the velocity V is conſtant); and therefore the quantity $8\sqrt{HO}\,d\dot{t}$. On the other hand, the quantity of air at the beginning was CD, C being the capacity of the veſſel; and when the air has acquired the denſity d, the quantity is Cd, and the quantity run out is $CD - Cd$; therefore the quantity which has run out in the time $\dot{t}$ muſt be the fluxion of $CD - Cd$, or $-C\dot{d}$. Therefore we have the equation $8\sqrt{HO}\,d\dot{t} = -C\dot{d}$, and $\dot{t} = \frac{-C\dot{d}}{8\sqrt{HO}\,d}$; $= \frac{C}{8\sqrt{HO}} \times -\frac{\dot{d}}{d}$.

The fluent of this is $t = \frac{C}{8\sqrt{HO}} \log. d$. This fluent muſt be ſo taken that t may be $= o$ when $d = D$. Therefore the correct fluent will be $t = \frac{C}{8\sqrt{HO}} \log. \frac{D}{d}$, for $\log. \frac{D}{D} = \log. 1, = o$. We deduce from this, that it requires an infinite time for the whole air of a veſſel to flow out of it into a void. N. B. By log. d, &c. is meant the hyperbolic logarithm of d, &c.

290 When the veſſel emits it into rarer air.

Let us next ſuppoſe that the veſſel, inſtead of letting out its air into a void, emits it into air of a leſs denſity, which remains conſtant during the efflux, as we may ſuppoſe to be the caſe when a veſſel containing condenſed air emits it into the ſurrounding atmoſphere. Let the initial denſity of the air in the veſſel be δ, and that of the atmoſphere D. Then it is plain that the expelling force is $P - \frac{PD}{\delta}$, and that after the time t it is $\frac{Pd}{\delta} - \frac{PD}{\delta}$. We have therefore $P - \frac{PD}{\delta} : \frac{Pd}{\delta} - \frac{PD}{\delta} = MV : mv, = \delta V^2 : dv^2$. Whence we derive $v = V\sqrt{\frac{\delta\,\overline{d - D}}{d\,\overline{\delta - D}}}$

From this equation we learn that the motion will be at an end when $d = D$: and if $\delta = D$ there can be no efflux.

291 Relation between the time and denſity when iſſuing into a void.

To find the relation between the time and the denſity, let H as before be the height producing the velocity V. The height producing the velocity of efflux v muſt be $H \times \frac{\delta\,\overline{d - D}}{d\,\overline{\delta - D}}$, and the little parcel of air which will flow out in the time $\dot{t}$ will be $= 8\sqrt{HO}\,d\dot{t}\sqrt{\frac{\delta\,\overline{d - D}}{d\,\overline{\delta - D}}}$. On the other hand, it is $= -C\dot{d}$.

Hence we deduce the fluxionary equation $\dot{t} = \frac{C\sqrt{\delta - D}}{8\sqrt{HO}\sqrt{\delta}} \times \frac{-\dot{d}}{\sqrt{d^2 - Dd}}$. The fluent of this, corrected ſo as to make $t = O$ when $d = \delta$, is $t = \frac{C\sqrt{\delta - D}}{8\sqrt{HO}\sqrt{\delta}} \times \log. \left(\frac{\delta - \frac{1}{2}D + \sqrt{\delta^2 - D\delta}}{d - \frac{1}{2}D + \sqrt{d^2 - Dd}}\right)$. And the time of completing the efflux, when $d = D$, is $t = \frac{C\sqrt{\delta - D}}{8\sqrt{HO}\sqrt{\delta}} \times \log. \left(\frac{\delta - \frac{1}{2}D + \sqrt{\delta^2 - D\delta}}{\frac{1}{2}D}\right)$.

Plate CCCCV. 292 When iſſuing from denſer into rarer air.

Laſtly, let ABCD, CFGH (fig. 65.) be two veſſels containing airs of different denſities, and communicating by the orifice C, there will be a current from the veſſel containing the denſer air into that containing the rarer: ſuppoſe from ABCD into CFGH.

Let P be the elaſtic force of the air in ABCD, Q its

its denſity, and V its velocity, and D the denſity of the air in CFGH. And, after the time t, let the denſity of the air in ABCD be q, its velocity v, and the denſity of the air in CFGH be s. The expelling force from ABCD will be $P-\frac{PD}{Q}$ at the firſt inſtant, and at the end of the time t it will be $\frac{Pq}{Q}-\frac{Ps}{Q}$. Therefore we ſhall have $P-\frac{PD}{Q}:\frac{Pq}{Q}-\frac{Ps}{Q}=QV^2:qv^2$, which gives $v=V\times\sqrt{\frac{Q(q-s)}{q(Q-D)}}$, and the motion will ceaſe when $s=q$.

Let A be the capacity of the firſt veſſel, and B that of the ſecond. We have the ſecond equation $AQ+BD=Aq+Bs$, and therefore $s=\frac{A(Q-q)+BD.}{B}$ Subſtituting this value of s in the former value of v, we have $v=V\times\sqrt{\frac{Q[B(q-D)-A(Q-q)]}{qB(Q-D)}}$, which gives the relation between the velocity v and the denſity q.

In order to aſcertain the time when the air in ABCD has acquired the denſity q, it will be convenient to abridge the work by ſome ſubſtitutions. Therefore make $Q(B+A)=M$, $BQD+BQ^2=N$, $BQ-BD=R$ and $\frac{N}{M}=m$. Then, proceeding as before, we obtain the fluxionary equation $8\sqrt{HO}q\frac{\sqrt{Mq-N}}{\sqrt{R}\sqrt{q}}\dot{t}=\overline{AQ-Aq}=-A\dot{q}$ whence $\dot{t}=\frac{A\sqrt{R}}{8\sqrt{HO}\sqrt{M}}\times\frac{\dot{q}}{\sqrt{q^2-mq}}$ of which the fluent, completed ſo that $t=o$ when $q=Q$, is $t=\frac{A\sqrt{R}}{8\sqrt{HO}\sqrt{M}}\times\text{Log.}\left(\frac{Q-\frac{1}{2}m+\sqrt{(Q^2mQ)}}{q-\frac{1}{2}m+\sqrt{(q^2mq)}}\right)$

293 When air is expelled by force, as in bellows.

Some of theſe queſtions are of difficult ſolution, and they are not of frequent uſe in the more important and uſual applications of the doctrines of pneumatics, at leaſt in their preſent form. The caſes of greateſt uſe are when the air is expelled from a veſſel by an external force, as when bellows are worked, whether of the ordinary form or conſiſting of a cylinder fitted with a moveable piſton. This laſt caſe merits a particular conſideration; and, fortunately, the inveſtigation is extremely eaſy.

Plate CCCCV.

Let AD fig. 64. be conſidered as a piſton moving downward with the uniform velocity f, and let the area of the piſton be n times the area of the hole of efflux, then the velocity of efflux ariſing from the motion of the piſton will be nf. Add this to the velocity V produced by the elaſticity of the air in the firſt queſtion, and the whole velocity will be $V+nf$. It will be the ſame in the others. The problem is alſo freed from the conſideration of the time of efflux. For this depends now on the velocity of the piſton. It is ſtill, however, a very intricate problem to aſcertain the relation between the time and the denſity, even though the piſton is moving uniformly; for at the beginning of the motion the air is of common denſity. As the piſton deſcends, it both expels and compreſſes the air, and the denſity of the air in the veſſel varies in a very intricate manner, as alſo its reſiſtance or reaction on the piſton. For this reaſon, a piſton which moves uniformly by means of an external force will never make an uniform blaſt by ſucceſſive ſtrokes; it will always be weaker at the beginning of the ſtroke. The beſt way for ſecuring an uniform blaſt is to employ the external force only for lifting up the piſton, and then to let the piſton deſcend by its own weight. In this way it will quickly ſink down, compreſſing the air, till its denſity and correſponding elaſticity exactly balance the weight of the piſton. After this the piſton will deſcend equably, and the blaſt will be uniform. We ſhall have occaſion to conſider this more particulary under the head of *Pneumatical Machines*. Theſe obſervations and theorems will ſerve to determine the initial velocity of the air in all important caſes of its expulſion. The philoſopher will learn the rate of its efflux out of one veſſel into another; the chemiſt will be able to calculate the quantities of the different gaſes which are employed in the curious experiments of the ingenious but unfortunate Lavoiſier on Combuſtion, and will find them extremely different from what he ſuppoſed; the engineer will learn how to proportion the motive force of his machine to the quantity of aerial matter which his bellows muſt ſupply. But it is not enough, for this purpoſe, that the air *begin* to iſſue in the proper quantity; we muſt ſee whether it be not affected by the circumſtances of its ſubſequent paſſage.

294 Paſſage of air through pipes, &c. ſimilar to the motion of water in conduits.

All the modifications of motion which are obſerved in water conduits take place alſo in the paſſage of air through pipes and holes of all kinds. There is the ſame diminution of quantity paſſing through a hole in a thin plate that is obſerved in water. We know that (abating the ſmall effect of friction) water iſſues with the velocity acquired by falling from the ſurface; and yet if we calculate by this velocity and by the area of the orifice, we ſhall find the quantity of water deficient nearly in the proportion of 63 to 100. This is owing to the water preſſing towards the orifice from all ſides, which occaſions a contraction of the jet. The ſame thing happens in the efflux of air. Alſo the motion of water is greatly impeded by all contractions of its paſſage. Theſe oblige it to accelerate its velocity, and therefore require an increaſe of preſſure to force it through them, and this in proportion to the ſquares of the velocities. Thus, if a machine working a pump cauſes it to give a certain number of ſtrokes in a minute, it will deliver a determined quantity of water in that time. Should it happen that the paſſage of the water is contracted to one half in any part of the machine (a thing which frequently happens at the valves), the water muſt move through this contraction with twice the velocity that it has in the reſt of the paſſage. This will require four times the force to be exerted on the piſton. Nay (which will appear very odd, and is never ſuſpected by engineers), if no part of the paſſage is narrower than the barrel of the pump, but on the contrary a part much wider, and if the conduit be again contracted to the width of the barrel, an additional force muſt be applied to the piſton to drive the water through this paſſage, which would not have been neceſſary if the paſſage had not been widened in any part. It will require a force equal to the weight of a column of water of the height neceſſary for communicating a velocity the ſquare of which is equal to the difference of the ſquares of the velocities of the water in the wide and the narrow part of the conduit.

Air in Motion.

295. Air suffers the same retardation along pipes as water, and the necessity of attending to this.

The same thing takes place in the motion of air, and therefore all contractions and dilatations must be carefully avoided, when we want to preserve the velocity unimpaired.

Air also suffers the same retardation in its motion along pipes. By not knowing, or not attending to that, engineers of the first reputation have been prodigiously disappointed in their expectations of the quantity of air which will be delivered by long pipes. Its extreme mobility and lightness hindered them from suspecting that it would suffer any sensible retardation. Dr Papin, a most ingenious man, proposed this as the most effectual method of transferring the action of a moving power to a great distance. Suppose, for instance, that it was required to raise water out of a mine by a water-machine, and that there was no fall of water nearer than a mile's distance. He employed this water to drive a piston, which should compress the air in a cylinder communicating, by a long pipe, with another cylinder at the mouth of the mine. This second cylinder had a piston in it, whose rod was to give motion to the pumps at the mine. He expected, that as soon as the piston at the water-machine had compressed the air sufficiently, it would cause the air in the cylinder at the mine to force up its piston, and thus work the pumps. Doctor Hooke made many objections to the method, when laid before the Royal Society, and it was much debated there. But dynamics was at this time an infant science, and very little understood. Newton had not then taken any part in the business of the society, otherwise the true objections would not have escaped his sagacious mind. Notwithstanding Papin's great reputation as an engineer and mechanic, he could not bring his scheme into use in England; but afterwards, in France and in Germany, where he settled, he got some persons of great fortunes to employ him in this project; and he erected great machines in Auvergne and Westphalia for draining mines. But, so far from being effective machines, they would not even begin to move. He attributed the failure to the quantity of air in the pipe of communication, which must be condensed before it can condense the air in the remote cylinder. This indeed is true, and he should have thought of this earlier. He therefore diminished the size of this pipe, and made his water-machine exhaust instead of condensing, and had no doubt but that the immense velocity with which air rushes into a void would make a rapid and effectual communication of power. But he was equally disappointed here, and the machine at the mine stood still as before.

Near a century after this, a very intelligent engineer attempted a much more feasible thing of this kind at an iron-foundery in Wales. He erected a machine at a powerful fall of water, which worked a set of cylinder bellows, the blow pipe of which was conducted to the distance of a mile and a half, where it was applied to a blast furnace. But notwithstanding every care to make the conducting pipe very air-tight, of great size, and as smooth as possible, it would hardly blow out a candle. The failure was ascribed to the impossibility of making the pipe air-tight. But, what was surprising, above ten minutes elapsed after the action of the pistons in the bellows before the least wind could be perceived at the end of the pipe; whereas the engineer expected an interval of 6 seconds only.

295. No distinct theory on this subject.

No very distinct theory can be delivered on this subject; but we may derive considerable assistance in understanding the causes of the obstruction to the motion of water in long pipes, by considering what happens to air. The elasticity of the air, and its great compressibility, have given us the distinctest notions of fluidity in general, showing us, in a way that can hardly be controverted, that the particles of a fluid are kept at a distance from each other, and from other bodies, by the corpuscular forces. We shall therefore take this opportunity to give a view of the subject, which did not occur to us when treating of the motion of water in pipes, reserving a further discussion to the articles River, *Water-Works*.

296. How fluids are obstructed in moving along canals.

The writers on hydrodynamics have always considered the obstruction to the motion of fluids along canals of any kind, as owing to something like the friction by which the motion of solid bodies on each other is obstructed; but we cannot form to ourselves any distinct notion of resemblance, or even analogy between them. The fact is, however, that a fluid running along a canal has its motion obstructed; and that this obstruction is greatest in the immediate vicinity of the solid canal, and gradually diminishes to the middle of the stream. It appears, therefore, that the parts of fluids can no more move among each other than among solid bodies, without suffering a diminution of their motion. The parts in physical contact with the sides and bottom are retarded by these immoveable bodies. The particles of the next stratum of fluid cannot preserve their initial velocities without overpassing the particles of the first stratum; and it appears from the fact that they are by this means retarded. They retard in the same manner the particles of the third stratum, and so on to the middle stratum or thread of fluid. It appears from the fact, therefore, that this sort of friction is not a consequence of rigidity alone, but that it is equally competent to fluids. Nay, since it is a matter of fact in air, and is even more remarkable there than in any other fluid, as we shall see by the experiments which have been made on the subject; and as our experiments on the compression of air show us the particles of air ten times nearer to each other in some cases than in others (viz. when we see air a thousand times denser in these cases), and therefore force us to acknowledge that they are not in contact; it is plain that this obstruction has no analogy to friction, which supposes roughness or inequality of surface. No such inequality can be supposed in the surface of an aerial particle; nor would it be of any service in explaining the obstruction, since the particles do not rub on each other, but pass each other at some small and imperceptible distance.

We must therefore have recourse to some other mode of explication. We shall apply this to air only in this place; and, since it is proved by the uncontrovertible experiments of Canton, Zimmerman, and others, that water, mercury, oil, &c. are also compressible and perfectly elastic, the argument from this principle, which is conclusive in air, must equally explain the similar phenomenon in hydraulics.

The most highly polished body which we know must be conceived as having an uneven surface when we compare it with the small spaces in which the corpuscular forces are exerted; and a quantity of air moving in

Air in Motion.

in a polished pipe may be compared to a quantity of small shot sliding down a channel with undulated sides and bottom. The row of particles immediately contiguous to the sides will therefore have an undulated motion: but this undulation of the contiguous particles of air will not be so great as that of the surface along which they glide; for not only every motion requires force to produce it, but also every change of motion. The particles of air resist this change from a rectilineal to an undulating motion; and, being elastic, that is, repelling each other and other bodies, they keep a little nearer to the surface as they are passing over an eminence, and their path is less incurvated than the surface. The difference between the motion of the particles of air and the particles of a fluid quite unelastic is, in this respect, somewhat like the difference between the motion of a spring-carriage and that of a common carriage. When the common carriage passes along a road not perfectly smooth, the line described by the centre of gravity of the carriage keeps perfectly parallel to that described by the axis of the wheels, rising and falling along with it. Now let a spring body be put on the same wheels and pass along the same road. When the axis rises over an eminence perhaps half an inch, sinks down again into the next hollow, and then rises a second time, and so on, the centre of gravity of the body describes a much straighter line; for upon the rising of the wheels, the body resists the motion, and compresses the springs, and thus remains lower than it would have been had the springs not been interposed. In like manner, it does not sink so low as the axle does when the wheels go into a hollow. And thus the motion of spring-carriages becomes less violently undulated than the road along which they pass. This illustration will, we hope, enable the reader to conceive how the deviation of the particles next to the sides and bottom of the canal from a rectilineal motion is less than that of the canal itself.

297 Particles of air resist a change from a rectilineal to an undulating motion,

298 And the undulation of the second row of particles will be less than that of the first.

It is evident that the same reasoning will prove that the undulation of the next row of particles will be less than that of the first, that the undulation of the third row will be less than that of the second, and so on, as is represented in fig. A. Plate CCCCV. And thus it appears, that while the mass of air has a progressive motion along the pipe or canal, each particle is describing a waving line, of which a line parallel to the direction of the canal is the axis, cutting all these undulations. This axis of each undulated path will be straight or curved as the canal is, and the excursions of the path on each side of its axis will be less and less as the axis of the path is nearer to the axis of the canal.

299 Each particle appears to lose no velocity.

Let us now see what *sensible* effect this will have; for all the motion which we here speak of is imperceptible. It is demonstrated in mechanics, that if a body moving with any velocity be deflected from its rectilineal path by a curved and perfectly smooth channel, to which the rectilineal path is a tangent, it will proceed along this channel with undiminished velocity. Now the path, in the present case, may be considered as perfectly smooth, since the particles do not touch it. It is one of the undulations which we are considering, and we may at present conceive this as without any subordinate inequalities. There should not, therefore, be any diminution of the velocity. Let us grant this of the absolute velocity of the particle; but what we observe is the velocity of the mass, and we judge of it perhaps by the motion of a feather carried along by it. Let us suppose a single atom to be a sensible object, and let us attend to two such particles, one at the side, and the other in the middle: although we cannot perceive the undulations of these particles during their progressive motions, we see the progressive motions themselves. Let us suppose then that the middle particle has moved without any undulation whatever, and that it has advanced ten feet. The lateral particle will also have moved ten feet; but this has not been in a straight line. It will not be so far advanced, therefore, in the direction of the canal; it will be left behind, and will appear to us to have been retarded in its motion: and in like manner each thread of particles will be more and more retarded (apparently only) as it recedes farther from the axis of the canal, or what is usually called the thread of the stream.

300 But on the whole the undulatory motion is a real obstruction.

And thus the observed fact is shown to be a necessary consequence of what we know to be the nature of a compressible or elastic fluid; and that without supposing any diminution in the real velocity of each particle, there will be a diminution of the velocity of the sensible threads of the general stream, and a diminution of the whole quantity of air which passes along it during a given time.

Let us now suppose a parcel of air impelled along a pipe, which is *perfectly* smooth, out of a larger vessel, and issuing from this pipe with a certain velocity. It requires a certain force to change its velocity in the vessel to the greater velocity which it has in the pipe. This is abundantly demonstrated. How long soever we suppose this pipe, there will be no change in the velocity, or in the force to keep it up. But let us suppose that about the middle of this pipe there is a part of it which has suddenly got an undulated surface, however imperceptible. Let us further suppose that the final velocity of the middle thread is the same as before. In this case it is evident that the sum total of the motions of all the particles is greater than before, because the absolute motions of the lateral particles is greater than that of the central particle, which we suppose the same as before. This absolute increase of motion cannot be without an increase of propelling force: the force acting now, therefore, must be greater than the force acting formerly. Therefore, if only the former force had continued to act, the same motion of the central particle could not have been preserved, or the progressive motion of the whole stream must be diminished.

And thus we see that this internal insensible undulatory motion becomes a real obstruction to the sensible motion which we observe, and occasions an expence of power.

301 An additional force necessary for preserving a given progressive motion.

Let us see what will be the consequence of extending this obstructing surface further along the canal. It must evidently be accompanied by an augmentation of the motion produced, if the central velocity be still kept up; for the particles which are now in contact with the sides do not continue to occupy that situation: the middle particles moving faster *forward* get over them, and in their turn come next the side; and as they are really moving equally fast, but not in the direction into which they are now to be forced, force is necessary

necessary for changing the direction also; and this is in addition to the force necessary for producing the undulations so minutely treated of. The consequence of this must be, that an additional force will be necessary for preserving a given progressive motion in a longer *obstructing* pipe, and that the motion produced in a pipe of greater length by a given force will be less than in a shorter one, and the efflux will be diminished.

302 Especially through any contraction.

There is another consideration which must have an influence here. Nothing is more irrefragably demonstrated than the necessity of an additional force for producing an efflux through any contraction, even though it should be succeeded by a dilatation of the passage. Now both the inequalities of the sides and the undulations of the motions of each particle are equivalent to a succession of contractions and dilatations; although each of these is next to infinitely small; their number is also next to infinitely great, and therefore the total effect may be sensible.

303 There are besides other obstructions, as angular asperities, &c.

We have hitherto supposed that the absolute velocity of the particles was not diminished: this we did, having assumed that the interval of each undulation of the sides was without inequalities. But this was gratuitous: it was also gratuitous that the sides were only undulated. We have no reason for excluding angular asperities. These will produce, and most certainly often produce, real diminutions in the velocity of the contiguous particles; and this must extend to the very axis of the canal, and produce a diminution of the sum total of motion: and in order to preserve the same sensible progressive motion, a greater force must be employed. This is all that can be meant by saying that there is a resistance to the motion of air through long pipes.

304 And a want of perfect fluidity.

There remains another cause of diminution, viz. the want of perfect fluidity, whether arising from the dissemination of solid particles in a real fluid, or from the viscidity of the fluid. We shall not insist on this at present, because it cannot be shown to obtain in air, at least in any case which deserves consideration. It seems of no importance to determine the motion of air hurrying along with it soot or dust. The effect of fogs on a particular modification of the motion of air will be considered under the article Sound. What has been said on this subject is sufficient for our purpose, as explaining the prodigious and unexpected obstruction to the passage of air through long and narrow pipes. We are able to collect an important maxim from it, viz. that all pipes of communication should be made as wide as circumstances will permit: for it is plain that the obstruction depends on the internal surface, and the force to overcome it must be in proportion to the mass of matter which is in motion. The first increases as the diameter of the pipe, and the last as the square. The obstruction must therefore bear a greater proportion to the whole motion in a small pipe than in a large one.

305 The law of retardation extending from the axis to the sides of the canal unknown.

It were very desirable to know the law by which the retardation extends from the axis to the sides of the canal, and the proportion which subsists between the lengths of canal and the forces necessary for overcoming the obstructions when the velocity is given; as also whether the proportion of the obstruction to the whole motion varies with the velocity: but all this is unknown. It does not, however, seem a desperate case in air: we know pretty distinctly the law of action among its particles, viz. that their mutual repulsions are inversely as their distances. This promises to enable us to trace the progress of undulation from the sides of the canal to the axis.

306 It will not increase so fast as the square of the velocities.

We can see that the retardations will not increase so fast as the square of the velocity. Were the fluid incompressible, so that the undulatory path of a particle were invariable, the deflecting forces by which each individual particle is made to describe its undulating path would be precisely such as arise from the path itself and the motion in it; for each particle would be in the situation of a body moving along a fixed path. But in a very compressible fluid, such as air, each particle may be considered as a solitary body, actuated by a projectile and a transverse force, arising from the action of the adjoining particles. Its motion must depend on the adjustment of these forces, in the same manner as the elliptical motion of a planet depends on the adjustment of the force of projection, with a gravitation inversely proportional to the square of the distance from the focus. The transverse force in the present case has its origin in the pressure on the air which is propelling it along the pipe: this, by squeezing the particles together, brings their mutual repulsion into action. Now it is the property of a perfect fluid, that a pressure exerted on any part of it is propagated equally through the whole fluid; therefore the transverse forces which are excited by this pressure are proportional to the pressure itself: and we know that the pressures exerted on the surface of a fluid, so as to expel it through any orifice, or along any canal, are proportional to the squares of the velocities which they produce. Therefore, in every point of the undulatory motion of any particle, the transverse force by which it is deflected into a curve is proportional to the square of its velocity. When this is the case, a body would continue to describe the same curve as before; but, by the very compression, the curvatures are increased, supposing them to remain similar. This would require an increase of the transverse forces; but this is not to be found: therefore the particle will not describe a similar curve, but one which is less incurvated in all its parts; consequently the progressive velocity of the whole, which is the only thing perceivable by us, will not be so much diminished; that is, the obstructions will not increase so fast as they would otherwise do, or as the squares of the velocities.

This reasoning is equally applicable to all fluids, and is abundantly confirmed by experiments in hydraulics, as we shall see when considering the motion of rivers. We have taken this opportunity of delivering our notions on this subject; because, as we have often said, it is in the avowed discrete constitution of air that we see most distinctly the operation of those natural powers which constitute fluidity in general.

307 M. Bossut's experiments on pipes and canals.

We would beg leave to mention a form of experiment for discovering the law of retardation with considerable accuracy. Experiments have been made on pipes and canals. Mr Bossut, in his *Hydrodynamique*, has given a very beautiful set made on pipes of an inch and two inches diameter, and 200 feet long: but although these experiments are very instructive, they do not give us any rule by which we can extend the result to pipes of greater length and different diameters.

Plate CCCCV.

Let a smooth cylinder be set upright in a very large vessel or pond, and be moveable round its axis: let it be turned

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turned round by means of a wheel and pulley with an uniform motion and determined velocity. It will exert the same force on the contiguous water which would be exerted on it by water turning round it with the same velocity: and as this water would have its motion gradually retarded by the fixed cylinder, so the moving cylinder will gradually communicate motion to the surrounding water. We should observe the water gradually dragged round by it; and the vortex would extend farther and farther from it as the motion is continued, and the velocities of the parts of the vortex will be less and less as we recede from the axis. Now, we apprehend, that when a point of the surface of the cylinder has moved over 200 feet, the *motion* of the water at different distances from it will be similar and proportional to, if not precisely the same with, the *retardations* of water flowing 200 feet at the same distance from the side of a canal: at any rate, the two are susceptible of an accurate comparison, and the law of retardation may be accurately deduced from observations made on the motions of this vortex.

308 Wind is air in motion.

Air in motion is a very familiar object of observation; and it is interesting. In all languages it has got a name; we call it wind: and it is only upon reflection that we consider air as wind in a quiescent state. Many persons hardly know what is meant when air is mentioned; but they cannot refuse that the blast from a bellows is the expulsion of what they contained; and thus they learn that wind is air in motion.

309 The velocity of wind not easily discovered.

It is of consequence to know the velocity of wind; but no good and unexceptionable method has been contrived for this purpose. The best seems to be by measuring the space passed over by the shadow of a cloud; but this is extremely fallacious. In the first place, it is certain, that although we suppose that the cloud has the velocity of the air in which it is carried along, this is not an exact measure of the current on the surface of the earth; we may be almost certain that it is greater: for air, like all other fluids, is retarded by the sides and bottom of the channel in which it moves. But, in the next place, it is very gratuitous to suppose, that the velocity of the cloud is the velocity of the stratum of air between the cloud and the earth; we are almost certain that it is not. It is abundantly proved by Dr Hutton of Edinburgh, that clouds are always formed when two parcels of air of different temperatures mix together, each containing a proper quantity of vapour in the state of chemical solution. We know that different strata of air will frequently flow in different directions for a long time. In 1781 while a great fleet rendezvouzed in Leith Roads during the Dutch war, there was a brisk easterly wind for about five weeks; and, during the last fortnight of this period, there was a brisk westerly current at the height of about $\frac{1}{2}$ of a mile. This was distinctly indicated by frequent fleecy clouds at a great distance above a lower stratum of these clouds, which were driving all this time from the eastward. A gentleman who was at the siege of Quebec in 1759, informed us, that one day while there blew a gale from the west, so hard that the ships at anchor in the river were obliged to strike their topmasts, and it was with the utmost difficulty that some well manned boats could row against it, carrying some artillery stores to a post above the town, several shells were thrown from the town to destroy the boats: one of the shells burst in the air near the top of its flight, which was about half a mile high. The smoke of this bomb remained in the same spot for above a quarter of an hour, like a great round ball, and gradually dissipated by diffusion, without removing many yards from its place. When, therefore, two strata of air come from different quarters, and one of them flows over the other, it will be only in the contiguous surfaces that a precipitation of vapour will be made. This will form a thin fleecy cloud; and it will have a velocity and direction which neither belongs to the upper nor to the lower stratum of air which produced it. Should one of these strata come from the east and the other from the west with equal velocities, the cloud formed between them will have no motion at all; should one come from the east, and the other from the north, the cloud will move from the north-east with a greater velocity than either of the strata. So uncertain then is the information given by the clouds either of the velocity or the direction of the wind. A thick smoke from a furnace will give us a much less equivocal measure: and this, combined with the effects of the wind in impelling bodies, or deflecting a loaded plane from the perpendicular, or other effects of this kind, may give us measures of the different currents of wind with a precision sufficient for all practical uses.

310 The result of Smeaton's observation on this head.

The celebrated engineer Mr John Smeaton has given, in the 51st volume of the Philosophical Transactions, the velocities of wind corresponding to the usual denominations in our language. These are founded on a great number of observations made by himself in the course of his practice in erecting wind-mills. They are contained in the following table.

Miles per hour.	Feet per second.	Names.
1	1,47	
2	2,93	Light airs.
3	4,40	
4	5,87	Breeze.
5	7,33	
10	14,67	Brisk gale.
15	22,	
20	29,34	Fresh gale.
25	36,67	
30	44,01	Strong gale.
35	51,34	
40	58,68	Hard gale.
45	66,01	
50	73,35	Storm.
60	88,02	
80	117,36	Hurricane, turning up trees, overturning buildings, &c.
100	146,70	

See also some valuable experiments by him on this subject, Philosophical Transactions 1760 and 1761.

311 Account of Dr Lynd's anemometer.

One of the most ingenious and convenient methods for measuring the velocity of the wind is to employ its pressure in supporting a column of water, in the same way as Mr Pitot measures the velocity of a current of water. We believe that it was first proposed by Dr James Lynd of Windsor, a gentleman eminent for his great knowledge in all the branches of natural science, and for his ingenuity in every matter of experiment or practical application.

His anemometer (as these instruments are called) consists of a glass tube of the form ABCD (fig. 66.), open at

Plate CCCCV.

at both ends, and having the branch AB at right angles to the branch CD. This tube contains a few inches of water or any fluid (the lighter the better); it is held with the part CD upright, and AB horizontal and in the direction of the wind; that is, with the mouth A fronting the wind. The wind acts in the way of pressure on the air in AB, compresses it, and causes it to press on the surface of the liquor; forcing it down to F, while it rises to E in the other leg. The velocity of the wind is concluded from the difference E*f* between the heights of the liquor in the legs. As the wind does not generally blow with uniform velocity, the liquor is apt to dance in the tube, and render the observation difficult and uncertain: to remedy this, it is proper to contract very much the communication at C between the two legs. If the tube has half an inch of diameter (and it should not have less), a hole of $\frac{1}{10}$ of an inch is large enough; indeed the hole can hardly be too small, nor the tubes too large.

312 It is ingenious and useful.

This instrument is extremely ingenious, and will undoubtedly give the proportions of the velocities of different currents with the greatest precision; for in whatever way the pressure of wind is produced by its motion, we are certain that the different pressures are as the squares of the velocities: if, therefore, we can obtain one certain measure of the velocity of the wind, and observe the degree to which the pressure produced by it raises the liquor, we can at all other times observe the pressures and compute the velocities from them, making proper allowances for the temperature and the height of the mercury in the barometer; because the velocity will be in the subduplicate ratio of the density of the air inversely when the pressure is the same.

It is usually concluded, that the velocity of the wind is that which would be acquired by falling from a height which is to E*f* as the weight of water is to that of an equal bulk of air. Thus, supposing air to be 840 times lighter than water, and that E*f* is $\frac{1}{10}$ of an inch, the velocity will be about 63 feet *per* second; which is that of a very hard gale, approaching to a storm. Hence we see by the bye, that the scale of this instrument is extremely short, and that it would be a great improvement of it to make the leg CD not perpendicular, but very much sloping; or perhaps the following form of the instrument will give it all the perfection of which it is capable. Let the horizontal branch AB (fig. 67.) be contracted at B, and continued horizontally for several inches BG of a much smaller bore, and then turned down for two or three inches GC, and then upwards with a wide bore. To use the instrument, hold it with the part DC perpendicular; and (having sheltered the mouth A from the wind) pour in water at D till it advances along GB to the point B, which is made the beginning of the scale; the water in the upright branch standing at *f* in the same horizontal line with BG. Now, turn the mouth A to the wind; the air in AB will be compressed and will force the water along BG to F, and cause it to rise from *f* to E; and the range *f*E will be to the range BF on the scale as the section of the tube BG to that of CD. Thus, if the width of DC be $\frac{1}{2}$ an inch, and that of BG $\frac{1}{10}$, we shall have 25 inches in the scale for one inch of real pressure E*f*.

Plate CCCCV.

But it has not been demonstrated in a very satisfactory manner, that the velocity of the wind is that acquired by falling through the height of a column of air whose weight is equal to that of the column of water E*f*. Experiments made with Pitot's tube in currents of water show that several corrections are necessary for concluding the velocity of the current from the elevations in the tube: these corrections may however be made, and safely applied to the present case; and then the instrument will enable us to conclude the velocity of the wind immediately, without any fundamental comparison of the elevation, with a velocity actually determined upon other principles. The chief use which we have for this information is in our employment of wind as an impelling power, by which we can actuate machinery or navigate ships. These are very important applications of pneumatical doctrines, and merit a particular consideration; and this naturally brings us to the last part of our subject, viz. the consideration of the impulse of air on bodies exposed to its action, and the resistance which it opposes to the passage of bodies through it.

313 This subject is most important, but it is also difficult.

This is a subject of the greatest importance; being the foundation of that art which has done the greatest honour to the ingenuity of man, and the greatest service to human society, by connecting together the most distant inhabitants of this globe, and making a communication of benefits which would otherwise have been impossible; we mean the art of Navigation or Seamanship. Of all the machines which human art has constructed, a ship is not only the greatest and most magnificent, but also the most ingenious and intricate; and the clever seaman possesses a knowledge founded on the most difficult and abstruse doctrines of mechanics. The seaman probably cannot give any account of his own science; and he possesses it rather by a kind of intuition than by any process of reasoning: but the success and efficacy of all the mechanism of this complicated engine, and the propriety of all the manoeuvres which the seaman practises, depend on the invariable laws of mechanics; and a thorough knowledge of these would enable an intelligent person not only to understand the machine and the manner of working it, but to improve both.

Unfortunately this is a subject of very great difficulty; and although it has employed the genius of Newton, and he has considered it with great care, and his followers have added more to his labours on this subject than on any other, it still remains in a very imperfect state.

A minute discussion of this subject cannot therefore be expected in a work like this: we must content ourselves with such a general statement of the most approved doctrine on the subject as shall enable our readers to conceive it distinctly, and judge with intelligence and confidence of the practical deductions which may be made from it.

314 Impulse and resistance of air.

It is evidently a branch of the general theory of the impulse and resistance of fluids, which should have been treated of under the article Hydraulics, but was then deferred till the mechanical properties of compressible fluids should also be considered. It was thought very reasonable to suppose that the circumstances of elasticity would introduce the same changes in the impulse and resistance of fluids that it does in solid bodies. It would greatly divert the attention from the distinctive properties of air, if we should in this place enter on this subject, which is both extensive and difficult. We reckon it better therefore to take the whole together: this we shall do under the article *Resistance of Fluids*, and confine ourselves at present to what relates to the impulse

impulse and resistance of air alone; anticipating a few of the general propositions of that theory, but without demonstration, in order to understand the applications which may be made of it.

Plate CCCCV. Suppose then a plane surface, of which a C (fig. 68.) is the section, exposed to the action of a stream of wind blowing in the direction QC, perpendicular to a C. The motion of the wind will be obstructed, and the surface a C pressed forward. And as all impulse or pressure is exerted in a direction perpendicular to the surface, and is resisted in the opposite direction, the surface will be impelled in the direction CD, the continuation of QC. And as the mutual actions of bodies depend on their relative motions, the force acting on the surface a C will be the same, if we shall suppose the air at rest, and the surface moving equally swift in the opposite direction. The resistance of the air to the motion of the body will be equal to the impulse of the air in the former case. Thus resistance and impulse are equal and contrary.

315 Air moving with a double velocity will generally impel as the square of that velocity.

If the air be moving twice as fast, its particles will give a double impulse; but in this case a double number of particles will exert their impulse in the same time: the impulse will therefore be fourfold; and in general it will be as the square of the velocity: or if the air and body be both in motion, the impulse and resistance will be proportional to the square of the relative velocity.

This is the first proposition on the subject, and it appears very consonant to reason. There will therefore be some analogy between the force of the air's impulse or the resistance of a body, and the weight of a column of air incumbent on the surface: for it is a principle in the action of fluids, that the heights of the columns of fluid are as the squares of the velocities which their pressures produce. Accordingly the second proposition is, that the absolute impulse of a stream of air, blowing perpendicularly on any surface, is equal to the weight of a column of air which has that surface for its base, and for its height the space through which a body must fall in order to acquire the velocity of the air.

Thirdly, Suppose the surface AC equal to a C no longer to be perpendicular to the stream of air, but inclined to it in the angle ACD, which we shall call the *angle of incidence*; then, by the resolution of forces, it follows, that the action of each particle is diminished in the proportion of radius to the sine of the angle of incidence, or of AC to AL, AL being perpendicular to CD.

Again: Draw AK parallel to CD. It is plain that no air lying farther from CD than KA is will strike the plane. The quantity of impulse therefore is diminished still farther in the proportion of a C to KC, or of AC to AL. Therefore, on the whole, the absolute impulse is diminished in the proportion of AC^2 to AL^2: hence the proposition, that the impulse and resistance of a given surface are in the proportion of the square of the sine of the angle of incidence.

Fourthly, This impulse is in the direction PL, perpendicular to the impelled surface, and the surface tends to move in this direction: but suppose it moveable only in some other direction PO, or that it is in the direction PO that we wish to employ this impulse, its action is therefore oblique; and if we wish to know the intensity of the impulse in this direction, it must be diminished still farther in the proportion of radius to the cosine of the angle LPO or sine of CPO. Hence the general proposition: The *effective impulse is as the surface, as the square of the velocity of the wind, as the square of the sine of the angle of incidence, and as the sine of the obliquity jointly*, which we may express by the symbol $R = S \cdot V^2 \cdot \text{sin}^2 . I \cdot \text{sin} . O$; and as the impulse depends on the density of the impelling fluid, we may take in every circumstance by the equation $R = S \cdot D \cdot V^2 . \text{sin}^2 . I \cdot \text{sin} . O$. If the impulse be estimated in the direction of the stream, the angle of obliquity ACD is the same with the angle of incidence, and the impulse in this direction is as the surface, as the square of the velocity, and as the cube of the angle of incidence jointly.

It evidently follows from these premises, that if ACA′ be a wedge, of which the base AA′ is perpendicular to the wind, and the angle ACA′ bisected by its direction, the direct or perpendicular impulse on the base is to the oblique impulse on the sides as radius to the square of the sine of half the angle ACA′.

The same must be affirmed of a pyramid or cone ACA′, of which the axis is in the direction of the wind.

If ACA′ (fig. 69.) represent the section of a solid, produced by the revolution of a curve line APC round the axis CD, which lies in the direction of the wind, the impulse on this body may be compared with the direct impulse on its base, or the resistance to the motion of this body through the air may be compared with the direct resistance of its base, by resolving its surface into elementary planes Pp, which are coincident with a tangent plane PR, and comparing the impulse on Pp with the direct impulse on the corresponding part Kk of the base.

In this way it follows that the impulse on a sphere is one half of the impulse on its great circle, or on the base of a cylinder of equal diameter.

We shall conclude this sketch of the doctrine with a very important proposition to determine the most advantageous position of a plane surface, when required to move in one direction while it is impelled by the wind blowing in a different direction. Thus, 316 Important inference from this doctrine.

Let AB (fig. 70.) be the sail of a ship, CA the direction in which the wind blows, and AD the line of the ship's course. It is required to place the yard AC in such a position that the impulse of the wind upon the sail may have the greatest effect possible in impelling the ship along AD.

Let AB, Ab, be two positions of the sail very near the best position, but on opposite sides of it. Draw BE, be, perpendicular to CA, and BF, bf, perpendicular to AD, calling AB radius; it is evident that BE, BF, are the sines of impulse and obliquity, and that the effective impulse is $BE^2 \times BF$, or $be^2 \times bf$. This must be a maximum.

Let the points B, b, continually approach and ultimately coincide; the chord bB will ultimately coincide with a straight line CBD touching the circle in B; the triangles CBE, cbe are similar, as also the triangles DBF, Dbf: therefore $BE^2 : be^2 = BC^2 : bc^2$, and $BF : bf = BD : bD$; and $BE^2 \times BF : be^2 \times bf = CB^2 \times BD : cb^2 \times bD$. Therefore when AB is in the best position, so that $BE^2 \times BF$ is greater than $be^2 \times bf$, we shall have $CB \times BD$ greater than $Cb^2 \times bD$, or $cB^2 \times BD$ is also a maximum. This we know to be the case when $CB = 2BD$: therefore the sail must be so placed that the

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the tangent of the angle of incidence shall be double of the tangent of the angle of the sail and keel.

In a common windmill the angle CAD is necessarily a right angle; for the sail moves in a circle to which the wind is perpendicular: therefore the best angle of the sail and axle will be 54°.44 nearly.

Such is the theory of the resistance and impulse of the air. It is extremely simple and of easy application. In all physical theories there are assumptions which depend on other principles, and those on the judgment of the naturalist; so that it is always proper to confront the theory with experiment. There are even circumstances in the present case which have not been attended to in the theory. When a stream of air is obstructed by a solid body, or when a solid body moves along in air, the air is condensed before it and rarefied behind. There is therefore a pressure on the anterior parts arising from this want of equilibrium in the elasticity of the air. This must be superadded to the force arising from the impetus or inertia of the air. We cannot tell with precision what may be the amount of this condensation; it depends on the velocity with which any condensation diffuses itself.

Also, if the motion be so rapid that the pressure of the atmosphere cannot make the air immediately occupy the place quitted by the body, it will sustain this pressure on its forepart to be added to the other forces.

317 Account of the principal experiments on this subject.

Experiments on this subject are by no means numerous; at least such experiments as can be depended on for the foundation of any practical application. The first that have this character are those published by Mr Robins in 1742 in his treatise on Gunnery. They were repeated with some additions by the Chevalier Borda, and some account of them published in the Memoirs of the Academy of Sciences in 1763. In the Philosophical Transactions of the Royal Society of London, Vol. LXXIII. there are some experiments of the same kind on a larger scale by Mr Edgeworth. These were all made in the way described in our account of Mr Robins's improvements in gunnery. Bodies were made to move with determined velocities, and the resistances were measured by weights.

In all these experiments the resistances were found very exactly in the proportion of the squares of the velocities; but they were found considerably greater than the weight of the column of air, whose height would produce the velocity in a falling body. Mr Robins's experiments on a square of 16 inches, describing 25,2 feet per second, indicate the resistance to be to this weight nearly as 4 to 3. Borda's experiments on the same surface state the disproportion still greater.

The resistances are found not to be in the proportion of the surfaces, but increase considerably faster. Surfaces of 9, 16, 36, and 81 inches, moving with one velocity, had resistances in the proportion of 9, $17\frac{1}{2}$, $42\frac{1}{2}$, and $104\frac{1}{2}$.

Now as this deviation from the proportion of the surfaces increases with great regularity, it is most probable that it continues to increase in surfaces of still greater extent; and these are the most generally to be met with in practice in the action of wind on ships and mills.

Borda's experiments on 81 inches show that the impulse of wind moving one foot per second is about $\frac{1}{500}$ of a pound on a square foot. Therefore to find the impulse on a foot corresponding to any velocity, divide the square of the velocity by 500, and we obtain the impulse in pounds. Mr Rouse of Leicestershire made many experiments, which are mentioned with great approbation by Mr Smeaton. His great sagacity and experience in the erection of windmills oblige us to pay a considerable deference to his judgment. These experiments confirm our opinion, that the impulses increase faster than the surfaces. The following table was calculated from Mr Rouse's observations, and may be considered as pretty near the truth.

Velocity in Feet.	Impulse on a Foot in Pounds.
0	0,000
10	0,229
20	0,915
30	2,059
40	3,660
50	5,718
60	8,234
70	11,207
80	14,638
90	18,526
100	22,872
110	27,675
120	32,926
130	38,654
140	44,830
150	51,462

If we multiply the square of the velocity in feet by 16, the product will be the impulse or resistance on a square foot in grains, according to Mr Rouse's numbers.

The greatest deviation from the theory occurs in the oblique impulses. Mr Robins compared the resistance of a wedge, whose angle was 90°, with the resistance of its base; and instead of finding it less in the proportion of $\sqrt{2}$ to 1, as determined by the theory, he found it greater in the proportion of 55 to 68 nearly; and when he formed the body into a pyramid, of which the sides had the same surface and the same inclination as the sides of the wedge, the resistance of the base and face were now as 55 to 39 nearly: so that here the same surface with the same inclination had its resistance reduced from 68 to 39 by being put into this form. Similar deviations occur in the experiments of the Chevalier Borda; and it may be collected from both, that the resistances diminish more nearly in the proportion of the sines of incidence than in the proportion of the squares of those sines.

The irregularity in the resistance of curved surfaces is as great as in plane surfaces. In general, the theory gives the oblique impulses on plane surfaces much too small, and the impulses on curved surfaces too great. The resistance of a sphere does not exceed the fourth part of the resistance of its great circle, instead of being its half; but the anomaly is such as to leave hardly any room for calculation. It would be very desirable to have the experiments on this subject repeated in a greater variety of cases, and on larger surfaces, so that the errors of the experiments may be of less consequence. Till this matter be reduced to some rule, the art of working ships must remain very imperfect, as must also the construction of windmills.

The case in which we are most interested in the know-

Resistance of Air in Gunnery.

knowledge of the resistance of the air is the motion of bullets and shells. Writers on artillery have long been sensible of the great effect of the air's resistance. It seems to have been this consideration that chiefly engaged Sir Isaac Newton to consider the motions of bodies in a resisting medium. A proposition or two would have sufficed for showing the incompatibility of the planetary motions with the supposition that the celestial spaces were filled with a fluid matter; but he has with great solicitude considered the motion of a body projected on the surface of the earth, and its deviation from the parabolic track assigned by Galileo. He has bestowed more pains on this problem than any other in his whole work; and his investigation has pointed out almost all the improvements which have been made in the application of mathematical knowledge to the study of nature. Nowhere does his sagacity and fertility of resource appear in so strong a light as in the second book of the *Principia*, which is almost wholly occupied by this problem. The celebrated mathematician John Bernouilli engaged in it as the finest opportunity of displaying his superiority. A mistake committed by Newton in his attempt to a solution was matter of triumph to him; and the whole of his performance, though a piece of elegant and elaborate geometry, is greatly hurt by his continually bringing this mistake (which is a mere trifle) into view. The difficulty of the subject is so great, that subsequent mathematicians seem to have kept aloof from it; and it has been entirely overlooked by the many voluminous writers who have treated professedly on military projectiles. They have spoken indeed of the resistance of the air as affecting the flight of shot, but have saved themselves from the task of investigating this effect (a task to which they were unequal), by supposing that it was not so great as to render their theories and practical deductions very erroneous. Mr Robins was the first who seriously examined the subject. He showed, that even the Newtonian theory (which had been corrected, but not in the smallest degree improved or extended in its principles) was sufficient to show that the path of a cannon ball could not resemble a parabola. Even this theory showed that the resistance was more than eight times the weight of the ball, and should produce a greater deviation from the parabola than the parabola deviated from a straight line.

318 It is of great consequence to know the resistance of air in the motion of bullets, &c.

319 The ignorance of the writers on artillery in this respect.

This simple but singular observation was a strong proof how faulty the professed writers on artillery had been, in rather amusing themselves with elegant but useless applications of easy geometry, than in endeavouring to give their readers any useful information. He added, that the difference between the ranges by the Newtonian theory and by experiment were so great, that the resistance of the air must be vastly superior to what that theory supposed. It was this which suggested to him the necessity of experiments to ascertain this point. We have seen the result of these experiments in moderate velocities; and that they were sufficient for calling the whole theory in question, or at least for rendering it useless. It became necessary therefore to settle every point by means of a direct experiment. Here was a great difficulty. How shall we measure either these great velocities which are observed in the motions of cannon shot, or the resistances which these enormous velocities occasion? Mr Robins had the ingenuity to do both. The method which he took for measuring the velocity of a musket-ball was quite original; and it was susceptible of great accuracy. We have already given an account of it under the article GUNNERY. Having gained this point, the other was not difficult. In the moderate velocities he had determined the resistances by the forces which balanced them, the weights which kept the resisted body in a state of uniform motion. In the great velocities, he proposed to determine the resistances by their immediate effects, by the retardations which they occasioned. This was to be done by first ascertaining the velocity of the ball, and then measuring its velocity after it had passed thro' a certain quantity of air. The difference of these velocities is the retardation, and the proper measure of the resistance; for, by the initial and final velocities of the ball, we learn the time which was employed in passing through this air with the medium velocity. In this time the air's resistance diminished the velocity by a certain quantity. Compare this with the velocity which a body projected directly upwards would lose in the same time by the resistance of gravity. The two forces must be in the proportion of their effects. Thus we learn the proportion of the resistance of the air to the weight of the ball. It is indeed true, that the time of passing through this space is not accurately had by taking the arithmetical medium of the initial and final velocities; nor does the resistance deduced from this calculation accurately correspond to this mean velocity; but both may be accurately found by the experiment by a very troublesome computation, as is shown in the 5th and 6th propositions of the second book of Newton's *Principia*. The difference between the quantities thus found and those deduced from the simple process is quite trifling, and far within the limits of accuracy attainable in experiments of this kind; it may therefore be safely neglected.

320 Mr Robins made many experiments on this subject.

Mr Robins made many experiments on this subject; but unfortunately he has published only a very few, such as were sufficient for ascertaining the point he had in view. He intended a regular work on the subject, in which the gradual variations of resistance corresponding to different velocities should all be determined by experiment: but he was then newly engaged in an important and laborious employment, as chief engineer to the East India Company, in whose service he went out to India, where he died in less than two years. It is to be regretted that no person has prosecuted these experiments. It would be neither laborious nor difficult, and would add more to the improvement of artillery than any thing that has been done since Mr Robins's death, if we except the prosecution of his experiments on the initial velocities of cannon-shot by Dr Charles Hutton royal professor at the Woolwich Academy. It is to be hoped that this gentleman, after having with such effect and success extended Mr Robins's experiments on the initial velocities of musket-shot to cannon, will take up this other subject, and thus give the art of artillery all the scientific foundation which it can receive in the present state of our mathematical knowledge. Till then we must content ourselves with the practical rules which Robins has deduced from his own experiments. As he has not given us the mode of deduction, we must compare the results with experiment. He has indeed given a very extensive comparison with the numerous experiments made both in Britain and

and on the continent; and the agreement is very great. His learned commentator Euler has been at no pains to investigate these rules, and has employed himself chiefly in detecting errors, most of which are supposed, because he takes for a finished work what Mr Robins only gives to the public as a hasty but useful sketch of a new and very difficult branch of science.

321 General result of them, &c.

The general result of Robins's experiments on the retardation of musket-shot is, that although in moderate velocities the resistance is so nearly in the duplicate proportion of the velocities that we cannot observe any deviation, yet in velocities exceeding 200 feet per second the retardations increase faster, and the deviation from this rate increases rapidly with the velocity. He ascribes this to the causes already mentioned, viz. the condensation of the air before the ball and to the rarefaction behind, in consequence of the air not immediately occupying the space left by the bullet. This increase is so great, that if the resistance to a ball moving with the velocity of 1700 feet in a second be computed on the supposition that the resistance observed in moderate velocities is increased in the duplicate ratio of the velocity, it will be found hardly one-third part of its real quantity. He found, for instance, that a ball moving thro' 1670 feet in a second lost about 125 feet per second of its velocity in passing through 50 feet of air. This it must have done in the $\frac{1}{11}$ of a second, in which time it would have lost one foot if projected directly upwards; from which it appears that the resistance was about 125 times its weight, and more than three times greater than if it had increased from the resistance in small velocities in the duplicate ratio of the velocities. He relates other experiments which show similar results.

But he also mentions a singular circumstance, that till the velocities exceed 1100 feet per second, the resistances increase pretty regularly, in a ratio exceeding the duplicate ratio of the velocities; but that in greater velocities the resistances become suddenly triple of what they would have been, even according to this law of increase. He thinks this explicable by the vacuum which is then left behind the ball, it being well known that air rushes into a vacuum with the velocity of 1132 feet per second nearly. Mr Euler controverts this conclusion, as inconsistent with that gradation which is observed in all the operations of nature; and says, that although the vacuum is not produced in smaller velocities than this, the air behind the ball must be so rare (the space being but imperfectly filled), that the pressure on the anterior part of the ball must gradually approximate to that pressure which an absolute vacuum would produce; but this is like his other criticisms. Robins does nowhere assert that this sudden change of resistance happens in the transition of the velocity from 1132 feet to that of 1131 feet 11 inches or the like, but only that it is very sudden and very great. It may be strictly demonstrated, that such a change must happen in a narrow enough limit of velocities to justify the appellation of sudden: a similar fact may be observed in the motion of a solid through water. If it be gradually accelerated, the water will be found nearly to fill up its place, till the velocity arrives at a certain magnitude, corresponding to the immersion of the body in the water; and then the smallest augmentation of its motion immediately produces a void behind it, into which the water rushes in a violent manner and is dashed into froth. A gentleman, who has had many opportunities for such observations, assures us, that when standing near the line of direction of a cannon discharging a ball with a large allotment of powder, so that the initial velocity certainly exceeded 1100 feet per second, he always observed a very sudden diminution of the noise which the bullet made during its passage. Although the ball was coming towards him, and therefore its noise, if equable, would be continually increasing, he observed that it was loudest at first. That this continued for a second or two, and suddenly diminished, changing to a sound which was not only weaker, but differed in kind, and gradually increased as the bullet approached him. He said, that the first noise was like the hissing of red-hot iron in water, and that the subsequent noise rather resembled a hazy whistling. Such a change of sound is a necessary consequence of the different agitation of the air in the two cases. We know also, that air rushing into a void, as when we break an exhausted bottle, makes a report like a musket.

322 Partly controverted by Euler, but without sufficient grounds.

Mr Robins's assertion therefore has every argument for its truth that the nature of the thing will admit. But we are not left to this vague reasoning: his experiments show us this diminution of resistance. It clearly appears from them, that in a velocity of 1700 feet the resistance is more than three times the resistance determined by the theory which he supposes the common one. When the velocity was 1065 feet, the actual resistance was $\frac{11}{7}$ of the theoretical; and when the velocity was 400 feet, the actual resistance was about $\frac{4}{7}$ of the theoretical. That he assumed a theory of resistance which gave them all too small, is of no consequence in the present argument.

323 Rule by Robins for computing resistances and very rapid motions.

Mr Robins, in summing up the results of his observations on this subject, gives a rule very easily remembered for computing the resistances to those very rapid motions. It has been already mentioned in the article GUNNERY, but we repeat it here, in order to accommodate it to the quantities which have been determined in some degree by experiment.

A C B D

Let AB represent the velocity of 1700 feet per second, and AC any other velocity. Make BD to AD as the resistance given by the ordinary theory to the resistance actually observed in the velocity 1700: then will CD be to AD as the resistance assigned by the ordinary theory to the velocity AC is to that which really corresponds to it.

To accommodate this to experiment, recollect* that a sphere of the size of a 12 pound iron shot, moving 25 feet in a second, had a resistance of $\frac{1}{21}$ of a pound. Augment this in the ratio of 25^2 to 1700^2, and we obtain 210 nearly for the theoretical resistance to this velocity; but by comparing its diameter of $4\frac{1}{2}$ inches with $\frac{3}{4}$, the diameter of the leaden ball, which had a resistance of at least 11 pounds with this velocity, we conclude that the 12 pound shot would have had a resistance of 396 pounds: therefore BD : AD = 210 : 396, and AB : AD = 186 : 396; and AB being 1700, AD will be 3613.

Let AD = a, AC = x, and let R be the resistance to a 12 pound iron shot moving one foot per second, and r the resistance (in pounds) wanted for the velocity x;

* See Gunnery, n° 19, &c.

we have $r = R\frac{a x^2}{a - x}$. Mr Robins's experiments give $R = \frac{1}{13750}$ very nearly. This gives $Ra = 0,263235$, which is nearly one-fourth. Thus our formula becomes $r = \frac{0,263235\, x^2}{3613 - x}$, or very nearly $\frac{x^2}{4(3613 - x)}$, falling short of the truth about $\frac{1}{10}$th part. The simplicity of the formula recommends it to our use, and when we increase its result $\frac{1}{10}$, it is incomparably nearer to the true result of the theory as corrected by Mr Robins than we can hope that the theory is to the actual resistance. We can easily see that Mr Robins's correction is only a sagacious approximation. If we suppose the velocity 3613 feet, a very possible thing, the resistance by this formula is infinite, which cannot be. We may even suppose that the resistance given by the formula is near the truth only in such velocities as do not greatly exceed 1700 feet per second. No military projectile exceeds 2200, and it is great folly to make it so great, because it is reduced to 1700 almost in an instant, by the enormous resistance.

The resistance to other balls will be made by taking them in the duplicate ratio of the diameters.

324 The discussions of mathematicians not easily applied.

It has been already observed, that the first mathematicians of Europe have lately employed themselves in improving this theory of the motion of bodies in a resisting medium; but their discussions are such as few artillerists can understand. The problem can only be solved by approximation, and this by the quadrature of very complicated curves. They have not been able therefore to deduce from them any practical rules of easy application, and have been obliged to compute tables suited to different cases. Of these performances, that of the Chevalier Borda, in the Memoirs of the Academy of Sciences in 1769, seems the best adapted to military readers, and the tables are undoubtedly of considerable use; but it is not too much to say, that the simple rules of Mr Robins are of as much service, and are more easily remembered: besides, it must be observed, that the nature of military service does not give room for the application of any very precise rule. The only advantage that we can derive from a perfect theory would be an improvement in the construction of pieces of ordnance, and a more judicious appropriation of certain velocities to certain purposes. The service of a gun or mortar must always be regulated by the eye.

325 Borda's and Robins's apparently the best.

326 Undulation of air.

There is another motion of which air and other elastic fluids are susceptible, viz. an internal vibration of their particles, or undulation, by which any extended portion of air is distributed into alternate parcels of condensed and rarefied air, which are continually changing their condition without changing their places. By this change the condensation which is produced in one part of the air is gradually transferred along the mass of air to the greatest distances in all directions. It is of importance to have some distinct conception of this motion. It is found to be by this means that distant bodies produce in us the sensation of sound. See SOUND, ACOUSTICS. Sir Isaac Newton treated this subject with his accustomed ingenuity, and has given us a theory of it in the end of the second book of his *Principia*. This theory has been objected to with respect to the conduct of the argument, and other explanations have been given by the most eminent mathematicians. Though they appear to differ from Newton's, their results are precisely the same; but, on a close examination, they differ no more than John Bernouilli's theorem of centripetal forces differs from Newton's, viz. the one being expressed by geometry and the other by literal analysis. The celebrated De la Grange reduces Newton's investigation to a tautological proposition or identical equation; but Mr Young of Trinity College, Dublin, has, by a different turn of expression, freed Newton's method from this objection. We shall not repeat it here, but refer our mathematical readers to the article ACOUSTICS, it not being our business at present to consider its connection with sound. This will make the subject of a distinct article.

327 Has been used to explain a variety of natural phenomena.

But since Newton published this theory of aerial undulations, and of their propagation along the air, and since the theory has been so corrected and improved as to be received by the most accurate philosophers as a branch of natural philosophy susceptible of rigid demonstration, it has been freely resorted to by many writers on other parts of natural science, who did not profess to be mathematicians, but made use of it for explaining phenomena in their own line on the authority of the mathematicians themselves. Learning from them that this vibration, and the *quaquaversum* propagation of the pulses, were the necessary properties of an elastic fluid, and that the rapidity of this propagation had a certain assignable proportion to the elasticity and density of the fluid, they freely made use of these concessions, and have introduced elastic vibrating fluids into many facts, where others would suspect no such thing, and have attempted to explain by their means many abstruse phenomena of nature. Æthers are everywhere introduced, endued with great elasticity and tenuity. Vibrations and pulses are supposed in this æther, and these are offered as explanations. The doctrines of animal spirits and nervous fluids, and the whole mechanical system of Hartley, by which the operations of the soul are said to be explained, have their foundation in this theory of aerial undulations. If these fancied fluids, and their internal vibrations, really operate in the phenomena ascribed to them, any explanation that can be given of the phenomena from this principle must be nothing else than showing that the legitimate consequences of these undulations are similar to the phenomena; or, if we are no more able to see this last step than in the case of sound (which we know to be *one* consequence of the aerial undulations, although we cannot tell how), we must be able to point out, as in the case of sound, certain constant relations between the general laws of these undulations and the general laws of the phenomena. It is only in this way that we think ourselves intitled to say that the aerial undulations are causes, though not the only causes, of sound; and it is because there is no such relation, but, on the contrary, a total dissimilarity, to be observed between the laws of elastic undulations and the laws of the propagation of light, that we assert with confidence that ethereal undulations are not the causes of vision.

328 But the application not being made with sufficient precision,

Explanations of this kind suppose, therefore, in the first place, that the philosopher who proposes them understands precisely the nature of these undulations; in the next place, that he makes his reader sensible of those circumstances of them which are concerned in the effect to be explained; and, in the third place, that he makes the reader understand how this circumstance of the vibrating fluid is connected with the phenomenon, either by showing it to be its mechanical cause, as as when the philosopher explains the resounding of a musical chord to a flute or pipe which gave the same tone; or by showing that this circumstance of the undulation always accompanies the phenomenon, as when the philosopher shows that 233 vibrations of air in a second, in whatever manner or by whatever cause they are produced, always are followed by the sensation of the tone C in the middle of the harpsichord.

But here we must observe, that, with the exception of Euler's unsuccessful attempt to explain the optical phenomena by the undulations of ether, we have met with no explanation of natural phenomena, by means of elastic and vibrating fluids, where the author has so much as attempted any one of these three things, so indispensably requisite in a logical explanation. They have talked of vibrations without describing them, or giving the reader the least notion of what kind they are; and in no instance that we can recollect have they showed how such vibrations could have any influence in the phenomenon. Indeed, by not describing with precision the undulations, they were freed from the task of showing them to be mechanical causes of the phenomenon; and when any of them show any analogy between the general laws of elastic undulations and the general laws of the phenomenon, the analogy is so vague, indistinct, or partial, that no person of common prudence would receive it as argument in any case in which he was much interested.

329 Has become the foundation of materialism.

We think it our duty to remonstrate against this slovenly way of writing: we would even hold it up to reprobation. It has been chiefly on this faithless foundation that the blind vanity of men has raised that degrading system of opinions called MATERIALISM, by which the affections and faculties of the soul of man have been resolved into vibrations and pulses of ether.

330 Of the motion of elastic fluids.

We also think it our duty to give some account of this motion of elastic fluids. It must be such an account as shall be understood by those who are not mathematicians, because those only are in danger of being misled by the improper application of them. Mathematical discussion is, however, unavoidable in a subject purely mathematical; but we shall introduce nothing that may not be easily understood or confided in; and we trust that mathematical readers will excuse us for a mode of reasoning which appears to them lax and inelegant.

331 How they differ from unelastic fluids in propagating any agitation of their parts.

The first thing incumbent on us is to show how elastic fluids differ from the unelastic in the propagation of any agitation of their parts. When a long tube is filled with water, and any one part of it pushed out of its place, the whole is instantly moved like a solid mass. But this is not the case with air. If a door be suddenly shut, the window at the farther end of a long and close room will rattle; but some time will elapse between the shutting of the door and the motion of the window. If some light dust be lying on a braced drum, and another be violently beat at a little distance from it, an attentive observer will see the dust dance up from the parchment; but this will be at the instant he hears the sound of the stroke on the other drum, and a sensible time after the stroke. Many such familiar facts show that the agitation is gradually communicated along the air; and therefore that when one particle is agitated by any sensible motion, a finite time, however small, must elapse before the adjoining particle is agitated in the same manner. This would not be the case in water if water be perfectly incompressible. We think that this may be made intelligible with very little trouble.

A a   B b   C   D

Let A, B, C, D, &c. be a row of aerial particles, at such distances that their elasticity just balances the pressure of the atmosphere; and let us suppose (as is deducible from the observed density of air being proportional to the compressing force) that the elasticity of the particles, by which they keep each other at a distance, is as their distances inversely. Let us farther suppose that the particle A has been carried, with an uniform motion, to a by some external force. It is evident that B cannot remain in its present state; for being now nearer to a than to C, it is propelled towards C by the excess of the elasticity of A above the natural elasticity of C. Let E be the natural elasticity of the particles, or the force corresponding to the distance BC or BA, and let F be the force which impels B towards C, and let f be the force exerted by A when at a. We have

$$E : f = Ba : BC, = Ba : BA;$$
$$\text{and } E : f - E = Ba : BA - Ba = Ba : Aa;$$
$$\text{or } E : F = Ba : Aa.$$

Now in fig. 71. let ABC be the line joining three particles, to which draw FG, PH parallel, and IAF, HBG perpendicular. Take IF or HG to represent the elasticity corresponding to the distance AB. Let the particle A be supposed to have been carried with an uniform motion to a by some external force, and draw RaM perpendicular to RG, and make FI : RM = Ba : BA. We shall then have FI : PM = Ba : Aa; and PM will represent the force with which the particle B is urged towards C. Suppose this construction to be made for every point of the line AB, and that a point M is thus determined for each of them, mathematicians know that all these points M lie in the curve of a hyperbola, of which FG and GH are the asymptotes. It is also known by the elements of mechanics, that since the motion of A along AB is uniform, Aa or IP may be taken to represent the time of describing Aa; and that the area IPM represents the whole velocity which B has acquired in its motion towards C when A has come to a, the force urging B being always as the portion PM of the ordinate. Plate CCCCV.

Take GX of any length in HG produced, and let GX represent the velocity which the uniform action of the natural elasticity IF could communicate to the particle B during the time that A would uniformly describe AB. Make GX to GY as the rectangle IFGH to the hyperbolic space IFRM, and draw YS cutting MR produced in S, and draw FX cutting MR in T. It is known to the mathematicians that the point S is in a curve line FSs called the *logarithmic curve*; of which the leading property is, that any line RS parallel to GX is to GX as the rectangle IFGH is to the hyperbolic space IFRM, and that FX touches the curve in F.

This being the case, it is plain, that because RT increases in the same proportion with FR, or with the rectangle IFRP, and RS increases in the proportion of the space IFRM, TS increases in the proportion of the space IPM. Therefore TS is proportional to the velocity of B when A has reached a, and RT is pro-

Undulation of Air. proportional to the velocity which the uniform action of the natural elasticity would communicate to B in the same time. Then since FT is as the time, and TS is as the velocity, the area FTS will be as the space described by B (urged by the variable force PM); while A, urged by the external force, describes A *a*; and the triangle FRT will represent the space which the uniform action of the natural elasticity would cause B to describe in the same time.

And thus it is plain that these three motions can be compared together: the uniform motion of the agitated particle A, the uniformly accelerated motion which the natural elasticity would communicate to B by its constant action, and the motion produced in B by the agitation of A. But this comparison, requiring the quadrature of the hyperbola and logarithmic curve, would lead us into most intricate and tedious computations. Of these we need only give the result, and make some other comparisons which are palpable.

Let A *a* be supposed indefinitely small in comparison of AB. The space described by A is therefore indefinitely small; but in this case we know that the ratio of the space FRT to the rectangle IFRP is indefinitely small. There is therefore no comparison between the agitation of A by the external force, and the agitation which natural elasticity would produce on a single particle in the same time, the last being incomparably smaller than the first. And this space FRT is incomparably greater than FTS; and therefore the space which B would describe by the uniform action of the natural elasticity is incomparably greater than what it would describe in consequence of the agitation of A.

From this reasoning we see evidently that A must be sensibly moved, or a finite or measurable time must elapse before B acquires a measurable motion. In like manner B must move during a measurable time before C acquires a measurable motion, &c.; and therefore the agitation of A is communicated to the distant particles in gradual succession.

By a farther comparison of these spaces we learn the time in which each succeeding particle acquires the very agitation of A. If the particles B and C only are considered, and the motion of C neglected, it will be found that B has acquired the motion of A a little before it has described $\frac{1}{7}$ of the space described by A; but if the motion of C be considered, the acceleration of B must be increased by the retreat of C, and B must describe a greater space in proportion to that described by A. By computation it appears, that when both B and C have acquired the velocity of A, B has described nearly $\frac{1}{3}$ of A's motion, and C more nearly $\frac{1}{3}$. Extending this to D, we shall find that D has described still more nearly $\frac{1}{3}$ of A's motion. And from the nature of the computation it appears that this approximation goes on rapidly: therefore, supposing it accurate from the very first particle, it follows from the equable motion of A, that each succeeding particle moves through an equal space in acquiring the motion of A.

The conclusion which we must draw from all this is, that when the agitation of A has been fully communicated to a particle at a *sensible* distance, the intervening particles, all moving forward with a common velocity, are equally compressed as to sense, except a very few of the first particles; and that this communication, or this propagation of the original agitation, goes on with an uniform velocity.

These computations need not be attended to by such as do not wish for an accurate knowledge of the precise agitation of each particle. It is enough for such readers to see clearly that time *must* escape between the agitation of A and that of a distant particle; and this is abundantly manifest from the incomparability (excuse the term) of the nascent rectangle IFRP with the nascent triangle FRT, and the incomparability of FRT with FTS.

What has now been shown of the communication of any sensible motion A *a* must hold equally with respect to any change of this motion. Therefore if a tremulous motion of a body, such as a spring or bell, should agitate the adjoining particle A by pushing it forward in the direction AB, and then allowing it to come back again in the direction BA, an agitation similar to this will take place in all the particles of the row one after the other. Now if this body vibrate according to the law of motion of a pendulum vibrating in a cycloid, the neighbouring particle of air *will of necessity* vibrate in the same manner; and then Newton's demonstration in art. ACOUSTICS needs no apology. Its only deficiency was, that it *seemed* to prove that this *would be* the way in which every particle would of necessity vibrate; which is not true, for the successive parcels of air will be differently agitated according to the original agitation. Newton only wants to prove the uniform propagation of the agitations, and he selects that form which renders the proof easiest. He proves, in the most unexceptionable manner, that if the particles of a pulse of air are really moving like a cycloidal pendulum, the forces acting on each particle, in consequence of the compression and dilatation of the different parts of the pulse, are precisely such as are necessary for continuing this motion, and therefore no other forces are required. Then since each particle is in a certain part of its path, is moving in a certain direction, and with a certain velocity, and urged by a determined force, it *must* move in that very manner. The objection started by John Bernouilli against Newton's demonstration (in a single line) of the elliptical motion of a body urged by a force in the inverse duplicate ratio of the distance from the focus, is precisely the same with the objection against Newton's demonstration of the progress of aerial undulations, and is equally futile.

332
Newton's demonstration of this subject just as far as it goes;

It must, however, be observed, that Newton's demonstration proceeds on the supposition that the linear agitations of a particle are incomparably smaller than the extent of an undulation. This is not strictly the case in any instance, and in many it is far from being true. In a pretty strong twang of a harpsichord wire, the agitation of a particle may be near the 50th part of the extent of the undulation. This must disturb the regularity of the motion, and cause the agitations in the remote undulations to differ from those in the first pulse. In the explosion of a cannon, the breaking of an exhausted bottle, and many instances which may be given, the agitations are still greater. The commentators on Newton's *Principia*, Le Sueur and Jacquier, have shown, and Euler more clearly, that when the original agitations are very violent, the particles of air will acquire a subordinate vibration compounded with the regular cycloidal vibration, and the progress of the pulses will be somewhat more rapid; but the intricacy of the calculus is so great, that they have not been able to determine with any tolerable precision what the change of velocity will be.

 All

Undulation of Air.

333 It is strengthened by comparing the sound of a cannon near and at a distance.

All this, however, is fully confirmed by experiment on sounds. The sound of a cannon at 10 or 20 miles distance does not in the least resemble its sound when near. In this case it is a loud instantaneous crack, to which we can assign no musical pitch: at a distance, it is a grave sound, of which we can tell the note; and it begins softly, swells to its greatest loudness, and then dies away growling. The same may be said of a clap of thunder, which we know to be a loud snap of still less duration. It is highly probable that the appreciable tone which those distant sounds afford are produced by the continuance of these subordinate vibrations which are added together and fortified in the successive pulses, though not perceptible in the first, in a way somewhat resembling the resonance of a musical chord. Newton's explanation gathers evidence therefore from this circumstance. And we must further observe, that all elastic bodies tremble or vibrate almost precisely as a pendulum swinging in a cycloid, unless their vibrations are uncommonly violent; in which case they are quickly reduced to a moderate quantity by the resistance of the air. The only very loud sounds which we can produce in this way are from great bells; and in these the utmost extent of the vibration is very small in comparison with the breadth of the pulse. The velocity of these sounds has not been compared with that of cannon, or perhaps it would be found less, and an objection against Newton's determination removed. He gives 969 feet per second, Experiment 1142.

334 The agitation in all probability in the successive pulses assumes a cycloidal form.

But it is also very probable, that in the propagation through the air, the agitation gradually and rapidly approaches to this regular cycloidal form in the successive pulses, in the same way as we observe that whatever is the form of agitation in the middle of a smooth pond of water, the spreading circles are always of one gentle form without asperities. In like manner, into whatever form we throw a stretched cord by the twang which we give it, it almost immediately makes smooth undulations, keeping itself in the shape of an elongated trochoid. Of this last we can demonstrate the necessity, because the case is simple. In the wave, the investigation is next to impossible; but we see the fact. We may therefore presume it in air. And accordingly we know that any noise, however abrupt and jarring, near at hand, is smooth at a distance. Nothing is more rough and harsh than the scream of a heron; but at half a mile's distance it is soft. The ruffle of a drum is also smooth at a distance

Plate CCCCVI.

Fig. 72. shows the successive situations of the particles of a row. Each line of the figure shows the same particles marked with the same letters; the first particle *a* being supposed to be removed successively from its quiescent situation and back to it again. The mark × is put on that part of each line where the agitated particles are at their natural distances, and the air is of the natural density. The mark ı is put where the air is most of all compressed, and : where it is most of all dilated; the curve line drawn through the lowest line of the figure is intended to represent the density in every point, by drawing ordinates to it from the straight line: the ordinates below the line indicate a rarity, and those above the line a density, greater than common.

It appears that when *a* has come back to its natural situation, the part of greatest density is between the particles · and *k*, and the greatest rarity between *c* and *d*.

We have only to add, that the velocity of this propagation depends on the elasticity and density of the fluid. If these vary in the same proportion, that is, if the fluid has its elasticity proportional to its density, the velocity will remain the same. If the elasticity or density alone be changed, the velocity of the undulations will change in the direct subduplicate ratio of the elasticity and the inverse subduplicate ratio of the density; for should the elasticity be quadrupled, the quantity of motion produced by it in any given time will be quadrupled. This will be the case if the velocity be doubled; for there would then be double the number of particles doubly agitated. Should the density be quadrupled, the elasticity remaining the same, the quantity of motion must remain the same. This will be the case if the velocity be reduced to one half; for this will propagate half the agitation to half the distance, which will communicate it to twice the number of particles, and the quantity of motion will remain the same. The same may be said of other proportions, and therefore $V=\frac{\sqrt{E}}{\sqrt{D}}$. Therefore a change in the barometer will not affect the velocity of the undulations in air, but they will be accelerated by heat, which diminishes its density, or increases its elasticity. The velocity of the pulses in inflammable air must be at least thrice as great, because its density is but one-tenth of that of air when the elasticity of both are the same.

335 Further considerations of aerial pulses as they really occur.

Let us now attend a little to the propagation of aerial pulses as they really happen; for this hypothesis of a single row of particles is nowhere to be observed.

Suppose a sphere A, fig. 73. filled with condensed air, and that the vessel which contains it is suddenly annihilated. The air must expand to its natural dimensions, suppose BCD. But it cannot do this without pressing aside the surrounding air. We have seen that in any single row of particles this cannot be at once diffused to a distance, but must produce a condensation in the air adjoining; which will be gradually propagated to a distance. Therefore this sphere BCD of the common density will form round it a shell, bounded by EFG, of condensed air. Suppose that at this instant the inner air BCD becomes solid. The shell of condensed air can expand only outwards. Let it expand till it is of the common density, occupying the shell HIK. This expansion, in like manner, must produce a shell of condensed air without it: at this instant let HIK become solid. The surrounding shell of condensed air can expand only outward, condensing another shell without it. It is plain that this must go on continually, and the central agitation will be gradually propagated to a distance in all directions. But, in this process, it is not the same numerical particles that go to a distance. Those of the original sphere go no further than BCD, those of the next shell go no further than HIK, &c. Farther, the expansion outwards of any particle will be more moderate as the diffusion advances; for the whole motion of each shell cannot exceed the original quantity of motion; and the number of particles in each successive shell increases as the surface, that is, as the square of the distance from the centre: therefore the agitation of the particles will decrease in the same ratio, or will be in the inverse duplicate ratio of the distance from the centre. Each successive shell, therefore, contains the same quantity of motion, and the successive agitations of the particles of any row

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row out from the centre will not be equal to the original agitation, as happens in the solitary row. But this does not affect the velocity of the propagation, because all agitations are propagated equally fast.

We supposed the air A to become solid as soon as it acquired the common density; but this was to facilitate the conception of the diffusion. It does not stop at this bulk; for while it was denser it had a tendency to expand. Therefore each particle has attained this distance with an accelerated motion. It will, therefore, continue this motion like a pendulum that has passed the perpendicular, till it is brought to rest by the air without it; and it is now rarer than common air, and collapses again by the greater elasticity of the air without it. This outward air, therefore, in regaining its natural density, must expand both ways. It expands towards the centre, following the collapsing of the air within it; and it expands outwards, condensing the air beyond it. By expanding inwards, it will again condense the air within it, and this will again expand; a similar motion happens in all the outward shells; and thus there is propagated a succession of condensed and rarefied shells of air, which gradually swell to the greatest distance.

It may be demonstrated, that when the central air has for the second time acquired the natural density, it will be at rest, and be disturbed no more; and that this will happen to all the shells in succession. But the demonstration is much too intricate for this place; we must be contented with pointing out a fact perfectly analogous. When we drop a small pebble into water, we see it produce a series of circular waves, which go along the surface of smooth water to a great distance, becoming more and more gentle as they recede from the centre; and the middle, where the agitation was first produced, remains perfectly smooth, and this smoothness extends continually; that is, each wave when brought to a level remains at rest. Now these waves are produced and propagated by the depression and elevation made at the centre. The elevation tends to diffuse itself; and the force with which each particle of water is actuated is a force acting directly up and down, and is proportional to the elevation or depression of the particle. This hydrostatical pressure operates precisely in the same way as the condensation and rarefaction of the air; and the mathematical investigation of the propagation of the circular undulations on smooth water is similar in every step to that of the propagation of the spherical waves in still air. For this we appeal to Newton's *Principia*, or to Euler's *Opuscula*, where he gives a very beautiful investigation of the velocity of the aerial pulses; and to some memoirs of de la Grange in the collections of the academies of Berlin and Turin. These two last authors have made the investigation as simple as seems possible, and have freed it from every objection which can be stated against the geometrical one of their great teacher Newton.

336 Application of the fact of dropping a pebble into water.

337 The waves of water are useful for explaining those of air.

Having said this much on the similarity between the waves on water and the aerial undulations, we shall have recourse to them, as affording us a very sensible object to represent many affections of the other which it would be extremely difficult to explain. We neither see nor feel the aerial undulations; and they behoved, therefore, to be described very abstractedly and imperfectly. In the watery wave there is no permanent progressive motion of the water from the centre. Throw a small bit of cork on the surface, and it will be observed to popple up and down without the least motion outwards. In like manner, the particles of air are only agitated a very little outwards and inwards; which motion is communicated to the particles beyond them, while they themselves come to rest, unless agitated afresh; and this agitation of the particles is inconceivably small. Even the explosion of a cannon at no great distance will but gently agitate a feather, giving it a single impulse outwards, and immediately after another inwards or towards the cannon. When a harpsichord wire is forcibly twanged at a few feet distance, the agitation of the air is next to insensible. It is not, however, nothing; and it differs from that in a watery wave by being *really* outwards and inwards. In consequence of this, when the condensed shell reaches an elastic body, it impels it slightly. If its elasticity be such as to make it acquire the opposite shape at the instant that the next agitation and condensed shell of air touches it, its agitation will be doubled, and a third agitation will increase it, and so on, till it acquire the agitation competent to that of the shell of air which reaches it, and it is thrown into *sensible* vibration, and gives a sound extremely faint indeed, because the agitation which it acquires is that corresponding to a shell of air considerably removed from the original string. Hence it happens that a musical chord, pipe, or bell, will cause another to resound, whose vibrations are isochronous with its own; or if the vibrations of the one coincides with every second, or third, or fourth, &c. of the other; just as we can put a very heavy pendulum into sensible motion by giving it a gentle puff with the breath at every vibration, or at every second, third, or fourth, &c. A drum struck in the neighbourhood of another drum will agitate it *very sensibly*; for here the stroke depresses a very considerable surface, and produces an agitation of a considerable mass of air: it will even agitate the surface of stagnant water. The explosion of a cannon will even break a neighbouring window. The shell of condensed air which comes against the glass has a great surface and a great agitation: the best security in this case is to throw up the sash; this admits the condensed air into the room, which acts on the inside of the window, balancing part of the external impulse.

338 For waves of air and of water are in many respects very similar.

It is demonstrated in every elementary treatise of natural philosophy, that when a wave on water meets any plane obstacle, it is reflected by it from a centre equally removed behind the obstacle; that waves radiating from the focus of a parabola are reflected in waves perpendicular to its axis; that waves radiating from one focus of an ellipse are made to converge to the other focus, &c. &c. All this may be affirmed of the aerial undulations; that when part of a wave gets through a hole in the obstacle, it becomes the centre of a new series of waves; that waves bend round the extremities of an obstacle: all this happens in the aerial undulations. And lastly, that when the surface of water is thrown into regular undulations by one agitation, another agitation in another place will produce other regular waves, which will cross the former without disturbing them in the smallest degree. The same thing happens in air; and experiments may be made on water which will illustrate in the most perfect manner many other affections of the aerial pulses, which we should otherwise conceive very imperfectly. We would recom-

Undulation of Air. recommend to our curious readers to make some of these experiments in a large vessel of milk. Take a long and narrow plate of lead, which, when set on the bottom of the vessel will reach above the surface of the milk; bend this plate into a parabola, elliptical or other curve. Make the undulations by dropping milk on the focus from a small pipe, which will cause the agitations to succeed with rapidity, and then all that we have said will be most distinctly seen, and the experiment will be very amusing and instructive, especially to the musical reader.

339 Caution to the supporters of æthers, animal spirits, &c. We would now request all who make or read explanations of natural phenomena by means of vibrations of ethers, animal spirits, nervous fluids, &c. to fix their attention on the nature of the agitation in one of these undulations. Let him consider whether this can produce the phenomenon, acting as any matter must act, by impulse or by pressure. If he sees that it can produce the phenomenon, he will be able to point out the very motion it will produce, both in quantity and direction, in the same manner as Sir Isaac Newton has pointed out all the irregularities of the moon's motion produced by the disturbing force of the sun. If he cannot do this, he fails in giving the first evidence of a mechanical explanation by the action of an elastic vibrating fluid. Let him then try to point out some palpable connection between the general phenomena of elastic undulations and the phenomenon in question; this would show an accompaniment to have at least some probability. It is thus only we learn that the undulations of air produce sound: we cannot tell how they affect the mechanism of the ear; but we see that the phenomena of sound always accompany them, and that certain modifications of the one are regularly accompanied by certain modifications of the other. If we cannot do this neither, we have derived neither explanation nor illustration from the elastic fluid. And lastly, let him remember that even if he should be able to show the competency of this fluid to the production of the phenomenon, the whole is still an hypothesis, because we do not know that such a fluid exists.

340 The folly of appealing to such unknown substances. We will venture to say, that whoever will proceed in this prudent manner will soon see the futility of most of the explanations of this kind which have been given. They are unfit for any but consummate mathematicians; for they alone really understand the mechanism of aerial undulations, and even they speak of them with hesitation as a thing but imperfectly understood. But even the unlearned in this science can see the incompatibility of the hypotheses with many things which they are brought to explain. To take an instance of the conveyance of sensation along the nerves; an elastic fluid is supposed to occupy them, and the undulations of this fluid are thought to be propagated along the nerves. Let us just think a little how the undulations would be conveyed along the surface of a canal which was completely filled up with reeds and bulrushes, or let us make the experiment on such a canal: we may rest assured that the undulations in the one case will resemble those in the other; and we may see that in the canal there will be no regular or sensible propagation of the waves.

Let these observations have their influence, along with others which we have made on other occasions, to wean our readers from this fashionable proneness to introduce invisible fluids and unknown vibrations into our physical discussions. They have done immense, and we fear irreparable, mischief in science; and there is but one phenomenon that has ever received any explanation by their means. Air's Pressure.

This may suffice for a loose and popular account of aerial undulations; and with it we conclude our account of the motion, impulse, and resistance of air.

We shall now explain a number of natural appearances, depending on its pressure and elasticity, appearances not sufficiently general, or too complicated for the purposes of argument, while we were employed in the investigation of these properties, but too important to be passed over in silence.

It is owing to the pressure of the atmosphere that two surfaces which accurately fit each other cohere with such force. This is a fact familiarly known to the glass-grinders, polishers of marble, &c. A large lense or speculum, ground on its tool till it becomes very smooth, requires more than any man's strength to separate it directly from the tool. If the surface is only a square inch, it will require 15 pounds to separate them perpendicularly, though a very moderate force will make them slide along each other. But this cohesion is not observed unless the surfaces are wetted or smeared with oil or grease; otherwise the air gets between them, and they separate without any trouble. That this cohesion is owing to the atmospheric pressure, is evident from the ease with which the plates may be separated in an exhausted receiver. 341 The air's pressure occasions the cohesion of two surfaces accurately fitting each other;

To the same cause we must ascribe the very strong adhesion of snails, periwinkles, limpets, and other univalve shells, to the rocks. The animal forms the rim of its shell, so as to fit the shape of the rock to which it intends to cling. It then fills its shell (if not already filled by its own body) with water. In this condition it is evident that we must act with a force equal to 15 pounds for every square inch of touching surface before we can detach it. This may be illustrated by filling a drinking glass to the brim with water; and having covered it with a piece of thin wet leather, whelm it on a table, and then try to pull it straight up; it will require a considerable force. But if we expose a snail adhering to a stone in the exhausted receiver, we shall see it drop off by its own weight. In the same manner do the remora, the polypus, the lamprey, and many other animals, adhere with such firmness. Boys frequently amuse themselves by pulling out large stones from the pavement by means of a circle of stiff wetted leather fastened to a string. It is owing to the same cause that the bivalve shell fishes keep themselves so firmly shut. We think the muscular force of an oyster prodigious, because it requires such force to open it; but if we grind off a bit of the convex shell, so as to make a hole in it, though without hurting the fish in the smallest degree, it opens with great ease, as it does also *in vacuo*. 342 And the adhesion of snails, &c. to rocks.

The pressure of the air, operating in this way contributes much to the cohesion of bodies, where we do not suspect its influence. The tenacity of our mortars and cements would frequently be ineffectual without this assistance. 343 Other effects of the air's pressure.

It is owing to the pressure of the atmosphere that a cask will not run by the cock unless a hole be opened in some other part of the cask. If the cask is not quite full,

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ful, some liquor indeed will run out, but it will stop as soon as the diminished elasticity of the air above the liquor is in equilibrio (together with the liquor) with the atmospheric pressure. In like manner, a teapot must have a small hole in its lid to ensure its pouring out the tea. If indeed the hole in the cask is of large dimensions, it will run without any other hole, because air will get in at the upper side of the hole while the liquor runs out by the lower part of it.

On the same principle depends the performance of an instrument used by the spirit dealers for taking out a sample of their spirits. It consists of a long tinplate tube AB (fig. 57.), open atop at A, and ending in a small hole at B. The end B is dipped into the spirits, which rises into the tube; then the thumb is clapt on the mouth A, and the whole is lifted out of the cask. The spirit remains in it till the thumb be taken off; it is then allowed to run into a glass for examination.

Plate CCCCV.

344 Why frosts instantly occasion a scarcity of water.

It seems principally owing to the pressure of the air that frosts immediately occasion a scantiness of water in our fountains and wells. This is erroneously accounted for, by supposing that the water freezes in the bowels of the earth. But this is a great mistake: the most intense frost of a Siberian winter would not freeze the ground two feet deep; but a very moderate frost will consolidate the whole surface of a country, and make it impervious to the air; especially if the frost has been preceded by rain, which has soaked the surface. When this happens, the water which was filtering through the ground is all arrested and kept suspended in its capillary tubes by the pressure of the air, in the very same manner as the spirits are kept suspended in the instrument just now described by the thumb's shutting the hole A. A thaw melts the superficial ice, and allows the water to run in the same manner as the spirits run when the thumb is removed.

345 The necessity of common air to animal life.

Common air is necessary for supporting the lives of most animals. If a small animal, such as a mouse or bird, be put under the receiver of an air-pump, and the air be exhausted, the animal will quickly be thrown into convulsions and fall down dead; if the air be immediately readmitted, the animal will sometimes revive, especially if the rarefaction has been briskly made, and has not been very great. We do not know that any breathing animal can bear the air to be reduced to $\frac{1}{4}$ of its ordinary density, nor even $\frac{1}{3}$; nor have we good evidence that an animal will ever recover if the rarefaction is pushed very far, although continued for a very short time.

But the mere presence of the air is by no means sufficient for preserving the life of the animal; for it is found, that an animal shut up in a vessel of air cannot live in it for any length of time. If a man be shut up in a box, containing a wine hogshead of air, he cannot live in it much above an hour, and long before this he will find his breathing very unsatisfactory and uneasy. A gallon of air will support him about a minute. A box EF (fig. 58.) may be made, having a pipe AB inserted into its top, and fitted with a very light valve at B, opening upwards. This pipe sends off a lateral branch aDdC, which enters the box at the bottom, and is also fitted with a light valve at C opening upwards. If a person breathe through the pipe, keeping his nostrils shut, it is evident that the air which he expires will not enter the box by the hole B, nor return through the pipe CDd; and by this contrivance he will gradually employ the whole air of the box. With this apparatus experiments can be made without any risk or inconveniency, and the quantity of air necessary for a given time of easy breathing may be accurately ascertained.

How the air of our atmosphere produces this effect, is a question which does not belong to mechanical philosophy to investigate or determine. We can, however, affirm, that it is neither the pressure nor the elasticity of the air which is immediately concerned in maintaining the animal functions. We know that we can live and breathe with perfect freedom on the tops of the highest mountains. The valley of Quito in Peru, and the country round Gondar in Abyssinia, are so far elevated above the surface of the ocean, that the pressure and the elasticity of the air are one-third less than in the low countries; yet these are populous and healthy places. And, on the other hand, we know, that when an animal has breathed in any quantity of air for a certain time without renewal, it will not only be suffocated, but another animal put into this air will die immediately; and we do not find either the pressure or elasticity of the air remarkably diminished: it is indeed diminished, but by a very small quantity. Restoring the former pressure and elasticity has not the smallest tendency to prevent the death of the animal: for an animal will live no longer under a receiver that has its mouth inverted on water, than in one set upon the pump-plate covered with leather. Now when the receiver is set on water, the pressure of the atmosphere acts completely on the included air, and preserves it in the same state of elasticity.

346 The nature of air when it has maintained animal functions is quite altered.

In short, it is known that the air which has already served to maintain the animal functions has its chemical and alimentary properties completely changed, and is no longer fit for this purpose. So much of any mass of air as has really been thus employed is changed into what is called *fixed air* by Dr Black, or *carbonic acid* by the chemists of the Lavoisierian school. Any person may be convinced of this by breathing or blowing through a pipe immersed in lime water. Every expiration will produce white clouds on the water, till all the lime which it contains is precipitated in the form of pure chalk. In this case we know that the lime has combined with the fixed air.

347 Hales's experiments to restore its former qualities, &c.

The celebrated Dr Stephen Hales made many experiments, with a view to clear the air from the noxious vapour which he supposed to be emitted from the lungs.

He made use of the apparatus which we have been just now mentioning; and he put several diaphragms *ff. ff.* &c. of thin woollen stuff into the box, and moistened them with various liquids. He found nothing so efficacious as a solution of potash. We now understand this perfectly. If the solution is not already saturated with fixed air, it will take it up as fast as it is produced, and thus will purify the air: a solution of caustic alkali therefore will have this effect till it is rendered quite mild.

348 How it comes to be changed by breathing, and the nature of inspiration, &c.

These experiments have been repeated, and varied in many circumstances, in order to ascertain whether this fixed air was really emitted by the lungs, or whether the inspired air was in part changed into fixed air by its combination with some other substance. This is a question which comes properly in our way, and which the

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the doctrines of pneumatics enable us to answer. If the fixed air be emitted in substance from the lungs, it does not appear how a renewal of the air into which it is emitted is necessary: for this does not hinder the subsequent emission; and the bulk of the air would be increased by breathing in it, viz. by the bulk of all the fixed air emitted; but, on the contrary, it is a little diminished. We must therefore adopt the other opinion; and the discoveries in modern chemistry enable us to give a pretty accurate account of the whole process. Fixed air is acknowledged to be a compound, of which one ingredient is found to constitute about $\frac{1}{4}$ of the whole atmospheric fluid; we mean vital air or the oxygene of Lavoisier. When this is combined with phlogiston, according to the doctrine of Stahl, or with charcoal, according to Lavoisier, the result is fixed air or carbonic acid. The change therefore which breathing makes on the air is the solution of this matter by vital air; and the use of air in breathing is the carrying off this noxious principle in the way of solution. When therefore the air is already so far saturated as not to dissolve this substance as fast as it is secreted, or must be secreted in the lungs, the animal suffers the pain of suffocation, or is otherwise mortally affected. Suffocation is not the only consequence; for we can remain for a number of seconds without breathing, and then we begin to feel the true pain of suffocation; but those who have been instantaneously struck down by an inspiration of fixed air, and afterwards recovered to life, complained of no such pain, and seemed to have suffered chiefly by a nervous affection. It is said (but we will not vouch for the truth of it), that a person may safely take a full inspiration of fixed air, if the passages of the nose be shut; and that unless these nerves are stimulated by the fixed air, it is not instantaneously mortal. But these are questions out of our present line of inquiry. They are questions of physiology, and are treated of in other places of this work. See ANATOMY and PHYSIOLOGY; see also LUNGS and RESPIRATION. Our business is to explain in what manner the pressure and elasticity of the air, combined with the structure and mechanism of the body, operate in producing this necessary secretion and removal of the matter discharged from the lungs in the act of breathing.

It is well ascertained, that the secretion is made from the mass of blood during its passage through the lungs. The blood delivered into the lungs is of a dark blackish colour, and it is there changed into a florid red. In the lungs it is exposed to the action of the air in a prodigiously extended surface: for the lungs consist of an inconceivable number of small vessels or bladders, communicating with each other and with the windpipe. These are filled with air in every inspiration. These vessels are everywhere in contact with minute blood-vessels. The blood does not *in toto* come into immediate contact with the air; and it would seem that it is only the thin serous part of it which is acted on by the air at the mouths of the vessels or pores, where it stands by capillary attraction. Dr Priestley found, that venous blood inclosed in thin bladders and other membranes was rendered florid by keeping the bladders in contact with abundance of pure vital air. We know also, that breath is moist or damp, and *must* have acquired this moisture in the lungs. It is immaterial whether this secretion of water or lymph (as the anatomists call it) be furnished by mere exudation through simple pores, or by a vascular and organic secretion; in either case, some ingredient of the blood comes in contact with air in the lungs, and there unites with it. This is farther confirmed, by observing, that all breathing animals are warmer than the surrounding medium, and that by every process in which fixed air is formed from vital air heat is produced. Hence this solution in air of something from the blood has been assigned by many as the source of animal heat. We touch on these things in a very transitory way in this place, only in order to prove that, for the support of animal life, there must be a very extensive application of air to the blood, and that this is made in the lungs.

The question before us in this place is, How is this brought about by the weight and elasticity of the air? This is done in two ways; by the action of the muscles of the ribs, and by the action of the diaphragm and other muscles of the abdomen. The thorax or chest is a great cavity, completely filled by the lungs. The sides of this cavity are formed by the ribs. These are crooked or arched, and each is moveable round its two ends, one of them being inserted into the vertebræ of the back, and the other into the sternum or breast-bone. The rib turns in a manner resembling the hand[illegible] drawer. The inspection of fig. 59. will illustrat[illegible] matter a little. Suppose the curves *a c e*, *b k f*, *c l g*, &c. to represent the ribs moveable round the extremities. Each succeeding rib is more bent than the one above it, and this curvature is both in the vertical and horizontal direction. Suppose each so broad as to project a little over its inferior like the tiles of a roof. It is evident, that if we take the lower one by its middle, and draw it out a little, moving it round the line *n p*, it will bring out the next *d m h* along with it. Also, because the distance of the middle point *o* from the axis of motion *n p* is greater than the distance of *m* from the axis *d h*, and because *o* will therefore describe a portion of a larger circle than *m* does, the rib *n o p* will slide up a little under the rib *d m h*, or the rib *d m h* will overlap *n o p* a little more than before; the distance *o m* will therefore be diminished. The same must happen to all the superior ribs; but the change of distance will be less and less as we go upwards. Now, instead of this great breadth of the ribs overlapping each other, suppose each inferior rib connected with the one above it by threads or fibres susceptible of contraction at the will of man. The articulations *e*, *a*, of the first or upper rib with the spine and sternum are so broad and firm, that this rib can have little or no motion round the line *a e*; this rib therefore is as a fixture for the ends of all the contracting fibres: therefore, whenever the fibres which connect the second rib with the first rib contract, the second must rise a little, and also go outward, and will carry the lower ribs along with it; the third rib will rise still farther by the contraction of the muscles which connect it with the second, and so on: and thus the whole ribs are raised and thrown outward (and a little forward, because the articulation of each with the spine is considerably higher than that with the sternum), and the capacity of the thorax is enlarged by the contraction of its muscular covering. The direction of the muscular fibres is very oblique to the direction of the circular motion which it produces; from which circumstance it follows, that a very minute contraction of the muscles

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muscles produces all the motion which is necessary. This indeed is not great; the whole motion of the lowest ribs is less than an inch in the most violent inspiration, and the whole contraction of the muscles of the 12 ribs does not exceed the eighth part of an inch, even supposing the intercostal muscles at right angles to the ribs; and being oblique, the contraction is still less (see Borelli, Sabatier, Monro, &c.) It would seem, that the intensity of the contractive power of a muscular fibre is easily obtained, but that the space through which it can be exerted is very limited; for in most cases nature places the muscles in situations of great mechanical disadvantage in this respect, in order to procure other conveniences.

But this is not the whole effect of the contraction of the intercostal muscles: since the compound action of the two sets of muscles, which cross each other from rib to rib like the letter X, is nearly at right angles to the rib, but is oblique to its plane, it tends to push the ribs closer on their articulations, and thus to press out the two pillars on which they are articulated. Thus, supposing *a f* (fig. 60.) to represent the section of one of

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the vertebræ of the spine, and *c d* a section of the sternum, and *a b c*, *f e d*, two opposite ribs, with a lax thread *b e* connecting them. If this thread be pulled upwards by the middle *g* till it is tight, it will tend to pull the points *b* [illegible] *e* nearer to each other, and to press the verte[illegible] *a f* and the sternum *c d* outwards. The spine being the chief pillar of the body, may be considered as immoveable in the present instance. The sternum is sufficiently susceptible of motion for the present purpose. It remains almost fixed atop at its articulation with the first rib, but it gradually yields below; and thus the capacity of the thorax is enlarged in this direction also. The whole enlargement of the diameters of the thorax during inspiration is very small, not exceeding the fiftieth part of an inch in ordinary cases. This is easily calculated. Its quiescent capacity is about two cubic feet, and we never draw in more than 15 inches. Two spheres, one of which holds 2 cubic feet and the other 2 feet and 15 inches, will not differ in diameter above the fiftieth part of an inch.

The other method of enlarging the capacity of the thorax is very different. It is separated from the abdomen by a strong muscular partition called the *diaphragm*, which is attached to firm parts all around. In its quiescent or relaxed state it is considerably convex upwards, that is, towards the thorax, rising up into its cavity like the bottom of an ordinary quart bottle, only not so regular in its shape. Many of its fibres tend from its middle to the circumference, where they are inserted into firm parts of the body. Now suppose these fibres to contract. This must draw down its middle, or make it flatter than before, and thus enlarge the capacity of the thorax.

Physiologists are not well agreed as to the share which each of these actions has in the operation of enlarging the thorax. Many refuse all share of it to the intercostal muscles, and say that it is performed by the diaphragm alone. But the fact is, that the ribs are really observed to rise even while the person is asleep; and this cannot possibly be produced by the diaphragm, as these anatomists assert. Such an opinion shows either ignorance or neglect of the laws of pneumatics. If the capacity of the thorax were enlarged only by drawing down the diaphragm, the pressure of the air would compress the ribs, and make them descend. And the simple laws of mechanics make it as evident as any proposition in geometry, that the contraction of the intercostal muscles *must* produce an elevation of the ribs and enlargement of the thorax; and it is one of the most beautiful contrivances of nature. It depends much on the will of the animal what share each of these actions shall have. In general, the greatest part is done by the diaphragm; and any person can breathe in such a manner that his ribs shall remain motionless; and, on the contrary, he can breathe almost entirely by raising his chest. In the first method of breathing, the belly rises during inspiration, because the contraction of the diaphragm compresses the upper part of the bowels, and therefore squeezes them outwards; so that an ignorant person would be apt to think that the breathing was performed by the belly, and that the belly is inflated with the air. The strait lacing of the women impedes the motion of the ribs, and changes the natural habit of breathing, or brings on an unnatural habit. When the mind is depressed, it is observed that the breathing is more performed by the muscles of the thorax; and a deep sigh is always made in this way.

Effects of Air's pressure.

These observations on the manner in which the capacity of the chest can be enlarged were necessary, before we can acquire a just notion of the way in which the mechanical properties of air operate in applying it to the mass of blood during its passage through the lungs. Suppose the thorax quite empty, and communicating with the external air by means of the trachea or windpipe, it would then resemble a pair of bellows. Raising the boards corresponds to the raising of the ribs; and we might imitate the action of the diaphragm by forcibly pulling outwards the folded leather which unites them. Thus their capacity is enlarged, and the air rushes in at the nozzle by its weight in the same manner as water would do. The thorax differs from bellows only in this respect, that it is filled by the lungs, which is a vast collection of little bladders, like the holes in a piece of fermented bread, all communicating with the trachea, and many of them with each other. When the chest is enlarged, the air rushes into them all in the same manner as into the single cavity of an empty thorax. It cannot be said with propriety that they are inflated: all that is done is the *allowing* the air to come in. At the same time, as their membranous covering must have some thickness, however small, and some elasticity, it is not unlikely that, when compressed by expiration, they tend a little to recover their former shape, and thus aid the voluntary action of the muscles. It is in this manner that a small bladder of caoutchouc swells again after compression, and fills itself with air or water. But this cannot happen except in the most minute vesicles: those of sensible bulk have not elasticity enough for this purpose. The lungs of birds, however, have some very large bladders, which have a very considerable elasticity, and recover their shape and size with great force after compression, and thus fill themselves with air. The respiration of these animals is considerably different from that of land animals, and their muscles act chiefly in expiration. This will be explained by and by as a curious variety in the pneumatic instrument.

This account of the manner in which the lungs are filled

filled with air does not seem agreeable to the notions we entertain of it. We seem to suck in the air; but although it be true that we act, and exert force, in order to get air into our lungs, it is not by our action, but by external pressure, that it does come in. If we apply our mouth to the top of a bottle filled with water, we find that no draught, as we call it, of our chest will suck in any of the water; but if we suck in the very same manner at the end of a pipe immersed in water, it follows immediately. Our interest in the thing makes us connect in imagination our own action with the effect, without thinking on the many steps which may intervene in the train of natural operations; and we consider the action as the immediate cause of the air's reception into the lungs. It is as if we opened the door, and took in by the hand a person who was really pushed in by the crowd without. If an incision be made into the side of the thorax, so that the air can get in by that way, when the animal acts in the usual manner, the air will really come in by this hole, and fill the space between the lungs and thorax; but no air is sucked into the lungs by this process, and the animal is as completely suffocated as if the windpipe were shut up. And, on the other hand, if a hole be made into the lungs without communicating with the thorax, the animal will breathe through this hole, though the windpipe be stopped. This is successfully performed in cases of patients whose trachea is shut up by accident or by inflammation; only it is necessary that this perforation be made into a part of the lungs where it may meet with some of the great pulmonary passages; for if made into some remote part of a lobe, the air cannot find its way into the rest of the lungs through such narrow passages, obstructed too by blood, &c.

349 We take in air not by our own action, but by external pressure.

350 Nature of expiration

We have now explained, on pneumatical principles, the process of inspiration. The expiration is chiefly performed by the natural tone of the parts. In the act of inspiration the ribs were raised and drawn outwards in opposition to the elasticity of the solids themselves; for although the ribs are articulated at their extremities, the articulations are by no means such as to give a free and easy motion like the joints of the limbs. This is particularly the case in the articulations with the sternum, which are by no means fitted for motion. It would seem that the motion really produced here is chiefly by the yielding of the cartilaginous parts and the bending of the rib; when therefore the muscles which produced this effect are allowed to relax, the ribs again collapse. Perhaps this is assisted a little by the action of the long muscles which come down across the ribs without being inserted into them. These may draw them together a little, as we compress a loose bundle by a string.

In like manner, when the diaphragm was drawn down, it compressed the abdomen in opposition to the elasticity of all the viscera contained in it, and to the elasticity and tone of the teguments and muscles which surround it. When therefore the diaphragm is relaxed, these parts push it up again into its natural situation, and in doing this expel the air from the lungs.

351 It requires no effort.

If this be a just account of the matter, expiration should be performed without any effort. This accordingly is the case. We feel that, after having made an ordinary easy inspiration, it requires the continuance of the effort to keep the thorax in this enlarged state, and that all that is necessary for expiration is to cease to act. No person feels any difficulty in emptying the lungs; but weak people often feel a difficulty of inspiration, and compare it to the feeling of a weight on their breast; and expiration is the last motion of the thorax in a dying person.

But nature has also given us a mechanism by which we can expire, namely, the abdominal muscles; and when we have finished an ordinary and easy expiration, we can still expel a considerable bulk of air (nearly half of the contents of the lungs) by contracting the abdominal muscles. These, by compressing the body, force up its moveable contents against the diaphragm, and cause it to rise further into the thorax, acting in the same manner as when we expel the fæces *per anum*. When a person breathes out as much air as he can in this manner, he may observe that his ribs do not collapse during the whole operation.

352 A certain quantity of air necessary to keep the lungs of a natural size.

There seems then to be a certain natural unconstrained state of the vesicles of the lungs, and a certain quantity of air necessary for keeping them of this size. It is probable that this state of the lungs gives the freest motion to the blood. Were they more compressed, the blood vessels would be compressed by the adjoining vesicles; were they more lax, the vessels would be more crooked, and by this means obstructed. The frequent inspirations gradually change this air by mixing fresh air with it, and at every expiration carrying off some of it. In catarrhs and inflammations, especially when attended with suppuration, the small passages into the remote vessels are obstructed, and thus the renewal of air in them will be prevented. The painful feeling which this occasions causes us to expel the air with violence, shutting the windpipe, till we have exerted strongly with the abdominal muscles, and made a strong compression on the lower part of the thorax. We then open the passage suddenly, and expel the air and obstructing matter by violent coughing.

353 Process of breathing in birds.

We have said, that birds exhibit a curious variety in the process of breathing. The muscles of their wings being so very great, required a very extensive insertion, and this is one use of the great breast-bone. Another use of it is, to form a firm partition to hinder the action of these muscles from compressing the thorax in the act of flying: therefore the form of their chest does not admit of alternate enlargement and contraction to that degree as in land animals. Moreover, the muscles of their abdomen are also very small; and it would seem that they are not sufficient for producing the compression on the bowels which is necessary for carrying on the process of concoction and digestion. Instead of aiding the lungs, they receive help from them.

Plate CCCCV.

In an ostrich, the lungs consist of a fleshy part A, A (fig. 61.), composed of vesicles like those of land animals, and, like theirs, serving to expose the blood to the action of the air. Besides these, they have on each side four large bags B, C, D, E, each of which has an orifice G communicating with the trachea; but the second, C, has also an orifice H, by which it communicates with another bag F situated below the rest in the abdomen. Now, when the lungs are compressed by the action of the diaphragm, the air in C is partly expelled by the trachea through the orifice G, and partly driven through the orifice H into the bag F, which

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which is then allowed to receive it; because the same action which compresses the lungs enlarges the abdomen. When the thorax is enlarged, the bag C is partly supplied with fresh air through the trachea, and partly from the bag F. As the lungs of other animals resemble a common bellows, the lungs of birds resemble the smith's bellows with a partition; and anatomists have discovered passages from this part of the lungs into their hollow bones and quills. We do not know all the uses of this contrivance; and only can observe, that this alternate action must assist the muscles of the abdomen in promoting the motion of the food along the alimentary canal, &c. We can distinctly observe in birds that their belly dilates when the chest collapses, and *vice versa*, contrary to what we see in the land animals. Another use of this double passage may be to produce a circulation of air in the lungs, by which a compensation is made for the smaller surface of action on the blood: for the number of small vesicles, of equal capacity with these large bags, gives a much more extensive surface.

If we try to raise mercury in a pipe by the action of the chest alone, we cannot raise it above two or three inches; and the attempt is both painful and hazardous. It is painful chiefly in the breast, and it provokes coughing. Probably the fluids ooze through the pores of the vesicles by the pressure of the surrounding parts.

On the other hand, we can by expiration support mercury about five or six inches high: but this also is very painful, and apt to produce extravasation of blood. This seems to be done entirely by the abdominal muscles.

354 The operation of sucking,

The operation properly termed SUCKING is totally different from breathing, and resembles exceedingly the action of a common pump. Suppose a pipe held in the mouth, and its lower end immersed in water. We fill the mouth with the tongue, bringing it forward, and applying it closely to the teeth and to the palate; we then draw it back, or bend it downwards (behind) from the palate, thus leaving a void. The pressure of the air on the cheeks immediately depresses them, and applies them close to the gums and teeth; and its pressure on the water in the vessel causes it to rise through the pipe into the empty part of the mouth, which it quickly fills. We then push forward the tip of the tongue, below the water, to the teeth, and apply it to them all round, the water being above the tongue, which is kept much depressed. We then apply the tongue to the palate, beginning at the tip, and gradually going backward in this application. By this means the water is gradually forced backward by an operation similar to that of the gullet in swallowing. This is done by contracting the gullet above and relaxing it below, just as we would empty a gut of its contents by drawing our closed hand along it. By this operation the mouth is again completely occupied by the tongue, and we are ready for repeating the operation. Thus the mouth and tongue resemble the barrel and piston of a pump; and the application of the tip of the tongue to the teeth performs the office of the valve at the bottom of the barrel, preventing the return of the water into the pipe. Although usual, it is not absolutely necessary, to withdraw the tip of the tongue, making a void before the tongue. Sucking may be performed by merely separating the tongue gradually from the palate, beginning at the root. If we withdraw the tip of the tongue a very minute quantity, the water gets in and flows back above the tongue.

The action of the tongue in this operation is very powerful; some persons can raise mercury 25 inches: but this strong exertion is very fatiguing, and the soft parts are prodigiously swelled by it. It causes the blood to ooze plentifully through the pores of the tongue, fauces, and palate, in the same manner as if a cupping-glass and syringe were applied to them; and, when the inside of the mouth is excoriated or tender, as is frequent with infants, even a very moderate exertion of this kind is accompanied with extravasation of blood. When children suck the nurses breast, the milk follows their exertion by the pressure of the air on the breast; and a weak child, or one that withholds its exertions on account of pain from the above-mentioned cause, may be assisted by a gentle pressure of the hand on the breast: the infant pupil of nature, without any knowledge of pneumatics, frequently helps itself by pressing its face to the yielding breast.

In the whole of this operation the breathing is performed through the nostrils; and it is a prodigious distress to an infant when this passage is obstructed by mucus. We beg to be forgiven for observing by the way, that this obstruction may be almost certainly removed, for a little while, by rubbing the child's nose with any liquid of quick evaporation, or even with water.

355 And of drinking, which is very similar.

The operation in drinking is not very different from that in sucking: we have indeed little occasion here to suck, but we must do it a little. Dogs and some other animals cannot drink, but only lap the water into their mouths with their tongue, and then swallow it. The gallinaceous birds seem to drink very imperfectly; they seem merely to dip their head into the water up to the eyes till their mouth is filled with water, and then holding up the head, it gets into the gullet by its weight, and is then swallowed. The elephant drinks in a very complicated manner; he dips his trunk into the water, and fills it by making a void in his mouth: this he does in the contrary way to man. After having depressed his tongue, he begins the application of it to the palate at the root, and by extending the application forward, he expels the air by the mouth which came into it from the trunk. The process here is not very unlike that of the condensing syringe without a piston valve, described in n° 58, in which the external air (corresponding here to the air in the trunk) enters by the hole F in the side, and is expelled through the hole in the end of the barrel; by this operation the trunk is filled with water: then he lifts his trunk out of the water, and bringing it to his mouth, pours the contents into it, and swallows it. On considering this operation, it appears that, by the same process by which the air of the trunk is taken into the mouth, the water could also be taken in, to be afterwards swallowed: but we do not find, upon inquiry, that this is done by the elephant; we have always observed him to drink in the manner now described. In either way it is a double operation, and cannot be carried on any way but by alternately sucking and swallowing, and while one operation is going on the other is interrupted; whereas man can do both at the same time. Nature seems to delight in exhibiting to rational observers her inexhaustible variety of resources; for many insects, which drink with a trunk, drink without interruption: yet we

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do not call in question the truth of the aphorism, *Natura maxime simplex et semper sibi consona*, nor doubt but that, if the *whole* of her purpose were seen, we should find that her process is the simplest possible: for Nature, or Nature's God, is wise above our wisest thoughts, and simplicity is certainly the choice of wisdom: but alas! it is generally but a small and the most obvious part of her purpose that we can observe or appreciate. We seldom see this simplicity of nature stated to us, except by some system-maker, who has found a principle which somehow tallies with a considerable variety of phenomena, and then cries out, *Frustra fit per plura quod fieri potest per pauciora*.

356 Mode of keeping up a continued blast with a blow-pipe.

There is an operation similar to that of the elephant, which many find a great difficulty in acquiring, viz. keeping up a continued blast with a blow-pipe. We would desire our chemical reader to attend minutely to the gradual action of his tongue in sucking, and he will find it such as we have described. Let him attend particularly to the way in which the tip of the tongue performs the office of a valve, preventing the return of the water into the pipe: the same position of the tongue would hinder air from coming into the mouth. Next let him observe, that in swallowing what water he has now got lodged above his tongue, he continues the tip of the tongue applied to the teeth; now let him shut his mouth, keeping his lips firm together, the tip of the tongue at the teeth, and the whole tongue forcibly kept at a distance from the palate; bring up the tongue to the palate, and allow the tip to separate a little from the teeth; this will expel the air into the space between the fauces and cheeks, and will blow up the cheeks a little: then, acting with the tip of the tongue as a valve, hinder this air from getting back, and depressing the tongue again, more air (from the nostrils) will get into the mouth, which may be expelled into the space without the teeth as before, and the cheeks will be more inflated: continue this operation, and the lips will no longer be able to retain it, and it will ooze through as long as the operation is continued. When this has become familiar and easy, take the blow-pipe, and there will be no difficulty in maintaining a blast as uniform as a smith's bellows, breathing all the while through the nostrils. The only difficulty is the holding the pipe: this fatigues the lips; but it may be removed by giving the pipe a convenient shape, a pretty flat oval, and wrapping it round with leather or thread.

Another phenomenon depending on the principles already established, is the land and sea-breeze in the warm countries.

357 Nature of the land and sea breeze in warm countries.

We have seen that air expands exceedingly by heat; therefore heated air, being lighter than an equal bulk of cold air, must rise in it. If we lay a hot stone in the sunshine in a room, we shall observe the shadow of the stone surrounded with a fluttering shadow of different degrees of brightness, and that this flutter rises rapidly in a column above the stone. If we hold an extinguished candle near the stone, we shall see the smoke move towards the stone, and then ascend up from it. Now, suppose an island receiving the first rays of the sun in a perfectly calm morning; the ground will soon be warmed, and will warm the contiguous air. If the island be mountainous, this effect will be more remarkable; because the inclined sides of the hills will receive the light more directly: the midland air will therefore be most warmed: the heated air will rise, and that in the middle will rise fastest; and thus a current of air upwards will begin, which must be supplied by air coming in from all sides, to be heated and to rise in its turn; and thus the morning *sea-breeze* is produced, and continues all day. This current will frequently be reversed during the night, by the air cooling and gliding down the sides of the hills, and we shall have the *land-breeze*.

358 Circulation of air in mines.

It is owing to the same cause that we have a circulation of air in mines which have the mouths of their shafts of unequal heights. The temperature underground is pretty constant through the whole year, while that of the atmosphere is extremely variable. Now, suppose a mine having a long horizontal drift, communicating between two pits or shafts, and that one of these shafts terminates in a valley, while the other opens on the brow of a hill perhaps 100 feet higher. Let us further suppose it summer, and the air heated to 65°, while the temperature of the earth is but 45°; this last will be also the temperature of the air in the shafts and the drift. Now, since air expands nearly 24 parts in 10000 by one degree of heat, we shall have an odds of pressure at the bottom of the two shafts equal to nearly the 20th part of the weight of a column of air 100 feet high (100 feet being supposed the difference of the heights of the shafts). This will be about six ounces on every square foot of the section of the shaft. If this pressure could be continued, it would produce a prodigious current of air down the long shaft, along the drift, and up the short shaft. The weight of the air acting through 100 feet would communicate to it the velocity of 80 feet *per* second: divide this by $\sqrt{20}$, that is, by 4,5, and we shall have 18 feet *per* second for the velocity: this is the velocity of what is called a brisk gale. This pressure *would* be continued, if the warm air which enters the long shaft were cooled and condensed as fast as it comes in; but this is not the case. *It is however cooled* and condensed, and a current is produced sufficient to make an abundant circulation of air along the whole passage; and care is taken to dispose the shafts and conduct the passages in such a manner that no part of the mine is out of the circle. When any new lateral drift is made, the renewal of air at its extremity becomes more imperfect as it advances; and when it is carried a certain length, the air stagnates and becomes suffocating, till either a communication can be made with the rest of the mine, or a shaft be made at the end of this drift.

As this current depends entirely on the difference of temperature between the air below and that above, it must cease when this difference ceases. Accordingly, in the spring and autumn, the miners complain much of stagnation; but in summer they never want a current from the deep pits to the shallow, nor in the winter a current from the shallow pits to the deep ones. It frequently happens also, that in mineral countries the chemical changes which are going on in different parts of the earth make differences of temperature sufficient to produce a sensible current.

It is easy to see that the same causes must produce a current down our chimneys in summer. The chimney is colder than the summer air, and must therefore condense it, and it will come down and run out at the doors and windows. 359

359 The nature of what is called the draught in chimneys.

And this naturally leads us to consider a very important effect of the expansion and consequent ascent of air by chimneys.

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by heat, namely the drawing (as it is called) of chimneys. The air which has contributed to the burning of fuel must be intensely heated, and will rise in the atmosphere. This will also be the case with much of the surrounding air which has come very near the fire, although not in contact with it. If this heated air be made to rise in a pipe, it will be kept together, and therefore will not soon cool and collapse: thus we shall obtain a long column of light air, which will rise with a force so much the greater as the column is longer or more heated. Therefore the taller we make the chimney, or the hotter we make the fire, the more rapid will be the current, or the draught or suction, as it is injudiciously called, will be so much the greater. The ascensional force is the difference between the weight of the column of heated air in the funnel and a column of the surrounding atmosphere of equal height. We increase the draught, therefore, by increasing the perpendicular height of the chimney. Its length in a horizontal direction gives no increase, but, on the contrary, diminishes the draught by cooling the air before it gets into the effective part of the funnel. We increase the draught also by obliging all the air which enters the chimney to come very near the fuel; therefore a low mantle-piece will produce this effect; also filling up all the spaces on each side of the grate. When much air gets in above the fire, by having a lofty mantle-piece, the general mass of air in the chimney cannot be much heated. Hence it must happen that the greatest draught will be produced by bringing down the mantle-piece to the very fuel; but this converts a fire-place into a furnace, and by thus sending the whole air through the fuel, causes it to burn with great rapidity, producing a prodigious heat; and this producing an increase of ascensional force, the current becomes furiously rapid, and the heat and consumption of fuel immense. If the fire-place be a cube of a foot and a half, and the front closed by a door, so that all the air must enter through the bottom of the grate, a chimney of 15 or 20 feet high, and sufficiently wide to give passage to all the expanded air which can pass through the fire, will produce a current which will roar like thunder, and a heat sufficient to run the whole inside into a lump of glass.

All that is necessary, however, in a chamber fire-place, is a current sufficiently great for carrying up the smoke and vitiated air of the fuel. And as we want also the enlivening flutter and light of the fire, we give the chimney-piece both a much greater height and width than what is merely necessary for carrying up the smoke, only wishing to have the current sufficiently determinate and steady for counteracting any occasional tendency which it may sometimes have to come into the room. By allowing a greater quantity of air to get into the chimney, heated only to a moderate degree, we produce a more rapid renewal of the air of the room: did we oblige it to come so much nearer the fire as to produce the same renewal of the air in consequence of a more rapid current, we should produce an inconvenient heat. But in this country, where pit-coal is in general so very cheap, we carry this indulgence to an extreme; or rather we have not studied how to get all the desired advantages with economy. A much smaller renewal of air than we commonly produce is abundantly wholesome and pleasant, and we may have all the pleasure of the light and flame of the fuel at much less expence, by contracting greatly the passage into the vent. The best way of doing this is by contracting the brick-work on each side behind the mantle-piece, and reducing it to a narrow parallelogram, having the back of the vent for one of its long sides. Make an iron plate to fit this hole, of the same length, but broader, so that it may lie sloping, its lower edge being in contact with the foreside of the hole, and its upper edge leaning on the back of the vent. In this position it shuts the hole entirely. Now let the plate have a hinge along the front or lower edge, and fold up like the lid of a chest. We shall thus be able to enlarge the passage at pleasure. In a fire-place fit for a room of 24 feet by 18, if this plate may be about 18 inches long from side to side, and folded back within an inch or an inch and a half of the wall, this will allow passage for as much air as will keep up a very cheerful fire; and by raising or lowering this REGISTER, the fire may be made to burn more or less rapidly. A free passage of half an inch will be sufficient in weather that is not immoderately cold. The principle on which this construction produces its effect is, that the air which is in the front of the fire, and much warmed by it, is not allowed to get into the chimney, where it would be immediately hurried up the vent, but rises up to the ceiling and is diffused over the whole room. This double motion of the air may be distinctly observed by opening a little of the door and holding a candle in the way. If the candle be held near the floor, the flame will be blown into the room; but if held near the top of the door, the flame will be blown outward.

360 Description of a stove-grate or chapelle.

But the most perfect method of warming an apartment in these temperate climates, where we can indulge in the cheerfulness and sweet air produced by an open fire, is what we call a stove-grate, and our neighbours on the continent call a chapelle, from its resemblance to the chapels or oratories in the great churches.

In the great chimney-piece, which, in this case, may be made even larger than ordinary, is set a smaller one fitted up in the same stile of ornament, but of a size no greater than is sufficient for holding the fuel. The sides and back of it are made of iron (cast iron is preferable to hammered iron, because it does not so readily calcine), and are kept at a small distance from the sides and back of the main chimney-piece, and are continued down to the hearth, so that the ash-pit is also separated. The pipe or chimney of the stove grate is carried up behind the ornaments of the mantle-piece till it rises above the mantle-piece of the main chimney-piece, and is fitted with a register or damper-plate turning round a transverse axis. The best form of this register is that which we have recommended for an ordinary fire-place, having its axis or joint close at the front; so that when it is open or turned up, the burnt air and smoke striking it obliquely, are directed with certainty into the vent, without any risk of reverberating and coming out into the room. All the rest of the vent is shut up by iron plates or brick-work out of sight.

361 Effect of its construction.

The effect of this construction is very obvious. The fuel, being in immediate contact with the back and sides of the grate, heat them to a great degree, and they heat the air contiguous to them. This heated

air

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It is surprising to a person who does not consider it with skill how powerfully this grate warms a room. Less than one-fourth of the fuel consumed in an ordinary fire-place is sufficient; and this with the same cheerful blazing hearth and salutary renewal of air. It even requires attention to keep the room cool enough. The heat communicated to those parts in contact with the fuel is needlessly great; and it will be a considerable improvement to line this part with very thick plates of cast iron, or with tiles made of fire-clay which will not crack with the heat. These, being very bad conductors, will make the heat, ultimately communicated to the air, very moderate. If, with all these precautions, the heat should be found too great, it may be brought under perfect management by opening passages into the vent from the lateral spaces. These may be valves or trap-doors moved by rods concealed behind the ornaments.

Thus we have a fire-place under the most complete regulation, where we can always have a cheerful fire without being for a quarter of an hour incommoded by the heat; and we can as quickly raise our fire, when too low, by hanging on a plate of iron on the front, which shall reach as low as the grate. This in five minutes will blow up the fire into a glow; and the plate may be sent out of the room, or set behind the stove-grate out of sight.

The propriety of inclosing the ash-pit is not so obvious; but if this be not done, the light ashes, not finding a ready passage up the chimney, will come out into the room along with the heated air.

We do not consider in this place the various extraneous circumstances which impede the current of air in our chimneys and produce smoky houses: these will be treated of, and the methods of removing or remedying them, under the article SMOKE. We consider at present only the theory of this motion in general, and the modifications of its operation arising from the various purposes to which it may be applied.

362 Mode of warming apartments by stoves.

Under this head we shall next give a general account and description of the method of warming apartments by stoves. A STOVE in general is a fire-place shut up on all sides, having only a passage for admitting the air to support the fire, and a tube for carrying off the vitiated air and smoke; and the air of the room is warmed by coming into contact with the outside of the stove and flue. The general principle of construction, therefore, is very simple. The air must be made to come into as close contact as possible with the fire, or even to pass through it, and this in such quantities as just to consume a quantity of fuel sufficient for producing the heat required; and the stove must be so constructed, that both the burning fuel and the air which has been heated by it shall be applied to as extensive a surface as possible of furnace, all in contact with the air of the room; and the heated air within the stove must not be allowed to get into the funnel which is to carry it off till it is too much cooled to produce any considerable heat on the outside of the stove.

In this temperate climate no great ingenuity is necessary for warming an ordinary apartment; and stoves are made rather to please the eye as furniture than as economical substitutes for an open fire of equal calorific power. But our neighbours on the continent, and especially towards the north, where the cold of winter is intense and fuel very dear, have bestowed much attention on their construction, and have combined ingenious economy with every elegance of form. Nothing can be handsomer than the stoves of Fayencerie that are to be seen in French Flanders, or the Russian stoves at St Petersburgh, finished in stucco. Our readers will not, therefore, be displeased with a description of them. In this place, however, we shall only consider a stove in general as a subject of pneumatical discussion, and we refer our readers to the article STOVE for an account of them as articles of domestic accommodation.

363 General form of a stove.

The general form, therefore, of a stove, and of which all others are only modifications adapted to circumstances of utility or taste, is as follows:

Plate CCCCV.

MIKL (fig. 62.) is a quadrangular box of any size in the directions MI, IK. The inside width from front to back is pretty constant, never less than ten inches, and rarely extending to 20; the included space is divided by a great many partitions. The lowest chamber AB is the receptacle for the fuel, which lies on the bottom of the stove without any grate: this fire-place has a door AO turning on hinges, and in this door is a very small wicket P: the roof of the fire-place extends to within a very few inches of the farther end, leaving a narrow passage B for the flame. The next partition cC is about eight inches higher, and reaches almost to the other end, leaving a narrow passage for the flame at C. The partitions are repeated above, at the distance of eight inches, leaving passages at the ends, alternately disposed as in the figure; the last of them H communicates with the room vent. This communication may be regulated by a plate of iron, which can be slid across it by means of a rod or handle which comes through the side. The more usual way of shutting up this passage is by a sort of pan or bowl of earthen ware, which is whelmed over it with its brim resting in sand contained in a groove formed all round the hole. This damper is introduced by a door in the front, which is then shut. The whole is set on low pillars, so that its bottom may be a few inches from the floor of the room: it is usually placed in a corner, and the apartments are so disposed that their chimneys can be joined in stacks as with us.

Some straw or wood-shavings are first burnt on the hearth at its farther end. This warms the air in the stove, and creates a determined current. The fuel is then laid on the hearth close by the door, and pretty much piled up. It is now kindled; and the current being already directed to the vent, there is no danger of any smoke coming out into the room. Effectually to prevent this, the door is shut, and the wicket P opened. The air supplied by this, being directed to the middle or bottom of the fuel, quickly kindles it, and the operation goes on.

364 Aim and effects of this construction.

The aim of this construction is very obvious. The flame and heated air are retained as long as possible within the body of the stove by means of the long passages; and the narrowness of these passages obliges the flame to come in contact with every particle of soot, so as to consume it completely, and thus convert the whole combustible

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combustible matter of the fuel into heat. For want of this a very considerable portion of our fuel is wasted by our open fires, even under the very best management: the soot which sticks to our vents is very inflammable, and a pound weight of it will give as much if not more heat than a pound of coal. And what sticks to our vents is very inconsiderable in comparison with what escapes unconsumed at the chimney top. In fires of green wood, peat, and some kinds of pit-coal, nearly $\frac{1}{7}$ of the fuel is lost in this way; but in these stoves there is hardly ever any mark of soot to be seen; and even this small quantity is produced only after lighting the fires. The volatile inflammable matters are expelled from parts much heated indeed, but not so hot as to burn; and some of it charred or half-burnt cannot be any further consumed, being enveloped in flame and air already vitiated and unfit for combustion. But when the stove is well heated, and the current brisk, no part of the soot escapes the action of the air.

The hot air retained in this manner in the body of the stove is applied to its sides in a very extended surface. To increase this still more, the stove is made narrower from front to back in its upper part; a certain breadth is necessary below, that there may be room for fuel. If this breadth were preserved all the way up, much heat would be lost, because the heat communicated to the partitions of the stove does no good. By diminishing their breadth, the proportion of useful surface is increased. The whole body of the stove may be considered as a long pipe folded up, and its effect would be the greatest possible if it really were so; that is, if each partition *c*C, *d*D, &c. were split into two, and a free passage allowed between them for the air of the room. Something like this will be observed afterwards in some German stoves.

It is with the same view of making an extensive application of a hot surface to the air, that the stove is not built in the wall, nor even in contact with it, nor with the floor: for by its detached situation, the air in contact with the back, and with the bottom (where it is hottest), is warmed, and contributes at least one half of the whole effect; for the great heat of the bottom makes its effect on the air of the room at least equal to that of the two ends. Sometimes a stove makes part of the wall between two small rooms, and is found sufficient.

It must be remarked, on the whole, that the effect of a stove depends much on keeping in the room the air already heated by it. This is so remarkably the case, that a small open fire in the same room will be so far from increasing its heat, that it will greatly diminish it: it will even draw the warm air from a suite of adjoining apartments. This is distinctly observed in the houses of the English merchants in St Petersburgh: their habits of life in Britain make them uneasy without an open fire in their sitting rooms; and this obliges them to heat all their stoves twice a day, and their houses are cooler than those of the Russians who heat them only once. In many German houses, especially of the lower class, the fire-place of the stove does not open into the room, but into the yard or a lobby, where all the fires are lighted and tended; by this means is avoided the expence of warm air which must have been carried off by the stove: but it is evident, that this must be very unpleasant, and cannot be wholesome. We must breathe the same quantity of stagnant air loaded with all the vapours and exhalations which must be produced in every inhabited place. Going into one of these houses from the open air, is like putting one's head into a stew-pan or under a pie-crust, and quickly nauseates us who are accustomed to fresh air and cleanliness. In these countries it is a matter almost of necessity, to fumigate the rooms with frankincense and other gums burnt. The censer in ancient worship was in all probability an utensil introduced by necessity for sweetening or rendering tolerable the air of a crouded place: and it is a constant practice in the Russian houses for a servant to go round the room after dinner, waving a censer with some gums burning on bits of charcoal.

365 Of hot walls in gardening, &c.

The account now given of stoves for heating rooms, and of the circumstances which must be attended to in their construction, will equally apply to hot walls in gardening, whether within or without doors. The only new circumstance which this employment of a flue introduces, is the attention which must be paid to the equability of the heat, and the gradation which must be observed in different parts of the building. The heat in the flue gradually diminishes as it recedes from the fire-place, because it is continually giving out heat to the flue. It must therefore be so conducted through the building by frequent returns, that in every part there may be a mixture of warmer and cooler branches of the flue, and the final chimney should be close by the fire-place. It would, however, be improper to run the flue from the end of the floor up to the ceiling, where the second horizontal pipe would be placed, and then return it downward again and make the third horizontal flue adjoining to the first, &c. This would make the middle of the wall the coldest. If it is the flue of a greenhouse, this would be highly improper, because the upper part of the wall can be very little employed; and in this case it is better to allow the flue to proceed gradually up the wall in its different returns, by which the lowest part would be the warmest, and the heated air will ascend among the pots and plants; but in a hot wall, where the trees are to receive heat by contact, some approximation to the above method may be useful.

In the hypocausta and sudaria of the Greeks and Romans, the flue was conducted chiefly under the floors.

366 Malt-kilns a species of stove.

Malt-kilns are a species of stove which merit our attention. Many attempts have been made to improve them on the principal of flue stoves; but they have been unsuccessful, because heat is not what is chiefly wanted in malting: it is a copious current of very dry air to carry off the moisture. We must refer the examination of this subject also to the article Stove, and proceed to consider the current of heated air in the chief varieties of furnaces.

367 Of the current of air in melting furnaces.

All that is to be attended to in the different kinds of melting furnaces is, that the current of air be sufficiently rapid, and that it be applied in as extensive a surface as possible to the substance to be melted. The more rapid the current it is the hotter, because it is consuming more fuel; and therefore its effect increases in a higher proportion than its rapidity. It is doubly effectual if twice as hot; and if it then be twice as rapid, there is twice the quantity of doubly hot air applied to the subject; it would therefore be four times more powerful. This is procured by raising the chimney of the furnace to a greater height. The close application of it to the subject can hardly be laid down in general terms, be-

cause

Effects of Air's pressure. cause it depends on the precise circumstances of each case.

368 In reverberatory furnaces; In reverberatory furnaces, such as refining furnaces for gold, silver, and copper, the flame is made to play over the surface of the melted metal. This is produced entirely by the form of the furnace, by making the arch of the furnace as low as the circumstances of the manipulation will allow (See FURNACE, p. 509.). Experience has pointed out in general the chief circumstances of their construction, viz. that the fuel should be at one end on a grate, through which the air enters to maintain the fire; and that the metal should be placed on a level floor between the fuel and the tall chimney which produces the current. But there is no kind of furnace more variable in its effect, and almost every place has a small peculiarity of construction, on which its preeminence is rested. This has occasioned many whimsical varieties in their form. This uncertainty seems to depend much on a circumstance rather foreign to our present purpose; but as we do not observe it taken notice of by mineralogical writers, we beg leave to mention it here. It is not heat alone that is wanted in the refining of silver by lead, for instance. We must make a continual application to its surface of air, which has not contributed to the combustion of the fuel. Any quantity of the hottest air, already saturated with the fuel, may play on the surface of the metal for ever, and keep it in the state of most perfect fusion, but without refining it in the least. Now, in the ordinary construction of a furnace, this is much the case. If the whole air has come in by the grate, and passed through the middle of the fuel, it can hardly be otherwise than nearly saturated with it; and if air be also admitted by the door (which is generally done or something equivalent), the pure air lies above the vitiated air, and during the passage along the horizontal part of the furnace, and along the surface of the metal, it still keeps above it, at least there is nothing to promote their mixture. Thus the metal does not come into contact with air fit to act on the base metal and calcine it, and the operation of refining goes on slowly. Trifling circumstances in the form of the arch or canal may tend to promote the jumbling of the airs together, and thus render the operation more expeditious; and as these are but ill understood, or perhaps this circumstance not attended to, no wonder that we see these considered as so many nostrums of great importance. It were therefore worth while to try the effect of changes in the form of the roof directed to this very circumstance. Perhaps some little prominence down from the arch of the reverberatory would have this effect, by suddenly throwing the current into confusion. If the additional length of passage do not cool the air too much, we should think that if there were interposed between the fuel and the refining floor a passage twisted like a cork-screw, making just half a turn, it would be most effectual: for we imagine, that the two airs, keeping each to their respective sides of the passage, would by this means be turned upside down, and that the pure stratum would now be in contact with the metal, and the vitiated air would be above it.

369 And in the glass-house furnaces. The glasshouse furnace exhibits the chief variety in the management of the current of heated air. In this it is necessary that the hole at which the workman dips his pipe into the pot shall be as hot as any part of the furnace. This could never be the case, if the furnace had a chimney situated in a part above the dipping-hole; for in this case cold air would immediately rush in at the hole, play over the surface of the pot, and go up the chimney. To prevent this the hole itself is made the chimney; but as this would be too short, and would produce very little current and very little heat, the whole furnace is set under a tall dome. Thus the heated air from the real furnace is confined in this dome, and constitutes a high column of very light air, which will therefore rise with great force up the dome, and escape at the top. The dome is therefore the chimney, and will produce a draught or current proportioned to its height. Some are raised above an hundred feet. When all the doors of this house are shut, and thus no supply given except through the fire, the current and heat become prodigious. This, however, cannot be done, because the workmen are in this chimney, and must have respirable air. But notwithstanding this supply by the house-doors, the draught of the real furnace is vastly increased by the dome, and a heat produced sufficient for the work, and which could not have been produced without the dome.

370 Improvement of Mr Cotterel for melting iron from the ore. This has been applied with great ingenuity and effect to a furnace for melting iron from the ore, and an iron finery, both without a blast. The common blast iron furnace is well known. It is a tall cone with the apex undermost. The ore and fluxes are thrown into this cone mixed intimately with the fuel till it is full, and the blast of most powerful bellows is directed into the bottom of this cone through a hole in the side. The air is thrown in with such force, that it makes its way through the mass of matter, kindles the fuel in its passage, and fluxes the materials, which then drop down into a receptacle below the blast-hole, and thus the passage for the air is kept unobstructed. It was thought impossible to produce or maintain this current without bellows; but Mr Cotterel, an ingenious founder, tried the effect of a tall dome placed over the mouth of the furnace, and though it was not half the height of many glasshouse domes it had the desired effect. Considerable difficulties, however, occurred; and he had not surmounted them all when he left the neighbourhood of Edinburgh, nor have we heard that he has yet brought the invention to perfection. It is extremely difficult to place the holes below, at which the air is to enter, at such a precise height as neither to be choked by the melted matter, nor to leave ore and stones below them unmelted; but the invention is very ingenious, and will be of immense service if it can be perfected; for in many places iron ore is to be found where water cannot be had for working a blast furnace.

371 Currents of air applied to free mines, ships, prisons, &c. of noxious air. The last application which we shall make of the currents produced by heating the air is to the freeing mines, ships, prisons, &c. from the damp and noxious vapours which frequently infest them.

As a drift or work is carried on in the mine, let a trunk of dale boards, about 6 or 8 inches square, be laid along the bottom of the drift, communicating with a trunk carried up in the corner of one of the shafts. Let the top of this last trunk open into the ash-pit of a small furnace, having a tall chimney. Let fire be kindled in the furnace; and when it is well heated, shut the fire-place and ash-pit doors. There being no other supply for the current produced in the chimney of this

 furnace,

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furnace, the air will flow into it from the trunk, and will bring along with it all the offensive vapours. This is the most effectual method yet found out. In the same manner may trunks be conducted into the ash-pit of a furnace from the cells of a prison or the wards of an hospital.

372 Air necessary for the combustion of fuel.

In the account which we have been giving of the management of air in furnaces and common fires, we have frequently mentioned the immediate application of air to the burning fuel as necessary for its combustion. This is a general fact. In order that any inflammable body may be really inflamed, and its combustible matter consumed and ashes produced, it is not enough that the body be made hot. A piece of charcoal inclosed in a box of iron may be kept red-hot for ever, without wasting its substance in the smallest degree. It is farther necessary, that it be in contact with a particular species of air, which constitutes about $\frac{1}{4}$ths of the air of the atmosphere, viz. the vital air of Lavoisier. It was called *empyreal air* by Scheele, who first observed its indispensable use in maintaining fire: and it appears, that, in contributing to the combustion of an inflammable body, this air combines with some of its ingredients, and becomes fixed air, suffering the same change as by the breathing of animals. Combustion may therefore be considered as a solution of the inflammable body in air. This doctrine was first promulgated by the celebrated Dr Hooke in his *Micrographia*, published in 1660, and afterwards improved in his treatise on Lamps. It is now completely established, and considered as a new discovery. It is for this reason that in fire-places of all kinds we have directed the construction, so as to produce a close application of the air to the fuel. It is quite needless at this day to enter into the discussions which formerly occupied philosophers about the manner in which the pressure and elasticity of the air promoted combustion. Many experiments were made in the last century by the first members of the Royal Society, to discover the office of air in combustion. It was thought that the flame was extinguished in rare air for want of a pressure to keep it together; but this did not explain its extinction when the air was not renewed. These experiments are still retained in courses of experimental philosophy, as they are injudiciously styled; but they give little or no information, nor tend to the illustration of any pneumatical doctrine; they are therefore omitted in this place. In short, it is now fully established, that it is not a mechanical but a chemical phenomenon. We can only inform the chemist, that a candle will consume faster in the low countries than in the elevated regions of Quito and Gondar, because the air is nearly one half denser below, and will act proportionally faster in decomposing the candle.

373 Curious effect of the air's pressure.

We shall conclude this part of our subject with the explanation of a curious phenomenon observed in many places. Certain springs or fountains are observed to have periods of repletion and scantiness, or seem to ebb and flow at regular intervals; and some of these periods are of a complicated nature. Thus a well will have several returns of high and low water, the difference of which gradually increases to a maximum, and then diminishes, just as we observe in the ocean. A very ingenious and probable explanation of this has been given in N° 424. of the Philosophical Transactions, by Mr Atwell, as follows.

Pneumatic Engines.

Plate CCCCV.

Let ABCD (fig. 63.) represent a cavern, into which water is brought by the subterraneous passage OT. Let it have an outlet MNP, of a crooked form, with its highest part N considerably raised above the bottom of the cavern, and thence sloping downwards into lower ground, and terminating in an open well at P. Let the dimensions of this canal be such that it will discharge much more water than is supplied by TO. All this is very natural, and may be very common. The effect of this arrangement will be a remitting spring at P: for when the cavern is filled higher than the point N, the canal MNP will act as a syphon; and, by the conditions assumed, it will discharge the water faster than TO supplies it; it will therefore run it dry, and then the spring at P will cease to furnish water. After some time the cavern will again be filled up to the height N, and the flow at P will recommence.

If, besides this supply, the well P also receive water from a constant source, we shall have a reciprocating spring.

The situation and dimensions of this syphon canal, and the supply of the feeder, may be such, that the efflux at P will be constant. If the supply increase in a certain degree, a reciprocation will be produced at P with very short intervals; if the supply diminishes considerably, we shall have another kind of reciprocation with great intervals and great differences of water.

If the cavern has another simple outlet R, new varieties will be produced in the spring P, and R will afford a curious spring. Let the mouth of R, by which the water enters it from the cavern, be lower than N, and let the supply of the feeding spring be no greater than R can discharge, we shall have a constant spring from R, and P will give no water. But suppose that the main feeder increases in winter or in rainy seasons, but not so much as will supply both P and R, the cavern will fill till the water gets over N, and R will be running all the while; but soon after P has begun to flow, and the water in the cavern sinks below R, the stream from R will stop. The cavern will be emptied by the syphon canal MNP, and then P will stop. The cavern will then begin to fill, and when near full R will give a little water, and soon after P will run and R stop as before, &c.

Desaguliers shows, Vol. II. p. 177, &c. in what manner a prodigious variety of periodical ebbs and flows may be produced by underground canals, which are extremely simple and probable.

374 Account of some pneumatic engines.

We shall conclude this article with the descriptions of some pneumatical machines or engines which have not been particularly noticed under their names in the former volumes of this work.

Bellows are of most extensive and important use; and it will be of service to describe such as are of uncommon construction and great power, fit for the great operations in metallurgy.

It is not the impulsive force of the blast that is wanted in most cases, but merely the copious supply of air, to produce the rapid combustion of inflammable matter; and the service would be better performed in general if this could be done with moderate velocities, and an extended surface. What are called air-furnaces, where a considerable surface of inflammable matter is acted on at once by the current which the mere heat of the

the expended air has produced, are found more operative in proportion to the air expended than blast furnaces animated by bellows; and we doubt not but that the method proposed by Mr Cotterel (which we have already mentioned) of increasing this current in a melting furnace by means of a dome, will in time supersede the blast furnaces. There is indeed a great impulsive force required in some cases; as for blowing off the scoriæ from the surface of silver or copper in refining furnaces, or for keeping a clear passage for the air in the great iron furnace.

In general, however, we cannot procure this abundant supply of air any other way than by giving it a great velocity by means of a great pressure, so that the general construction of bellows is pretty much the same in all kinds. The air is admitted into a very large cavity, and then expelled from it through a small hole.

The furnaces at the mines having been greatly enlarged; it was necessary to enlarge the bellows also: and the leathern bellows becoming exceedingly expensive, wooden ones were substituted in Germany about the beginning of last century, and from them became general through Europe. They consist of a wooden box ABCPFE (fig. 74. A), which has its top and two sides flat or straight, and the end BAE*e* formed into an arched or cylindrical surface, of which the line FP at the other end is the axis. This box is open below, and receives within it the shallow box KHGNML (fig. B), which exactly fills it. The line FP of the one coincides with FP of the other, and along this line is a set of hinges on which the upper box turns as it rises and sinks. The lower box is made fast to a frame fixed in the ground. A pipe OQ proceeds from the end of it, and terminates at the furnace, where it ends in a small pipe called the *tewer* or *tuyere*. This lower box is open above, and has in its bottom two large valves V, V, opening inwards. The conducting pipe is sometimes furnished with a valve opening outwards, to prevent burning coals from being sucked into the bellows when the upper box is drawn up. The joint along PF is made tight by thin leather nailed along it. The sides and ends of the fixed box are made to fit the sides and curved end of the upper box, so that this last can be raised and lowered round the joint FP without sensible friction, and yet without suffering much air to escape: but as this would not be sufficiently air-tight by reason of the shrinking and warping of the wood, a farther contrivance is adopted. A slender lath of wood, divided into several joints, and covered on the outer edge with very soft leather, is laid along the upper edges of the sides and ends of the lower box. This lath is so broad, that when its inner edge is even with the inside of the box, its outer edge projects about an inch. It is kept in this position by a number of steel wires, which are driven into the bottom of the box, and stand up touching the sides, as represented in figure D, where *a b c* are the wires, and *e* the lath, projecting over the outside of the box. By this contrivance the laths are pressed close to the sides and curved end of the moveable box, and the spring wires yield to all their inequalities. A bar of wood RS is fixed to the upper board, by which it is either raised by machinery, to sink again by its own weight, having an additional load laid on it, or it is forced downward by a crank or wiper of the machinery, and afterwards raised.

Plate CCCCVI.

The operation here is precisely similar to that of blowing with a chamber-bellows. When the board is lifted up, the air enters by the valves V, V, and is expelled at the pipe OQ by depressing the boards. There is therefore no occasion to insist on this point.

These bellows are made of a very great size, AD being 16 feet, AB five feet, and the circular end AE also five feet. The rise, however, is but about 3 or 3½ feet. They expel at each stroke about 90 cubic feet of air, and they make about 8 strokes per minute.

Such are the bellows in general use on the continent. We have adopted a different form in this kingdom, which seems much preferable. We use an iron or wooden cylinder, with a piston sliding along it. This may be made with much greater accuracy than the wooden boxes, at less expence, if of wood, because it may be of coopers work, held together by hoops; but the great advantage of this form is its being more easily made air-tight. The piston is surrounded with a broad strap of thick and soft leather, and it has around its edge a deep groove, in which is lodged a quantity of wool. This is called the packing or stuffing, and keeps the leather very closely applied to the inner surface of the cylinder. Iron cylinders may be very neatly bored and smoothed, so that the piston, even when very tight, will slide along it very smoothly. To promote this, a quantity of black lead is ground very fine with water, and a little of this is smeared on the inside of the cylinder from time to time.

The cylinder has a large valve, or sometimes two, in the bottom, by which the atmospheric air enters when the piston is drawn up. When the piston is thrust down, this air is expelled along a pipe of great diameter, which terminates in the furnace with a small orifice.

This is the simplest form of bellows which can be conceived. It differs in nothing but size from the bellows used by the rudest nations. The Chinese smiths have a bellows very similar, being a square pipe of wood ABCDE (fig. 75.), with a square board G which exactly fits it, moved by the handle FG. At the farther end is the blast pipe HK, and on each side of it a valve in the end of the square pipe, opening inwards. The piston is sufficiently tight for their purposes without any leathering.

The piston of this cylinder bellows is moved by machinery. In some blast engines the piston is simply raised by the machine, and then let go, and it descends by its own weight, and compresses the air below it to such a degree, that the velocity of efflux becomes constant, and the piston descends uniformly: for this purpose it must be loaded with a proper weight. This produces a very uniform blast, except at the very beginning, while the piston falls suddenly and compresses the air: but in most engines the piston rod is forced down the cylinder with a determined motion, by means of a beam, crank, or other contrivance. This gives a more unequal blast, because the motion of the piston is necessarily slow in the beginning and end of the stroke, and quicker in the middle.

But in all it is plain that the blast must be desultory. It ceases while the piston is rising; for this reason it is usual to have two cylinders, as it was formerly usual to have two bellows which worked alternately. Sometimes three or four are used, as at the Carron iron works. This makes a blast abundantly uniform.

3 But

But an uniform blast may be made with a single cylinder, by making it deliver its air into another cylinder, which has a piston exactly fitted to its bore, and loaded with a sufficient weight. The blowing cylinder ABCD (fig. 76.) has its piston P worked by a rod NP, connected by double chains with the arched head of the working beam NO, moving round a gudgeon at R. The other end O of this beam is connected by the rod OP, with the crank PQ of a wheel machine; or it may be connected with the piston of a steam engine, &c. &c. The blowing cylinder has a valve or valves E in its bottom, opening inwards. There proceeds from it a large pipe CF, which enters the regulating cylinder GHKI, and has a valve at top to prevent the air from getting back into the blowing cylinder. It is evident that the air forced into this cylinder must raise its piston L, and that it must afterwards descend, while the other piston is rising. It must descend uniformly, and make a perfectly equable blast.

Plate CCCCVI.

Observe, that if the piston L be at the bottom when the machine begins to work, it will be at the bottom at the end of every stroke, if the *tuyere* T emits as much air as the cylinder ABCD furnishes; nay, it will lie a while at the bottom, for, while it was rising, air was issuing through T. This would make an interrupted blast. To prevent this, the orifice T must be lessened; but then there will be a surplus of air at the end of each stroke, and the piston L will rise continually, and at last get to the top, and allow air to escape. It is just possible to adjust circumstances, so that neither shall happen. This is done easier by putting a stop in the way of the piston, and putting a valve on the piston, or on the conducting pipe KST, loaded with a weight a little superior to the intended elasticity of the air in the cylinder. Therefore, when the piston is prevented by the stop from rising, the snifting valve, as it is called, is forced open, the superfluous air escapes, and the blast preserves its uniformity.

It may be of use to give the dimensions of a machine of this kind, which has worked for some years at a very great furnace, and given satisfaction.

The diameter of the blowing cylinder is 5 feet, and the length of the stroke is 6. Its piston is loaded with $3\frac{1}{4}$ tons. It is worked by a steam-engine whose cylinder is 3 feet 4 inches wide, with a six feet stroke. The regulating cylinder is 8 feet wide, and its piston is loaded with $8\frac{1}{2}$ tons, making about 2,63 pounds on the square inch; and it is very nearly in equilibrio with the load on the piston of the blowing cylinder. The conducting pipe KST is 12 inches in diameter, and the orifice of the tuyere was $1\frac{1}{4}$ inches when the engine was erected, but it has gradually enlarged by reason of the intense heat to which it is exposed. The snifting valve is loaded with 3 pounds on the square inch.

When the engine worked briskly, it made 18 strokes per minute, and there was always much air discharged by the snifting valve. When the engine made 15 strokes per minute, the snifting valve opened but seldom, so that things were nearly adjusted to this supply. Each stroke of the blowing cylinder sent in 118 cubic feet of common air. The ordinary pressure of the air being supposed $14\frac{1}{2}$ pounds on an inch, the density of the air in the regulating cylinder must be $\frac{14{,}75+2{,}63}{14{,}75}, =1{,}1783$, the natural density being 1.

This machine gives an opportunity of comparing the expence of air with the theory. It must (at the rate of 15 strokes) expel 30 cubic feet of air in a second through a hole of $1\frac{1}{4}$ inches in diameter. This gives a velocity of near 2000 feet per second, and of more than 1600 feet for the condensed air. This is vastly greater than the theory can give, or is indeed possible; for air does not rush into a void with so great velocity. It shows with great evidence, that a vast quantity of air must escape round the two pistons. Their united circumferences amount to above 40 feet, and they move in a dry cylinder. It is impossible to prevent a very great loss. Accordingly, a candle held near the edge of the piston L has its flame very much disturbed. This case, therefore, gives no hold for a calculation; and it suggests the propriety of attempting to diminish this great waste.

This has been very ingeniously done (in part at least) at some other furnaces. At Omoah foundery, near Glasgow, the blowing cylinder (also worked by a steam engine) delivers its air into a chest without a bottom, which is immersed in a large cistern of water, and supported at a small height from the bottom of the cistern, and has a pipe from its top leading to the tuyere. The water stands about five feet above the lower brim of the regulating air-chest, and by its pressure gives the most perfect uniformity of blast, without allowing a particle of air to get off by any other passage besides the tuyere. This is a very effectual regulator, and must produce a great saving of power, because a smaller blowing cylinder will thus supply the blast. We have not learned the dimensions and performance of this engine. We must observe, that the loss round the piston of the blowing cylinder remains undiminished.

A blowing machine was erected many years ago at Chatillon in France on a principle considerably different, and which must be perfectly air-tight throughout. Two cylinders A, B (fig. 77.), loaded with great weights, were suspended at the ends of the lever CD, moving round the gudgeon E. From the top F, G of each there was a large flexible pipe which united in H, from whence a pipe KT led to the tuyere T. There were valves at F and G opening outwards, or into the flexible pipes; and other valves L, M, adjoining to them in the top of each cylinder, opening inwards, but kept shut by a slight spring. Motion was given to the lever by a machine. The operation of this blowing machine is evident. When the cylinder A was pulled down, or allowed to descend, the water, entering at its bottom, compressed the air, and forced it along the passage FHKT. In the mean time, the cylinder B was rising, and the air entered by the valve M. We see that the blast will be very unequal, increasing as the cylinder is immersed deeper. It is needless to describe this machine more particularly, because we shall give an account of one which we think perfect in its kind, and which leaves hardly any thing to be desired in a machine of this sort. It was invented by Mr John Laurie, land-surveyor in Edinburgh, about 15 years ago, and improved in some respects since his death by an ingenious person of that city.

Plate CCCCVII.

ABCD (fig. 78.) is an iron cylinder, truly bored within, and evasated a-top like a cup. EFGH is another, truly turned both without and within, and a small matter less than the inner diameter of the first cylinder.

This

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This cylinder is close above, and hangs from the end of a lever moved by a machine. It is also loaded with weights at N. KILM is a third cylinder, whose outside diameter is somewhat less than the inside diameter of the second. This inner cylinder is fixed to the same bottom with the outer cylinder. The middle cylinder is loose, and can move up and down between the outer and inner cylinders without rubbing on either of them. The inner cylinder is perforated from top to bottom by three pipes OQ, SV, PR. The pipes OQ, PR have valves at their upper ends O, P, and communicate with the external air below. The pipe SV has a horizontal part VW, which again turns upwards, and has a valve at top X. This upright part WX is in the middle of a cistern of water *fhkg*. Into this cistern is fixed an air-chest *a*YZ*b*, open below, and having at top a pipe *cde* terminating in the tuyere at the furnace.

When the machine is at rest, the valves X, O, P, are shut by their own weights, and the air-chest is full of water. When things are in this state, the middle cylinder EFGH is drawn up by the machinery till its lower brims F and G are equal with the top RM of the inner cylinder. Now pour in water or oil between the outer and middle cylinders: it will run down and fill the space between the outer and inner cylinders. Let it come to the top of the inner cylinder.

Now let the loaded middle cylinder descend. It cannot do this without compressing the air which is between its top and the top of the inner cylinder. This air being compressed will cause the water to descend between the inner and middle cylinders, and rise between the middle and outer cylinders, spreading into the cup; and as the middle cylinder advances downwards, the water will descend farther within it and rise farther without it. When it has got so far down, and the air has been so much compressed, that the difference between the surface of the water on the inside and outside of this cylinder is greater than the depth of water between X and the surface of the water *fg*, air will go out by the pipe SVW, and will lodge in the air-chest, and will remain there if *c* be shut, which we shall suppose for the present. Pushing down the middle cylinder till the partition touch the top of the inner cylinder, all the air which was formerly between them will be forced into the air-chest, and will drive out water from it. Draw up the middle cylinder, and the external air will open the valves O, P, and again fill the space between the middle and inner cylinders; for the valve X will shut, and prevent the regress of the condensed air. By pushing down the middle cylinder a second time, more air will be forced into the air-chest, and it will at last escape by getting out between its brims Y, Z and the bottom of the cistern; or if we open the passage *c*, it will pass along the conduit *cde* to the tuyere, and form a blast.

The operation of this machine is similar to Mr Haskins's quicksilver pump described by Desaguliers at the end of the second volume of his Experimental Philosophy. The force which condenses the air is the load on the middle cylinder. The use of the water between the inner and outer cylinders is to prevent this air from escaping; and the inner cylinder thus performs the office of a piston, having no friction. It is necessary that the length of the outer and middle cylinders be greater than the depth of the regulator-cistern, that there may be a sufficient height for the water to rise between the middle and outer cylinders, to balance the compressed air, and oblige it to go into the air-chest. A large blast-furnace will require the regulator-cistern five feet deep, and the cylinders about six or seven feet long.

It is in fact a pump without friction, and is perfectly air-tight. The quickness of its operation depends on the small space between the middle cylinder and the two others; and this is the only use of these two. Without these it would be similar to the engine at Chastillon, and operate more unequally and slowly. Its only imperfection is, that if the cylinder begin its motion of ascent or descent rapidly, as it will do when worked by a steam-engine, there will be some danger of water dashing over the top of the inner cylinder and getting into the pipe SV; but should this happen, an issue can easily be contrived for it at V, covered with a loaded valve *v*. This will never happen if the cylinder is moved by a crank.

One blowing cylinder only is represented here, but two may be used.

We do not hesitate in recommending this form of bellows as the most perfect of any, and fit for all uses where standing bellows are required. They will be cheaper than any other sort for common purposes. For a common smith's forge they may be made with square wooden boxes instead of cylinders. They are also easily repaired. They are perfectly tight; and they may be made with a blast almost perfectly uniform, by making the cistern in which the air-chest stands of considerable dimensions. When this is the case, the height of water, which regulates the blast, will vary very little.

This may suffice for an account of blast machines. The leading parts of their construction have been described as far only as was necessary for understanding their operation, and enabling an engineer to erect them in the most commodious manner. Views of complete machines might have amused, but they would not have added to our reader's information.

But the account is imperfect unless we show how their parts may be so proportioned that they shall perform what is expected from them. The engineer should know what size of bellows, and what load on the board or piston, and what size of tuyere, will give the blast which the service requires, and what force must be employed to give them the necessary degree of motion. We shall accomplish these purposes by considering the efflux of the compressed air through the tuyere. The propositions formerly delivered will enable us to ascertain this.

That we may proportion every thing to the power employed, we must recollect, that if the piston of a cylinder employed for expelling air be pressed down with any force *p*, it must be considered as superadded to the atmospheric pressure P on the same piston, in order that we may compare the velocity *v* of efflux with the known velocity V with which air rushes into a void. By what has been formerly delivered, it appears that this velocity

$v = V \times \sqrt{\frac{p}{P \times p}}$, where P is the pressure of the atmosphere on the piston, and *p* the additional load laid on it. This velocity is expressed in feet *per* second; and, when

4 multiplied

multiplied by the area of the orifice (also expressed in square feet), it will give us the cubical feet of condensed air expelled in a second: but the bellows are always to be filled again with common air, and therefore we want to know the quantity of common air which will be expelled; for it is this which determines the number of strokes which must be made in a minute, in order that the proper supply may be obtained. Therefore recollect that the quantity expelled from a given orifice with a given velocity, is in the proportion of the density; and that when D is the density of common air produced by the pressure P, the density d produced by the pressure $P+p$, is $D\times\frac{P+p}{P}$; or if D be made 1, we have $d=\frac{P+p}{P}$.

Therefore, calling the area of the orifice expressed in square feet O, and the quantity of common air, or the cubic feet expelled in a second Q, we have $Q=V\times O\times\sqrt{\frac{p}{P+p}}\times\frac{P+p}{P}$.

It will be sufficiently exact for all practical purposes to suppose P to be 15 pounds on every square inch of the piston; and p is then conveniently expressed by the pounds of additional load on every square inch: we may also take $V=1332$ feet.

As the orifice through which the air is expelled is generally very small, never exceeding three inches in diameter, it will be more convenient to express it in square inches; which being the $\frac{1}{144}$ of a square foot, we shall have the cubic feet of common air expelled in a second. or $Q=\frac{1332}{144}O\sqrt{\frac{p}{P+p}}\times\frac{P+p}{P},=O\times 9{,}25\times\sqrt{\frac{p}{P+p}}\times\frac{P+p}{P}$; and this seems to be as simple an expression as we can obtain.

This will perhaps be illustrated by taking an example in numbers. Let the area of the piston be four square feet, and the area of the round hole through which the air is expelled be two inches, its diameter being 1,6, and let the load on the piston be 1728 pounds: this is three pounds on every square inch. We have $P=15$, $p=3$, $P+p=18$, and $O=2$; therefore we will have $Q=2\times 9{,}25\times\sqrt{\frac{3}{18}}\;\frac{18}{15},=9{,}053$ cubic feet of common air expelled in a second. This will however be diminished at least one third by the contraction of the jet; and therefore the supply will not exceed six cubic feet *per* second. Supposing therefore that this blowing machine is a cylinder or prism of this dimension in its section, the piston so loaded would (after having compressed the air) descend about 15 inches in a second: It would first sink $\frac{1}{6}$ of the whole length of the cylinder pretty suddenly, till it had reduced the air to the density $\frac{18}{15}$, and would then descend uniformly at the above rate, expelling six cubic feet of common air in a second.

The computation is made much in the same way for bellows of the common form, with this additional circumstance, that as the loaded board moves round a hinge at one end, the pressure of the load must be calculated accordingly. The computation, however, becomes a little intricate, when the form of the loaded board is not rectangular: it is almost useless when the bellows have flexible sides, either like smith's bellows or like organ bellows, because the change of figure during their motion makes continual variation on the compressing powers. It is therefore chiefly with respect to the great wooden bellows, of which the upper board slides down between the sides, that the above calculation is of service.

The propriety however of this piece of information is evident: we do not know precisely the quantity of air necessary for animating a furnace; but this calculation tells us what force must be employed for expelling the air that may be thought necessary. If we have fixed on the strength of the blast, and the diameter of the cylinder, we learn the weight with which the piston must be loaded; the length of the cylinder determines its capacity, the above calculation tells the expence *per* second; hence we have the time of the piston's coming to the bottom. This gives us the number of strokes *per* minute: the load must be lifted up by the machine this number of times, making the time of ascent precisely equal to that of descent; otherwise the machine will either catch and stop the descent of the piston, or allow it to lie inactive for a while of each stroke. These circumstances determine the labour to be performed by the machine, and it must be constructed accordingly. Thus the engineer will not be affronted by its failure, nor will he expend needless power and cost.

In machines which force the piston or bellows-board with a certain determined motion, different from what arises from their own weight, the computation is extremely intricate. When a piston moves by a crank, its motion at the beginning and end of each stroke is slow, and the compression and efflux is continually changing: we can however approximate to a statement of the force required.

Every time the piston is drawn up, a certain space of the cylinder is filled again with air of the common density; and this is expelled during the descent of the piston. A certain number of cubic feet of common air is therefore expelled with a velocity which perhaps continually varies; but there is a medium velocity with which it might have been uniformly expelled, and a pressure corresponding to this velocity. To find this, divide the area of the piston by the area of the blast-hole (or rather by this area multiplied by 0,613, in order to take in the effect of the contracted jet), and multiply the length of the stroke performed in a second by the quotient arising from this division; the product is the medium velocity of the air (of the natural density). Then find by calculation the height through which a heavy body must fall in order to acquire this velocity; this is the height of a column of homogeneous air which would expel it with this velocity. The weight of this column is the least force that can be exerted by the engine: but this force is too small to overcome the resistance in the middle of the stroke, and it is too great even for the end of the stroke, and much too great for the beginning of it. But if the machine is turned by a very heavy water-wheel, this will act as a regulator, accumulating in itself the superfluous force during the too favourable positions of the crank, and exerting it by its *vis insita* during the time of greatest effort. A force not greatly exceeding the weight of this column of air will therefore suffice. On the other hand, if the strength of the blast be determined, which is the general state of the problem, this

determines

determines the degree of condensation of the air, and the load on the square inch of the piston, or the mean force which the machine must exert on it. A table, which will be given presently, determines the cubic feet of common air expelled in a second, corresponding to this load. This combined with the proposed dimensions of the cylinder, will give the descent of the piston or the length of the stroke.

These general observations apply to all forms of bellows; and without a knowledge of them no person can erect a machine for working them without total uncertainty or servile imitation. In order, therefore, that they may be useful to such as are not accustomed to the management of even these simple formulæ, we insert the following short table of the velocity and quantity of air discharged from a cylinder whose piston is loaded with the pounds contained in the first column on every square inch. The second column contains the velocity with which the *condensed air* rushes out through any *small* hole; and the third column is the cubic feet discharged from a hole whose area is a square inch; column fourth contains the mean velocity of air of the common density; and column fifth is the cubic feet of common air discharged; the sixth column is the height in inches at which the force of the blast would support a column of water if a pipe were inserted into the side of the cylinder. This is an extremely proper addition to such machines, showing at all times the power of the machines, and teaching us what intensity of blast is employed for different purposes. The table is computed from the supposition that the ordinary pressure of the air is 15 pounds on a square inch. This is somewhat too great, and therefore the velocities are a little too small; but the quantities discharged will be found about $\frac{1}{5}$ too great (without affecting the velocities) on account of the convergency of the stream.

I	II	III	IV	V	VI
$\frac{1}{2}$	239	1,66	247	1,72	14
1	333	2,31	355	2,47	27
$1\frac{1}{2}$	404	2,79	437	3,05	40
2	457	3,17	518	3,60	54
$2\frac{1}{2}$	500	3,48	584	4,2	68
3	544	3,76	653	4,53	82
$3\frac{1}{2}$	582	4,03	715	4,98	95
4	611	4,24	774	5,38	109
$4\frac{1}{2}$	642	4,46	822	5,75	122
5	666	4,67	888	6,17	136
$5\frac{1}{2}$	693	4,84	950	6,49	150
6	711	5,06	997	6,92	163

This table extends far beyond the limits of ordinary use, very few blast-furnaces having a force exceeding 60 inches of water.

We shall conclude this account of blowing machines with a description of a small one for a blow-pipe. Fig. 79. ABCD, is a vessel containing water, about two feet deep. EFGH is the air-box of the blower open below, and having a pipe ILK rising up from it to a convenient height; an arm ON which grasps this pipe carries the lamp N: the blow-pipe LM comes from the top of the upright pipe. PKQ is the feeding pipe reaching near to the bottom of the vessel.

Plate CCCCVII.

Water being poured into the vessel below, and its cover being put on, which fits the upright pipe, and touches two studs *a*, *a*, projecting from it, blow in a quantity of air by the feeding pipe PQ; this expels the water from the air-box, and occasions a pressure which produces the blast through the blow-pipe M.

In n° 54. of this article, we mentioned an application which has been made of Hero's fountain, at Chemnitz in Hungary, for raising water from the bottom of a mine. We shall now give an account of this very ingenious contrivance.

In fig. 80. B represents the source of water elevated above the mouth of the pit 136 feet. From this there is led a pipe B*b*CD four inches diameter. This pipe enters the top of a copper cylinder *bcde*, $8\frac{1}{2}$ feet high, five feet diameter, and two inches thick, and it reaches to within four inches of the bottom; it has a cock at C. This cylinder has a cock at F, and a very large one at E. From the top *bc* proceeds a pipe GHH' two inches in diameter, which goes down the pit 96 feet, and is inserted into the top of another brass cylinder *fghi*, which is $6\frac{1}{2}$ feet high, four feet diameter, and two inches thick, containing 83 cubic feet, which is very nearly one half of the capacity of the other, viz. of 170 cubic feet. There is another pipe NI of four inches diameter, which rises from within four inches of the bottom of this lower cylinder, is soldered into its top, and rises to the trough NO, which carries off the water from the mouth of the pit. This lower cylinder communicates at the bottom with the water L which collects in the drains of the mine. A large cock K serves to admit or exclude this water; another cock M, at the top of this cylinder, communicates with the external air.

Now suppose the cock C shut, and all the rest open; the upper cylinder will contain air, and the lower cylinder will be filled with water, because it is sunk so deep that its top is below the usual surface of the mine-waters. Now shut the cocks F, E, M, K, and open the cock C. The water of the source B must run in by the orifice D, and rise in the upper cylinder, compressing the air above it and along the pipe GHH', and thus acting on the surface of the water in the lower cylinder. It will therefore cause it to rise gradually in the pipe IN, where it will always be of such a height that its weight balances the elasticity of the compressed air. Suppose no issue given to the air from the upper cylinder, it would be compressed into $\frac{1}{5}$th of its bulk by the column of 136 feet high; for a column of 34 feet nearly balances the ordinary elasticity of the air. Therefore, when there is an issue given to it through the pipe GHH', it will drive the compressed air along this pipe, and it will expel water from the lower cylinder. When the upper cylinder is full of water, there will be 34 cubic feet of water expelled from the lower cylinder. If the pipe IN had been more than 136 feet long, the water would have risen 136 feet, being then in equilibrio with the water in the feeding pipe B*b*CD (as was shown in n° 52.), by the intervention of the elastic air; but no more water would have been expelled from the lower cylinder than what fills this pipe. But the pipe being only 96 feet high, the water will be thrown out at N with a very great velocity. If it were not for the great obstructions which water and air must meet with in their passage along pipes, it would issue at N with a velocity of more than 50 feet per second. It issues

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issues much more slowly, and at last the upper cylinder is full of water, and the water would enter the pipe GH and enter the lower cylinder, and without displacing the air in it, would rise through the discharging pipe IN, and run off to waste. To prevent this there hangs in the pipe HG a cork ball or double cone, by a brass wire which is guided by holes in two cross pieces in the pipe HG. When the upper cylinder is filled with water, this cork plugs up the orifice G, and no water is wasted; the influx at D now stops. But the lower cylinder contains compressed air, which would balance water in a discharging pipe 136 feet high, whereas IN is only 96. Therefore the water will continue to flow at N till the air has so far expanded as to balance only 96 feet of water, that is, till it occupies $\frac{1}{3}$ of its ordinary bulk, that is, $\frac{1}{3}$ of the capacity of the upper cylinder, or $42\frac{1}{2}$ cubic feet. Therefore $42\frac{1}{2}$ cubic feet will be expelled, and the efflux at N will cease; and the lower cylinder is about $\frac{1}{2}$ full of water. When the attending workman observes this, he shuts the cock C. He might have done this before, had he known when the orifice G was stopped; but no loss ensues from the delay. At the same time the attendant opens the cock E, the water issues with great violence, being pressed by the condensed air from the lower cylinder. It therefore issues with the sum of its own weight and of this compression. These gradually decrease together, by the efflux of the water and the expansion of the air; but this efflux stops before all the water has flowed out; for there is $42\frac{1}{2}$ feet of the lower cylinder occupied by air. This quantity of water remains, therefore, in the upper cylinder nearly: the workman knows this, because the discharged water is received first of all into a vessel containing $\frac{1}{3}$ of the capacity of the upper cylinder. Whenever this is filled, the attendant opens the cock K by a long rod which goes down the shaft; this allows the water of the mine to fill the lower cylinder, allows the air to get into the upper cylinder, and this allows the remaining water to run out of it.

And thus every thing is brought into its first condition; and when the attendant sees no more water come out at E, he shuts the cocks E and M, and opens the cock C, and the operation is repeated.

There is a very surprising appearance in the working of this engine. When the efflux at N has stopped, if the cock F be opened, the water and air rush out together with prodigious violence, and the drops of water are changed into hail or lumps of ice. It is a sight usually shown to strangers, who are desired to hold their hats to receive the blast of air: the ice comes out with such violence as frequently to pierce the hat like a pistol bullet. This rapid congelation is a remarkable instance of the general fact, that air by suddenly expanding, generates cold, its capacity for heat being increased. Thus the peasant cools his broth by blowing over the spoon, even from warm lungs: a stream of air from a pipe is always cooling.

The above account of the procedure in working this engine shows that the efflux both at N and E becomes very slow near the end. It is found convenient therefore not to wait for the complete discharges, but to turn the cocks when about 30 cubic feet of water have been discharged at N: more work is done in this way. A gentleman of great accuracy and knowledge of these subjects took the trouble, at our desire, of noticing particularly the performance of the machine. He observed that each stroke, as it may be called, took up about three minutes and $\frac{1}{4}$; and that 32 cubic feet of water were discharged at N, and 66 were expended at E. The expence therefore is 66 feet of water falling 136 feet, and the performance is 32 raised 96, and they are in the proportion of 66×136 to 32×96, or of 1 to 0,3422, or nearly as 3 to 1. This is superior to the performance of the most perfect undershot mill, even when all friction and irregular obstructions are neglected; and is not much inferior to any overshot pump-mill that has yet been erected. When we reflect on the great obstructions which water meets with in its passage through long pipes, we may be assured that, by doubling the size of the feeder and discharger, the performance of the machine will be greatly improved; we do not hesitate to say, that it would be increased $\frac{1}{3}$: it is true that it will expend more water; but this will not be nearly in the same proportion; for most of the deficiency of the machine arises from the needless velocity of the first efflux at N. The discharging pipe ought to be 110 feet high, and not give sensibly less water.

Then it must be considered how inferior in original expence this simple machine must be to a mill of any kind which would raise 10 cubic feet 96 feet high in a minute, and how small the repairs on it need be, when compared with a mill.

And, lastly, let it be noticed, that such a machine can be used where no mill whatever can be put in motion. A small stream of water, which would not move any kind of wheel, will here raise $\frac{1}{3}$ of its own quantity to the same height; working as fast as it is supplied.

For all these reasons, we think that the Hungarian machine eminently deserves the attention of mathematicians and engineers, to bring it to its utmost perfection, and into general use. There are situations where this kind of machine may be very useful. Thus, where the tide rises 17 feet, it may be used for compressing air to $\frac{2}{3}$ of its bulk; and a pipe leading from a very large vessel inverted in it, may be used for raising the water from a vessel of $\frac{1}{3}$ of its capacity 17 feet high; or if this vessel has only $\frac{1}{16}$ of the capacity of the large one set in the tide-way, two pipes may be led from it; one into the small vessel, and the other into an equal vessel 16 feet higher, which receives the water from the first. Thus $\frac{1}{16}$ of the water may be raised 34 feet, and a smaller quantity to a still greater height; and this with a kind of power that can hardly be applied in any other way. Machines of this kind are described by Schottus, Sturmius, Leupold, and other old writers; and they should not be forgotten, because opportunities may offer of making them highly useful. A gentleman's house in the country may thus be supplied with water by a machine that will cost little, and hardly go out of repair.

The last pneumatical engine which we shall speak of at present is the common fanners, used for winnowing grain, and for drawing air out of a room: and we have but few observations to make on them.

The wings of the fanners are inclosed in a cylinder or drum, whose circular sides have a large opening BDE (fig. 81.) round the centre, to admit the air. By turning the wings rapidly round, the air is hurried round along with them, and thus acquires a centrifugal tendency, by which it presses strongly on the outer rim of the drum: this

Plate CCCCVII.

this is gradually detached from the circle as at KI, and terminated in a trunk IHGF, which goes off in a tangential direction: the air therefore is driven along this passage.

If the wings were disposed in planes passing through the axis C, the compression of the air by their anterior surface would give it some tendency to escape in every direction, and would obstruct in some degree the arrival of more air through the side-holes. They are therefore reclined a little backward, as represented in the figure. It may be shown that their best form would be that of a hyperbolic spiral *a b c;* but the straight form approaches sufficiently near to the most perfect shape.

Much labour is lost, however, in carrying the air round those parts of the drum where it cannot escape. The fanners would either draw or discharge almost twice as much air if an opening were made all round one side. This could be gradually contracted (where required for winnowing) by a surrounding cone, and thus directed against the falling grain: this has been verified by actual trial. When used for drawing air out of a room for ventilation, it would be much better to remove the outer side of the drum entirely, and let the air fly freely off on all sides; but the flat sides are necessary, in order to prevent the air from arriving at the fanners any other way but through the central holes, to which trunks should be fitted leading to the apartment which is to be ventilated.

PNEUMATOSIS. See MEDICINE, n° 336.

PNEUMONIA. See MEDICINE, n° 183.

PNEUMONICS, in pharmacy, medicines proper in diseases of the lungs, in which respiration is affected.

PO, a large and celebrated river of Italy, which has its source at mount Vis in Piedmont, and on the confines of Dauphiny. It runs through Piedmont, Montferrat, the Milanese, and duchy of Mantua; from thence it runs to the borders of the Parmezan, and a part of the Modenese; and having entered the Ferarese, it begins to divide at Ficheruolo, and proceeds to discharge itself into the Gulf of Venice by four principal mouths. As it passes along, it receives several rivers, and often overflows its banks, doing a great deal of mischief: the reason of which is, that most of those rivers descend from the Alps, and are increased by the melting of the snow.

POA, MEADOW-GRASS: A genus of the digynia order, belonging to the pentandria class of plants; and in the natural method ranking under the fourth order, *Gramina.* The calyx is bivalved and multiflorous; the spicula or partial spike is ovate, with the valvules scarious and a little sharp, or thin on the margin. There are 20 species; most of them grasses, and very agreeable food for cattle; for one species, which grows in marshes, the cattle will frequently go so deep as to endanger their lives. This is called the *aquatica,* or *water reed-grass.* It is the largest of the British grasses, growing to the height of five or six feet. The leaves are smooth, and half an inch wide or more. The panicle is eight or ten inches long, greatly branched, and decked with numerous spicula: these are of a reddish brown colour intermixed with green, of a compressed lanceolate form, imbricated with about six flowers for the most part, but varying from five to ten.

POCHETTI. See BARBATELLI.

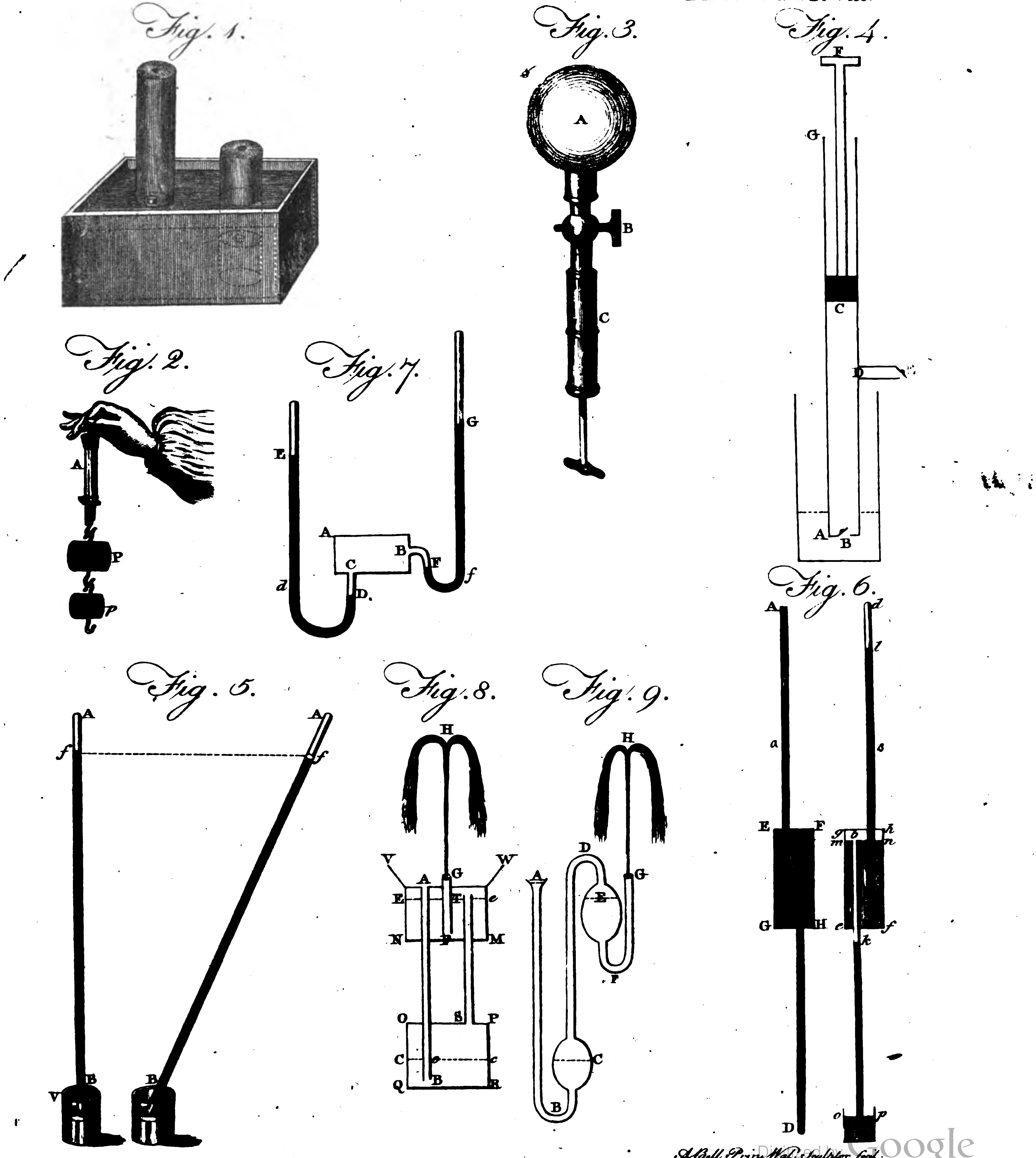
POCOCKE (Dr Edward), one of the most learned men in the oriental tongues in Europe, was the eldest son of the Rev. Edward Pococke; and was born at Oxford in 1604, where he was also bred. In 1628 he was admitted probationer-fellow of his college, and about the same time had prepared an edition of the Second Epistle of St Peter, the Second and Third of St John, and that of St Jude, in Syriac and Greek, with a Latin Translation and Notes. In 1629 he was ordained priest, and appointed chaplain to the English merchants at Aleppo, where he continued five or six

years; in which time he distinguished himself by his fortitude and zeal while the plague raged there. At length returning to England, he was in 1636 appointed reader of the Arabic lectures founded by archbishop Laud. Three years after he went to Constantinople, where he prosecuted his studies of the eastern tongues, and procured many valuable manuscripts. After near four years stay in that city, he embarked in 1640; and taking Paris in his way, visited Gabriel Sionita the famous Maronite, and Hugo Grotius. In 1643 he was presented to the rectory of Childrey in Berks; and about three years after married the daughter of Thomas Burdett, Esq. About the middle of 1647 he obtained the restitution of the salary of his Arabic lecture, which had been detained from him about three years. In 1648 king Charles I. who was then prisoner in the isle of Wight, nominated Mr Pococke to the professorship of Hebrew, and the canonry of Christ-church annexed to it; but in 1650 he was ejected from his canonry for refusing to take the engagement, and soon after a vote passed for depriving him of his Hebrew and Arabic lectures; but several governors of houses, &c. presenting a petition in his favour, he was suffered to enjoy both these places. He had some years before published his *Specimen Historiæ Arabum;* and now appeared his *Porta Mosis:* and soon after the English Polyglot edition of the Bible, to which he had largely contributed, and also Eutychius's Annals, with a Latin version. At the Restoration, he was restored to the canonry of Christ-church, and also received the degree of doctor of divinity. He then published his Arabic version of Grotius's Treatise of the Truth of the Christian Religion; and an Arabic poem intitled *Lamiato'l Ajam,* with a Latin translation and notes. Soon after he published Gregory Abul Pharajius's *Historia Dynastiarum.* In 1674 he published an Arabic version of the chief parts of the Liturgy of the Church of England; and a few years after his Commentary on the Prophecies of Micah, Malachi, Hosea, and Joel. This great man died in 1691, after having been for many years confessedly the first person in Europe for eastern learning; and was no less worthy of admiration for his uncommon modesty and humility, and all the virtues that can adorn a Christian. His theological works were republished at London in 1740, in two volumes in folio.

PODAGRA, or the GOUT. See MEDICINE, n° 211.

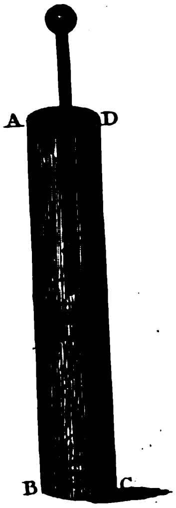
PODALIRIUS,

PNEUMATICS. Plate CCCXCIX.



A. Bell Prin. Wal. Sculptor fecit.

Fig. 11.



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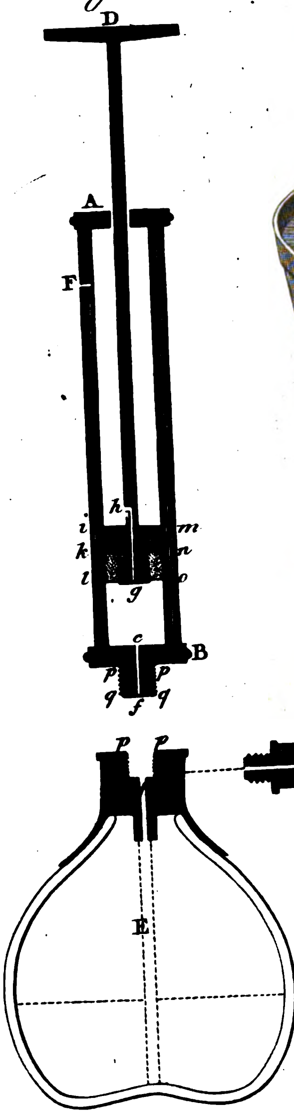


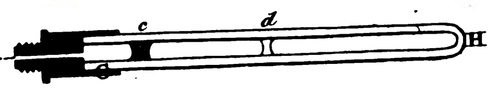
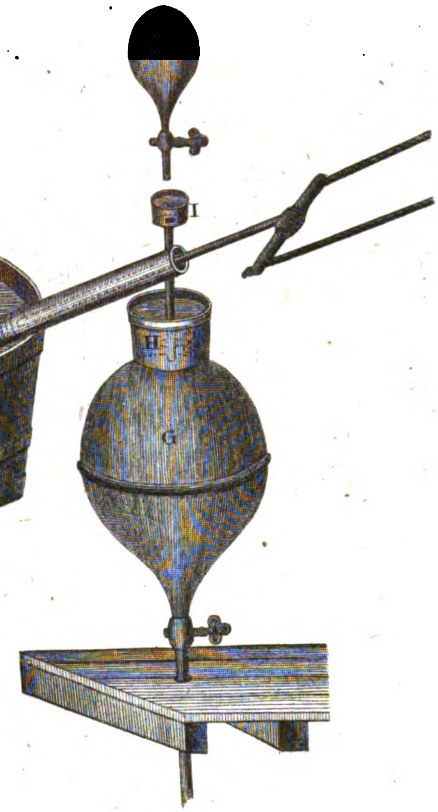


Fig. 16.

Fig. 17.



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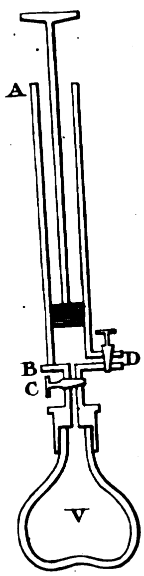

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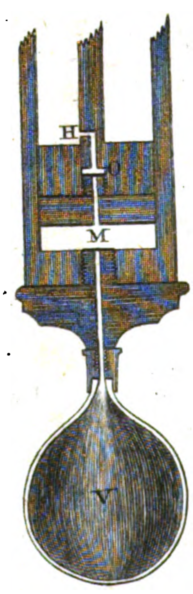

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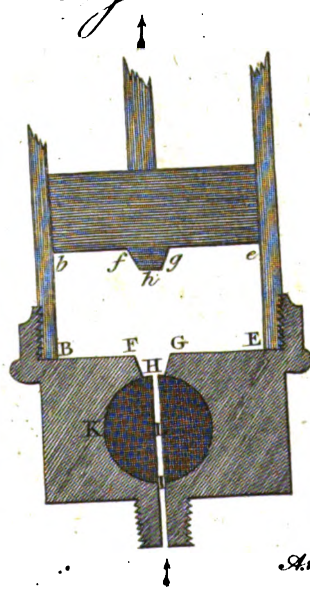

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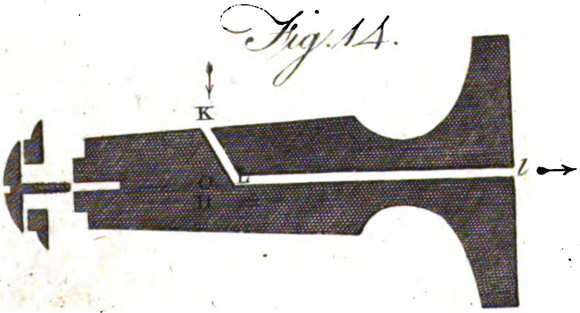
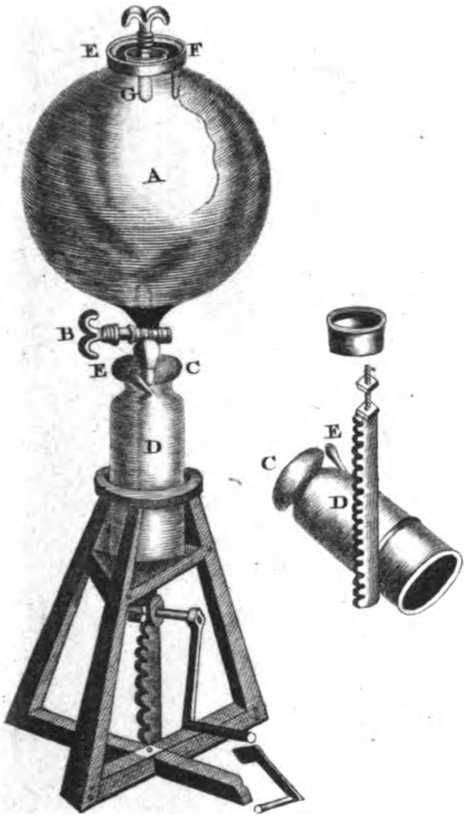


A. Bell Prin. Wal. Sculptor fecit.

Fig. 18.



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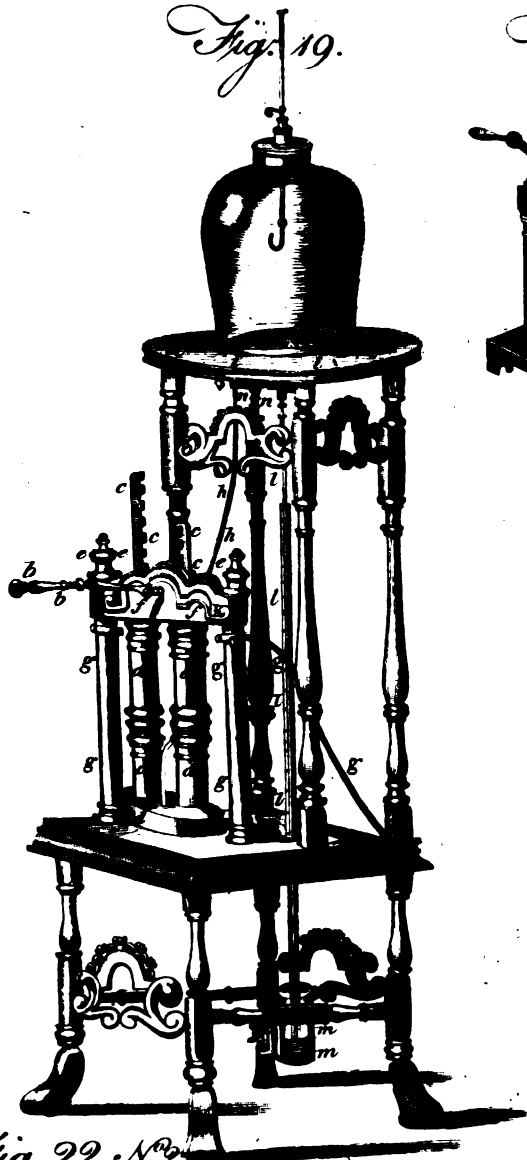

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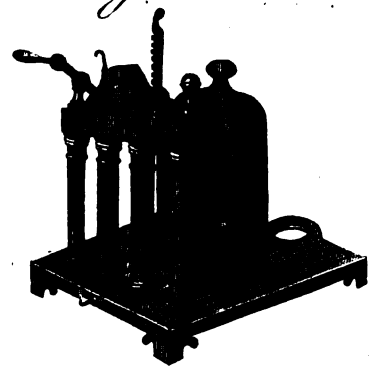

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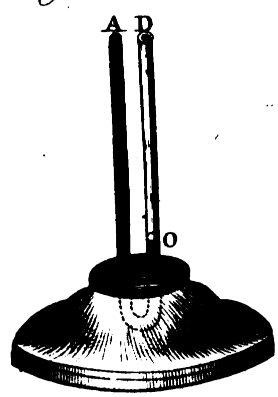

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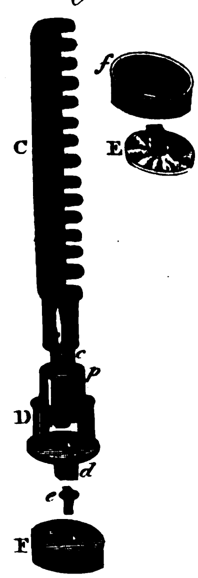

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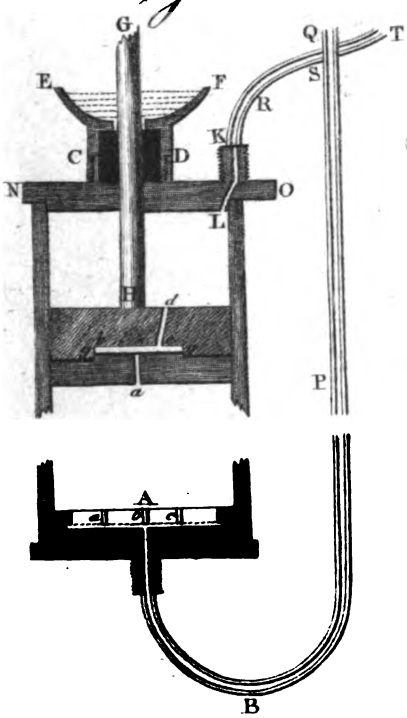

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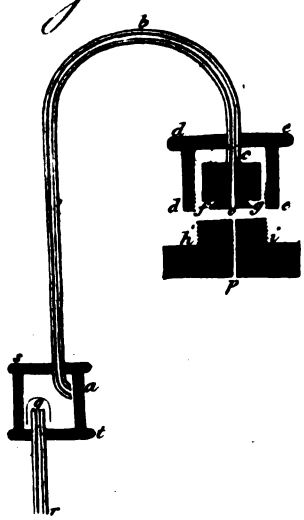

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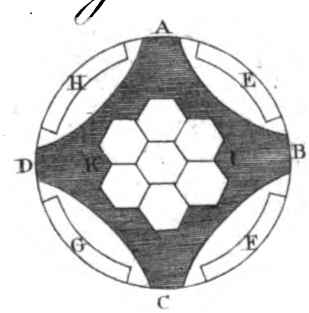


A. Bell Prin. Wal. Sculptor fecit.

Fig. 23.

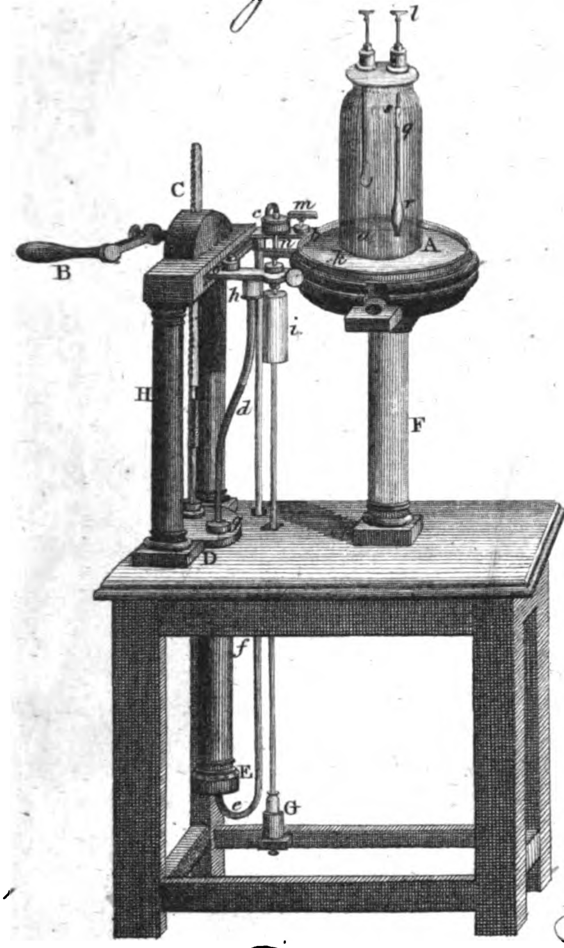


Fig. 24.

Fig. 30.

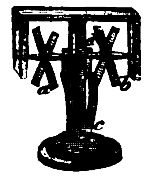
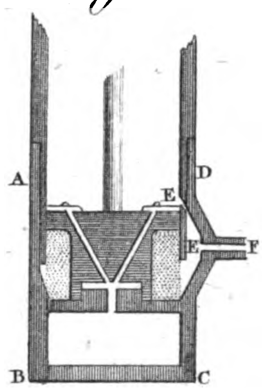


Fig. 31.

Fig. 27.



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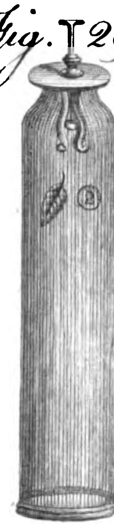

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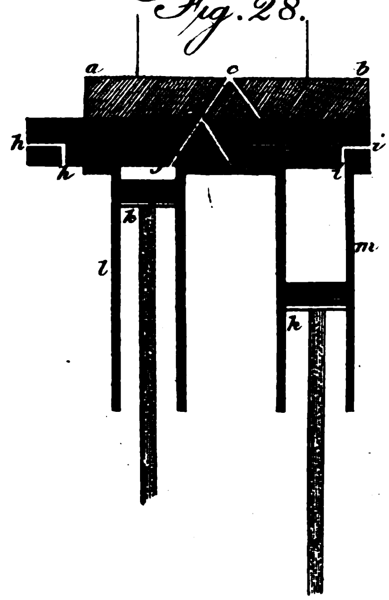

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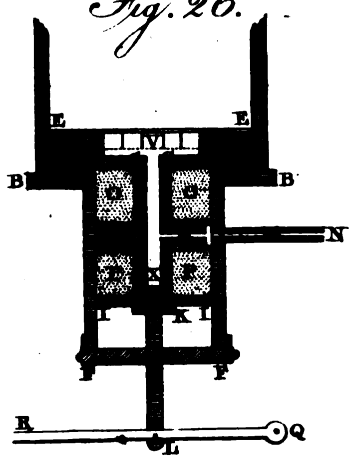

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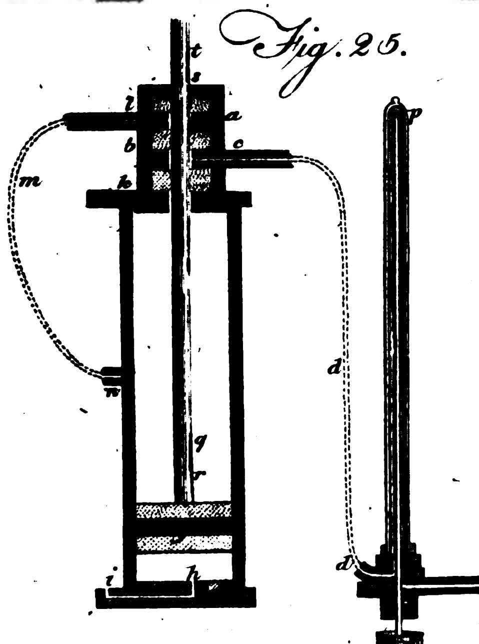


A. Bell Prin. Wal. Sculptor fecit.

Fig. 32.

Fig. 33.

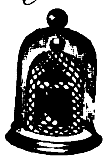
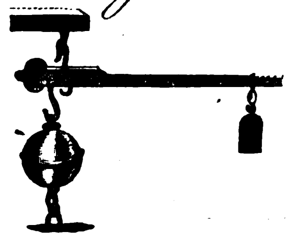


Fig. 34.

Fig. 35.



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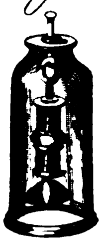

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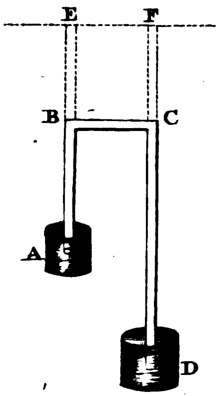

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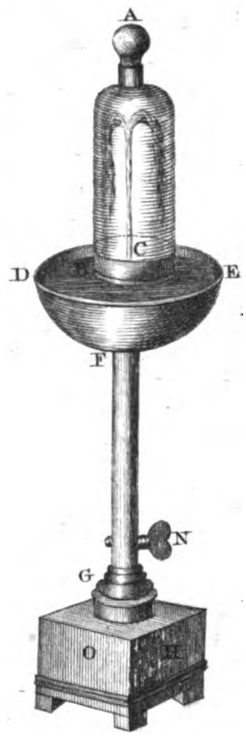

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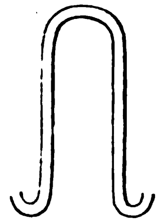

Fig. 38.

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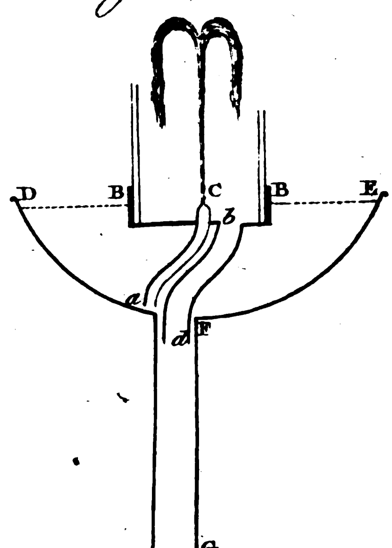

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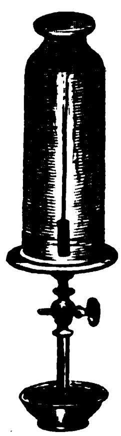

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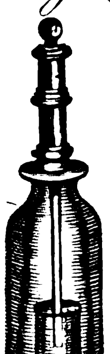

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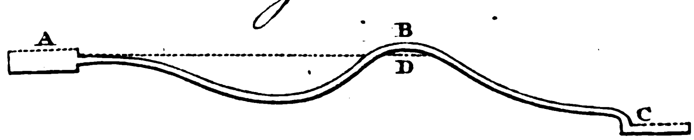
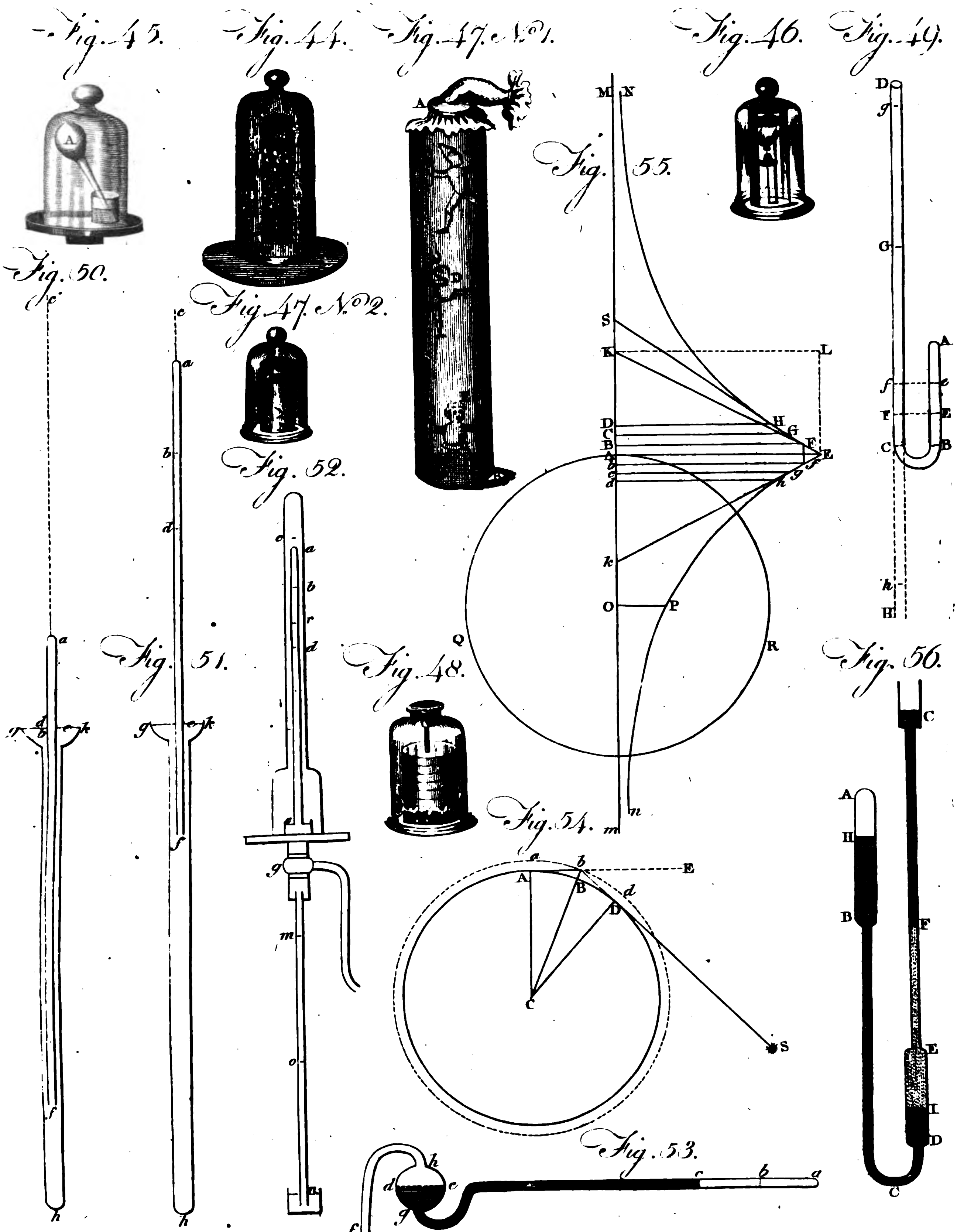


A. Bell Prin. Wal. Sculptor fecit.



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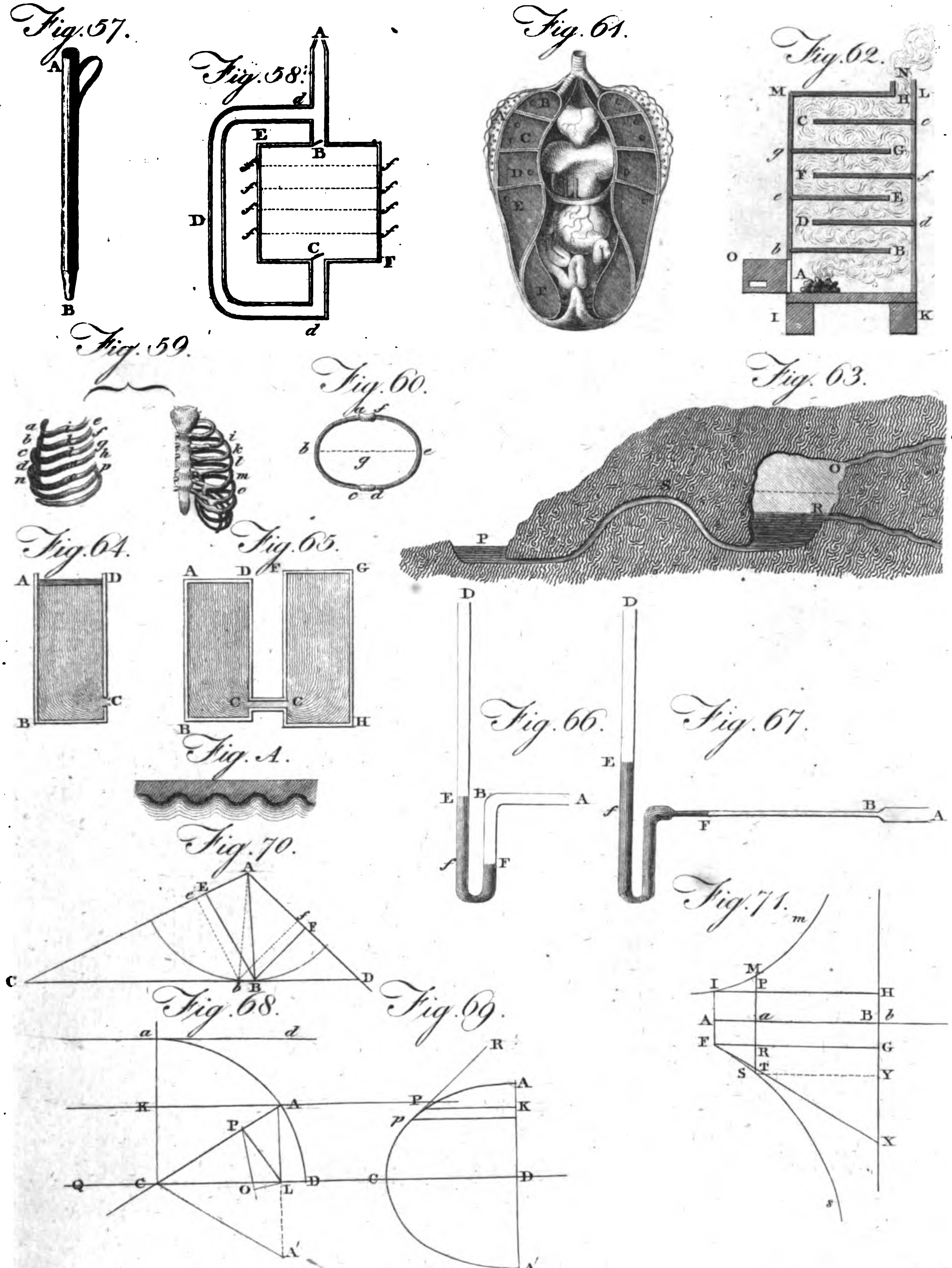
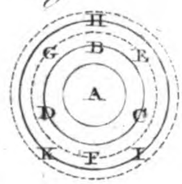


A. Bell Prin. Wal. Sculptor fecit.

Fig. 72.

Fig. 73.



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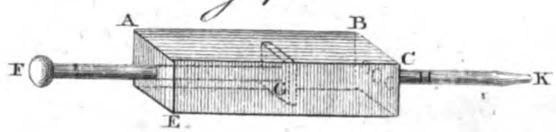

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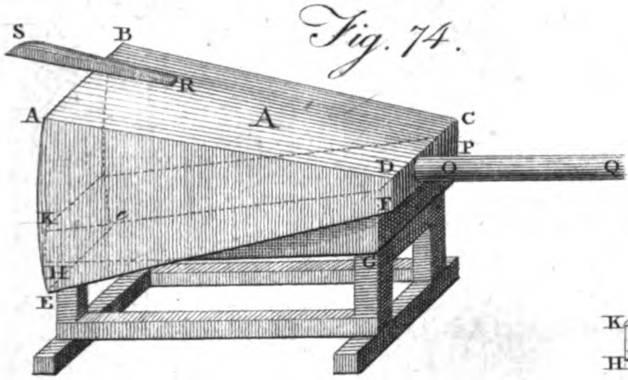

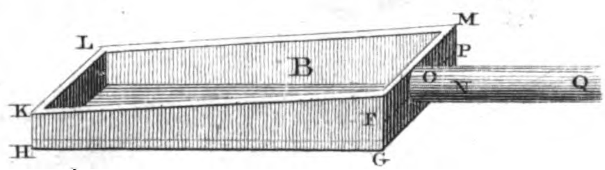

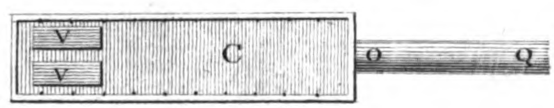

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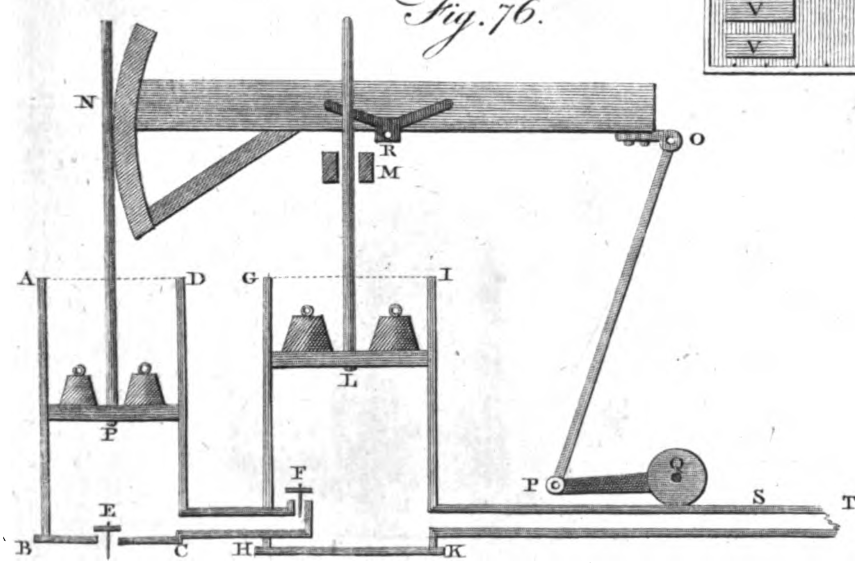
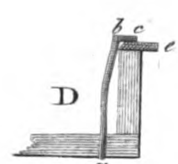
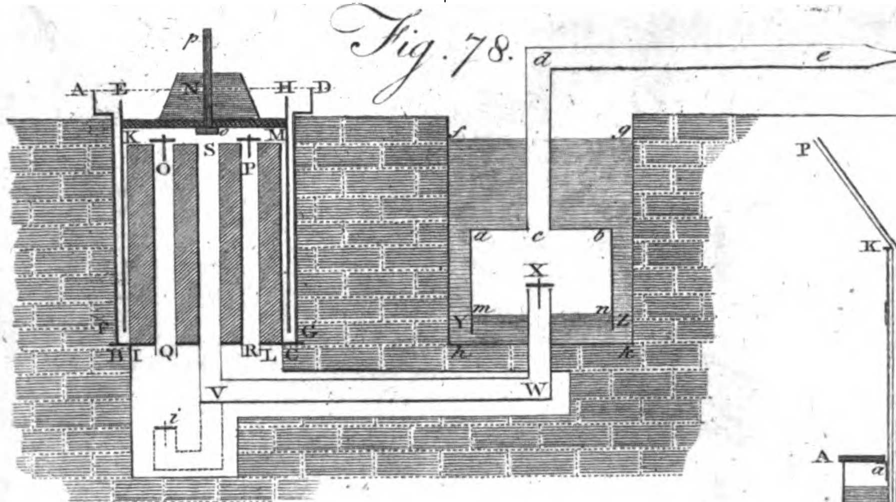




A. Bell Prin. Wal. Sculptor fecit.



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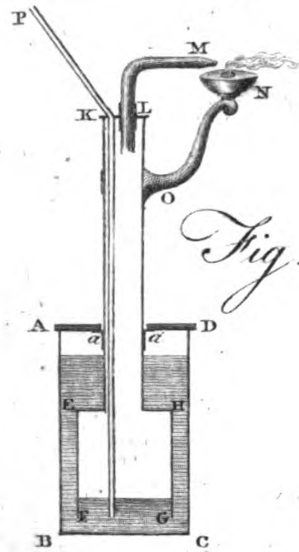

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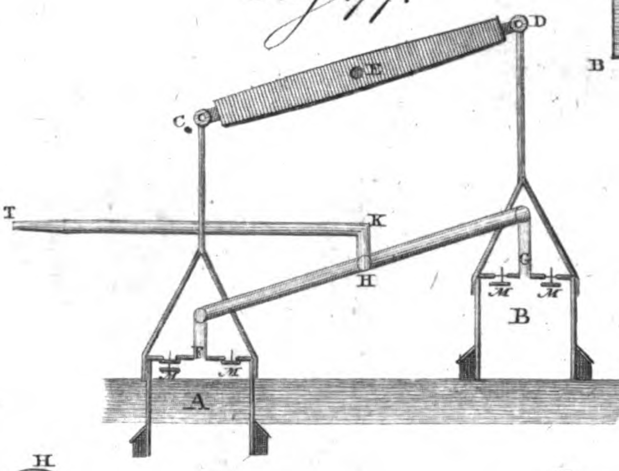

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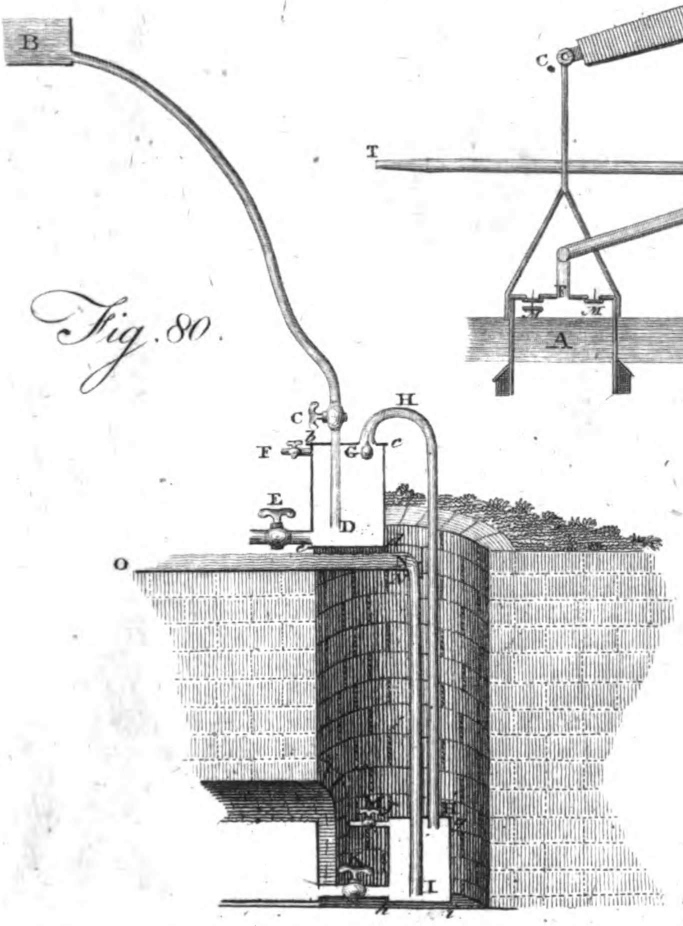

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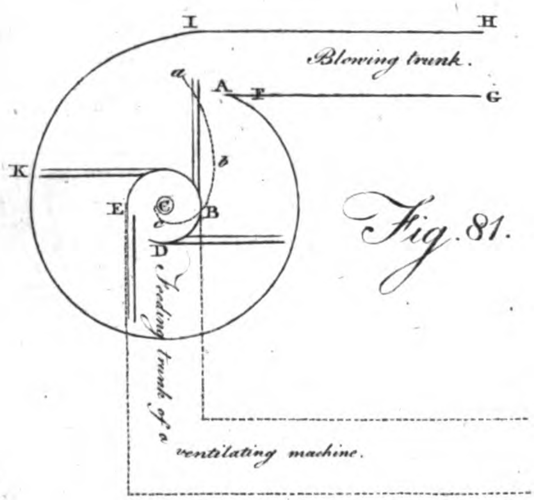


Fig. 81.

A. Bell Prin. Wal. Sculptor fecit.

Cuthbertson's Air pump.

Fig. 1.

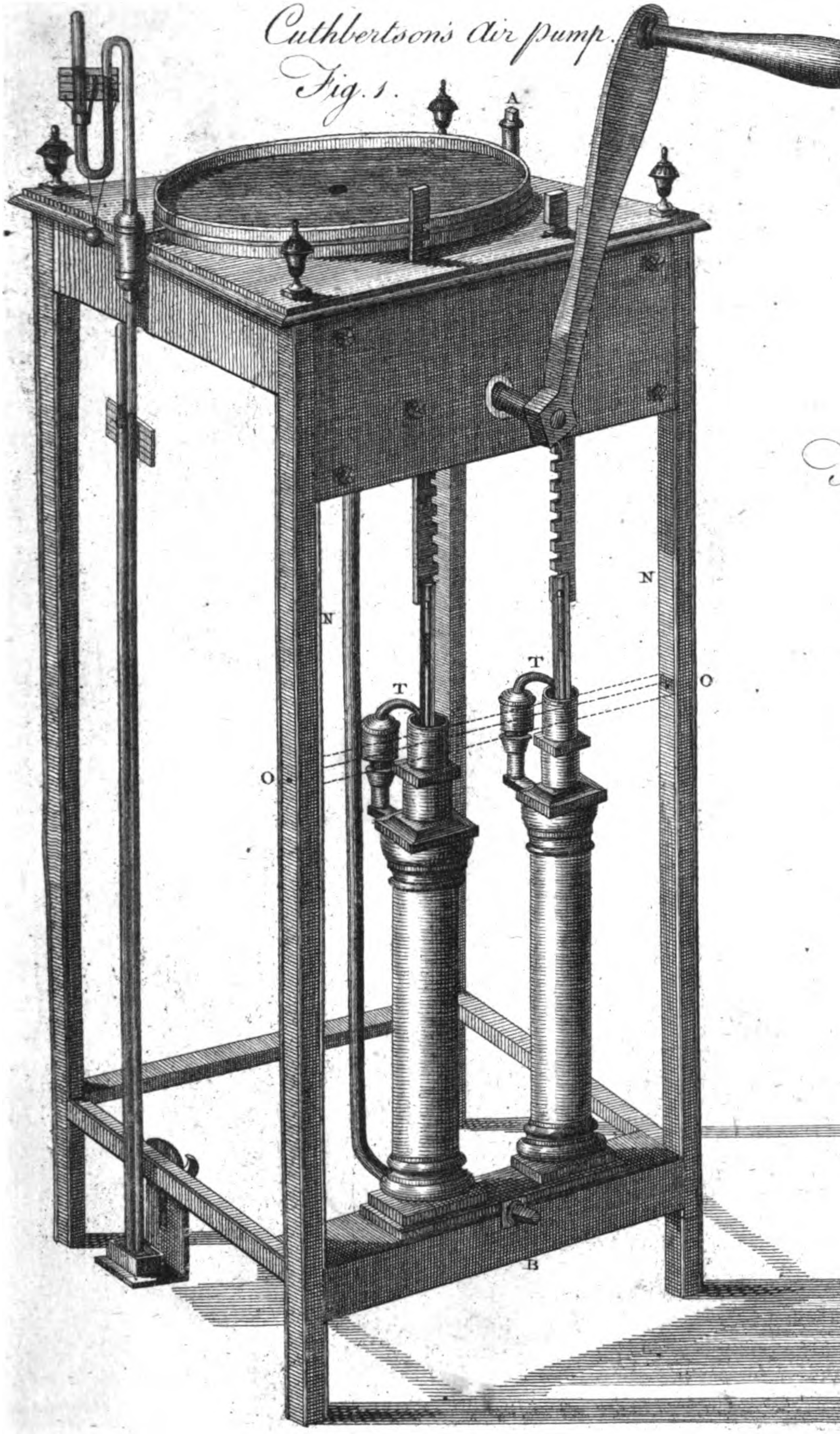
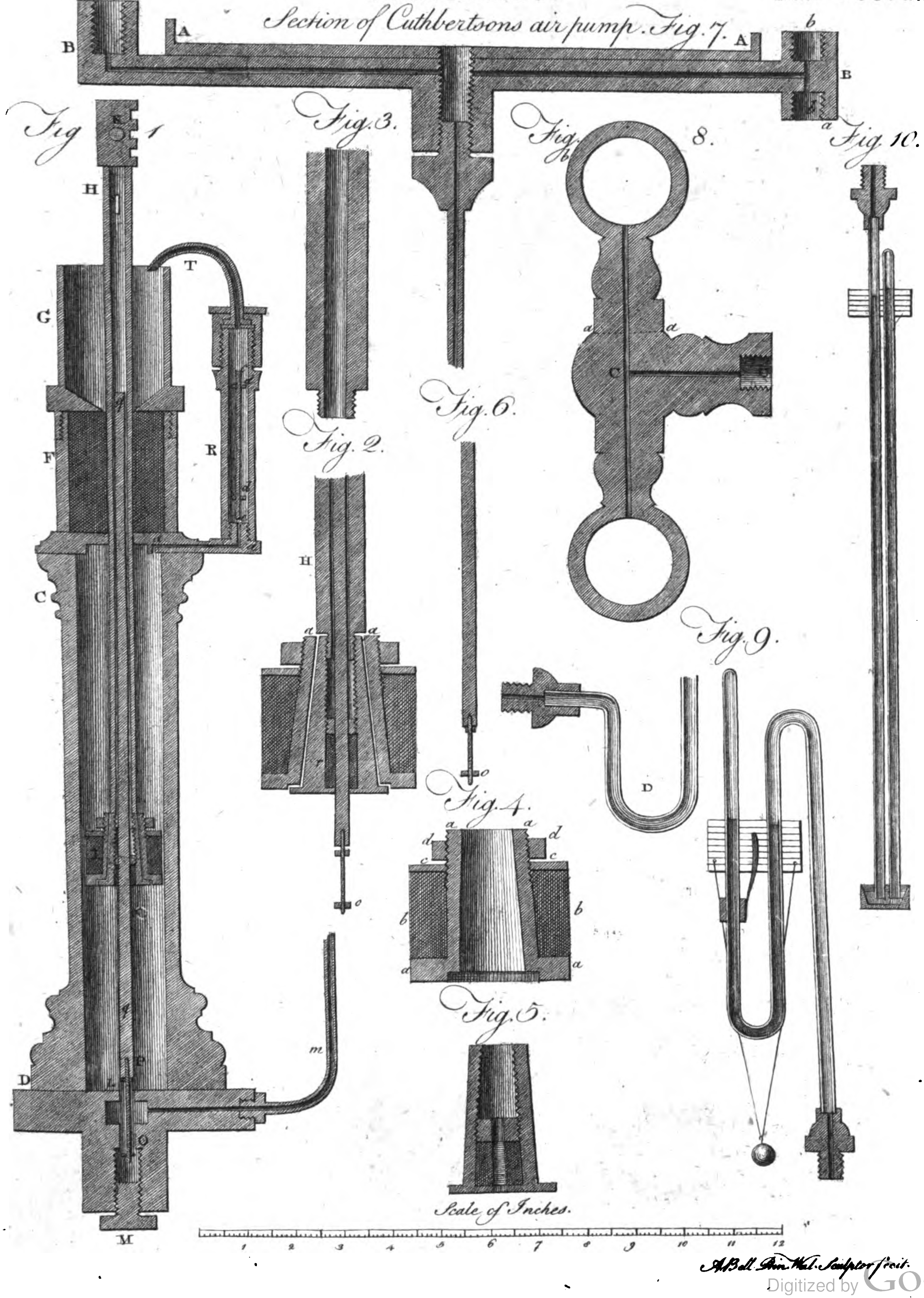


Fig. 2.

C.A.Bell Prin.Wal.Sculptor fecit.



A. Bell. Prin. Wal. Sculptor fecit.

PODALIRIUS, son of Æsculapius and Epione, was one of the pupils of the Centaur Chiron, under whom he made himself such a master of medicine, that during the Trojan war the Greeks invited him to their camp to stop a pestilence which had baffled the skill of all their physicians. Some suppose, however, that he went to the Trojan war, not in the capacity of a physician in the Grecian army, but as a warrior, attended by his brother Machaon, in 30 ships, with soldiers from Œchalia, Ithome, and Trica. At his return Podalirius was shipwrecked on the coast of Caria, where he cured of the falling sickness a daughter of the king of the place. He fixed his habitation there; and built two towns, one of which he called *Syrna*, after his wife. The Carians, on his death, built him a temple, and paid him divine honours.

PODEX, in anatomy, the same with ANUS.

PODGRAJE. See ASISIA.

PODOLIA, a province of Poland, bounded on the east by Volhinia and the river Ukrain; on the north and north-east, by Budsiac Tartary; on the south-east, by the river Niester, which separates it from Bessarabia and Moldavia in European Turkey on the south-west; and by the province of Red Russia on the north-west. It is usually divided into the Upper and Lower. In the Upper, which is the western part, the chief town is Kamieck, the capital of Podolia, and of a palatinate. In the Lower, or eastern part of Podolia, the chief town is Bracklaw, the capital of a palatinate.

PODOPHYLLUM, in botany: A genus of the monogynia order, belonging to the polyandria class of plants; and in the natural method ranking under the 27th order, *Rhœade*. The corolla has nine petals; the calyx triphyllous; the berry unilocular, crowned with the stigma.

PODURA, or SPRING TAIL, in zoology, a genus of insects of the order of aptera. *Linn. Syst. Nat.* p. 1013. They have six feet formed for running; two eyes composed of eight facets; a tail forked, bent under the body, elastic, and acting like a spring; the antennæ are long and setaceous. "This genus is distinguished (says Barbut) into several species. Some inhabit still waters, leaping and walking with ease on the surface of that element. They assemble in troops in the morning, on the banks of pools, fish-ponds, and reservoirs; others are found in damp places, under leaves, bark, and stones; others among heaps of rotten wood, mushrooms, and in melon-beds. In Lapland, they are seen running upon the snow, but when it begins to melt they perish. The podura, by its elasticity, eludes the eager grasp of the naturalist. Its hard forky tail is a kind of spring, by means of which the body of the animal is thrown up into the air." The podura villosa is one of the largest species found in Britain, and appears to be of a brown sooty colour, though it is really of a yellow brown, interspersed throughout with black-coloured spots and streaks. The head and thorax are hairy, and stick to the fingers when touched: the abdomen is smooth: the antennæ, consisting of four articulations, are as long as two-thirds of the body. It is commonly found under stones.

POE-BIRD, in ornithology, is an inhabitant of some of the South Sea islands, where it is held in great esteem and veneration by the natives. It goes by the name of *kogo* in New Zealand; but it is better known by that of *poë-bird*. It is somewhat less than our blackbird. The feathers are of a fine mazarine blue, except those of its neck, which are of a most beautiful silver grey, and two or three short white ones which are on the pinion-joint of the wing. Under its throat hang two little tufts of curled snow-white feathers, called its *poies* (the Otaheitian word for ear-rings); which occasioned the name of *poë-bird* being given to it. It is remarkable for the sweetness of its note, as well as the beauty of its plumage. Its flesh is also delicate food.

PŒCILE was a famous portico at Athens, which received its name from the variety (ποικιλος) of paintings which it contained. Zeno kept his school there; and there also the stoics received their lessons, whence their name, ἀ στοα, *a porch*. The Pœcile was adorned, among many others, with a picture of the siege and sacking of Troy, the battle of Theseus against the Amazons, and the fight between the Lacedæmonians and Athenians at Œnoe in Argolis. The only reward which Miltiades obtained after the battle of Marathon was to have his picture drawn more conspicuous than that of the rest of the officers that fought with him, in the representation which was made of the engagement, and which was hung up in the Pœcile in commemoration of that celebrated victory.

POEM, a poetical composition. See POETRY.

POESTUM, or POSIDONIA, an ancient city of Grecia Magna, now part of the kingdom of Naples. It was founded by one of those colonies from Greece which in the early ages established themselves in Italy; and it flourished before the foundation of Rome itself. It was destroyed by the Goths on the decline of the Roman empire, who in their barbarous zeal for the Christian religion overturned every place of Pagan worship which was exposed to their ravages. Since that time it has been in ruins; and these ruins were unknown till they were discovered in the following manner: "In the year 1755 (says the author of the *Antiquities, History, and Views of Pœstum*), an apprentice to a painter at Naples, who was on a visit to his friends at Capaccio, by accident took a walk to the mountains which surround the territory of Poestum. The only habitation he perceived was the cottage of a farmer, who cultivated the best part of the ground, and reserved the rest for pasture. The ruins of the ancient city made a part of this view, and particularly struck the eyes of the young painter; who, approaching nearer, saw with astonishment walls, towers, gates, and temples. Upon his return to Capaccio, he consulted the neighbouring people about the origin of these monuments of antiquity. He could only learn, that this part of the country had been uncultivated and abandoned during their memory; that about ten years before, the farmer, whose habitation he had noticed, established himself there; and that having dug in many places and searched among the ruins that lay round him, he had found treasures sufficient to enable him to purchase the whole. At the painter's return to Naples, he informed his master of these particulars, whose curiosity was so greatly excited by the description, that he took a journey to the place, and made drawings of the principal views. These were shown to the king of Naples, who ordered the ruins to be cleared, and Poestum arose from the obscurity in which it had remained for upwards of 700 years, as little known to the neighbouring inhabitants as to travellers."

Our author gives the following description of it in its

Pœstum. its present state. It is, says he, of an oblong figure, about two miles and a half in circumference. It has four gates, which are opposite to each other. On the key-stone of the arch of the north gate, on the outside, is the figure of Neptune in basso relievo, and within a hippocampus. The walls which still remain are composed of very large cubical stones, and are extremely thick, in some parts 18 feet. That the walls have remained unto this time is owing to the very exact manner in which the stones are fitted to one another (a circumstance observed universally in the masonry of the ancients), and perhaps in some measure to a stalactical concretion which has grown over them. On the walls here and there are placed towers of different heights; those near the gates being much higher and larger than the others, and evidently of modern workmanship. He observes, that, from its situation among marshes, bituminous and sulphureous springs, Poestum must have been unwholesome; a circumstance mentioned by Strabo, *Morbosam eam facit fluvius in paludes diffusus*. In such a situation the water must have been bad. Hence the inhabitants were obliged to convey that necessary of life from purer springs by means of aqueducts, of which many vestiges still remain.

The principal monuments of antiquity are a theatre, an amphitheatre, and three temples. The theatre and amphitheatre are much ruined. The first temple is hexastylos, and amphiprostylos. At one end, the pilasters and two columns which divided the cella from the pronaos are still remaining. Within the cella are two rows of smaller columns, with an architrave, which support the second order. This temple our author takes to be of that kind called by Vitruvius *hyphæthros*, and supports his opinion by a quotation from that author. The second temple is also amphiprostylos: it has nine columns in front and 18 in flank, and seems to be of that kind called by Vitruvius *pseudodipteros*. The third is likewise amphiprostylos. It has six columns in front and 13 in flank. Vitruvius calls this kind of temple *peripteros*. "The columns of these temples (says our author) are of that kind of Doric order which we find employed in works of the greatest antiquity. They are hardly five diameters in height. They are without bases, which also has been urged as a proof of their antiquity; but we do not find that the ancients ever used bases to this order, at least till very late. Vitruvius makes no mention of bases for this order: and the only instance we have of it is in the first order of the colisæum at Rome, which was built by Vespasian. The pillars of these temples are fluted with very shallow flutings in the manner described by Vitruvius. The columns diminish from the bottom, which was the most ancient method almost universally in all the orders. The columns have astragals of a very singular form; which shows the error of those who imagine that this member was first invented with the Ionic order, to which the Greeks gave an astragal, and that the Romans were the first who applied it to the Doric. The echinus of the capitol is of the same form with that of the temple of Corinth described by Le Roy." See *Swinburne's Travels in the Two Sicilies*, vol. ii. p. 131—140. Pœstum, Poet.

POET, the author of a poem. See the article POETRY.

Provencal Poets. See TROUBADOURS.

POETRY.

AMIDST those thick clouds which envelope the first ages of the world, reason and history throw some lights on the origin and primitive employment of this divine art. Reason suggests, that before the invention of letters, all the people of the earth had no other method of transmitting to their descendants the principles of their worship, their religious ceremonies, their laws, and the renowned actions of their sages and heroes, than by poetry; which included all these objects in a kind of hymns that fathers sung to their children, in order to engrave them with indelible strokes in their hearts. History not only informs us, that Moses and Miriam, the first authors that are known to mankind, sung, on the borders of the Red Sea, a song of divine praise, to celebrate the deliverance which the Almighty had vouchsafed to the people of Israel, by opening a passage to them through the waters; but it has also transmitted to us the song itself, which is at once the most ancient monument and a master-piece of poetic composition.

1 Origin of poetry.

The Greeks, a people the most ingenious, the most animated, and in every sense the most accomplished, that the world ever produced—strove to ravish from the Hebrews the precious gift of poetry, which was vouchsafed them by the Supreme Author of all nature, that they might ascribe it to their false deities. According to their ingenious fictions, Apollo became the god of poetry, and dwelt on the hills of Phocis, Parnassus, and Helicon, whose feet were washed by the waters of Hyppocrene, of which each mortal that ever drank was seized with a sacred delirium. The immortal swans floated on its waves. Apollo was accompanied by the Muses—those nine learned sisters—the daughters of Memory: and he was constantly attended by the Graces. Pegasus, his winged courser, transported him with a rapid flight into all the regions of the universe. Happy emblems! by which we at this day embellish our poetry, as no one has ever yet been able to invent more brilliant images.

The literary annals of all nations afford vestiges of poetry from the remotest ages. They are found among the most savage of the ancient barbarians, and the most desolate of all the Americans. Nature asserts her rights in every country and every age. Tacitus mentions the verses and the hymns of the Germans, at the time when that rough people yet inhabited the woods, and while their manners were still savage. The first inhabitants of Runnia, and the other northern countries, those of Gaul, Albion, Iberia, Ausonia, and other nations of Europe, had their poetry, as well as the ancient people of Asia, and of the known borders of Africa. But the simple productions of nature have constantly something unformed, rough, and savage. The Divine Wisdom appears to have placed the ingenious and polished part of mankind on the earth, in order to refine that which comes from her bosom rude and imperfect: and thus art has polished poetry, which issued quite naked and savage from the brains of the first of mankind.

But what is Poetry? It would be to abridge the limits

2 Definition of poetry. limits of the poetic empire, to contract the sphere of this divine art, should we say, in imitation of all the dictionaries and other treatises on versification, That *poetry is the art of making verses, of lines or periods that are in rhyme or metre.* This is rather a grammatical explanation of the word, than a real definition of the thing, and it would be to degrade poetry thus to define it. The father of criticism has denominated poetry τεχνη μιμητικη, *an imitative art*: but this, though just in itself, is too general for a definition, as it does not discriminate poetry from other arts which depend equally on imitation. The justest definition seems to be that given by Baron Bielfield *, *That poetry is the art of expressing our thoughts by fiction.* In fact, it is after this manner (if we reflect with attention) that all the metaphors and allegories, all the various kinds of fiction, form the first materials of a poetic edifice: it is thus that all images, all comparisons, allusions, and figures, especially those which personify moral subjects, as virtues and vices, concur to the decorating of such a structure. A work, therefore, that is filled with invention, that incessantly presents images which render the reader attentive and affected, where the author gives interesting sentiments to every thing that he makes speak, and where he makes speak by sensible figures all those objects which would affect the mind but weakly when clothed in a simple prosaic style, such a work is a poem. While that, though it be in verse, which is of a didactic, dogmatic, or moral nature, and where the objects are presented in a manner quite simple, without fiction, without images or ornaments, cannot be called *poetry*, but merely a work in verse; for the art of reducing thoughts, maxims, and periods, into rhyme or metre, is very different from the art of poetry.

* *Elem. of Univ. Erud.*

An ingenious fable, a lively and interesting romance, a comedy, the sublime narrative of the actions of a hero, such as the Telemachus of M. Fenelon, though written in prose, but in measured prose, is therefore a work of poetry: because the foundation and the superstructure are the productions of genius, as the whole proceeds from fiction; and truth itself appears to have employed an innocent and agreeable deception to instruct with efficacy. This is so true, that the pencil also, in order to please and affect, has recourse to fiction; and this part of painting is called the *poetic composition of a picture*. It is therefore by the aid of fiction that poetry, so to speak, paints its expressions, that it gives a body and a mind to its thoughts, that it animates and exalts that which would otherwise have remained arid and insensible. It is the peculiar privilege of poetry to exalt inanimate things into animals, and abstract ideas into persons. The former licence is so common, that it is now considered as nothing more than a characteristical dialect appropriated by the poets to distinguish themselves from the writers of prose; and it is at the same time so essential, that we question much if this species of composition could subsist without it: for it will perhaps, upon examination, be found, that in every poetical description some of the qualities of Animal Nature are ascribed to things not having life. Every work, therefore, where the thoughts are expressed by fictions or images, is poetic; and every work where they are expressed naturally, simply, and without ornament, although it be in verse, is prosaic.

Verse, however, is not to be regarded as foreign or superfluous to poetry. To reduce those images, those fictions, into verse, is one of the greatest difficulties in poetry, and one of the greatest merits in a poem: and for these reasons, the cadence, the harmony of sounds, particularly that of rhyme, delight the ear to a high degree, and the mind insensibly repeats them while the eye reads them. There results therefore a pleasure to the mind, and a strong attachment to these ornaments: but this pleasure would be frivolous, and even childish, 3 Verse, though not essential to poetry, one of its excellencies.
if it were not attended by a real utility. Verses were invented in the first ages of the world, merely to aid and to strengthen the memory: for cadence, harmony, and especially rhyme, afford the greatest assistance to the memory that art can invent; and the images, or poetic fictions, that strike our senses, assist in graving them with such deep traces in our minds, as even time itself frequently cannot efface. How many excellent apophthegms, sentences, maxims, and precepts, would have been buried in the abyss of oblivion, if poetry had not preserved them by its harmony? To give more efficacy to this lively impression, the first poets sung their verses, and the words and phrases must necessarily have been reduced, at least to cadence, or they could not have been susceptible of musical expression. One of the great excellencies, therefore, though not a necessary constituent, of poetry, consists in its being expressed in verse. See Part III.

PART I. GENERAL PRINCIPLES OF THE ART.

SECT. I. *Of the Essence and End of Poetry.*

THE *essence* of *Polite Arts* in general, and consequently of poetry in particular, consists in *expression*; and we think that, to be poetic, the expression must necessarily arise from *fiction*, or invention. (See the article ART, particularly from n° 12. to the end.) This invention, which is the fruit of happy genius alone, arises, 1. From the subject itself of which we undertake to treat: 2. From the manner in which we treat that subject, or the species of writing of which we make use: 3. From the plan that we propose to follow in conformity to this manner; and, 4. From the method of executing this plan in its full detail.) Our first guides, the ancients, afford us no lights that can elucidate all these objects in general. The precepts which Aristotle lays down, relate to epic and dramatic poetry only: and which, by the way, confirms our idea, that antiquity itself made the essence of poetry to consist in fiction, and not in that species of verse which is destitute of it, or in that which is not capable of it. But since this art has arrived to a great degree of perfection; and as poetry, like electricity, communicates its fire to every thing it touches, and animates and embellishes whatever it treats; there seems to be no subject in the universe to which poetry cannot be applied, and which it cannot render equally brilliant and pleasing. From this universality of poetry, from its peculiar property of expression by fiction, which is applicable to all subjects, have arisen its different species, of which a particular description will be given in the *second* part.

4 Essence of poetry.

Horace, in a well-known verse, has been supposed to

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declare the *end* of poetry to be twofold, to please, or to instruct:

Aut prodesse volunt, aut delectare poetæ.

5 End of poetry.

But Dr Beattie * maintains, that the ultimate end of this art is to please; instruction being only one of the means (and not always a necessary one) by which that ultimate end is to be accomplished. The passage rightly understood, he observes, will not appear to contain any thing inconsistent with this doctrine. The author is there stating a comparison between the Greek and Roman writers, with a view to the poetry of the stage; and, after commending the former for their correctness, and for the liberal spirit wherewith they conducted their literary labours, and blaming his countrymen for their inaccuracy and avarice, he proceeds thus: "The ends proposed by our dramatic poets (or by poets in general) are, to please, to instruct, or to do both. When instruction is your aim, let your moral sentences be expressed with brevity, that they may be readily understood, and long remembered: where you mean to please, let your fictions be conformable to truth, or probability. The elder part of your audience (or readers) have no relish for poems that give pleasure only without instruction; nor the younger for such writings as give instruction without pleasure. He only can secure the universal suffrage in his favour, who blends the useful with the agreeable, and delights at the same time that he instructs the reader. Such are the works that bring money to the bookseller, that pass into foreign countries, and perpetuate the author's name through a long succession of ages †."—Now, what is the meaning of all this? What, but that to the *perfection* of dramatic poetry (or, if you please, of poetry in general) both sound morals and beautiful fiction are requisite? But Horace never meant to say, that instruction, as well as pleasure, is necessary to give to any composition the *poetical character*; or he would not in another place have celebrated with so much affection and rapture the melting strains of Sappho, and the playful genius of Anacreon ‡,—two authors transcendently sweet, but not remarkably instructive. We are sure, that pathos, and harmony, and elevated language, were, in Horace's opinion, essential to poetry §; and of these decorations nobody will affirm that instruction is the end, who considers that the most instructive books in the world are written in plain prose.

* *Essays on Poetry and Music*, Part I. chap. i.

† *Hor. Ar. Poet.* 333--347.

‡ *Hor. Carm* lib 4. ode 9.

§ *Hor. Sat.* lib. 1. sat. 4 ver. 40.

In short, our author has endeavoured by many ingenious arguments and illustrations to establish it as a truth in criticism, that the end of poetry is *to please*. Verses, if pleasing, may be poetical, though they convey little or no instruction; but verses, whose sole merit it is that they convey instruction, are not poetical. Instruction, however, he admits, especially in poems of length, is necessary to their *perfection*, because they would not be *perfectly agreeable* without it.

Sect. II. *Of the Standard of Poetical Invention.*

6 Poetical invention to be regulated

Homer's beautiful description of the heavens and earth, as they appear in a calm evening by the light of the moon and stars, concludes with this circumstance, "And the heart of the shepherd is glad ¶." Madame Dacier, from the turn she gives to the passage in her version, seems to think, and Pope, in order perhaps to make out his couplet, insinuates, that the gladness of the shepherd is owing to his sense of the utility of those luminaries. And this may in part be the case: but this is not in Homer; nor is it a necessary consideration. It is true, that, in contemplating the material universe, they who discern the causes and effects of things must be more rapturously entertained than those who perceive nothing but shape and size, colour and motion. Yet, in the mere outside of Nature's work, there is a splendor and a magnificence to which even untutored minds cannot attend without great delight.

¶ *Iliad*, b. 8. v. 555.

Beattie's Essays, Part I. chap. ii.

Not that all peasants or all philosophers are equally susceptible of these charming impressions. It is strange to observe the callousness of some men, before whom all the glories of heaven and earth pass in daily succession, without touching their hearts, elevating their fancy, or leaving any durable remembrance. Even of those who pretend to sensibility, how many are there to whom the lustre of the rising or setting sun; the sparkling concave of the midnight-sky; the mountain-forest tossing and roaring to the storm, or warbling with all the melodies of a summer-evening; the sweet interchange of hill and dale, shade and sunshine, grove, lawn, and water, which an extensive landscape offers to the view; the scenery of the ocean, so lovely, so majestic, and so tremendous; and the many pleasing varieties of the animal and vegetable kingdoms, could never afford so much real satisfaction, as the steams and noise of a ball-room, the insipid fiddling and squeaking of an opera, or the vexations and wranglings of a card-table!

But some minds there are of a different make; who, even in the early part of life, receive from the contemplation of Nature a species of delight which they would hardly exchange for any other, and who, as avarice and ambition are not the infirmities of that period, would, with equal sincerity and rapture, exclaim,

> I care not, Fortune, what you me deny;
> You cannot rob me of free Nature's grace;
> You cannot shut the windows of the sky,
> Through which Aurora shows her bright'ning face;
> You cannot bar my constant feet to trace
> The woods and lawns by living stream at eve.
>
> *Castle of Indolence.*

Such minds have always in them the seeds of true taste, and frequently of imitative genius. At least, though their enthusiastic or visionary turn of mind (as the man of the world would call it) should not always incline them to practise poetry or painting, we need not scruple to affirm, that without some portion of this enthusiasm no person ever became a true poet or painter. For he who would imitate the works of nature, must first accurately observe them; and accurate observation is to be expected from those only who take great pleasure in it.

To a mind thus disposed no part of creation is indifferent. In the crowded city and howling wilderness; in the cultivated province and solitary isle; in the flowery lawn and craggy mountain; in the murmur of the rivulet and in the uproar of the ocean; in the radiance of summer and gloom of winter; in the thunder of heaven and in the whisper of the breeze; he still finds something to rouze or to soothe his imagination, to draw forth his affections, or to employ his understanding. And from every mental energy that is not attended

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attended with pain, and even from some of those that are, as moderate terror and pity, a sound mind derives satisfaction; exercise being equally necessary to the body and the soul, and to both equally productive of health and pleasure.

This happy sensibility to the beauties of nature should be cherished in young persons. It engages them to contemplate the Creator in his wonderful works; it purifies and harmonizes the soul, and prepares it for moral and intellectual discipline; it supplies an endless source of amusement; it contributes even to bodily health: and, as a strict analogy subsists between material and moral beauty, it leads the heart by an easy transition from the one to the other; and thus recommends virtue for its transcendant loveliness, and makes vice appear the object of contempt and abomination. An intimate acquaintance with the best descriptive poets, Spenser, Milton, and Thomson, but above all with the divine Georgic, joined to some practice in the art of drawing, will promote this amiable sensibility in early years: for then the face of nature has novelty superadded to its other charms, the passions are not pre-engaged, the heart is free from care, and the imagination warm and romantic.

7 By the standard of nature.

But not to insist longer on those ardent emotions that are peculiar to the enthusiastic disciple of nature, may it not be affirmed of all men, without exception, or at least of all the enlightened part of mankind, that they are gratified by the contemplation of things natural, as opposed to unnatural? Monstrous sights please but for a moment, if they please at all; for they derive their charm from the beholder's amazement, which is quickly over. We read indeed of a man of rank in Sicily *, who chooses to adorn his villa with pictures and statues of most unnatural deformity: but it is a singular instance; and one would not be much more surprised to hear of a person living without food, or growing fat by the use of poison. To say of any thing, that it is *contrary to nature*, denotes censure and disgust on the part of the speaker; as the epithet *natural* intimates an agreeable quality, and seems for the most part to imply, that a thing is as it ought to be, suitable to our own taste, and congenial with our own constitution. Think with what sentiments we should peruse a poem, in which nature was totally misrepresented, and principles of thought, and of operation supposed to take place, repugnant to every thing we had seen or heard of:—in which, for example, avarice and coldness were ascribed to youth, and prodigality and passionate attachment to the old; in which men were made to act at random, sometimes according to character, and sometimes contrary to it; in which cruelty and envy were productive of love, and beneficence and kind affection of hatred; in which beauty was invariably the object of dislike, and ugliness of desire; in which society was rendered happy by atheism and the promiscuous perpetration of crimes, and justice and fortitude were held in universal contempt. Or think, how we should relish a painting, where no regard was had to the proportions, colours, or any of the physical laws, of Nature:—where the ears and eyes of animals were placed in their shoulders; where the sky was green and the grass crimson; where trees grew with their branches in the earth and their roots in the air; where men were seen fighting after their heads were cut off, ships sailing on the land, lions entangled in cobwebs, sheep preying on dead carcases, fishes sporting in the woods, and elephants walking on the sea. Could such figures and combinations give pleasure, or merit the appellation of sublime or beautiful? Should we hesitate to pronounce their author mad? And are the absurdities of madmen proper subjects either of amusement or of imitation to reasonable beings?

* *Brydone's Tour in Sicily*, let. 24.

Let it be remarked, too, that though we distinguish our internal powers by different names, because otherwise we could not speak of them so as to be understood, they are all but so many energies of the same individual mind; and therefore it is not to be supposed, that what contradicts any one leading faculty should yield permanent delight to the rest. That cannot be agreeable to reason, which conscience disapproves; nor can that gratify imagination, which is repugnant to reason.——Besides, belief and acquiescence of mind are pleasant, as distrust and disbelief are painful: and therefore, that only can give solid and general satisfaction, which has something of plausibility in it; something which we conceive it possible for a rational being to believe. But no rational being can acquiesce in what is obviously contrary to nature, or implies palpable absurdity.

Poetry, therefore, and indeed every art whose end is to please, must be natural; and if so, must exhibit real matter of fact, or something like it; that is, in other words, must be either according to truth or according to verisimilitude.

And tho' every part of the material universe abounds in objects of pleasurable contemplation, yet nothing in nature so powerfully touches our hearts, or gives so great variety of exercise to our moral and intellectual faculties, as man. Human affairs and human feelings are universally interesting. There are many who have no great relish for the poetry that delineates only irrational or inanimate beings; but to that which exhibits the fortunes, the characters, and the conduct of men, there is hardly any person who does not listen with sympathy and delight. And hence, to imitate human action, is considered by Aristotle as essential to this art; and must be allowed to be essential to the most pleasing and most instructive part of it, Epic and Dramatic composition. Mere descriptions, however beautiful, and moral reflections, however just, become tiresome, where our passions are not occasionally awakened by some event that concerns our fellow-men. Do not all readers of taste receive peculiar pleasure from those little tales or episodes with which Thomson's descriptive poem on the Seasons is here and there enlivened? and are they not sensible, that the thunder-storm would not have been half so interesting without the tale of the two lovers (*Summ.* v. 1171); nor the harvest-scene, without that of Palemon and Lavinia (*Aut.* v. 177.); nor the driving snows, without that exquisite picture of a man perishing among them (*Winter*, v. 276.)? It is much to be regretted, that Young did not employ the same artifice to animate his Night-Thoughts. Sentiments and descriptions may be regarded as the pilasters, carvings, gildings, and other decorations of the poetical fabric: but human actions are the columns and the rafters that give it stability and elevation. Or, changing the metaphor, we may consider these as the soul which informs the lovely frame; while those are little more than the ornaments of the body.

Whether the pleasure we take in things natural, and our

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our dislike to what is the reverse, be the effect of habit or of constitution, is not a material inquiry. There is nothing absurd in supposing, that between the soul, in its first formation, and the rest of nature, a mutual harmony and sympathy may have been established, which experience may indeed confirm, but no perverse habits could entirely subdue. As no sort of education could make man believe the contrary of a self-evident axiom, or reconcile him to a life of perfect solitude; so we should imagine, that our love of nature and regularity might still remain with us in some degree, though we had been born and bred in the Sicilian villa abovementioned, and never heard any thing applauded but what deserved censure, nor censured but what merited applause. Yet habit must be allowed to have a powerful influence over the sentiments and feelings of mankind: for objects to which we have been long accustomed, we are apt to contract a fondness: we conceive them readily, and contemplate them with pleasure; nor do we quit our old tracts of speculation or practice without reluctance and pain. Hence in part arises our attachment to our own professions, our old acquaintance, our native soil, our homes, and to the very hills, streams, and rocks in our neighbourhood. It would therefore be strange, if man, accustomed as he is from his earliest days to the regularity of nature, did not contract a liking to her productions and principles of operation.

8 Habit has great influence over sentiment and feeling, and of course upon poetry.

9 No necessity that the poet should exactly copy nature.

Yet we neither expect nor desire, that every human invention, where the end is only to please, should be an exact transcript of real existence. It is enough, that the mind acquiesce in it as probable or plausible, or such as we think might happen without any direct opposition to the laws of nature:—Or, to speak more accurately, it is enough that it be consistent, either, first, with general experience; or, secondly, with popular opinion; or, thirdly, that it be consistent with itself, and connected with probable circumstances.

First: If a human invention be consistent with *general* experience, we acquiesce in it as sufficiently probable. *Particular* experiences, however, there may be, so uncommon, and so little expected, that we should not admit their probability, if we did not know them to be true. No man of sense believes, that he has any likelihood of being enriched by the discovery of hidden treasure; or thinks it probable, on purchasing a lottery-ticket, that he shall gain the first prize: and yet great wealth has actually been acquired by such good fortune. But we should look upon these as poor expedients in a play or romance for bringing about a happy catastrophe. We expect that fiction should be more consonant to the general tenor of human affairs; in a word, that not possibility, but probability, should be the standard of poetical invention.

10 Fiction sufficiently conformable to nature when it accords with received opinions.

Secondly: Fiction is admitted as conformable to this standard, when it accords with received opinions. These may be erroneous, but are not often *apparently* repugnant to nature. On this account, and because they are familiar to us from our infancy, the mind readily acquiesces in them, or at least yields them that degree of credit which is necessary to render them pleasing: hence the fairies, ghosts, and witches of Shakespeare, are admitted as probable beings; and angels obtain a place in religious pictures though we know that they do not now appear in the scenery of real life. A poet who should at this day make the whole action of his tragedy depend upon enchantment, and produce the chief events by the assistance of supernatural agents, would indeed be censured as transgressing the bounds of probability, be banished from the theatre to the nursery, and condemned to write fairy tales instead of tragedies. But Shakespeare was in no danger of such censures: In his days the doctrine of witchcraft was established both by law and by the fashion; and it was not only unpolite, but criminal, to doubt it. Now indeed it is admitted only by the vulgar; but it does not therefore follow that an old poem built upon it should not be acceptable to the learned themselves. When a popular opinion has long been exploded, and has become repugnant to philosophical belief, the fictions built upon it are still admitted as natural, both because we all remember to have listened to them in childhood with some degree of credit, and because we know that they were accounted natural by the people to whom they were first addressed; whose sentiments and views of things we are willing to adopt, when, by the power of pleasing description, we are introduced into their scenes, and made acquainted with their manners. Hence we admit the theology of the ancient poets, their Elysium and Tartarus, Scylla and Charybdis, Cyclops and Circe, and the rest of those "beautiful wonders" (as Horace calls them) which were believed in the heroic ages; as well as the demons and enchantments of Tasso, which may be supposed to have obtained no small degree of credit among the Italians of the 16th century, and are suitable enough to the notions that prevailed universally in Europe not long before (A). In fact, when poetry is in other respects true, when it gives an accurate display of those parts of nature about which we know that men in all ages must have entertained the same opinion, namely, those appearances in the visible creation, and those feelings and workings of the human mind, which are obvious to all mankind;—when poetry is thus far according to nature, we are very willing to be indulgent to what is fictitious in it, and to grant a temporary allowance to any system of fable which the author pleases to adopt; provided that he lay the scene in a distant country, or fix the date to a remote period. This is no unreasonable piece of complaisance; we owe it both to the poet and to ourselves; for without it we should neither form a right estimate of his genius, nor receive from his works that pleasure which they were intended to impart. Let him, however, take care, that his system of fable be such as his countrymen and cotemporaries (to whom his work is immediately addressed) might be supposed capable of yielding their assent to; for otherwise we should not believe him to be in earnest: and let him connect it as much

(A) In the 14th century, the common people of Italy believed, that the poet Dante went down to hell; that the *Inferno* was a true account of what he saw there; and that his sallow complexion, and stunted beard (which seemed by its growth and colour to have been too near the fire), were the consequence of his passing so much of his time in that hot and smoky region. See *Vicende della Literatura del Sig. C. Denina*, cap. 4.

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much as he can with probable circumstances, and make it appear in a series of events consistent with itself.

For (thirdly) if this be the case, we shall admit his story as probable, or at least as natural, and consequently be interested in it, even though it be not warranted by general experience, and derive but slender authority from popular opinion. Calyban, in the Tempest, would have shocked the mind as an improbability, if we had not been made acquainted with his origin, and seen his character displayed in a series of consistent behaviour. But when we are told that he sprung from a witch and a demon, a connection not contrary to the laws of nature, as they were understood in Shakespeare's time, and find his manners conformable to his descent, we are easily reconciled to the fiction. In the same sense, the Lilliputians of Swift may pass for probable beings; not so much because we know that a belief in pigmies was once current in the world (for the true ancient pigmy was at least thrice as tall as those whom Gulliver visited), but because we find that every circumstance relating to them accords with itself, and with their supposed character. It is not the size of the people only that is diminutive; their country, seas, ships, and towns, are all in exact proportion; their theological and political principles, their passions, manners, customs, and all the parts of their conduct, betray a levity and littleness perfectly suitable; and so simple is the whole narration, and apparently so artless and sincere, that we should not much wonder if it had imposed (as we have been told it has) upon some persons of no contemptible understanding. The same degree of credit may perhaps for the same reasons be due to his giants. But when he grounds his narrative upon a contradiction to nature; when he presents us with rational brutes, and irrational men; when he tells us of horses building houses for habitation, milking cows for food, riding in carriages, and holding conversations on the laws and politics of Europe; not all his genius (and he there exerts it to the utmost) is able to reconcile us to so monstrous a fiction: we may smile at some of his absurd exaggerations; we may be pleased with the energy of style, and accuracy of description, in particular places; and a malevolent heart may triumph in the satire; but we can never relish it as a fable, because it is at once unnatural and self-contradictory. Swift's judgment seems to have forsaken him on this occasion: he wallows in nastiness and brutality: and the general run of his satire is downright defamation. Lucian's *True History* is a heap of extravagancies put together without order or unity, or any other apparent design than to ridicule the language and manner of grave authors. His ravings, which have no better right to the name of *fable*, than a hill of rubbish has to that of palace, are destitute of every colour of plausibility. Animal trees, ships sailing in the sky, armies of monstrous things travelling between the sun and moon on a pavement of cobwebs, rival nations of men inhabiting woods and mountains in a whale's belly,—are liker the dreams of a bedlamite than the inventions of a rational being.

11 And is consistent with itself.

Beattie's Essays, ut supra.

12 A stricter probability requisite in some kinds of poetry than in others.

If we were to prosecute this subject any farther, it would be proper to remark, that in some kinds of poetical invention a stricter probability is required than in others:—that, for instance, Comedy, whether dramatic or narrative (B), must seldom deviate from the ordinary course of human affairs, because it exhibits the manners of real and even of familiar life:—that the tragic poet, because he imitates characters more exalted, and generally refers to events little known, or long since past, may be allowed a wider range; but must never attempt the marvellous fictions of the epic muse, because he addresses his work, not only to the passions and imagination of mankind, but also to their eyes and ears, which are not easily imposed on, and refuse to be gratified with any representation that does not come very near the truth:—that the epic poem may claim still ampler privileges, because its fictions are not subject to the scrutiny of any outward sense, and because it conveys information in regard both to the highest human characters, and the most important and wonderful events, and also to the affairs of unseen worlds and superior beings. Nor would it be improper to observe, that the several species of comic, of tragic, of epic composition, are not confined to the same degree of probability: for that farce may be allowed to be less probable than the regular comedy; the masque than the regular tragedy; and the mixed epic, such as the Fairy Queen, and Orlando Furioso, than the pure epopee of Homer, Virgil, and Milton. But this part of the subject seems not to require further illustration. Enough has been said to show, that nothing unnatural can please; and that therefore poetry, whose end is to please, must be *according to nature.*

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And if so, it must be either according to real nature, or according to nature somewhat different from the reality.

Sect. III. *Of the System of Nature exhibited by Poetry.*

To exhibit *real nature* is the business of the historian; who, if he were strictly to confine himself to his own sphere, would never record even the minutest circumstance of any speech, event, or description, which was not warranted by sufficient authority. It has been the language of critics in every age, that the historian ought to relate nothing as true which is false or dubious, and to conceal nothing material which he knows to be true. But it is to be doubted whether any writer of profane history has ever been so scrupulous. Thucydides himself, who began his history when that war began which he records, and who set down every event soon after it happened, according to the most authentic information, seems, however, to have indulged his fancy not a little in his harangues and descriptions, particularly that of the plague of Athens: and the same thing has been practised, with greater latitude, by Livy and Tacitus, and more or less by all the best historians both ancient and modern. Nor are they to be blamed for it. By these improved or invented speeches, and by the heightenings thus given to their descriptions, their work becomes more interesting, and more useful; nobody is deceived,

13 Historians embellish their works by fiction, and make them

(B) Fielding's *Tom Jones*, *Amelia*, and *Joseph Andrews*, are examples of what may be called the *Epic* or *Narrative Comedy*, or more properly perhaps the *Comic Epopee*.

ceived, and historical truth is not materially affected. A medium is, however, to be observed in this, as in other things. When the historian lengthens a description into a detail of fictitious events, as Voltaire has done in his account of the battle of Fontenoy, he loses his credit with us, by raising a suspicion that he is more intent upon a pretty story than upon the truth. And we are disgusted with his insincerity, when, in defiance even of verisimilitude, he puts long elaborate orations in the mouth of those, of whom we know, either from the circumstances that they could not, or from more authentic records that they did not, make any such orations; as Dionysius of Halicarnassus has done in the case of Volumnia haranguing her son Coriolanus, and Flavius Josephus in that of Judah addressing his brother as viceroy of Egypt. From what these historians relate, one would conjecture that the Roman matron had studied at Athens under some long-winded rhetorician, and that the Jewish patriarch must have been one of the most flowery orators of antiquity. But the fictitious part of history, or of story-telling, ought never to take up much room; and must be highly blameable when it leads into any mistake either of facts or of characters.

Now, why do historians take the liberty to embellish their works in this manner? One reason, no doubt, is, that they may display their talents in oratory and narration: but the chief reason, as hinted already, is, to render their composition more agreeable. It would seem, then, that something more pleasing than real nature, or something which shall add to the pleasing qualities of real nature, may be devised by human fancy. And this may certainly be done. And this it is the poet's business to do. And when this is in any degree done by the historian, his narrative becomes in that degree poetical.

14 In some degree poetical.

The possibility of thus improving upon nature must be obvious to every one. When we look at a landscape, we can fancy a thousand additional embellishments. Mountains loftier and more picturesque; rivers more copious, more limpid, and more beautifully winding; smoother and wider lawns; valleys more richly diversified; caverns and rocks more gloomy and more stupendous; ruins more majestic; buildings more magnificent; oceans more varied with islands, more splendid with shipping, or more agitated by storm, than any we have ever seen—it is easy for human imagination to conceive. Many things in art and nature exceed expectation; but nothing sensible transcends or equals the capacity of thought:—a striking evidence of the dignity of the human soul! The finest woman in the world appears to every eye susceptible of improvement, except perhaps to that of her lover. No wonder, then, if in poetry events can be exhibited more compact, and of more pleasing variety, than those delineated by the historian, and scenes of inanimate nature more dreadful or more lovely, and human characters more sublime and more exquisite, both in good and evil. Yet still let nature supply the ground-work and materials, as well as the standard, of poetical fiction. The most expert painters use a layman, or other visible figure, to direct their hand and regulate their fancy. Homer himself founds his two poems on authentic tradition; and tragic as well as epic poets have followed the example. The writers of romance, too, are ambitious to interweave true adventures with their fables; and when it can be conveniently done, to take the outlines of their plan from real life. Thus the tale of Robinson Crusoe is founded on an incident that actually befel one Alexander Selkirk, a sea-faring man, who lived several years alone in the island of Juan Fernandes: Smollet is thought to have given us several of his own adventures in the history of Roderic Random: and the chief characters in Tom Jones, Joseph Andrews, and Pamela, are said to have been copied from real originals. Dramatic comedy, indeed, is for the most part purely fictitious: for if it were to exhibit real events as well as present manners, it would become too personal to be endured by a well-bred audience, and degenerate into downright abuse; which appears to have been the case with the old comedy of the Greeks *. But in general, hints taken from real existence will be found to give no little grace and stability to fiction, even in the most fanciful poems. Those hints, however, may be improved by the poet's imagination, and set off with every probable ornament that can be devised, consistently with the design and genius of the work; or, in other words, with the sympathies that the poet means to awaken in the mind of his reader. For mere poetical ornament, when it fails to interest the affections, is not only useless, but improper; all true poetry being addressed to the heart, and intended to give pleasure by raising or soothing the passions;—the only effectual way of pleasing a rational and moral creature. And therefore we would take Horace's maxim to be universal in poetry: "*Non satis est, pulchra esse poemata;* dulcia *sunto:*" "It is not enough that poems be beautiful; let them also be *affecting:*"—For that this is the meaning of the word *dulcis* in this place, is admitted by the best interpreters, and is indeed evident from the context †.

Beattie's *Essays*, chap. ii.

15 Poets embellish nature itself,

* Compare *Hor.* lib. 2. sat. 4 vers. 1—5. with *Ar. Poet.* vers. 281.—285.

† *Hor. Ar. Poet.* vers. 95—100.

That the sentiments and feelings of percipient beings, when expressed in poetry, should call forth our affections, is natural enough; but can descriptions of inanimate things also be made affecting? certainly they can: and the more they affect, the more they please us, and the more poetical we allow them to be. Virgil's Georgic is a noble specimen (and indeed the noblest in the world) of this sort of poetry. His admiration of external nature gains upon a reader of taste, till it rise to perfect enthusiasm. The following observations will perhaps explain this matter.

16 And describe even things inanimate so as to make them affecting.

Every thing in nature is complex in itself, and bears innumerable relations to other things; and may therefore be viewed in an endless variety of lights, and consequently described in an endless variety of ways. Some descriptions are good, and others bad. An historical description, that enumerates all the qualities of any object, is certainly good, because it is true; but may be as unaffecting as a logical definition. In poetry, no unaffecting description is good, however conformable to truth: for here we expect not a complete enumeration of qualities (the chief end of the art being to please), but only such an enumeration as may give a lively and interesting idea. It is not memory, or the knowledge of rules, that can qualify a poet for this sort of description; but a peculiar liveliness of fancy and sensibility of heart, the nature whereof we may explain by its effects, but we cannot lay down rules for the attainment of it.

When our mind is occupied by any emotion, we naturally use words and meditate on things that are suitable

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able to it and tend to encourage it. If a man were to write a letter when he is very angry, there would probably be something of vehemence or bitterness in the style, even though the person to whom he wrote were not the object of his anger. The same thing holds true of every other strong passion or emotion:—while it predominates in the mind, it gives a peculiarity to our thoughts, as well as to our voice, gesture, and countenance: And hence we expect, that every personage introduced in poetry should see things through the medium of his ruling passion, and that his thoughts and language should be tinctured accordingly. A melancholy man walking in a grove, attends to those things that suit and encourage his melancholy; the sighing of the wind in the trees, the murmuring of waters, the darkness and solitude of the shades: A cheerful man in the same place, finds many subjects of cheerful meditation, in the singing of birds, the brisk motions of the babbling stream, and the liveliness and variety of the verdure. Persons of different characters, contemplating the same thing, a Roman triumph, for instance, feel different emotions, and turn their view to different objects. One is filled with wonder at such a display of wealth and power; another exults in the idea of conquest, and pants for military renown; a third, stunned with clamour, and harassed with confusion, wishes for silence, security, and solitude; one melts with pity to the vanquished, and makes many a sad reflection upon the insignificance of worldly grandeur, and the uncertainty of human things; while the buffoon, and perhaps the philosopher, considers the whole as a vain piece of pageantry, which, by its solemn procedure, and by the admiration of so many people, is only rendered the more ridiculous:—and each of these persons would describe it in a way suitable to his own feelings, and tending to raise the same in others. We see in Milton's Allegro and Penseroso, how a different cast of mind produces a variety in the manner of conceiving and contemplating the same rural scenery. In the former of these excellent poems, the author personates a cheerful man, and takes notice of those things in external nature that are suitable to cheerful thoughts, and tend to encourage them: in the latter, every object described is serious and solemn, and productive of calm reflection and tender melancholy: and we should not be easily persuaded, that Milton wrote the first under the influence of sorrow, or the second under that of gladness. We often see an author's character in his works; and if every author were in earnest when he writes, we should oftener see it. Thomson was a man of piety and benevolence, and a warm admirer of the beauties of nature; and every description in his delightful poem on the Seasons tends to raise the same laudable affections in his reader. The parts of nature that attract his notice are those which an impious or hard-hearted man would neither attend to, nor be affected with, at least in the same manner. In Swift we see a turn of mind very different from that of the amiable Thomson; little relish for the sublime or beautiful, and a perpetual succession of violent emotions. All his pictures of human life seem to show, that deformity and meanness were the favourite objects of his attention, and that his soul was a constant prey to indignation (c), disgust, and other gloomy passions, arising from such a view of things. And it is the tendency of almost all his writings (though it was not always the author's design), to communicate the same passions to his reader: insomuch, that notwithstanding his erudition and knowledge of the world, his abilities as a popular orator and man of business, the energy of his style, the elegance of some of his verses, and his extraordinary talents in wit and humour, there is reason to doubt, whether by studying his works any person was ever much improved in piety or benevolence.

17 Every person introduced in poetry should see things through the medium of his ruling passion.

Beattie's Essay, ut supra.

18 It is thus that poetry affects the heart whatever be its subject.

And thus we see, how the compositions of an ingenious author may operate upon the heart, whatever be the subject. The affections that prevail in the author himself, direct his attention to objects congenial, and give a peculiar bias to his inventive powers, and a peculiar colour to his language. Hence his work, as well as face, if nature is permitted to exert herself freely in it, will exhibit a picture of his mind, and awaken correspondent sympathies in the reader. When these are favourable to virtue, which they always ought to be, the work will have that sweet pathos to which Horace alludes in the passage above mentioned; and which we so highly admire, and so warmly approve, even in those parts of the Georgic that describe inanimate nature.

Horace's account of the matter in question differs not from what is here given. "It is not enough (says he*) that poems be beautiful; let them be affecting, and agitate the mind with whatever passions the poet wishes to impart. The human countenance, as it smiles on those who smile, accompanies also with sympathetic tears those who mourn. If you would have me weep, you must first weep yourself; then, and not before, shall I be touched with your misfortunes.—For nature first makes the emotions of our mind correspond with our circumstances, infusing real joy, sorrow, or resentment, according to the occasion; and afterwards gives the true pathetic utterance to the voice and language." This doctrine, which concerns the orator and the player no less than the poet, is strictly philosophical, and equally applicable to dramatic, to descriptive, and indeed to every species of interesting poetry. The poet's sensibility must first of all engage him warmly in his subject, and in every part of it; otherwise he will labour in vain to interest the reader. If he would paint external nature, as Virgil and Thomson have done, so as to make her amiable to others, he must first be enamoured of her himself; if he would have his heroes and heroines speak the language of love or sorrow, devotion or courage, ambition or anger, benevolence or pity, his heart must be susceptible of those emotions, and in some degree feel them, as long at least as he employs himself in framing words for them; being assured, that

* Ar. Poet. 99—111.

He best shall paint them who can feel them most.

POPE's *Eloisa*, v. 366.

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(c) For part of this remark we have his own authority, often in his letters, and very explicitly in the Latin epitaph which he composed for himself:—" ubi sæva indignatio ulterius cor lacerare nequit." *See his last will and testament.*

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19 The true poet must possess fancy to invent decorations to nature.

The true poet, therefore, must not only study nature, and know the reality of things, but must also possess fancy, to invent additional decorations; judgment, to direct him in the choice of such as accord with verisimilitude; and sensibility, to enter with ardent emotions into every part of his subject, so as to transfuse into every part of his work a pathos and energy sufficient to raise corresponding emotions in the reader.

* Poetic. sect. 9.

"The historian and the poet (says Aristotle *) differ in this, that the former exhibits things as they are, the latter as they might be;"—*i. e.* in that state of perfection which is consistent with probability, and in which, for the sake of our own gratification, we wish to find them. If the poet, after all the liberties he is allowed to take with the truth, can produce nothing more exquisite than is commonly to be met with in history, his reader will be disappointed and dissatisfied. Poetical representations must therefore be framed after a pattern of the highest probable perfection that the genius of the work will admit:—external nature must in them be more picturesque than in reality; action more animated; sentiments more expressive of the feelings and character, and more suitable to the circumstances of the speaker; personages better accomplished in those qualities that raise admiration, pity, terror, and other ardent emotions; and events more compact, more clearly connected with causes and consequences, and unfolded in an order more flattering to the fancy, and more interesting to the passions. But where, it may be said, is this pattern of perfection to be found? Not in real nature; otherwise history, which delineates real nature, would also delineate this pattern of perfection. It is to be found only in the mind of the poet; and it is imagination, regulated by knowledge, that enables him to form it.

In the beginning of life, and while experience is confined to a small circle, we admire every thing, and are pleased with very moderate excellence. A peasant thinks the hall of his landlord the finest apartment in the universe, listens with rapture to the strolling ballad-singer, and wonders at the rude wooden cuts that adorn his ruder compositions. A child looks upon his native village as a town; upon the brook that runs by as a river; and upon the meadows and hills in the neighbourhood as the most spacious and beautiful that can be. But when, after long absence, he returns in his declining years, to visit, once before he die, the dear spot that gave him birth, and those scenes whereof he remembers rather the original charms than the exact proportions; how is he disappointed to find every thing so debased and so diminished! The hills seem to have sunk into the ground, the brook to be dried up, and the village to be forsaken of its people; the parish-church, stripped of all its fancied magnificence, is become low, gloomy, and narrow; and the fields are now only the miniature of what they were. Had he never left this spot, his notions might have remained the same as at first; and had he travelled but a little way from it, they would not perhaps have received any material enlargement. It seems then to be from observation of many things of the same or similar kinds, that we acquire the talent of forming ideas more perfect than the real objects that lie immediately around us: and these ideas we may improve gradually more and more, according to the vivacity of our mind, and extent of our experience, till at last we come to raise them to a degree of perfection superior to any thing to be found in real life. There cannot sure be any mystery in this doctrine; for we think and speak to the same purpose every day. Thus nothing is more common than to say, that such an artist excels all we have ever known in his profession, and yet that we can still conceive a superior performance. A moralist, by bringing together into one view the separate virtues of many persons, is enabled to lay down a system of duty more perfect than any he has ever seen exemplified in human conduct. Whatever be the emotion the poet intends to raise in his reader, whether admiration or terror, joy or sorrow; and whatever be the object he would exhibit, whether Venus or Tisiphone, Achilles or Thersites, a palace or a pile of ruins, a dance or a battle; he generally copies an idea of his own imagination; considering each quality as it is found to exist in several individuals of a species, and thence forming an assemblage more or less perfect in its kind, according to the purpose to which he means to apply it.

20 Observation of many things of the same kind a great help to poetical fancy, because

21 Poetical conceptions must be general

Hence it would appear, that the ideas of poetry are rather general than singular; rather collected from the examination of a species or class of things, than copied from an individual. And this, according to Aristotle, is in fact the case, at least for the most part; whence that critic determines, that poetry is something more exquisite and more philosophical than history *. The historian may describe Bucephalus, but the poet delineates a war-horse; the former must have seen the animal he speaks of, or received authentic information concerning it, if he mean to describe it historically; for the latter, it is enough that he has seen several animals of that sort. The former tells us, what Achilles actually did and said; the latter, what such a species of human character as that which bears the name of Achilles would probably do or say in certain given circumstances.

* Poetic. § 9.

It is inded true, that the poet may, and often does, copy after individual objects. Homer, no doubt, took his characters from the life; or at least, in forming them, was careful to follow tradition as far as the nature of his plan would allow. But he probably took the freedom to add or heighten some qualities, and take away others; to make Achilles, for example, stronger, perhaps, and more impetuous, and more eminent for filial affection, and Hector more patriotic and more amiable than he really was. If he had not done this, or something like it, his work would have been rather a history than a poem; would have exhibited men and things as they were, and not as they might have been; and *Achilles* and *Hector* would have been the names of individual and real heroes; whereas, according to Aristotle, they are rather to be considered as two distinct modifications or species of the heroic character. Shakespeare's account of the cliffs of Dover comes so near the truth, that we cannot doubt of its having been written by one who had seen them: but he who takes it for an exact historical description, will be surprised when he comes to the place, and finds those cliffs not half so lofty as the poet had made him believe. An historian would be to blame for such amplification; because, being to describe an individual precipice, he ought to tell us just what it is; which if he did, the description would suit that place, and perhaps no other

in

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in the whole world. But the poet means only to give an idea of what such a precipice may be; and therefore his description may perhaps be equally applicable to many such chalky precipices on the sea-shore.

This method of copying after general ideas formed by the artist from observation of many individuals, distinguishes the Italian and all the sublime painters, from the Dutch and their imitators. These give us bare nature, with the imperfections and peculiarities of individual things or persons; but those give nature improved as far as probability and the design of the piece will admit. Teniers and Hogarth draw faces, and figures, and dresses, from real life, and present manners; and therefore their pieces must in some degree lose the effect, and become aukward, when the present fashions become obsolete.——Raphael and Reynolds take their models from general nature; avoiding, as far as possible, (at least in all their great performances), those peculiarities that derive their beauty from mere fashion; and therefore their works must give pleasure, and appear elegant, as long as men are capable of forming general ideas, and of judging from them. The last-mentioned incomparable artist is particularly observant of children, whose looks and attitudes, being less under the controul of art and local manners, are more characteristical of the species than those of men and women. This field of observation has supplied him with many fine figures, particularly that most exquisite one of Comedy, struggling for and winning (for who could resist her!) the affections of Garrick:—a figure which could never have occurred to the imagination of a painter who had confined his views to grown persons looking and moving in all the formality of polite life;—a figure which in all ages and countries would be pronounced natural and engaging;—whereas those human forms that we see every day bowing and courtesying, and strutting, and turning out their toes *secundum artem*, and dressed in ruffles, and wigs, and flounces, and hoop-petticoats, and full-trimmed suits, would appear elegant no further than the present fashions are propagated, and no longer than they remain unaltered.

22 In order to please all ages and countries.

23 The period in the progress of human society to which epic and tragic poets should attend.

There is, in the progress of human society, as well as of human life, a period to which it is of great importance for the higher order of poets to attend, and from which they will do well to take their characters, and manners, and the era of their events; namely, that wherein men are raised above savage life, and considerably improved by arts, government, and conversation; but not advanced so high in the ascent towards politeness, as to have acquired a habit of disguising their thoughts and passions, and of reducing their behaviour to the uniformity of the mode. Such was the period which Homer had the good fortune (as a poet) to live in, and to celebrate. This is the period at which the manners of men are most picturesque, and their adventures most romantic. This is the period when the appetites unperverted by luxury, the powers unenervated by effeminacy, and the thoughts disengaged from artificial restraint, will, in persons of similar dispositions and circumstances, operate in nearly the same way; and when, consequently, the characters of particular men will approach to the nature of poetical or general ideas, and, if well imitated, give pleasure to the whole, or at least to a great majority of mankind.

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But a character tinctured with the fashions of polite life would not be so generally interesting. Like a human figure adjusted by a modern dancing-master, and dressed by a modern tailor, it may have a good effect in satire, comedy, or farce: but if introduced into the higher poetry, it would be admired by those only who had learned to admire nothing but present fashions, and by them no longer than the present fashions lasted; and to all the rest of the world would appear aukward, unaffecting, and perhaps ridiculous. But Achilles and Sarpedon, Diomede and Hector, Nestor and Ulysses, as drawn by Homer, must in all ages, independently on fashion, command the attention and admiration of mankind. These have the qualities that are universally known to belong to human nature; whereas the modern fine gentleman is distinguished by qualities that belong only to a particular age, society, and corner of the world. We speak not of moral or intellectual virtues, which are objects of admiration to every age; but of those outward accomplishments, and that particular temperature of the passions, which form the most perceptible part of a human character.——As, therefore, the politician, in discussing the rights of mankind, must often allude to an imaginary state of nature; so the poet who intends to raise admiration, pity, terror, and other important emotions, in the generality of mankind, especially in those readers whose minds are most improved, must take his pictures of life and manners, rather from the heroic period we now speak of, than from the ages of refinement; and must therefore (to repeat the maxim of Aristotle) "exhibit things, not as they are, but as they might be."

SECT. IV. *Of Poetical Characters.*

24 Requisites to the delineation of poetical characters.

HORACE seems to think, that a competent knowledge of moral philosophy will fit an author for assigning the suitable qualities and duties to each poetical personage: (*Art. Poet.* v. 309.—316.) The maxim may be true, as far as mere morality is the aim of the poet; but cannot be understood to refer to the delineation of poetical characters in general: for a thorough acquaintance with all the moral philosophy in the world would not have enabled Blackmore to paint such a personage as Homer's Achilles, Shakespeare's Othello, or the Satan of Paradise Lost. To a competency of moral science, there must be added an extensive knowledge of mankind, a warm and elevated imagination, and the greatest sensibility of heart, before a genius can be formed equal to so difficult a task. Horace is indeed so sensible of the danger of introducing a new character in poetry, that he even discourages the attempt, and advises the poet rather to take his persons from the ancient authors, or from tradition: *Ibid.* v. 119.—130.

To conceive the idea of a good man, and to invent and support a great poetical character, are two very different things, however they may seem to have been confounded by some late critics. The first is easy to any person sufficiently instructed in the duties of life: the last is perhaps of all the efforts of human genius the most difficult; so very difficult, that, though attempted by many, Homer, Shakespeare, and Milton, are almost the only authors who have succeeded in it. But characters of perfect virtue are not the most pro-

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per for poetry. It seems to be agreed, that the Deity should not be introduced in the machinery of a poetical fable. To ascribe to him words and actions of our own invention, seems very unbecoming; nor can a poetical description, that is known to be, and must of necessity be, infinitely inadequate, ever satisfy the human mind. Poetry, according to the best critics, is an imitation of human action; and therefore poetical characters, though elevated, should still partake of the passions and frailties of humanity. If it were not for the vices of some principal personages, the Iliad would not be either so interesting or so moral: the most moving and most eventful parts of the Æneid are those that describe the effects of unlawful passion:—the most instructive tragedy in the world, we mean Macbeth, is founded in crimes of dreadful enormity:—and if Milton had not taken into his plan the fall of our first parents, as well as their state of innocence, his divine poem must have wanted much of its pathos, and could not have been (what it now is) such a treasure of important knowledge, as no other uninspired writer ever comprehended in so small a compass.——Virtue, like truth, is uniform and unchangeable. We may anticipate the part a good man will act in any given circumstances: and therefore the events that depend on such a man must be less surprising than those which proceed from passion; the vicissitudes whereof it is frequently impossible to foresee. From the violent temper of Achilles, in the Iliad, spring many great incidents; which could not have taken place, if he had been calm and prudent like Ulysses, or pious and patriotic like Eneas:—his rejection of Agamemnon's offers, in the ninth book, arises from the violence of his resentment;—his yielding to the request of Patroclus, in the 16th, from the violence of his friendship (if we may so speak) counteracting his resentment; and his restoring to Priam the dead body of Hector, in the 24th, from the violence of his affection to his own aged father, and his regard to the command of Jupiter, counteracting, in some measure, both his sorrow for his friend, and his thirst for vengeance.——Besides, except where there is some degree of vice, it pains us too exquisitely to see misfortune; and therefore poetry would cease to have a pleasurable influence over our tender passions, if it were to exhibit virtuous characters only. And as in life, evil is necessary to our moral probation, and the possibility of error to our intellectual improvement; so bad or mixed characters are useful in poetry, to give to the good such opposition, as puts them upon displaying and exercising their virtue.

25 Which, though elevated, should partake of the frailties of humanity;

26 Whilst the personages in whose fate the poet means that we should be interested ought to have good and great qualities.

All those personages, however, in whose fortune the poet means that we should be interested, must have agreeable and admirable qualities to recommend them to our regard. And perhaps the greatest difficulty in the art lies in suitably blending those faults which the poet finds it expedient to give to any particular hero, with such moral, intellectual, or coporeal accomplishments, as may engage our esteem, pity, or admiration, without weakening our hatred of vice, or love of virtue. In most of our novels, and in many of our plays, it happens unluckily, that the hero of the piece is so captivating, as to incline us to be indulgent to every part of his character, the bad as well as the good. But a great master knows how to give the proper direction to human sensibility; and, without any perversion of our faculties, or any confusion of right and wrong, to make the same person the object of very different emotions, of pity and hatred, of admiration and horror. Who does not esteem and admire Macbeth for his courage and generosity? who does not pity him when beset with all the terrors of a pregnant imagination, superstitious temper, and awakened conscience? who does not abhor him as a monster of cruelty, treachery, and ingratitude? His good qualities, by drawing us near to him, make us, as it were, eye-witnesses of his crime, and give us a fellow-feeling of his remorse; and therefore, his example cannot fail to have a powerful effect in cherishing our love of virtue, and fortifying our minds against criminal impressions: whereas, had he wanted those good qualities, we should have kept aloof from his concerns, or viewed them with a superficial attention; in which case his example would have had little more weight than that of the robber, of whom we know nothing, but that he was tried, condemned, and executed.—Satan, in Paradise Lost, is a character drawn and supported with the most consummate judgment. The old furies and demons, Hecate, Tisiphone, Alecto, Megara, are objects of unmixed and unmitigated abhorrence; Tityus, Enceladus, and their brethren, are remarkable for nothing but impiety, deformity, and vastness of size; Pluto is, at best, an insipid personage; Mars, a hair-brained ruffian; Tasso's infernal tyrant, an ugly and overgrown monster:—but in the Miltonic Satan, we are forced to admire the majesty of the ruined archangel, at the same time that we detest the unconquerable depravity of the fiend. "But, of all poetical characters, (says the elegant critic from whom we are extracting), the Achilles of Homer (D) seems to me the most exquisite of invention, and the most highly finished. The utility of this character in a moral view is obvious; for it may be considered as the source of all the morality of the Iliad. Had not the generous and violent temper of Achilles determined him to patronise the augur Calchas in defiance of Agamemnon, and afterwards, on being affronted by that vindictive commander, to abandon for a time the common cause of Greece;—the fatal effects of dissension among confederates, and of capricious and tyrannical behaviour in a sovereign, would not have been the leading moral of Homer's.

Beattie's Essays.

(D) "I say the *Achilles of Homer*. Latter authors have degraded the character of this hero, by supposing every part of his body invulnerable except the heel. I know not how often I have heard this urged as one of Homer's absurdities; and indeed the whole Iliad is one continued absurdity, on this supposition. But Homer all along makes his hero equally liable to wounds and death with other men. Nay, to prevent all mistakes in regard to this matter, (if those who cavil at the poet would but read his work), he actually wounds him in the right arm by the lance of Asteropæus, in the battle near the river Scamander." See *Iliad*, xxi. ver. 161.—168.

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Homer's poetry; nor could Hector, Sarpedon, Eneas, Ulysses, and the other amiable heroes, have been brought forward to signalize their virtues, and to recommend themselves to the esteem and imitation of mankind.

27
The excellence of the poetical character of Achilles, and

"They who form their judgment of Achilles from the imperfect sketch given of him by Horace in the *Art of Poetry*, (v. 121, 122.); and consider him only as a hateful composition of anger, revenge, fierceness, obstinacy, and pride, can never enter into the views of Homer, nor be suitably affected with his narration. All these vices are no doubt, in some degree, combined in Achilles; but they are tempered with qualities of a different sort, which render him a most interesting character, and of course make the Iliad a most interesting poem. Every reader abhors the faults of this hero: and yet, to an attentive reader of Homer, this hero must be the object of esteem, admiration, and pity; for he has many good as well as bad affections, and is equally violent in all:—Nor is he possessed of a single vice or virtue, which the wonderful art of the poet has not made subservient to the design of the poem, and to the progress and catastrophe of the action; so that the hero of the Iliad, considered as a poetical personage, is just what he should be, neither greater nor less, neither worse nor better.—He is everywhere distinguished by an abhorrence of oppression, by a liberal and elevated mind, by a passion for glory, and by a love of truth, freedom, and sincerity. He is for the most part attentive to the duties of religion; and, except to those who have injured him, courteous and kind: he is affectionate to his tutor Phenix; and not only pities the misfortunes of his enemy Priam, but in the most soothing manner administers to him the best consolation that Homer's poor theology could furnish. Though no admirer of the cause in which his evil destiny compels him to engage, he is warmly attached to his native land; and, ardent as he is in vengeance, he is equally so in love to his aged father Peleus, and to his friend Patroclus. He is not luxurious like Paris, nor clownish like Ajax; his accomplishments are princely, and his amusements worthy of a hero. Add to this, as an apology for the vehemence of his anger, that the affront he had received was (according to the manners of that age) of the most atrocious nature; and not only unprovoked, but such as, on the part of Agamemnon, betrayed a brutal insensibility to merit, as well as a proud, selfish, ungrateful, and tyrannical disposition. And though he is often inexcusably furious; yet it is but justice to remark, that he was not naturally cruel (E); and that his wildest outrages were such as in those rude times might be expected from a violent man of invincible strength and valour, when exasperated by injury, and frantic with sorrow.——Our hero's claim to the admiration of mankind is indisputable. Every part of his character is sublime and astonishing. In his person, he is the strongest, the swiftest, the most beautiful of men:—this last circumstance, however, occurs not to his own observation, being too trivial to attract the notice of so great a mind. The Fates had put it in his power, either to return home before the end of the war, or to remain at Troy:—if he chose the former, he would enjoy tranquillity and happiness in his own country to a good old age; if the latter, he must perish in the bloom of his youth:—his affection to his father and native country, and his hatred to Agamemnon, strongly urged him to the first; but a desire to avenge the death of his friend determines him to accept the last, with all its consequences. This at once displays the greatness of his fortitude, the warmth of his friendship, and the violence of his sanguinary passions: and it is this that so often and so powerfully recommends him to the pity, as well as admiration, of the attentive reader."

28
Of all Homer's characters.

It is equally a proof of rich invention and exact judgment in Homer, that he mixes some good qualities in all his bad characters, and some degree of imperfection in almost all his good ones.——Agamemnon, nothwithstanding his pride, is an able general, and a valiant man, and highly esteemed as such by the greater part of the army.——Paris, though effeminate, and vain of his dress and person, is, however, good-natured, patient of reproof, not destitute of courage, and eminently skilled in music and other fine arts.——Ajax is a huge giant; fearless rather from insensibility to danger, and confidence in his massy arms, than from any nobler principle; boastful and rough; regardless of the gods, though not downright impious: yet there is in his manner something of frankness and blunt sincerity, which entitle him to a share in our esteem; and he is ever ready to assist his countrymen, to whom he renders good service on many a perilous emergency.——The character of Helen, in spite of her faults, and of the many calamities whereof she is the guilty cause, Homer has found means to recommend to our pity, and almost to our love; and this he does, without seeking to extenuate the crime of Paris, of which the most respectable personages in the poem are made to speak with becoming abhorrence. She is so full of remorse, so ready on every occasion to condemn her past conduct, so affectionate to her friends, so willing to do justice to every body's merit, and withal so finely accomplished, that she extorts our admiration, as well as that of the Trojan senators.——Menelaus, though sufficiently sensible of the injury he had received, is yet a man of moderation, clemency, and good-nature, a valiant soldier, and a most affectionate brother: but there is a dash of vanity in his composition, and he entertains rather too high an opinion of his own abilities, yet never overlooks nor undervalues the merit of others.——Priam would claim unreserved esteem, as well as pity, if it were not for his inexcuseable weakness, in gratifying the humour, and by indulgence abetting the crimes, of the most worthless of all his children, to the utter ruin of his people, family, and kingdom. Madame Dacier supposes, that he had lost his authority, and was obliged to fall in with the politics of the times: but of this there appears no evidence;

Beattie, ut supra.

(E) See *Iliad* xxi. 100. and xxiv. 485.—673.——In the first of these passages, Achilles himself declares, that before Patroclus was slain, he often spared the lives of his enemies, and took pleasure in doing it. It is strange, as Dr Beattie observes, that this should be left out in Pope's Translation.

evidence; on the contrary, he and his unworthy favourite Paris seem to have been the only persons of distinction in Troy who were averse to the restoring of Helen. Priam's foible (if it can be called by so soft a name), however faulty, is not uncommon, and has often produced calamity both in private and public life. The Scripture gives a memorable instance in the history of the good old Eli.——Sarpedon comes nearer a perfect character than any other of Homer's heroes; but the part he has to act is short. It is a character which one could hardly have expected in those rude times: a sovereign prince, who considers himself as a magistrate set up by the people for the public good, and therefore bound in honour and gratitude to be himself their example, and study to excel as much in virtue as in rank and authority.——Hector is the favourite of every reader, and with good reason. To the truest valour he joins the most generous patriotism. He abominates the crime of Paris: but not being able to prevent the war, he thinks it his duty to defend his country, and his father and sovereign, to the last. He too, as well as Achilles, foresees his own death; which heightens our compassion, and raises our idea of his magnanimity. In all the relations of private life, as a son, a father, a husband, a brother, he is amiable in the highest degree; and he is distinguished among all the heroes for tenderness of affection, gentleness of manners, and a pious regard to the duties of religion. One circumstance of his character, strongly expressive of a great and delicate mind, we learn from Helen's lamentation over his dead body, that he was almost the only person in Troy who had always treated her with kindness, and never uttered one reproachful word to give her pain, nor heard others reproach her without blaming them for it. Some tendency to ostentation (which, however, may be pardonable in a commander in chief), and temporary fits of timidity, are the only blemishes discoverable in this hero; whose portrait Homer appears to have drawn with an affectionate and peculiar attention.

By ascribing so many amiable qualities to Hector and some others of the Trojans, the poet interests us in the fate of that people, notwithstanding our being continually kept in mind that they are the injurious party. And by thus blending good and evil, virtue and frailty, in the composition of his characters, he makes them the more conformable to the real appearances of human nature, and more useful as examples for our improvement; and at the same time, without hurting verisimilitude, gives every necessary embellishment to particular parts of his poem, and variety, coherence, and animation, to the whole fable. And it may also be observed, that though several of his characters are complex, not one of them is made up of incompatible parts: all are natural and probable, and such as we think we have met with, or might have met with, in our intercourse with mankind.

From the same extensive views of good and evil, in all their forms and combinations, Homer has been enabled to make each of his characters perfectly distinct in itself, and different from all the rest; insomuch, that before we come to the end of the Iliad, we are as well acquainted with his heroes, as with the faces and tempers

29 Virgil fails in drawing characters.

of our most familiar friends. Virgil, by confining himself to a few general ideas of fidelity and fortitude, has made his subordinate heroes a very good sort of people; but they are all the same, and we have no clear knowledge of any one of them. Achates is faithful, and Gyas is brave, and Cloanthus is brave; and this is all we can say of the matter. We see these heroes at a distance, and have some notion of their shape and size; but are not near enough to distinguish their features; and every face seems to exhibit the same faint and ambiguous appearance. But of Homer's heroes we know every particular that can be known. We eat, and drink, and talk, and fight, with them: we see them in action and out of it; in the field and in their tents and houses: the very face of the country about Troy we seem to be as well acquainted with as if we had been there. Similar characters there are among these heroes, as there are similar faces in every society; but we never mistake one for another. Nestor and Ulysses are both wise and both eloquent: but the wisdom of the former seems to be the effect of experience; that of the latter of genius: the eloquence of the one is sweet and copious, but not always to the purpose, and apt to degenerate into story-telling; that of the other is close, emphatical, and persuasive, and accompanied with a peculiar modesty and simplicity of manner. Homer's heroes are all valiant; yet each displays a modification of valour peculiar to himself; one is valiant from principle, another from constitution; one is rash, another cautious; one is impetuous and headstrong, another impetuous, but tractable; one is cruel, another merciful; one is insolent and ostentatious, another gentle and unassuming; one is vain of his person, another of his strength, and a third of his family.——It would be tedious to give a complete enumeration. Almost every species of the heroic character is to be found in Homer.

Of the agents in Paradise Lost, it has been observed*, that "the weakest are the highest and noblest of human beings, the original parents of mankind; with whose actions the elements consented; on whose rectitude or deviation of will depended the state of terrestrial nature, and the condition of all the future inhabitants of the globe. Of the other agents in the poem, the chief are such as it is irreverence to name on slight occasions: the rest are lower powers;

30 The difficulty of drawing and discriminating the characters in Paradise Lost.

> ——Of which the least could wield
> These elements, and arm him with the force
> Of all their regions:

Powers, which only the controul of Omnipotence restrains from laying creation waste, and filling the vast expanse of space with ruin and confusion. To display the motives and actions of beings thus superior, so far as human reason can examine, or human imagination represent them, is the task which Milton undertook and performed. The characters in the Paradise Lost, which admit of examination, are those of angels and of men: of angels good and evil; of man in his innocent and sinful state.

31 Milton's success in this part of his undertaking.

"Among the angels, the virtue of Raphael is mild and placid, of easy condescension, and free communication: that of Michael is regal and lofty, attentive to the dignity of his own nature. Abdiel and Gabriel appear occasionally, and act as every incident requires: the solitary fidelity of Abdiel is very amiably painted.

"Of the evil angels, the characters are more diversified. To Satan such sentiments are given as suit the most

* Johnson's Life of Milton.

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most exalted and most depraved being. Milton has been censured for the impiety which sometimes breaks from Satan's mouth; for there are thoughts, it is justly remarked, which no observation of character can justify; because no good man would willingly permit them to pass, however transiently, through his mind. This censure has been shown to be groundless by the great critic from whom we quote. To make Satan speak as a rebel, says he, without any such expressions as might taint the readers imagination, was indeed one of the great difficulties in Milton's undertaking; and I cannot but think that he has extricated himself with great happiness. There is in Satan's speeches little that can give pain to a pious ear. The language of rebellion cannot be the same with that of obedience: the malignity of Satan foams in haughtiness and obstinacy; but his expressions are commonly general, and no otherwise offensive than as they are wicked.—The other chiefs of the celestial rebellion are very judiciously discriminated; and the ferocious character of Moloch appears, both in the battle and in the council, with exact consistency.

"To Adam and to Eve are given, during their innocence, such sentiments as innocence can generate and utter. Their love is pure benevolence and mutual veneration; their repasts are without luxury, and their diligence without toil. Their addresses to their Maker have little more than the voice of admiration and gratitude: fruition left them nothing to ask, and innocence left them nothing to fear.—But with guilt enter distrust and discord, mutual accusation and stubborn self-defence: they regard each other with alienated minds, and dread their Creator as the avenger of their transgression; at last, they seek shelter in his mercy, soften to repentance, and melt in supplication. Both before and after the fall, the different sentiments arising from difference of sex are traced out with inimitable delicacy and philosophical propriety. Adam has always that pre-eminence in dignity, and Eve in loveliness, which we should naturally look for in the father and mother of mankind."

From what has been said, it seems abundantly evident,—That the end of poetry is to please; and therefore that the most perfect poetry must be the most pleasing;—that what is unnatural cannot give pleasure; and therefore that poetry must be according to nature:—that it must be either according to real nature, or according to nature somewhat different from the reality;—that, if according to real nature, it would give no greater pleasure than history, which is a transcript of real nature;—that greater pleasure is, however, to be expected from it, because we grant it superior indulgence, in regard to fiction, and the choice of words;—and, consequently, that poetry must be, not according to real nature, but according to nature improved to that degree which is consistent with probability and suitable to the poet's purpose.—And hence it is that we call poetry, *An imitation of nature*.—For that which is properly termed *imitation* has always in it something which is not in the original. If the prototype and transcript be exactly alike; if there be nothing in the one which is not in the other; we may call the latter a *representation*, a *copy*, a *draught*, or a *picture*, of the former; but we never call it an *imitation*.

32 Poetry according to nature improved to that degree which is consistent with probability.

Sect. V. *Of Arrangement, Unity, Digressions.—Further remarks on Nature in Poetry.*

Of Poetical Arrangement, &c.

I. The origin of nations, and the beginnings of great events, are little known, and seldom interesting; whence the first part of every history, compared with the sequel, is somewhat dry and tedious. But a poet must, even in the beginning of his work, interest the readers, and raise high expectation; not by any affected pomp of style, far less by ample promises or bold professions; but by setting immediately before them some incident, striking enough to raise curiosity, in regard both to its causes and to its consequences. He must therefore take up his story, not at the beginning, but in the middle; or rather, to prevent the work from being too long, as near the end as possible; and afterwards take some proper opportunity to inform us of the preceding events, in the way of narrative, or by conversation of the persons introduced, or by short and natural digressions.

33 How a poem ought to begin.

The action of both the *Iliad* and *Odyssey* begins about six weeks before its conclusion; although the principal events of the war of Troy are to be found in the former; and the adventures of a ten years voyage, followed by the suppression of a dangerous domestic enemy, in the latter. One of the first things mentioned by Homer in the Iliad, is a plague, which Apollo in anger sent into the Grecian army commanded by Agamemnon and now encamped before Troy. Who this Agamemnon was, and who the Grecians were; for what reason they had come hither; how long the siege had lasted; what memorable actions had been already performed; and in what condition both parties now were:—all this, and much more, we soon learn from occasional hints and conversations interspersed through the poem.

In the *Æneid*, which, though it comprehends the transactions of seven years, opens within a few months of the concluding event, we are first presented with a view of the Trojan fleet at sea, and no less a person than Juno interesting herself to raise a storm for their destruction. This excites a curiosity to know something further: who these Trojans were, whence they had come, and whither they were bound; why they had left their own country, and what had befallen them since they left it. On all these points, the poet, without quitting the track of his narrative, soon gives the fullest information: The storm rises; the Trojans are driven to Africa, and hospitably received by the queen of the country; at whose desire their commander relates his adventures.

The action of *Paradise Lost* commences not many days before Adam and Eve are expelled from the garden of Eden, which is the concluding event. This poem, as its plan is incomparably more sublime and more important than that of either the Iliad or Æneid, opens with a far more interesting scene: a multitude of angels and archangels shut up in a region of torment and darkness, and rolling on a lake of unquenchable fire. Who these angels are, and what brought them into this miserable condition, we naturally wish to know; and the poet in due time informs us; partly from the conversation of the fiends themselves; and more particularly by the mouth of a happy spirit, sent from heaven to caution the father and mother of mankind against temptation, and confirm their good resolutions by unfolding the dreadful effects of impiety and disobedience.

Beattie, ut supra.

34 The advantages of the poetical arrangement.

This poetical arrangement of events, so different from the historical, has other advantages besides those arising from brevity and compactness of detail: it is obviously more affecting to the fancy, and more alarming to the passions; and, being more suitable to the order and the manner in which the actions of other men strikes our senses, is a more exact imitation of human affairs. I hear a sudden noise in the street, and run to see what is the matter. An insurrection has happened, a great multitude is brought together, and something very important is going forward. The scene before me is the first thing that engages my attention; and is in itself so interesting, that for a moment or two I look at it in silence and wonder. By and by, when I get time for reflection, I begin to inquire into the cause of all this tumult, and what it is the people would be at; and one who is better informed than I, explains the affair from the beginning; or perhaps I make this out for myself, from the words and actions of the persons principally concerned.—This is a sort of picture of poetical arrangement, both in epic and dramatic composition; and this plan has been followed in narrative odes and ballads both ancient and modern.—The historian pursues a different method. He begins perhaps with an account of the manners of a certain age, and of the political constitution of a certain country; then introduces a particular person, gives the story of his birth, connections, private character, pursuits, disappointments, and of the events that promoted his views, and brought him acquainted with other turbulent spirits like himself; and so proceeds, unfolding, according to the order of time, the causes, principles, and progress of the conspiracy, if that be the subject which he undertakes to illustrate. It cannot be denied, that this latter method is more favourable to calm information: but the former, compared with it, will be found to have all the advantages already specified, and to be more effectually productive of that mental pleasure which depends on the passions and imagination.

35 Unity of design necessary to the higher poetry.

II. If a work have no determinate end, it has no meaning; and if it have many ends, it will distract by its multiplicity. Unity of design, therefore, belongs in some measure to all compositions, whether in verse or prose. But to some it is more essential than to others; and to none so much as in the higher poetry. In certain kinds of history, there is unity sufficient if all the events recorded be referred to one person; in others, if to one period of time, or to one people, or even to the inhabitants of one and the same planet. But it is not enough that the subject of a poetical fable be the exploits of one person; for these may be of various and even of opposite sorts and tendencies, and take up longer time than the nature of poetry can admit:—far less can a regular poem comprehend the affairs of one period or of one people:—it must be limited to one great action or event, to the illustration of which all the subordinate events must contribute; and these must be so connected with one another, as well as with the poet's general purpose, that one cannot be changed, transposed, or taken away, without affecting the consistence and stability of the whole *. In itself an incident may be interesting, a character well drawn, a description beautiful; and yet, if it disfigure the general plan, or if it obstruct or incumber the main action, instead of helping it forward, a correct artist would consider it but as a gaudy superfluity or splendid deformity; like a piece of scarlet cloth sewed upon a garment of a different colour †. Not that all the parts of the fable either are, or can be, equally essential. Many descriptions and thoughts, of little consequence to the plan, may be admitted for the sake of variety; and the poet may, as well as the historian and philosopher, drop his subject for a time, in order to take up an affecting or instructive digression.

* Arist. Poet. § 8.

† Hor. Ar. Poet. v. 15. &c.

36 The propriety of digressions and episodes depends upon

III. The doctrine of poetical digressions and episodes has been largely treated by the critics. We shall here only remark, that, in estimating their propriety, three things are to be attended to:—their connection with the fable or subject; their own peculiar excellence; and their subserviency to the poet's design.

37 Their connection with the subject of the poem,

(1.) Those digressions that both arise from and terminate in the subject, like the episode of the angel Raphael in Paradise Lost, and the transition to the death of Cæsar and the civil wars in the first book of the Georgic, are the most artful, and if suitably executed claim the highest praise:—those that arise from, but do not terminate in, the subject, are perhaps second in the order of merit; like the story of Dido in the Æneid, and the encomium on a country life in the second book of the Georgic: those come next that terminate in, but do not rise from, the fable; of which there are several in the third book of the Æneid, and in the Odyssey:—and those that neither terminate in the fable nor rise from it are the least artful; and if they be long, cannot escape censure, unless their beauty be very great.

38 Their own peculiar excellence, and

But (2.) we are willing to excuse a beautiful episode at whatever expence to the subject it may be introduced. They who can blame Virgil for obtruding upon them the charming tale of Orpheus and Euridice in the fourth Georgic, or Milton for the apostrophe to light in the beginning of his third book, ought to forfeit all title to the perusal of good poetry; for of such divine strains one would rather be the author than of all the books of criticism in the world. Yet still it is better that an episode possess the beauty of connection, together with its own intrinsic elegance, than this without the other.

39 Their subserviency to the poet's design.

Moreover, in judging of the propriety of episodes and other similar contrivances, it may be expedient to attend (3.) to the design of the poet, as distinguished from the fable or subject of the poem. The great design, for example, of Virgil, was to interest his countrymen in a poem written with a view to reconcile them to the person and government of Augustus. Whatever, therefore, in the poem tends to promote this design, even though it should in some degree hurt the contexture of the fable, is really a proof of the poet's judgment; and may be not only allowed, but applauded.—The progress of the action of the Æneid may seem to be too long obstructed in one place by the story of Dido, which, though it rises from the preceding part of the poem, has no influence upon the sequel; and, in another, by the episode of Cacus, which, without injury to the fable, might have been omitted altogether. Yet these episodes, interesting as they are to us and all mankind because of the transcendant merit of the poetry, must have been still more interesting to the Romans because of their connection with the Roman affairs; for the one accounts poetically for their wars with Carthage; and the other not only explains some of their religious ceremonies, but also gives a most charming rural picture of those hills and valleys in the neighbourhood of the Tiber, on which, in in after times, their majestic city was fated to stand.—And if we consider, that the design of Homer's Iliad was not only to show the fatal effects of dissension among confederates, but also to immortalize his country, and celebrate the most distinguished families in it, we shall be inclined to think more favourably than critics generally do of some of his long speeches and digressions; which, though to us they may seem trivial, must have been very interesting to his countrymen on account of the genealogies and private history recorded in them.—Shakespeare's historical plays, considered as dramatic fables, and tried by the laws of tragedy and comedy, appear very rude compositions; but if we attend to the poet's design (as the elegant critic * has with equal truth and beauty explained it), we shall be forced to admire his judgment in the general conduct of those pieces, as well as unequalled success in the execution of particular parts.

* *Essays on the writings and genius of Shakespeare*, p. 55.

There is yet another point of view in which these digressions may be considered. If they tend to elucidate any important character, or to introduce any interesting event not otherwise within the compass of the poem, or to give an amiable display of any particular virtue, they may be intitled, not to our pardon only, but even to our admiration, however loosely they may hang upon the fable. All these three ends are effected by that most beautiful episode of Hector and Andromache in the sixth book of the Iliad; and the two last, by the no less beautiful one of Euryalus and Nisus in the ninth of the Æneid.

IV. And now, from the position formerly established, that the end of this divine art is to give pleasure, it has been endeavoured to prove, that, whether in displaying the appearances of the material universe, or in imitating the workings of the human mind, and the varieties of human character, or in arranging and combining into one whole the several incidents and parts whereof his fable consists,—the aim of the poet must be to copy nature, not as it is, but in that state of perfection in which, consistently with the particular genius of the work, and the laws of verisimilitude, it may be supposed to be.

Such, in general, is the nature of that poetry which is intended to raise admiration, pity, and other serious emotions. But in this art, as in all others, there are different degrees of excellence; and we have hitherto directed our view chiefly to the highest. All serious poets are not equally solicitous to improve nature. Euripides is said to have represented men as they were; Sophocles, more poetically, as they should or might be †. Theocritus in his Idyls, and Spencer in his Shepherd's Calendar, give us language and sentiments more nearly approaching those of the *Rus verum et barbarum* ‡, than what we meet with in the Pastorals of Virgil and Pope. In the historical drama, human characters and events must be according to historical truth, or at least not so remote from it as to lead into any important misapprehension of fact. And in the historical epic poem, such as the Pharsalia of Lucan, and the Campaign of Addison, the historical arrangement is preferred to the poetical, as being nearer the truth. Yet nature is a little improved even in these poems. The persons in Shakespeare's historical plays, and the heroes of the Pharsalia, talk in verse, and suitably to their characters, and with a readiness, beauty, and harmony of expression, not to be met with in real life, nor even in history: speeches are invented, and, to heighten the description, circumstances added, with great latitude: real events are rendered more compact and more strictly dependent upon one another; and fictitious ones brought in, to elucidate human characters and diversify the narration.

† *Arist. Poet.*

‡ *Martial.*

40
Nature always to be improved by the poet, though

The more poetry improves nature, by copying after general ideas collected from extensive observation, the more it partakes (according to Aristotle) of the nature of philosophy; the greater stretch of fancy and of observation it requires in the artist, the better chance it has to be universally agreeable.

41
When poetry falls short of this perfection it may have great merit in other respects.

Yet poetry, when it falls short of this perfection, may have great merit as an instrument of both instruction and pleasure. To most men, simple unadorned nature is, at certain times, and in certain compositions, more agreeable than the most elaborate improvements of art; as a plain short period, without modulation, gives a pleasing variety to a discourse. Many such portraits of simple nature there are in the subordinate parts both of Homer's and of Virgil's poetry: and an excellent effect they have in giving probability to the fiction, as well as in gratifying the reader's fancy with images distinct and lively, and easily comprehended. The historical plays of Shakespeare raise not our pity and terror to such a height as Lear, Macbeth, or Othello; but they interest and instruct us greatly notwithstanding. The rudest of the eclogues of Theocritus, or even of Spenser, have by some authors been extolled above those of Virgil, because more like real life. Nay, Corneille is known to have preferred the Pharsalia to the Æneid, perhaps from its being nearer the truth, or perhaps from the sublime sentiments of stoical morality so forcibly and so ostentatiously displayed in it.

Poets may refine upon nature too much as well as too little; for affectation and rusticity are equally remote from true elegance. The style and sentiments of comedy should no doubt be more correct and more pointed than those of the most polite conversation: but to make every footman a wit, and every gentleman and lady an epigrammatist, as Congreve has done, is an excessive and faulty refinement. The proper medium has been hit by Menander and Terence, by Shakespeare in his happier scenes, and by Garrick, Cumberland, and some others of late renown. To describe the passion of love with as little delicacy as some men speak of it would be unpardonable; but to transform it into mere Platonic adoration is to run into another extreme, less criminal indeed, but too remote from universal truth to be universally interesting. To the former extreme Ovid inclines, and Petrarch and his imitators to the latter. Virgil has happily avoided both: but Milton has painted this passion as distinct from all others, with such peculiar truth and beauty, that we cannot think Voltaire's encomium too high, when he says, that love in all other poetry seems a weakness, but in Paradise Lost a virtue. There are many good strokes of nature in Ramsay's Gentle Shepherd; but the author's passion for the *rus verum* betrays him into some indelicacies: a censure that falls with greater weight upon Theocritus, who is often absolutely indecent. The Italian pastoral of Tasso and Guarini, and the French of Fontenelle, run into the opposite extreme (though in some parts beautifully simple), and display a system of rural manners so quaint

Of Poetical Language.

and affected as to outrage all probability. In fine, though mediocrity of execution in poetry be allowed to deserve the doom pronounced upon it by Horace; yet it is true, notwithstanding, that in this art, as in many other good things, the point of excellence lies in a middle between two extremes; and has been reached by those only who sought to improve nature as far as the genius of their work would permit, keeping at an equal distance from rusticity on the one hand, and affected elegance on the other.

Sect. VI. *Of Poetical Language.*

42 Words in poetry to be chosen for their sense and for their sound.

Words in poetry are chosen, first, for their *sense*; and, secondly, for their *sound*. That the first of these grounds of choice is the more excellent nobody can deny. He who in literary matters prefers sound to sense is a fool. Yet sound is to be attended to even in prose, and in verse demands particular attention. We shall consider poetical language, first, as SIGNIFICANT; and, secondly, as SUSCEPTIBLE OF HARMONY.

§ 1. *Of Poetical Language considered as* SIGNIFICANT.

43 The language of poetry an imitation of the language of nature,

If, as it has been endeavoured to prove, poetry be imitative of nature, poetical fictions of real events, poetical images of real appearances in the visible creation, and poetical personages of real human characters; it would seem to follow, that the *language of poetry* must be an imitation of the *language of nature*.

According to Dr Beattie *, that language is natural which is suited to the speaker's condition, character, and circumstances. And as, for the most part, the images and sentiments of serious poetry are copied from the images and sentiments, not of real, but of improved, nature; so the language of serious poetry must (as hinted already) be a transcript, not of the real language of nature, which is often dissonant and rude, but of natural language improved as far as may be consistent with probability, and with the supposed character of the speaker. If this be not the case, if the language of poetry be such only as we hear in conversation or read in history, it will, instead of delight, bring disappointment: because it will fall short of what we expect from an art which is recommended rather by its pleasurable qualities than by its intrinsic utility; and to which, in order to render it pleasing, we grant higher privileges than to any other kind of literary composition, or any other mode of human language.

* *Essays*, Part ii. chap. 1.

44 Improved as far as may be consistent with probability, &c.

The next inquiry must therefore be, "What are those improvements that peculiarly belong to the language of poetry?" And these may be comprehended under two heads; *poetical words*, and *tropes and figures*.

Art. I. Of Poetical Words.

One mode of improvement peculiar to poetical diction results from the use of those words and phrases which, because they rarely occur in prose, and frequently in verse, are by the grammarian and lexicographer termed *poetical*. In these some languages abound more than others; but no language perhaps is altogether without them, and perhaps no language can be so in which any number of good poems have been written: for poetry is better remembered than prose, especially by poetical authors, who will always be apt to imitate the phraseology of those they have been accustomed to read and

45 All languages have words peculiar to poetry.

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admire; and thus, in the works of poets down through successive generations, certain phrases may have been conveyed, which, though originally perhaps in common use, are now confined to poetical composition. Prose writers are not so apt to imitate one another, at least in words and phrases, both because they do not so well remember one another's phraseology, and also because their language is less artificial, and must not, if they would make it easy and flowing (without which it cannot be elegant), depart essentially from the style of correct conversation. Poets, too, on account of the greater difficulty of their numbers, have, both in the choice and in the arrangement of words, a better claim to indulgence, and stand more in need of a discretionary power.

The language of Homer differs materially from what was written and spoken in Greece in the days of Socrates. It differs in the mode of inflection, it differs in the syntax, it differs even in the words: so that one might read Homer with ease who could not read Xenophon; or Xenophon, without being able to read Homer. Yet we cannot believe that Homer, or the first Greek poet who wrote in his style, would make choice of a dialect quite different from what was intelligible in his own time: for poets have in all ages written with a view to be read, and to be read with pleasure; which they could not be if their diction were hard to be understood. It is more reasonable to suppose that the language of Homer is according to some ancient dialect, which, though not perhaps in familiar use among the Greeks at the time he wrote, was however intelligible. From the Homeric to the Socratic age, a period had elapsed of no less than 400 years; during which the style both of discourse and of writing must have undergone great alterations. Yet the Iliad continued the standard of heroic poetry, and was considered as the very perfection of poetical language; notwithstanding that some words in it were become so antiquated, or so ambiguous, that Aristotle himself seems to have been somewhat doubtful in regard to their meaning *. And if Chaucer's merit as a poet had been as great as Homer's, and the English tongue under Edward III. as perfect as the Greek was in the second century after the Trojan war, the style of Chaucer would probably have been our model for poetical diction at this day; even as Petrarch, his contemporary, is still imitated by the best poets of Italy.

* *Poetic.* cap. 25.

The rudeness of the style of Ennius has been imputed by the old critics to his having copied too closely the dialect of common life. But this appears to be a mistake. For if we compare the fragments of that author with the comedies of Plautus, who flourished in the same age, and whose language was certainly copied from that of common life, we shall be struck with an air of antiquity in the former that is not in the latter. Ennius, no doubt, like most other sublime poets, affected something of the antique in his expression: and many of his words and phrases, not adopted by any prose-writer now extant, are to be found in Lucretius and Virgil, and were by them transmitted to succeeding poets. These form part of the Roman poetical dialect; which appears from the writings of Virgil, where we have it in perfection, to have been very copious. The style of this charming poet is indeed so different from prose, and is altogether so peculiar, that it is perhaps impossible to analyse it on the common principles of

46 The poetical dialect different from that of prose.

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of Latin grammar. And yet no author can be more perspicuous or more expressive, notwithstanding the frequency of Grecism in his syntax, and his love of old words, which he, in the judgment of Quintilian, knew better than any other man how to improve into decoration *.

* *Instit.* viii. 3. § 3.

The poetical dialect of modern Italy is so different from the prosaic, that persons who can read the historians, and even speak with tolerable fluency the language of that country, may yet find it difficult to construe a page of Petrarch or Tasso. Yet it is not probable, that Petrarch, whose works are a standard of the Italian poetical diction †, made any material innovations in his native tongue. It is rather probable that he wrote it nearly as it was spoken in his time, that is, in the 14th century; omitting only harsh combinations, and taking that liberty which Homer probably, and Virgil certainly, took before him, of reviving such old, but not obsolete expressions, as seemed peculiarly significant and melodious; and polishing his style to that degree of elegance which human speech, without becoming unnatural, may admit of, and which the genius of poetry, as an art subservient to pleasure, may be thought to require.

† *Vicende della litteratura del Denina*, cap. 4.

The French poetry in general is distinguished from prose rather by the rhime and the measure, than by any old or uncommon phraseology. Yet the French, on certain subjects, imitate the style of their old poets, of Marot in particular; and may therefore be said to have something of a poetical dialect, though far less extensive than the Italian, or even than the English. And it may be presumed, that in future ages they will have more of this dialect than they have at present. This may be inferred from the very uncommon merit of some of their late poets, particularly Boileau and La Fontaine, who, in their respective departments, will continue to be imitated, when the present modes of French prose are greatly changed: an event that, for all the pains they take to preserve their language, must inevitably happen, and whereof there are not wanting some presages already.

The English poetical dialect is not characterised by any peculiarities of inflection, nor by any great latitude in the use of foreign idioms. More copious it is, however, than one would at first imagine; as may appear from the following specimen and observations.

47 Phrases in English poetry not usual in prose

(1.) A few Greek and Latin idioms are common in English poetry, which are seldom or never to be met with in prose. QUENCHED OF HOPE. Shakespeare.— SHORN OF HIS BEAMS. Milton.—*Created thing* NOR VALUED HE NOR SHUN'D. Milton.—*'Tis thus we riot, while* WHO SOW IT STARVE. Pope.—*This day* BE BREAD AND PEACE MY LOT. Pope.—INTO WHAT PIT THOU SEE'ST FROM WHAT HEIGHT FALLEN. Milton. *He deceived The mother of mankind,* WHAT TIME HIS PRIDE HAD CAST HIM *out of heaven.* Milton.—— Some of these, with others to be found in Milton, seem to have been adopted for the sake of brevity, which in the poetical tongue is indispensable. For the same reason, perhaps the articles *a* and *the* are sometimes omitted by our poets, though less frequently in serious than burlesque composition.——In English, the adjective generally goes before the substantive, the nominative before the verb, and the active verb before (what we call) the accusative. Exceptions, however, to this rule, are not uncommon even in prose. But in poetry they are more frequent. *Their homely joys,* and DESTINY OBSCURE. *Now fades the glimmering landscape on the sight; and all the air a solemn stillness holds.* In general, that versification may be less difficult, and the cadence more uniformly pleasing; and sometimes, too, in order to give energy to expression, or vivacity to an image;—the English poet is permitted to take much greater liberties than the prose-writer, in arranging his words, and modulating his lines and periods. Examples may be seen in every page of Paradise Lost.

(2.) Some of our poetical words take an additional syllable, that they may suit the verse the better; as, *dispart, distain, disport, affright, enchain,* for part, stain, sport, fright, chain. Others seem to be nothing else than common words made shorter, for the convenience of the versifier. Such are, *auxiliar, sublunar, trump, vale, part, clime, submiss, frolic, plain, drear, dread, helm, morn, mead, eve* and *even, gan, illume* and *illumine, ope, hoar, bide, swage, scape;* for auxiliary, sublunary, trumpet, valley, depart, climate, submissive, frolicsome, complain, dreary, dreadful, helmet, morning, meadow, evening, began or began to, illuminate, open, hoary, abide, assuage, escape.——Of some of these the short form is the more ancient. In Scotland, *even, morn, bide, swage,* are still in vulgar use; but *morn,* except when contradistinguished to *even,* is synonymous, not with *morning* (as in the English poetical dialect), but with *morrow.*—The Latin poets, in a way somewhat similar, and perhaps for a similar reason, shortened *fundamentum, tutamentum, munimentum,* &c. into fundamen, tutamen, munimen.

(3.) Of the following words, which are now almost peculiar to poetry, the greater part are ancient, and were once no doubt in common use in England, as many of them still are in Scotland. *Afield, amain, annoy* (a noun), *anon, aye* (ever), *behest, blithe, brand* (sword), *bridal, carol, dame* (lady), *featly, fell* (an adjective), *gaude, gore, host* (army), *lambkin, late* (of late), *lay* (poem), *lea, glade, gleam, hurl, lore, meed, orisons, plod* (to travel laboriously), *ringlet, rue* (a verb), *ruth, ruthless, sojourn* (a noun), *smite, speed* (an active verb), *save* (except), *spray* (twig), *steed, strain* (song), *strand, swain, thrall, thrill, trail* (a verb), *troll, wail, welter, warble, wayward, woo, the while* (in the mean time), *yon, of yore.*

(4.) These that follow are also poetical; but, so far as appears, were never in common use. *Appal, arrowy, attune, battailous, breezy, car* (chariot), *clarion, cates, courser, darkling, flicker, floweret, emblaze, gairish, circlet, impearl, nightly, noiseless, pinion* (wing), *shadowy, slumberous, streamy, troublous, wilder* (a verb), *shrill* (a verb), *shook* (shaken), *madding, viewless.*—The following, too, derived from the Greek and Latin, seem peculiar to poetry. *Clang, clangor, choral, bland, boreal, dire, ensanguined, ire, ireful, lave* (to wash), *nymph* (lady, girl), *orient, panoply, philomel, infuriate, jocund, radiant, rapt, redolent, refulgent, verdant, vernal, zephyr, zone* (girdle), *sylvan, suffuse.*

(5.) In most languages, the rapidity of pronunciation abbreviates some of the commonest words, or even joins two, or perhaps more, of them, into one; and some of those abbreviated forms find admission into writing. The English language was quite disfigured by them

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them in the end of the last century; but Swift, by his satire and example, brought them into disrepute: and, though some of them be retained in conversation, as *don't*, *shan't*, *can't*, they are now avoided in solemn style; and by elegant writers in general, except where the colloquial dialect is imitated, as in comedy. *'Tis* and *'twas*, since the time of Shaftesbury, seem to have been daily losing credit, at least in prose; but still have a place in poetry, perhaps because they contribute to conciseness. *'Twas on a lofty vase's side.* Gray.—*'Tis true, 'tis certain, man, though dead, retains part of himself.* Pope. In verse too, *over* may be shortened into *o'er*, (which is the Scotch, and probably was the old English, pronunciation); *never* into *ne'er*; and from *the* and *to*, when they go before a word beginning with a vowel, the final letter is sometimes cut off. *O'er hills, o'er dales, o'er crags, o'er rocks they go.* Pope.—*Where'er she turns, the Graces homage pay. And all that beauty, all that wealth e'er gave. Rich with the spoils of time did ne'er unroll.* Gray.—*T'alarm th' eternal midnight of the grave.*——These abbreviations are now peculiar to the poetical tongue, but not necessary to it. They sometimes promote brevity, and render versification less difficult.

(6.) Those words which are commonly called *compound epithets*, as *rosy-finger'd*, *rosy-bosom'd*, *many-twinkling*, *many-sounding*, *moss-grown*, *bright-eyed*, *straw-built*, *spirit-stirring*, *incense-breathing*, *heaven-taught*, *love-whispering*, *lute-resounding*, are also to be considered as part of our poetical dialect. It is true, we have compounded adjectives in familiar use, as *high-seasoned*, *well-natured*, *ill-bred*, and innumerable others. But we speak of those that are less common, that seldom occur except in poetry, and of which in prose the use would appear affected. And that they sometimes promote brevity and vivacity of expression, cannot be denied. But as they give, when too frequent, a stiff and finical air to a performance; as they are not always explicit in the sense, nor agreeable in the sound; as they are apt to produce a confusion, or too great a multiplicity, of images; as they tend to disfigure the language, and furnish a pretext for endless innovation; they ought to be used sparingly; and those only used which the practice of popular authors has rendered familiar to the ear, and which are in themselves peculiarly emphatical and harmonious.

48 To be used sparingly.

(7.) In the transformation of nouns into verbs and participles, our poetical dialect admits of greater latitude than prose. Hymn, pillow, curtain, story, pillar, picture, peal, surge, cavern, honey, career, cincture, bosom, sphere, are common nouns; but *to hymn*, *to pillow*, *curtained*, *pillared*, *pictured*, *pealing*, *surging*, *cavern'd*, *honied*, *careering*, *cinctured*, *bosomed*, *sphered*, would appear affected in prose, and yet in verse they are warranted by great authorities, though it must be confessed that they are censured by an able critic *, who had studied the English language, both poetical and prosaic, with wonderful diligence.

* *Johnson.*

Some late poets, particularly the imitators of Spencer, have introduced a great variety of uncommon words, as certes, eftsoons, ne, whilom, transmew, moil, sone, losel, albe, hight, dight, pight, thews, couthful, assot, muchel, wend, arrear, &c. These were once poetical words, no doubt; but they are now obsolete, and to many readers unintelligible. No man of the present age, however conversant in this dialect, would naturally express himself in it on any interesting emergence; or, supposing this natural to the antiquarian, it would never appear so to the common hearer or reader. A mixture of these words, therefore, must ruin the pathos of modern language; and as they are not familiar to our ear, and plainly appear to be sought after and affected, will generally give a stiffness to modern versification. Yet in subjects approaching to the ludicrous they may have a good effect; as in the *Schoolmistress* of Shenstone, Parnel's Fairy-tale, Thomson's Castle of Indolence, and Pope's lines in the Dunciad upon Wormius. But this effect will be most pleasing to those who have least occasion to recur to the glossary.

Indeed, it is not always easy to fix the boundary between poetical and obsolete expressions. To many readers, *lore*, *meed*, *behest*, *blithe*, *gaude*, *spray*, *thrall*, may already appear antiquated; and to some the style of Spencer, or even of Chaucer, may be as intelligible as that of Dryden. This however we may venture to affirm, that a word, which the majority of readers cannot understand without a glossary, may with reason be considered as obsolete; and ought not to be used in modern composition, unless revived, and recommended to the public ear, by some very eminent writer. There are but few words in Milton, as *nathless*, *tine*, *frore*, *bosky*, &c.; there are but one or two in Dryden, as *falsify* (F); and in Pope, there are none at all, which every reader of our poetry may not be supposed to understand: whereas in Shakespeare there are many, and in Spencer many more, for which one who knows English very well may be obliged to consult the dictionary. The practice of Milton, Dryden, or Pope, may therefore, in almost all cases, be admitted as good authority for the use of a poetical word. And in them, all the words above enumerated, as poetical, and in present use, may actually be found. And of such poets, as may choose to observe this rule, it will not be said, either that they reject the judgment of Quintilian, who recommends the newest of the old words, and the oldest of the new, or that they are inattentive to Pope's precept;

> Be not the first by whom the new are tried,
> Nor yet the last to lay the old aside.
>
> *Ess. on Crit.* v. 335.

We must not suppose that these poetical words never occur at all except in poetry. Even from conversation they are not excluded: and the ancient critics allow, that they may be admitted into prose, where they occasionally confer dignity upon a sublime subject, or heighten the ludicrous qualities of a mean one. But it is in poetry only where the frequent use of them does not savour of affectation.

Nor must we suppose them essential to this art. Many

(F) Dryden in one place (Æneid ix. vers. 1095.) uses *Falsified* to denote *Pierced through and through.* He acknowledges, that this use of the word is an innovation; and has nothing to plead for it but his own authority, and that *Falsare* in Italian sometimes means the same thing.

Of Poetical Words

Many passages there are of exquisite poetry, wherein not a single phrase occurs that might not be used in prose. In fact, the influence of these words in adorning English verse is not very extensive. Some influence however they have. They serve to render the poetical style, first, more melodious; and, secondly, more solemn.

49 In which case they may render the poetical style more melodious

First, They render the poetical style more melodious, and more easily reducible into measure. Words of unwieldy size, or difficult pronunciation, are never used by correct poets, where they can be avoided: unless in their sound they have something imitative of the sense. Homer's poetical inflections contribute wonderfully to the sweetness of his numbers: and if the reader is pleased to look back to the specimen above given of the English poetical dialect, he will find that the words are in general well-sounding, and such as may coalesce with other words, without producing harsh combinations. Quintilian observes, that poets, for the sake of their verse, are indulged in many liberties, not granted to the orator, of lengthening, shortening, and dividing their words*:—and if the Greek and Roman poets claimed this indulgence from necessity, and obtained it, the English, those of them especially who write in rhyme, may claim it with better reason; as the words of their language are less musical and far less susceptible of variety in arrangement and syntax.

* *Instit. Orat.* lib. 10. cap. 1. § 3.

50 And solemn.

Secondly, Such poetical words as are known to be ancient have something venerable in their appearance, and impart a solemnity to all around them. This remark is from Quintilian; who adds, that they give to a composition that cast and colour of antiquity which in painting is so highly valued, but which art can never effectually imitate†. Poetical words that are either not ancient, or not known to be such, have, however, a pleasing effect from association. We are accustomed to meet with them in sublime and elegant writing; and hence they come to acquire sublimity and elegance: Even as the words we hear on familiar occasions come to be accounted familiar; and as those that take their rise among pick-pockets, gamblers, and gypsies, are thought too indelicate to be used by any person of taste or good manners. When one hears the following lines, which abound in poetical words,

† Lib. 8. cap. 3. § 3.

> The breezy call of incense-breathing morn,
> The swallow twittering from the straw-built shed,
> The cock's shrill clarion, or the echoing horn,
> No more shall rouse them from their lowly bed:

—one is as sensible of the dignity of the language, as one would be of the vileness or vulgarity of that man's speech, who should prove his acquaintance with Bridewell, by interlarding his discourse with such terms as *mill-doll*, *queer cull*, or *nubbing cheat*‡; or who, in imitation of fops and gamblers, should on the common occasions of life, talk of being *beat hollow*, or *saving his distance*§. What gives dignity to persons gives dignity to language. A man of this character is one who has borne important employments, been connected with honourable associates, and never degraded himself by levity or immorality of conduct. Dignified phrases are those which have been used to express elevated sentiments, have always made their appearance in elegant composition, and have never been profaned by giving permanency or utterance to the passions of the vile, the giddy, or the worthless. And as by an active old age, the dignity of such men is confirmed and heightened; so the dignity of such words, if they be not suffered to fall into disuse, seldom fails to improve by length of time.

‡ See the *Scoundrel's Dictionary*.

§ Language of New-market.

Of Tropes and Figures.

Art. II. Of Tropes and Figures.

51 Tropes and figures necessary to poetical language.

If it appear that, by means of figures, language may be made more *pleasing* and more natural than it would be without them; it will follow, that to poetic language, whose end is to *please* by imitating *nature*, figures must be not only ornamental, but necessary. It will here be proper, therefore, first to point out the importance and utility of figurative language; secondly, to show, that figures are more necessary to poetry in general than to any other mode of writing.

I. *As to the importance and utility of figurative expression*, in making language more pleasing and more natural; it may be remarked,

52 To supply the defects of simple language, and

(1.) That tropes and figures are often necessary to supply the unavoidable defects of language. When *proper* words are wanting, or not recollected, or when we do not choose to be always repeating them, we must have recourse to tropes and figures. When philosophers began to explain the operations of the mind, they found that most of the words in common use, being framed to answer the more obvious exigencies of life, were in their proper signification applicable to matter only and its qualities. What was to be done in this case? Would they think of making a new language to express the qualities of mind? No: that would have been difficult or impracticable; and granting it both practicable and easy, they must have foreseen, that nobody would read or listen to what was thus spoken or written in a new and consequently in an unknown tongue. They therefore took the language as they found it; and wherever they thought there was a similarity or analogy between the qualities of the mind and the qualities of matter, scrupled not to use the names of the material qualities tropically, by applying them to the mental qualities. Hence came the phrases *solidity* of judgment, *warmth* of imagination, *enlargement* of understanding, and many others; which, though figurative, express the meaning just as well as proper words would have done. In fact, numerous as the words in every language are, they must always fall short of the unbounded variety of human thoughts and perceptions. Tastes and smells are almost as numerous as the species of bodies. Sounds admit of perceptible varieties that surpass all computation, and the seven primary colours may be diversified without end. If each variety of external perception were to have a name, language would be insurmountably difficult; nay, if men were to appropriate a class of names to each particular sense, they would multiply words exceedingly, without adding any thing to the clearness of speech. Those words, therefore, that in their proper signification denote the objects of one sense, we often apply tropically to the objects of another, and say, Sweet taste, sweet smell, sweet sound; sharp point, sharp taste, sharp sound; harmony of sounds, harmony of colours, harmony of parts; soft silk, soft colour, soft sound, soft temper; and so in a thousand instances: and yet these words, in their tropical signification, are not less intelligible than in their proper one; for sharp taste and sharp sound, are as expressive as sharp sword; and harmony of tones is not better understood by the musician, than harmony

mony of parts by the architect, and harmony of colours by the painter.

Savages, illiterate persons, and children, have comparatively but few words in proportion to the things they may have occasion to speak of; and must therefore recur to tropes and figures more frequently than persons of copious elocution. A seaman, or mechanic, even when he talks of that which does not belong to his art, borrows his language from that which does; and this makes his diction figurative to a degree that is sometimes entertaining enough. "Death (says a seaman in one of Smollet's novels) has not yet *boarded* my comrade; but they have been *yard-arm and yard-arm* these *three glasses*. His *starboard* eye is open, but fast *jammed* in his head; and the *haulyards* of his under jaw have given way." These phrases are exaggerated; but we allow them to be natural, because we know that illiterate people are apt to make use of tropes and figures taken from their own trade, even when they speak of things that are very remote and incongruous. In those poems, therefore, that imitate the conversation of illiterate persons, as in comedy, farce, and pastoral, such figures judiciously applied may render the imitation more pleasing, because more exact and natural.

53
To avoid harshness of diction.

Words that are untuneable and harsh, the poet is often obliged to avoid, when perhaps he has no other way to express their meaning than by tropes and figures; and sometimes the measure of his verse may oblige him to reject a proper word that is not harsh, merely on account of its being too long, or too short, or in any other way unsuitable to the rhythm, or to the rhyme. And hence another use of figurative language, that it contributes to poetical harmony. Thus, *to press the plain*, is frequently used to signify *to be slain in battle*; *liquid plain* is put for *ocean*, *blue serene* for *sky*, and *sylvan reign* for *country life*.

54
Tropes and figures favourable to delicacy.

(2.) Tropes and figures are favourable to delicacy. When the proper name of a thing is in any respect unpleasant, a well-chosen trope will convey the idea in such a way as to give no offence. This is agreeable, and even necessary, in polite conversation, and cannot be dispensed with in elegant writing of any kind. Many words, from their being often applied to vulgar use, acquire a meanness that disqualifies them for a place in serious poetry; while perhaps, under the influence of a different system of manners, the corresponding words in another language may be elegant, or at least not vulgar. When one reads Homer in the Greek, one takes no offence at his calling Eumeus by a name which, literally rendered, signifies *swine-herd*; first, because the Greek word is well-sounding in itself; secondly, because we have never heard it pronounced in conversation, nor consequently debased by vulgar use; and, thirdly, because we know, that the office denoted by it was, in the age of Eumeus, both important and honourable. But Pope would have been blamed, if a name so indelicate as *swine-herd* had in his translation been applied to so eminent a personage; and therefore he judiciously makes use of the trope *synecdoche*, and calls him *swain* *; a word both elegant and poetical, and not likely to lead the reader into any mistake about the person spoken of, as his employment had been described in a preceding passage. The same Eumeus is said, in the simple but melodious language of the original, to have been making his own shoes when Ulysses came to his door; a work which in those days the greatest heroes would often find necessary. This, too, the translator softens by a tropical expression:

* *Odyss.* b. 14. v. 41.

> Here sat Eumeus, and his cares applied,
> To form strong *buskins* of well season'd hide.

A hundred other examples might be quoted from this translation; but these will explain our meaning.

There are other occasions on which the delicacy of figurative language is still more needful; as in Virgil's account of the effects of animal love, and of the plague among the beasts, in the third Georgic; where Dryden's style, by being less figurative than the original, is in one place exceedingly filthy, and in another shockingly obscene.

Hobbes could construe a Greek author; but his skill in words must have been all derived from the dictionary: for he seems not to have known that any one articulate sound could be more agreeable, or any one phrase more dignified, than another. In his Iliad and Odyssey, even when he hits the author's sense (which is not always the case), he proves, by his choice of words, that of harmony, elegance, or energy of style, he had no manner of conception. And hence that work, though called a *Translation of Homer*, does not even deserve the name of *poem*; because it is in every respect unpleasing, being nothing more than a fictitious narrative delivered in a mean prose, with the additional meanness of harsh rhyme, and untuneable measure.——Trapp understood Virgil well enough as a grammarian, and had a taste for his beauties: yet his translation bears no resemblance to Virgil; which is owing to the same cause, an imprudent choice of words and figures, and a total want of harmony.

55
Which, however, may be carried too far.

The delicacy we here contend for, may indeed, both in conversation and in writing, be carried too far. To call *killing an innocent man in a duel* an affair of honour, and *a violation of the rights of wedlock* an affair of gallantry, is a prostitution of figurative language. Nor is it any credit to us, that we are said to have upwards of 40 figurative phrases to denote excessive drinking. Language of this sort generally implies, that the public abhorrence of such crimes is not so strong as it ought to be; and it is a question, whether even our morals might not be improved, if we were to call these and such like crimes by their proper names, *murder*, *adultery*, *drunkenness*, *gluttony*; names, that not only express our meaning, but also betoken our disapprobation.——As to writing, it cannot be denied, that even Pope himself, in the excellent version just now quoted, has sometimes, for the sake of his numbers, or for fear of giving offence by too close an imitation of Homer's simplicity, employed tropes and figures too quaint or too solemn for the occasion. And the finical style is in part characterised by the writer's dislike to literal expressions, and affectedly substituting in their stead unnecessary tropes and figures. With these authors, a man's only child must always be his *only hope*; a country maid becomes *a rural beauty*, or perhaps a *nymph of the groves*; if flattery sing at all, it must be a *syren song*; the shepherd's flute dwindles into an *oaten reed*, and his crook is exalted into a *sceptre*; the *silver lilies* rise from their *golden beds*, and *languish* to the *complaining* gale. A young woman, though a good Christian, cannot make herself agreeable without *sacrificing to the Graces*; nor hope

hope to do any execution among the *gentle swains*, till a whole legion of *Cupids*, armed with *flames* and *darts*, and other weapons, begin to discharge from her eyes their formidable artillery. For the sake of variety, or of the verse, some of these figures may now and then find a place in a poem; but in prose, unless very sparingly used, they savour of affectation.

56 Tropes and figures promote brevity, and

(3.) Tropes and figures promote brevity; and brevity, united with perspicuity, is always agreeable. An example or two will be given in the next paragraph. Sentiments thus delivered, and imagery thus painted, are readily apprehended by the mind, make a strong impression upon the fancy, and remain long in the memory; whereas too many words, even when the meaning is good, never fail to bring disgust and weariness. They argue a debility of mind which hinders the author from seeing his thoughts in one distinct point of view; and they also encourage a suspicion, that there is something faulty or defective in the matter. In the poetic style, therefore, which is addressed to the fancy and passions, and intended to make a vivid, a pleasing, and a permanent impression, brevity, and consequently tropes and figures, are indispensable. And a language will always be the better suited to poetical purposes, the more it admits of this brevity;—a character which is more conspicuous in the Greek and Latin than in any modern tongue, and much less in the French than in the Italian or English.

57 Contribute to strength and energy of language.

(4.) Tropes and figures contribute to strength or energy of language, not only by their conciseness, but also by conveying to the fancy ideas that are easily comprehended, and make a strong impression. We are powerfully affected with what we see, or feel, or hear. When a sentiment comes enforced or illustrated by figures taken from objects of sight, or touch, or hearing, one thinks, as it were, that one sees, or feels, or hears, the thing spoken of; and thus, what in itself would perhaps be obscure, or is merely intellectual, may be made to seize our attention and interest our passions almost as effectually as if it were an object of outward sense. When Virgil calls the Scipios *thunderbolts of war*, he very strongly expresses in one word, and by one image, the rapidity of their victories, the noise their atchievements made in the world, and the ruin and consternation that attended their irresistible career.——When Homer calls Ajax *the bulwark of the Greeks*, he paints with equal brevity his vast size and strength, the difficulty of prevailing against him, and the confidence wherewith his countrymen reposed on his valour. ——When Solomon says of the strange woman, or harlot, that "her feet go *down* to death," he lets us know, not only that her path ends in destruction, but also, that they who accompany her will find it easy to go forwards to ruin, and difficult to return to their duty.——Satan's enormous magnitude, and refulgent appearance, his perpendicular ascent through a region of darkness, and the inconceivable rapidity of his motion, are all painted out to our fancy by Milton, in one very short similitude,

> Sprung upward, like—a pyramid of fire.
> *Par. Lost*, b. 4. v. 1013.

To take in the full meaning of which figure, we must imagine ourselves in chaos, and a vast luminous body rising upward, near the place where we are, so swiftly as to appear a continued track of light, and lessening to the view according to the increase of distance, till it end in a point, and then disappear; and all this must be supposed to strike our eye at one instant.——Equal to this in propriety, though not in magnificence, is that allegory of Gray,

> The paths of glory lead but to the grave:

Which presents to the imagination a wide plain, where several roads appear, crowded with glittering multitudes, and issuing from different quarters, but drawing nearer and nearer as they advance, till they terminate in the dark and narrow house, where all their glories enter in succession, and disappear for ever.——When it is said in Scripture, of a good man who died, that he *fell asleep*, what a number of ideas are at once conveyed to our imagination, by this beautiful and expressive figure: As a labourer, at the close of day, goes to sleep, with the satisfaction of having performed his work, and with the agreeable hope of awaking in the morning of a new day, refreshed and cheerful; so a good man, at the end of life, resigns himself calm and contented to the will of his Maker, with the sweet reflection of having endeavoured to do his duty, and with the transporting hope of soon awaking in the regions of light, to life and happiness eternal. The figure also suggests, that to a good man the transition from life to death is, even in the sensation, no more painful, than when our faculties melt away into the pleasing insensibility of sleep.——Satan, flying among the stars, is said by Milton to "*sail* between worlds and worlds;" which has an elegance and force far superior to the proper word *fly*. For by this allusion to a ship, we are made to form a lively idea of his great size, and to conceive of his motion, that it was equable and majestic.——Virgil uses a happy figure to express the size of the great wooden horse, by means of which the Greeks were conveyed into Troy: "Equum divina Palladis arte *edificant*."——Milton is still bolder when he says,

> Who would not sing for Lycidas? he knew
> Himself to sing, and *build the lofty rhyme*.

The phrase, however, though bold, is emphatical; and gives a noble idea of the durability of poetry, as well as of the art and attention requisite to form a good poem.—— There are hundreds of tropical expressions in common use, incomparably more energetic than any proper words of equal brevity that could be put in their place. A cheek *burning* with blushes, is a trope which at once describes the colour as it appears to the beholder, and the glowing heat as it is felt by the person blushing. *Chilled* with despondence, *petrified* with astonishment, *thunderstruck* with disagreeable and unexpected intelligence, *melted* with love or pity, *dissolved* in luxury, *hardened* in wickedness, *softening* into remorse, *inflamed* with desire, *tossed* with uncertainty, &c.—every one is sensible of the force of these and the like phrases, and that they must contribute to the energy of composition.

58 They are likewise the language of strong passion.

(5.) Tropes and figures promote strength of expression; and are in poetry peculiarly requisite, because they are often more *natural*, and more *imitative*, than proper words. In fact, this is so much the case, that it would be impossible to imitate the language of passion without them. It is true, that when the mind is agitated, one does not run out into allegories, or long-winded similitudes, or any of the figures that require much attention and

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and many words, or that tend to withdraw the fancy from the object of the passion. Yet the language of many passions must be figurative notwithstanding; because they rouse the fancy, and direct it to objects congenial to their own nature, which diversify the language of the speaker with a multitude of allusions. The fancy of a very angry man, for example, presents to his view a train of disagreeable ideas connected with the passion of anger, and tending to encourage it; and if he speak without restraint during the paroxysm of his rage, those ideas will force themselves upon him, and compel him to give them utterance. "Infernal monster! (he will say),—my blood boils at him; he has used me like a dog; never was man so injured as I have been by this barbarian. He has no more sense of propriety than a stone. His countenance is diabolical, and his soul as ugly as his countenance. His heart is cold and hard, and his resolutions dark and bloody," &c. This speech is wholly figurative. It is made up of *metaphors* and *hyperboles*, which, with the *prosopopeia* and *apostrophe*, are the most passionate of all the figures. Lear, driven out of doors by his unnatural daughters, in the midst of darkness, thunder, and tempest, naturally breaks forth (for his indignation is just now raised to the very highest pitch) into the following violent exclamation against the crimes of mankind, in which almost every word is figurative.

Tremble, thou wretch,
That hast within thee undivulged crimes
Unwhipt of justice. Hide thee, thou bloody hand,
Thou perjur'd, and thou simular of virtue,
That art incestuous. Caitiff, to pieces shake,
That under covert, and convenient seeming,
Hast practis'd on man's life. Close pent-up guilts,
Rive your concealing continents, and cry
These dreadful summoners grace. *King Lear.*

——The vehemence of maternal love, and sorrow from the apprehension of losing her child, make the Lady Constance utter a language that is strongly figurative, though quite suitable to the condition and character of the speaker. The passage is too long for a quotation, but concludes thus:

O Lord! my boy, my Arthur, my fair son,
My life, my joy, my food, my all the world,
My widow-comfort, and my sorrow's cure. *King John.*

——Similar to this, and equally expressive of conjugal love, is that beautiful hyperbole in Homer; where Andromache, to dissuade her husband from going out to the battle, tells him that she had now no mother, father, or brethren, all her kindred being dead, and her native country desolate; and then tenderly adds,

But while my Hector yet survives, I see
My father, mother, brethren, all in thee. *Iliad*, b. 6.

59 The simplest language most suitable to depressing passions.

As the passions that agitate the soul, and rouse the fancy, are apt to vent themselves in tropes and figures, so those that depress the mind adopt for the most part a plain diction without any ornament: for to a dejected mind, wherein the imagination is generally inactive, it is not probable that any great variety of ideas will present themselves; and when these are few and familiar, the words that express them must be simple. As no author equals Shakespeare in boldness or variety of figures when he copies the style of those violent passions that stimulate the fancy; so, when he would exhibit the human mind in a dejected state, no uninspired writer excels him in simplicity. The same Lear whose resentment had impaired his understanding, while it broke out in the most boisterous language, when, after some medical applications, he recovers his reason, his rage being now exhausted, his pride humbled, and his spirits totally depressed, speaks in a style than which nothing can be imagined more simple or more affecting.

Pray, do not mock me:
I am a very foolish, fond old man,
Fourscore and upward; and, to deal plainly with you,
I fear I am not in my perfect mind.
Methinks I should know you, and know this man;
Yet I am doubtful: for I am mainly ignorant
What place this is; and all the skill I have
Remembers not these garments: nor I know not
Where I did lodge last night.——*Lear*, act 4. sc. 7.

——Desdemona, ever gentle, artless, and sincere, shocked at the unkindness of her husband, and overcome with melancholy, speaks in a style so beautifully simple, and so perfectly natural, that one knows not what to say in commendation of it:

My mother had a maid call'd Barbara;
She was in love, and he she lov'd prov'd mad,
And did forsake her. She had a song of willow;
An old thing it was, but it express'd her fortune,
And she died singing it. That song to-night
Will not go from my mind: I have much to do,
But to go hang my head all at one side,
And sing it like poor Barbara. *Othello*, act 4. sc. 3.

Sometimes the imagination, even when exerted to the utmost, takes in but few ideas. This happens when the attention is totally engrossed by some very great object; admiration being one of those emotions that rather suspend the exercise of the faculties than push them into action. And here, too, the simplest language is the most natural; as when Milton says of the Deity, that he sits "high-throned above all height." And as this simplicity is more suitable to that one great exertion which occupies the speaker's mind than a more elaborate imagery or language would have been, so has it also a more powerful effect in fixing and elevating the imagination of the hearer; for to introduce other thoughts for the sake of illustrating what cannot be illustrated, could answer no other purpose than to draw off the attention from the principle idea. In these and the like cases, the fancy left to itself will have more satisfaction in pursuing at leisure its own speculations than in attending to those of others; as they who see for the first time some admirable object would choose rather to feast upon it in silence, than to have their thoughts interrupted by a long description from another person, informing them of nothing but what they see before them, are already acquainted with, or may easily conceive.

60 And to the sentiment of admiration.

It was remarked above, that the *hyperbole*, *prosopopeia*, and *apostrophe*, are among the most passionate figures. This deserves illustration.

61 Hyperbole natural to the passions of anger, love, fear, in &c.

1*st*, A very angry man is apt to think the injury he has just received greater than it really is; and if he proceed immediately to retaliate by word or deed, seldom fails to exceed the due bounds, and to become injurious

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in his turn. The fond parent looks upon his child as a prodigy of genius and beauty; and the romantic lover will not be persuaded that his mistress has nothing supernatural either in her mind or person. Fear, in like manner, not only magnifies its object when real, but even forms an object out of nothing, and mistakes the fictions of fancy for the intimations of sense.—No wonder, then, that they who speak according to the impulse of passion should speak *hyperbolically*; that the angry man should exaggerate the injury he has received, and the vengeance he is going to inflict; that the sorrowful should magnify what they have lost, and the joyful what they have obtained; that the lover should speak extravagantly of the beauty of his mistress, the coward of the dangers he has encountered, and the credulous clown of the miracles performed by the juggler. In fact, these people would not do justice to what they feel if they did not say more than the truth. The valiant man, on the other hand, as naturally adopts the diminishing hyperbole when he speaks of danger; and the man of sense, when he is obliged to mention his own virtue or ability; because it appears to him, or he is willing to consider it, as less than the truth, or at best as inconsiderable. Contempt uses the same figure; and therefore Petruchio, affecting that passion, affects also the language of it:

Thou liest, thou thread, thou thimble,
Thou yard, three-quarters, half-yard, quarter, nail,
Thou flea, thou nit, thou winter-cricket, thou!
Brav'd in mine own house with a skein of thread!
Away, thou rag, thou quantity, thou remnant!
Taming of the Shrew, act 4. sc. 1.

For some passions consider their objects as important, and others as unimportant. Of the former sort are anger, love, fear, admiration, joy, sorrow, pride; of the latter are contempt and courage. Those may be said to subdue the mind to the object, and these to subdue the object to the mind. And the former, when violent, always magnify their objects; whence the hyperbole called amplification, or *auxesis*: and the latter as constantly diminish theirs; and give rise to the hyperbole called *meiosis*, or diminution.—Even when the mind cannot be said to be under the influence of any violent passion, we naturally employ the same figure when we would impress another very strongly with any idea. "He is a walking shadow; he is worn to skin and bone; he has one foot in the grave and the other following:"—these, and the like phrases, are proved to be natural by their frequency. By introducing great ideas, the hyperbole is further useful in poetry as a source of the sublime; but when employed injudiciously is very apt to become ridiculous. Cowley makes Goliah as big as the hill down which he was marching †; and tells us, that when he came into the valley he seemed to fill it, and to overtop the neighbouring mountains (which, by the by, seems rather to lessen the mountains and valleys than to magnify the giant); nay, he adds, that the sun started back when he saw the splendour of his arms. This poet seems to have thought that the figure in question could never be sufficiently enormous; but Quintilian would have taught him, "Quamvis omnis hyperbole ultra fidem, non tamen esse debet ultra modum." The reason is, that this figure, when excessive, betokens rather absolute infatuation than intense emotion; and resembles the efforts of a ranting tragedian, or the ravings of an enthusiastic declaimer, who, by putting on the gestures and looks of a lunatic, satisfy the discerning part of their audience, that, instead of feeling strongly, they have no rational feelings at all. In the wildest energies of nature there is a modesty which the imitative artist will be careful never to overstep.

† Davideis, b. 3.

62 Prosopopœia when proper.

2*dly*, That figure, by which things are spoken of as if they were persons, is called *prosopopœia*, or *personification*. It is a bold figure, and yet is often natural. Long acquaintance recommends to some share in our affection even things inanimate, as a house, a tree, a rock, a mountain, a country; and were we to leave such a thing, without hope of return, we should be inclined to address it with a farewel, as if it were a percipient creature. Hence it was that Mary queen of Scotland, when on her return to her own kingdom, so affectionately bade adieu to the country which she had left. "Farewel, France," said she; "farewel, beloved country, which I shall never more behold!" Nay, we find that ignorant nations have actually worshipped such things, or considered them as the haunt of certain powerful beings. Dryads and hamadryads were by the Greeks and Romans supposed to preside over trees and groves; river gods and nymphs, over streams and fountains; little deities, called *Lares* and *Penates*, were believed to be the guardians of hearths and houses. In Scotland there is hardly a hill remarkable for the beauty of its shape, that was not in former times thought to be the habitation of fairies. Nay, modern as well as ancient superstition has appropriated the waters to a peculiar sort of demon or goblin, and peopled the very regions of death, the tombs and charnel-houses, with multitudes of ghosts and phantoms.—Besides, when things inanimate make a strong impression upon us, whether argeeable or otherwise, we are apt to address them in terms of affection or dislike. The sailor blesses the plank that brought him ashore from the shipwreck; and the passionate man, and sometimes even the philosopher, will say bitter words to the stumbling-block that gave him a fall.—Moreover, a man agitated with any interesting passion, especially of long continuance, is apt to fancy that all nature sympathises with him. If he has lost a beloved friend, he thinks the sun less bright than at other times; and in the sighing of the winds and groves, in the lowings of the herd, and in the murmurs of the stream, he seems to hear the voice of lamentation. But when joy or hope predominate, the whole world assumes a gay appearance. In the contemplation of every part of nature, of every condition of mankind, of every form of human society, the benevolent and the pious man, the morose and the cheerful, the miser and the misanthrope, finds occasion to indulge his favourite passion, and sees, or thinks he sees, his own temper reflected back in the actions, sympathies, and tendencies of other things and persons. Our affections are indeed the medium through which we may be said to survey ourselves, and every thing else; and whatever be our inward frame, we are apt to perceive a wonderful congeniality in the world without us. And hence the fancy, when roused by real emotions, or by the pathos of composition, is easily reconciled to those figures of speech that ascribe sympathy, perception, and the other attributes of animal life, to things inanimate, or even to notions merely intellectual.—Motion, too, bears a close affinity

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affinity to action, and affects our imagination nearly in the same manner; and we see a great part of nature in motion, and by its sensible effects are led to contemplate energies innumerable. These conduct the rational mind to the Great First Cause; and these, in times of ignorance, disposed the vulgar to believe in a variety of subordinate agents employed in producing those appearances that could not otherwise be accounted for. Hence an endless train of fabulous deities, and of witches, dæmons, fairies, genii; which, if they prove our reason weak and our fancy strong, prove also that personification is natural to the human mind; and that a right use of this figure may have a powerful effect, in fabulous writing especially, to engage our sympathy in behalf of things as well as persons: for nothing can give lasting delight to a moral being, but that which awakens sympathy, and touches the heart; and though it be true that we sympathise in some degree even with inanimate things, yet what has, or is supposed to have, life, calls forth a more sincere and more permanent fellow-feeling. —Let it be observed further, that to awaken our sympathetic feelings, a lively conception of their object is necessary. This indeed is true of almost all our emotions; their keenness is in proportion to the vivacity of the perceptions that excite them. Distress that we see is more affecting than what we only hear of*; a perusal of the gayest scenes in a comedy does not rouse the mind so effectually as the presence of a cheerful companion; and the death of a friend is of greater energy in producing seriousness, and the consideration of our latter end, than all the pathos of Young. Of descriptions addressed to the fancy, those that are most vivid and picturesque will generally be found to have the most powerful influence over our affections; and those that exhibit persons engaged in action, and adorned with visible insignia, give a brisker impulse to the faculties than such as convey intellectual ideas only, or images taken from still life. No abstract notion of time, or of love, can be so striking to the fancy as the image of an old man accoutred with a scythe, or of a beautiful boy with wings and a bow and arrows: and no physiological account of frenzy could suggest so vivid an idea as the poet has given us in that exquisite portrait,

* Hor. Ar. Poet. v. 180.

And moody madness laughing wild amid severest wo.

And for this reason partly it is that the epic poet, in order to work the more effectually upon our passions and imagination, refers the secret springs of human conduct, and the vicissitudes of human affairs, to the agency of personified causes; that is, to the machinery of gods and goddesses, angels, demons, magicians, and other powerful beings. And hence, in all sublime poetry, life and motion, with their several modes and attributes, are liberally bestowed on those objects wherewith the author intends that we should be strongly impressed: scenes perfectly inanimate and still, tending rather to diffuse a languor over the mind than to communicate to our internal powers those lively energies without which a being essentially active can never receive complete gratification.—Lastly, some violent passions are peculiarly inclined to change things into persons. The horrors of his mind haunted Orestes in the shape of furies. Conscience, in the form of the murdered person, stares the murderer in the face, and often terrifies him to distraction. The superstitious man, travelling alone in the dark, mistakes a white stone for a ghost, a bush for a demon, a tree waving with the wind for an enormous giant brandishing a hundred arms. The lunatic and enthusiast converse with persons who exist only in their own distempered fancy; and the glutton and the miser, if they were to give utterance to all their thoughts, would often, it is presumable, speak, the one of his gold, the other of his belly, not only as a person, but as a god,—the object of his warmest love and most devout regard.—More need not be said to prove that personification is natural, and may frequently contribute to the pathos, energy, and beauty of poetic language.

65 Apostrophe how to be used.

3dly, *Apostrophe*, or a sudden diversion of speech from one person to another person or thing, is a figure nearly related to the former. Poets sometimes make use of it, in order to help out their verse, or merely to give variety to their style: but on these occasions it is to be considered as rather a trick of art, than an effort of nature. It is most natural, and most pathetic, when the person or thing to whom the apostrophe is made, and for whose sake we give a new direction to our speech, is in our eyes eminently distinguished for good or evil, or raises within us some sudden and powerful emotion, such as the hearer would acquiesce in, or at least acknowledge to be reasonable. But this, like the other pathetic figures, must be used with great prudence. For if, instead of calling forth the hearer's sympathy, it should only betray the levity of the speaker, or such wanderings of his mind as neither the subject nor the occasion would lead one to expect, it will then create disgust instead of approbation. The orator, therefore, must not attempt the passionate apostrophe, till the minds of the hearers be prepared to join in it. And every audience is not equally obsequious in this respect. In the forum of ancient Rome that would have passed for sublime and pathetic, which in the most respectable British auditories would appear ridiculous. For our style of public speaking is cool and argumentative; and partakes less of enthusiasm than the Roman did, and much less than the modern French or Italian. Of British eloquence, particularly that of the pulpit, the chief recommendations are gravity and simplicity. And it is vain to say, that our oratory *ought* to be more vehement: for that matter depends on causes, which it is not only inexpedient, but impossible to alter; namely, on the character and spirit of the people, and their rational notions in regard to religion, policy, and literature. The exclamations of Cicero would weigh but little in our parliament; and many of those which we meet with in French sermons would not be more effectual if attempted in our pulpit. To see one of our preachers, who the moment before was a cool reasoner, a temperate speaker, an humble Christian, and an orthodox divine, break out into a sudden apostrophe to the immortal powers, or to the walls of the church, tends to force a smile, rather than a tear, from those among us who reflect, that there is nothing in the subject, and should be nothing in the orator, to warrant such wanderings of fancy or vehemence of emotion. If he be careful to cultivate a pure style, and a grave and graceful utterance, a British clergyman, who speaks from conviction the plain unaffected words of truth and soberness, of benevolence and piety, will, it is believed, convey more pathetic, as well as more permanent, impressions to the heart,

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heart, and be more useful as a Christian teacher, than if he were to put in practice all the attitudes of Roscius, and all the tropes and figures of Cicero.

But where the language of passion and enthusiasm is permitted to display itself, whatever raises any strong emotion, whether it be animated or inanimate, absent or present, sensible or intellectual, may give rise to the apostrophe. A man in a distant country, speaking of the place of his birth, might naturally exclaim, "O my dear native land, shall I never see thee more!" Or, when some great misfortune befals him, "Happy are ye, O my parents, that ye are not alive to see this." We have a beautiful apostrophe in the third book of the Æneid, where Æneas, who is telling his story to Dido, happening to mention the death of his father, makes a sudden address to him as follows:

——— hic, pelagi tot tempestatibus actus,
Heu, genitorem, omnis curæ casusque levamen,
Amitto Anchisen: —hic me, pater optime, fessum
Deseris, heu, tantis nequicquam erepte periclis!

This apostrophe has a pleasing effect. It seems to intimate, that the love which the hero bore his father was so great, that when he mentioned him he forgot every thing else; and, without minding his company, one of whom was a queen, suddenly addressed himself to that which, though present only in idea, was still a principal object of his affection. An emotion so warm and so reasonable cannot fail to command the sympathy of the reader.—— When Michael, in the eleventh book of Paradise Lost, announces to Adam and Eve the necessity of their immediate departure from the garden of Eden, the poet's art in preserving the decorum of the two characters is very remarkable. Pierced to the heart at the thought of leaving that happy place, Eve, in all the violence of ungovernable sorrow, breaks forth into a pathetic apostrophe to Paradise, to the flowers she had reared, and to the nuptial bower she had adorned. Adam makes no address to the walks, the trees, or the flowers of the garden, the loss whereof did not so much afflict him; but, in his reply to the Archangel, expresses, without a figure, his regret for being banished from a place where he had been so oft honoured with a sensible manifestation of the divine presence. The use of the apostrophe in the one case, and the omission of it in the other, not only gives a beautiful variety to the style, but also marks that superior elevation and composure of mind, by which the poet had all along distinguished the character of Adam.—One of the finest applications of this figure that is anywhere to be seen, is in the fourth book of the same poem; where the author, catching by sympathy the devotion of our first parents, suddenly drops his narrative, and joins his voice to theirs in adoring the Father of the universe.

Thus at their shady lodge arriv'd, both stood,
Both turn'd, and under open sky ador'd
The God that made both sky, air, earth, and heav'n,
Which they beheld, the moon's resplendent globe,
And starry pole:—Thou also mad'st the night,
Maker omnipotent! and thou the day,
Which we in our appointed work employ'd
Have finish'd.———

Milton took the hint of this fine contrivance from a well-known passage of Virgil:

Hic juvenum chorus, ille senum; qui carmine laudes
Herculeas et facta ferant;———
——— ut duros mille labores
Rege sub Eurystheo, fatis Junonis iniquæ,
Pertulerit: —Tu nubigenas, invicte, bimembres,
Hylæum Pholoumque, manu; tu Cresia mactas
Prodigia. ———

The beauty arising from diversified composition is the same in both, and very great in each. But every reader must *feel*, that the figure is incomparably more affecting to the mind in the imitation than in the original. So true it is, that the most rational emotions raise the most intense fellow-feeling; and that the apostrophe is then the most emphatical, when it displays those workings of human affection which are at once ardent and well-founded.

64 Tropes and figures are useful, as they suggest an endless variety of agreeable images.

To conclude this head: Tropes and figures, particularly the *metaphor*, *similitude*, and *allegory*, are further useful in beautifying language, by suggesting, together with the thoughts essential to the subject, an endless variety of agreeable images, for which there would be no place, if writers were always to confine themselves to the *proper* names of things. And this beauty and variety, judiciously applied, is so far from distracting, that it tends rather to fix, the attention, and captivate the heart of the readers, by giving light, and life, and pathos, to the whole composition.

II. That tropes and figures are more necessary to poetry, than to any other mode of writing, was the second point proposed to be illustrated in this section.

65 Tropes and figures more necessary to poetry than to any other mode of writing.

Language, as already observed, is then natural, when it is suitable to the supposed condition of the speaker. Figurative language is peculiarly suitable to the supposed condition of the poet; because figures are suggested by the fancy; and the fancy of him who composes poetry is more employed than that of any other author. Of all historical, philosophical, and theological researches, the object is *real* truth, which is fixed and permanent. The aim of rhetorical declamation (according to Cicero) is *apparent* truth; which, being less determinate, leaves the fancy of the speaker more free, gives greater scope to the inventive powers, and supplies the materials of a more figurative phraseology. But the poet is subject to no restraints, but those of verisimilitude; which is still less determinate than rhetorical truth. He seeks not to convince the judgment of his reader by arguments of either real or apparent cogency; he means only to please and interest him, by an appeal to his sensibility and imagination. His own imagination is therefore continually at work, ranging through the whole of real and probable existence, "glancing from heaven to earth, from earth to heaven," in quest of images and ideas suited to the emotions he himself feels, and to the sympathies he would communicate to others. And, consequently, figures of speech, the offspring of excursive fancy, must (if he speak according to what he is supposed to think and feel, that is, according to his supposed condition) tincture the language of the poet more than that of any other composer. So that, if figurative diction be unnatural in geometry, because all wanderings of fancy are unsuitable, and even impossible, to the geometrician, while intent upon his argument; it is, upon the same principle, perfectly natural, and even unavoidable, in poetry; because the more a poet attends to his subject, and the better qualified he is to do it justice, the more active will his imagination be, and the more diversified the ideas that present themselves to his mind. —— Besides, the true poet addresses himself to the passions and sympathies of mankind; which, till his own be raised, he cannot hope to do with success. And it is the nature of many passions, though not of all, to increase the activity of imagination: and an active imagination naturally vents itself in figurative language; nay, unless restrained by a correct taste, has a tendency to exceed in it; of which Bishop Taylor and Lord Verulam, two geniuses different in kind, but of the highest order, are memorable examples.

We said, that "the poet seeks not to convince the judgment of his reader by arguments of either real or apparent cogency." —— We do not mean, that in poetry argument has no place. The most legitimate reasoning, the soundest philosophy, and narratives purely historical, may appear in a poem, and contribute greatly to the honour of the author, and to the importance of his work. All this we have in Paradise Lost. — We mean, that what distinguishes *pure* poetry from other writing, is its aptitude, not to sway the judgment by reasoning, but to please the fancy, and move the passions, by a lively imitation of nature. Nor would we exclude poetical embellishment from history, or even from philosophy. Plato's Dialogues and the Moral Essays of Addison and Johnson abound in poetic imagery; and Livy and Tacitus often amuse their readers with poetical description. In like manner, though geometry and physics be different sciences; though abstract ideas be the subject, and pure demonstration or intuition the evidence, of the former; and though the material universe, and the informations of sense, be the subject and the evidence of the latter; yet have these sciences been united by the best philosophers, and very happy effects resulted from the union. —— In one and the same work, poetry, history, philosophy, and oratory, may doubtless be blended; nay, these arts have all been actually blended in one and the same work, not by Milton only, but also by Homer, Virgil, Lucan, and Shakespeare. Yet still these arts are different; different in their ends and principles; and in the faculties of the mind to which they are respectively addressed: and it is easy to perceive when a writer employs one and when another.

§ 2. *Of the* Sound *of Poetical Language.*

66 The poet ought to attend to the harmony of language, which consists in

As the ear, like every other perceptive faculty, is capable of gratification, regard is to be had to the sound of words, even in prose. But to the harmony of language, it behoves the poet, more than any other writer, to attend; as it is more especially his concern to render his work pleasurable. In fact, we find, that no poet was ever popular who did not possess the art of harmonious composition.

What belongs to the subject of Poetical Harmony

may be referred to one or other of these heads, *Sweetness*, *Measure*, and *Imitation*.

67 Sweetness and

I. In order to give *sweetness* to language, either in verse or prose, all words of harsh sound, difficult pronunciation, or unwieldy magnitude, are to be avoided as much as possible, unless when they have in the sound something peculiarly emphatical; and words are to be so placed in respect of one another, as that discordant combinations may not result from their union. But in poetry this is more necessary than in prose; poetical language being understood to be an imitation of natural language improved to that perfection which is consistent with probability. To poetry, therefore, a greater latitude must be allowed than to prose, in expressing, by tropes and figures of pleasing sound, those ideas whereof the proper names are in any respect offensive, either to the ear or to the fancy.

II. How far versification or *regular measure* may be essential to this art, has been disputed by critical writers; some holding it to be indispensably necessary, and some not necessary at all.

68 Measure, which, though not essential,

The fact seems to be, as already hinted, that to poetry verse is not essential. In a prose work, we may have the fable, the arrangement, and a great deal of the pathos and language, of poetry; and such a work is certainly a poem, though perhaps not a perfect one. For how absurd would it be to say, that by changing the position only of a word or two in each line, one might divest Homer's Iliad of the poetical character! At this rate, the arts of poetry and versification would be the same; and the rules in Despauter's Grammar, and the moral distichs ascribed to Cato, would be as real poetry as any part of Virgil. In fact, some very ancient poems, when translated into a modern tongue, are far less poetical in verse than in prose; the alterations necessary to adapt them to our numbers being detrimental to their sublime simplicity; of which any person of taste will be sensible, who compares our common prose-version of Job, the Psalms, and the Song of Solomon, with the best metrical paraphrase of those books that has yet appeared. Nay, in many cases, Comedy will be more poetical, because more pleasing and natural, in prose than in verse. By versifying Tom Jones, and The Merry Wives of Windsor, we should spoil the two finest comic poems, the one epic, the other dramatical, now in the world.

69 Add to the perfection of poetry.

But, secondly, though verse be not essential to poetry, it is necessary to the perfection of all poetry that admits of it. Verse is to poetry, what colours are to painting (G). A painter might display great genius, and draw masterly figures with chalk or ink; but if he intend a perfect picture, he must employ in his work as many colours as are seen in the object he imitates. Or, to adopt a beautiful comparison of Demosthenes, quoted by Aristotle *, "Versification is to poetry what bloom is to the human countenance." A good face is agreeable when the bloom is gone, and good poetry may please without versification; harmonious numbers may

* Rhetor. lib. 3. cap. 4.

set

(G) Horace seems to hint at the same comparison, when, after specifying the several sorts of verse suitable to Epic, Elegiac, Lyric, and Dramatic Poetry, he adds,

Descriptas servare vices, *operumque colores*.
Cur ego, si nequeo ignoroque, Poeta salutor? *Ar. Poet.* ver. 86.

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set off an indifferent poem, and a fine bloom indifferent features: but, without verse, poetry is incomplete; and beauty is not perfect, unless to sweetness and regularity of feature there be superadded,

The bloom of young desire, and purple light of love.

If numbers are necessary to the perfection of the higher poetry, they are no less so to that of the lower kinds, to Pastoral, Song, and Satire, which have little besides the language and versification to distinguish them from prose; and which some ancient authors are unwilling to admit to the rank of poems: though it seems too nice a scruple, both because such writings are commonly termed *poetical;* and also because there is, even in them, something that may not improperly be considered as an imitation of nature.

That the rhythm and measures of verse are naturally agreeable, and therefore that by these poetry may be made more pleasing than it would be without them, is evident from this, that children and illiterate people, whose admiration we cannot suppose to be the effect of habit or prejudice, are exceedingly delighted with them. In many proverbial sayings, where there is neither rhime nor alliteration, rhythm is obviously studied. Nay, the use of rhythm in poetry is universal; whereas alliteration and rhime, though relished by some nations, are not much sought after by others. And we need not be at a loss to account for the agreeableness of proportion and order, if we reflect, that they suggest the agreeable ideas of contrivance and skill, at the same time that they render the connection of things obvious to the understanding, and imprint it deeply on the memory. Verse, by promoting distinct and easy remembrance, conveys ideas to the mind with energy, and enlivens every emotion the poet intends to raise in the reader or hearer. Besides, when we attend to verses, after hearing one or two, we become acquainted with the measure, which therefore we always look for in the sequel. This perpetual interchange of hope and gratification is a source of delight; and to this in part is owing the pleasure we take in the rhimes of modern poetry. And hence we see, that though an incorrect rhime or untuneable verse be in itself, and compared with an important sentiment, a very trifling matter; yet it is no trifle in regard to its effects on the hearer; because it brings disappointment, and so gives a temporary shock to the mind, and interrupts the current of the affections; and because it suggests the disagreeable ideas of negligence or want of skill on the part of the author. And therefore, as the public ear becomes more delicate, the negligence will be more glaring, and the disappointment more intensely felt; and correctness of rhime and of measure will of course be the more indispensable. In our tongue, rhime is more necessary to Lyric than to Heroic poetry. The reason seems to be, that in the latter the ear can of itself perceive the boundary of the measure, because the lines are all of equal length nearly, and every good reader makes a short pause at the end of each; whereas, in the former, the lines vary in length: and therefore the rhime is requisite to make the measure and rhythm sufficiently perceptible. Custom too may have some influence. English Odes without rhime are uncommon; and therefore have something aukward about them, or something at least to which the public ear is not yet thoroughly reconciled. Indeed, when the drama is excepted, we do not think that rhime can be safely spared from English poetry of any kind, but when the subject is able to support itself. "He that thinks himself capable of astonishing (says Johnson) may write blank verse; but those that hope only to please, must condescend to rhime."

70 In what cases rhime may be dispensed with in English poetry.

Rhime, however, is of less importance by far than rhythm, which in poetry as well as in music is the source of much pleasing variety; of variety tempered with uniformity, and regulated by art; insomuch that, notwithstanding the likeness of one hexameter verse to another, it is not common, either in Virgil or in Homer, to meet with two contiguous hexameters whose rhythm is exactly the same. And though all English heroic verses consist of five feet, among which the iambic predominates; yet this measure, in respect of rhythm alone, is susceptible of more than 30 varieties. And let it be remarked further, that different kinds of verse, by being adapted to different subjects and modes of writing, give variety to the poetic language, and multiply the charms of this pleasing art.

What has formerly been shown to be true in regard to style, will also in many cases hold true of versification, "that it is then *natural*, when it is adapted to the *supposed condition* of the speaker."—In the epopee, the poet assumes the character of calm inspiration; and therefore his language must be elevated, and his numbers majestic and uniform. A peasant speaking in heroic or hexameter verse is no improbability here; because his words are supposed to be transmitted by one who will of his own accord give them every ornament necessary to reduce them into dignified measure; as an eloquent man, in a solemn assembly, recapitulating the speech of a clown, would naturally express it in pure and perspicuous language. The uniform heroic measure will suit any subject of dignity, whether narrative or didactic, that admits or requires uniformity of style. In tragedy, where the imitation of real life is more perfect than in epic poetry, the uniform magnificence of epic numbers might be improper; because the heroes and heroines are supposed to speak in their own persons, and according to the immediate impulse of passion and sentiment. Yet, even in tragedy, the versification may be both harmonious and dignified; because the characters are taken chiefly from high life, and the events from a remote period; and because the higher poetry is permitted to imitate nature, not as it is, but in that state of perfection in which it might be. The Greeks and Romans considered their hexameter as too artificial for dramatic poetry; and therefore in tragedy, and even in comedy, made use of the iambic, and some other measures that came near the cadence of conversation: we use the iambic both in the epic and dramatic poem; but for the most part it is, or ought to be, much more elaborate in the former than in the latter. In dramatic comedy, where the manners and concerns of familiar life are exhibited, verse would seem to be unnatural, except it be so like the sound of common discourse as to be hardly distinguishable from it. Custom, however, may in some countries determine otherwise; and against custom, in these matters, it is vain to argue. The professed enthusiasm of the dithyrambic poet renders wildness, variety, and a sonorous harmony of numbers, peculiarly suitable to his odes. The love-sonnet, and Anacreontic song, will be less various, more regular,

71 The language of the epic poet must be elevated and his numbers uniformly majestic.

72 In tragedy the same uniform magnificence would be improper, and much more so in comedy.

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lar, and of a softer harmony; because the state of mind expressed in it has more composure. Philosophy can scarce go further in this investigation, without deviating into whim and hypothesis. The particular sorts of verse to be adopted in the lower species of poetry, are determined by fashion chiefly, and the practice of approved authors.

III. The origin and principles of *imitative harmony*, or of that artifice by which the sound is made, as Pope says, "an echo to the sense," may be explained in the following manner.

73 A striking analogy between moral and material beauty and deformity.

It is pleasing to observe the uniformity of nature in all her operations. Between moral and material beauty and harmony, between moral and material deformity and dissonance, there obtains a very striking analogy. The visible and audible expressions of almost every virtuous emotion are agreeable to the eye and the ear, and those of almost every criminal passion disagreeable. The looks, the attitudes, and the vocal sounds, natural to benevolence, to gratitude, to compassion, to piety, are in themselves graceful and pleasing; while anger, discontent, despair, and cruelty, bring discord to the voice, deformity to the features, and distortion to the limbs. That flowing curve, which painters know to be essential to the beauty of animal shape, gives place to a multiplicity of right lines and sharp angles in the countenance and gesture of him who knits his brows, stretches his nostrils, grinds his teeth, and clenches his fist; whereas, devotion, magnanimity, benevolence, contentment, and good-humour, soften the attitude, and give a more graceful swell to the outline of every feature. Certain vocal tones accompany certain mental emotions. The voice of sorrow is feeble and broken, that of despair boisterous and incoherent; joy assumes a sweet and sprightly note, fear a weak and tremulous cadence; the tones of love and benevolence are musical and uniform, those of rage loud and dissonant; the voice of the sedate reasoner is equable and grave, but not unpleasant; and he who declaims with energy, employs many varieties of modulation suited to the various emotions that predominate in his discourse.

But it is not in the language of passion only that the human voice varies its tone, or the human face its features. Every striking sentiment, and every interesting idea, has an effect upon it. One would esteem that person no adept in narrative eloquence, who should describe, with the very same accent, swift and slow motion, extreme labour and easy performance, agreeable sensation and excruciating pain; who should talk of the tumult of a tempestuous ocean, the roar of thunder, the devastations of an earthquake, or an Egyptian pyramid tumbling into ruins, in the same tone of voice wherewith he describes the murmur of a rill, the warbling of the harp of Æolus, the swinging of a cradle, or the descent of an angel. Elevation of mind gives dignity to the voice. From Achilles, Sarpedon, and Othello, we should as naturally expect a manly and sonorous accent, as a nervous style and majestic attitude. Coxcombs and bullies, while they assume airs of importance and valour, affect also a dignified articulation.

74 The source of imitative harmony of numbers.

Since the tones of natural language are so various, poetry, which imitates the language of nature, must also vary its tones; and, in respect of sound as well as of meaning, be framed after that model of ideal perfection, which the variety and energy of the human articulate voice render probable. This is the more easily accomplished, because in every language there is between the sound and sense of certain words a perceptible analogy; which, though not so accurate as to lead a foreigner from the sound to the signification, is yet accurate enough to show, that, in forming such words, regard has been had to the imitative qualities of vocal sound. Such, in English, are the words *yell*, *crash*, *crack*, *hiss*, *roar*, *murmur*, and many others.

All the particular laws that regulate this sort of imitation, as far as they are founded in nature, and liable to the cognizance of philosophy, depend on the general law of style above mentioned. Together with the other circumstances of the supposed speaker, the poet takes into consideration the tone of voice suitable to the ideas that occupy his mind, and thereto adapts the sound of his language, if it can be done consistently with ease and elegance of expression. But when this imitative harmony is too much sought after, or words appear to be chosen for sound rather than sense, the verse becomes finical and ridiculous. Such is Ronsard's affected imitation of the song of the sky-lark:

> Elle quindée du zephire
> Sublime en l'air vire et revire,
> Et y declique un joli cris,
> Qui rit, guérit, et tire l'ire
> Des esprit mieux que je n'écris.

This is as ridiculous as that line of Ennius,

> Tum tuba terribili sonitu taratantara dixit:

Or as the following verses of Swift;

> The man with the kettle-drum enters the gate,
> Dub dub a dub dub: the trumpeters follow,
> Tantara tantara; while all the boys hollow.

75 What harmony of numbers can imitate.

Words by their sound may imitate sound; and quick or slow articulation may imitate quick or slow motion. Hence, by a proper choice and arrangement of words, the poet may imitate *Sounds* that are sweet with dignity (H),—sweet and tender (I),—loud (K),—and harsh

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(H) No sooner had th' Almighty ceas'd, than all
The multitude of angels, with a shout
Loud as from numbers without number, sweet
As from blest voices uttering joy; heav'n rung
With jubilee, and loud hosannas fill'd
Th' eternal regions.—— *Par. Lost*, b. 3.

See also the night-storm of thunder, lightning, wind, and rain, in Virg. Georg. lib. 1. ver. 328—334.

(I) Et longum, formose, vale, vale, inquit, Iola.
Virg. Ecl. 1.

Formosam resonare doces Amaryllida silvas.
Virg. Ecl. 1.

See also the simile of the nightingale, Geor. lib. 4. vers. 511. And see that wonderful couplet describing the wailings of the owl, Æneid IV. 462.

(K) ———— vibratus ab æthere fulgor
Cum sonitu venit, et ruere omnia visa repente,
Tyrrhenusque tubæ mugire per æthera clangor,
Suspiciunt: iterum atque iterum fragor intonat ingens.
Æneid. 8.

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harsh (L);—and *Motions* that are slow, in consequence of dignity (M),—slow in consequence of difficulty (N), swift and noisy (O)—swift and smooth (P)—uneven and abrupt (Q),—quick and joyous (R). An unexpected pause in the verse may also imitate a sudden failure of strength (S), or interruption of motion (T), or give vivacity to an image or thought, by fixing our attention longer than usual upon the word that precedes it (U).—Moreover, when we describe great bulk, it is natural for us to articulate slowly, even in common discourse; and therefore a line of poetry that requires a slow pronunciation, or seems longer than it should be, may be used with good effect in describing vastness of size (X).—Sweet and smooth numbers are most proper, when the poet paints agreeable objects, or gentle energy (Y); and harsher sounds when he speaks of what is ugly, violent, or disagreeable (Z). This too is according to the nature of common language; for we generally employ harsher tones of voice to express what we dislike, and more melodious notes to describe the objects of love, complacency, or admiration. Harsh numbers, however, should not be frequent in poetry; for

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See also the storm in the first book of the Æneid, and in the fifth of the Odyssey.

(L) The hoarse rough verse shall like the torrent roar. *Pope.*

——— On a sudden open fly,
With impetuous recoil and jarring sound,
Th' infernal doors, and on their hinges grate
Harsh thunder.—— *Par. Lost*, II. 879.

See also Homer's Iliad, lib. 2. ver. 363. and Clarke's Annotation.

(M) See an exquisite example in Gray's Progress of Poesy; the conclusion of the third stanza.

(N) And when up ten steep slopes you've dragg'd your thighs. *Pope.*

Just brought out this, when scarce his tongue could stir. *Pope.*

—————The huge leviathan
Wallowing unwieldy, enormous in their gait,
Tempest the ocean. *Par. Lost*, VII. 411.

See the famous description of Sisyphus rolling the stone, Odyss. lib. 11. ver. 592. See Quintil. Inst. Orat. lib. 9. cap. 4. § 4. compared with Paradise Lost, book 2. ver. 1022.

(O) Quadrupedante putrem sonitu quatit ungula campum. *Æneid.*

Αυταρ επειτα πεδονδε κυλινδετο λαας αναιδης. *Odyss.* 11.

See also Virg. Æneid. lib. 1. ver. 83—87.

(P) See wild as the winds o'er the desert he flies. *Pope.*

Ille volat, simul arva fuga, simul æquora verrens. *Virg.*

Ρηιδιη τ' επειτα πελει, χαλεπη περ εουσα. *Hesiod.*

(Q) Πολλα δ' αναντα καταντα παραντα τε δοχμια τ' ηλθον. *Hom.*

The lass shriek'd, started up, and shriek'd again. *Anonym.*

(R) Let the merry bells ring round,
And the jocund rebecks sound,
To many a youth, and many a maid,
Dancing in the chequer'd shade. *Milt. Allegro.*

See also Gray's Progress of Poesy, stanza 3.

(S) Ac velut in somnis oculos ubi languida pressit
Nocte quies, nequicquam avidos extendere cursus
Velle videmur:—et in mediis conatibus ægri
Succidimus.—— *Æneid.*

See also Virg. Georg. lib. 3. ver. 515, 516.

(T) For this, be sure to-night thou shalt have cramps,
Side-stitches that shall pen thy breath up. Urchins
Shall exercise upon thee.——
Prospero to Calyban in *the Tempest.*

See Pope's Iliad, XIII. 199.

(U) ——How often from the steep
Of echoing hill or thicket have we heard
Celestial voices, to the midnight air,
Sole,—or responsive to each other's note,
Singing their great Creator?——*Par. Lost*, b. 4.

And over them triumphant Death his dart
Shook,——but delay'd to strike. *Id.*

See also Hom. Odyss. l. 9. v. 290.

(X) Thus stretch'd out, huge in length, the arch fiend lay. *Par. Lost.*

Monstrum horrendum, informe, ingens, cui lumen ademptum. *Æneid.* 3.

Et magnos membrorum artus, magna ossa, lacertosque
Exuit, atque ingens media consistit arena.
Æneid. v. 422.

(Y) Hic gelidi fontes, hic mollia prata, Lycori,
Hic nemus, hic ipso tecum consumerer ævo.
Virg. Ecl. 10.

The dumb shall sing; the lame his crutch forego,
And leap, exulting, like the bounding roe.
Pope's Messiah.

See Milton's description of the evening, Par. Lost, book 4. ver. 598—609.

Ye gentle gales beneath my body blow,
And softly lay me on the waves below.
Pope's Sappho.

(Z) Stridenti stipula miserum disperdere carmen.
Virg. Ecl. 3.

Immo ego Sardois videar tibi amarior herbis,
Horridior rusco, projecta vilior alga.
Virg. Ecl. 7.

Neu patriæ validas in viscera vertite vires.
Virg. Æneid. 6.

See also Milton's description of the Lazar-house in Paradise Lost, b. 11. v. 477—492.

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for in this art, as in music, concord and melody ought always to predominate. And we find in fact, that good poets can occasionally express themselves somewhat harshly, when the subject requires it, and yet preserve the sweetness and majesty of poetical diction. Further, the voice of complaint, pity, love, and all the gentler affections, is mild and musical, and should therefore be imitated in musical numbers; while despair, defiance, revenge, and turbulent emotions in general, assume an abrupt and sonorous cadence. Dignity of description (A), solemn vows (B), and all sentiments that proceed from a mind elevated with great ideas (C), require a correspondent pomp of language and versification.—Lastly, an irregular or uncommon movement in the verse may sometimes be of use, to make the reader conceive an image in a particular manner. Virgil, describing horses running over rocky heights at full speed, begins the line with two dactyls, to imitate rapidity, and concludes it with eight long syllables:

Saxa per, et scopulos, et depressas convalles.

Geor. III. 276.

which is a very unusual measure, but seems well adapted to the thing expressed, namely, to the descent of the animal from the hills to the low ground. At any rate, this extraordinary change of the rhythm may be allowed to bear some resemblance to the animal's change of motion, as it would be felt by a rider, and as we may suppose it is felt by the animal itself.

Other forms of imitative harmony, and many other examples, besides those referred to in the margin, will readily occur to all who are conversant in the writings of the best versifiers, particularly Homer, Virgil, Milton, Lucretius, Spenser, Dryden, Shakespeare, Pope, and Gray.

Part II. Of the DIFFERENT SPECIES of POETRY, with their Particular Principles.

Sect. I. *Of Epic and Dramatic Compositions.*

§ 1. *The Epopee and Drama compared.*

Elem. of Criticism.

76 In what tragic and epic poetry agree, and in what they differ.

Tragedy and the epic differ not in substantials: in both the same ends are proposed, viz. instruction and amusement; and in both the same mean is employed, viz. imitation of human actions. They differ only in the manner of imitating: epic poetry employs narration; tragedy represents its facts as passing in our sight; in the former, the poet introduces himself as an historian; in the latter, he presents his actors, and never himself.

This difference, regarding form only, may be thought slight: but the effects it occasions are by no means so; for what we see makes a deeper impression than what we learn from others. A narrative poem is a story told by another: facts and incidents passing upon the stage, come under our own observation; and are beside much enlivened by action and gesture, expressive of many sentiments beyond the reach of language.

A dramatic composition has another property, independent altogether of action; which is, that it makes a deeper impression than narration: in the former, persons express their own sentiments; in the latter, sentiments are related at second-hand. For that reason, Aristotle, the father of critics, lays it down as a rule*, That in an epic poem the author ought to take every opportunity of introducing his actors, and of confining the narrative part within the narrowest bounds. Homer understood perfectly the advantage of this method; and his poems are both of them in a great measure dramatic. Lucan runs to the opposite extreme: and is guilty of a still greater fault, in stuffing his *Pharsalia* with cold and languid reflections, the merit of which he assumes to himself, and deigns not to share with his actors. Nothing can be more injudiciously timed, than a chain of such reflections, which suspend the battle of Pharsalia after the leaders had made their speeches, and the two armies are ready to engage †.

* *Poet.* chap. 25. sect. 6.

† *Lib.* 7. from line 385 to line 460.

Aristotle, from the nature of the fable, divides tragedy into simple and complex: but it is of greater moment, with respect to dramatic as well as epic poetry, to found a distinction upon the different ends attained by such compositions. A poem, whether dramatic or epic, that has nothing in view but to move the passions and to exhibit pictures of virtue and vice, may be distinguished by the name of *pathetic*: but where a story is purposely contrived to illustrate some moral truth, by showing that disorderly passions naturally lead to external misfortunes, such composition may be denominated *moral*. Beside making a deeper impression than can be done by cool reasoning, a moral poem does not fall short of reasoning in affording conviction: the natural connection of vice with misery, and of virtue with happiness, may be illustrated by stating a fact as well as by urging an argument. Let us assume, for example, the following moral truths: That discord among the chiefs renders ineffectual all common measures; and that the consequences of a slightly-founded quarrel, fostered by pride and arrogance, are not less fatal than those of the grossest injury: these truths may be inculcated by the quarrel between Agamemnon and Achilles at the siege of Troy. If facts or circumstances be wanting, such as tend to rouse the turbulent passions, they must be invented; but no accidental nor unaccountable event ought to be admitted; for the necessary or probable connection between vice and misery is

77 Tragic and epic poetry pathetic or moral.

(A) See Virg. Geor. I. 328. and Homer, Virgil, and Milton, *passim*. See also Dryden's Alexander's Feast, and Gray's Odes.

(B) See Virg. Æneid, IV. 24.

(C) Examples are frequent in the great authors. See Othello's exclamation:

—— ———— O now for ever
Farewell the tranquil mind! &c. *Act* 3. *sc.* 3.

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is not learned from any events but what are naturally occasioned by the characters and passions of the persons represented, acting in such circumstances. A real event, of which we see not the cause, may afford a lesson, upon the presumption that what hath happened may again happen: but this cannot be inferred from a story that is known to be a fiction.

78 The good effects of such compositions.

Many are the good effects of such compositions. A pathetic composition, whether epic or dramatic, tends to a habit of virtue, by exciting us to do what is right, and restraining us from what is wrong. Its frequent pictures of human woes produce, beside, two effects, extremely salutary: they improve our sympathy, and fortify us to bear our own misfortunes. A moral composition must obviously produce the same good effects, because by being moral it ceaseth not to be pathetic: it enjoys besides an excellence peculiar to itself; for it not only improves the heart, as above-mentioned, but instructs the head by the moral it contains. It seems impossible to imagine any entertainment more suited to a rational being, than a work thus happily illustrating some moral truth; where a number of persons of different characters are engaged in an important action, some retarding, others promoting, the great catastrophe; and where there is dignity of style as well as of matter. A work of this kind has our sympathy at command, and can put in motion the whole train of the social affections: our curiosity in some scenes is excited, in others gratified; and our delight is consummated at the close, upon finding, from the characters and situations exhibited at the commencement, that every incident down to the final catastrophe is natural, and that the whole in conjunction make a regular chain of causes and effects.

Considering that an epic and a dramatic poem are the same in substance, and have the same aim or end, one will readily imagine, that subjects proper for the one must be equally proper for the other. But considering their difference as to form, there will be found reason to correct that conjecture, at least in some degree.

79 The same subjects not always fit for tragic and epic poetry.

Many subjects may indeed be treated with equal advantage in either form: but the subjects are still more numerous for which they are not equally qualified; and there are subjects proper for the one and not at all for the other. To give some slight notion of the difference, as there is no room here for enlarging upon every article, we observe, that dialogue is better qualified for expressing sentiments, and narrative for displaying facts. Heroism, magnanimity, undaunted courage, and other elevated virtues, figure best in action: tender passions, and the whole tribe of sympathetic affections, figure best in sentiment. It clearly follows, that tender passions are more peculiarly the province of tragedy, grand and heroic actions of epic poetry.

"The epic poem is universally allowed to be *, of all poetical works, the most dignified, and, at the same time, the most difficult in execution. To contrive a story which shall please and interest all readers, by being at once entertaining, important, and instructive; to fill it with suitable incidents; to enliven it with a variety of characters and of descriptions; and, throughout a long work, to maintain that propriety of sentiment, and that elevation of style, which the epic character requires, is unquestionably the highest effort of poetical genius.

* Blair's Lectures.

80 The proper subject of an epic poem.

"The action or subject of the epic poem must be great and interesting. Without greatness it would not have sufficient importance either to fix our attention or to justify the magnificent apparatus which the poet bestows on it. This is so evidently requisite as not to require illustration; and, indeed, hardly any who have attempted epic poetry have failed in choosing some subject sufficiently important, either by the nature of the action or by the fame of the personages concerned in it. The fame of Homer's heroes, and the consequences of dissension between the greatest of them, is a subject important in itself, and must have appeared particularly so to his countrymen, who boasted their descent from those heroes. The subject of the Æneid is still greater than that of the Iliad, as it is the foundation of the most powerful empire that ever was established upon this globe; an event of much greater importance than the destruction of a city, or the anger of a semibarbarous warrior. But the poems of Homer and Virgil fall in this respect infinitely short of that of Milton. 'Before the greatness displayed in Paradise Lost, it has been well observed § that all other greatness shrinks away. The subject of the English poet is not the destruction of a city, the conduct of a colony, or the foundation of an empire: it is the fate of worlds, the revolutions of heaven and earth; rebellion against the Supreme King, raised by the highest order of created beings; the overthrow of their host, and the punishment of their crime; the creation of a new race of reasonable creatures; their original happiness and innocence, their forfeiture of immortality, and their restoration to hope and peace."

§ Johnson's Life of Milton.

An epic poem, however, is defective if its action be not interesting as well as great; for a narrative of mere valour may be so constructed as to prove cold and tiresome. "Much * will depend on the happy choice of some subject, which shall by its nature interest the public; as when the poet selects for his hero one who is the founder, or the deliverer, or the favourite of his nation; or when he writes atchievements that have been highly celebrated, or have been connected with important consequences to any public cause. Most of the great epic poems are abundantly fortunate in this respect, and must have been very interesting to those ages in which they were composed." The subject of the Paradise Lost, as it is infinitely greater, must likewise be considered as more universally interesting than that of any other poem. "We all feel the effects of Adam's transgression; we all sin like him, and like him must all bewail our offences. We have restless and insidious enemies in the fallen angels, and in the blessed spirits we have guardians and friends; in the redemption of mankind we hope to be included; in the description of heaven and hell we are surely interested, as we are all to reside hereafter either in the regions of horror or bliss."

* Blair ubi supra.

81 Circumstances chiefly interesting in epic poetry.

"The chief circumstance which renders an epic poem interesting †, and which tends to interest not one age or country alone, but all readers, is the skilful conduct of the author in the management of his subject. His plan must comprehend many affecting incidents. He may sometimes be awful and august; he must often be tender and pathetic; he must give us gentle and pleasing scenes of love, friendship, and affection. The more that an epic poem abounds with situations which

† Blair and Johnson.

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awaken the feelings of humanity, it is the more interesting. In this respect perhaps no epic poets have been so happy as Virgil and Tasso. The plan of the *Paradise Lost* comprises neither human actions nor human manners. The man and woman who act and suffer, are in a state which no other man or woman can ever know. The reader finds no transaction in which he can be engaged; beholds no condition in which he can by any effort of imagination place himself; he has therefore little natural curiosity or sympathy."

82
Whether the hero must necessarily be successful.

A question has been moved, Whether the nature of the epic poem does not require that the hero should be ultimately successful? To this question Johnson replies, that "there is no reason why the hero should not be unfortunate, except established practice, since success and virtue do not necessarily go together." Most critics, however, are of a different opinion, and hold success to be, if not the necessary, at least the most proper issue of an epic poem. An unhappy conclusion depresses the mind, and is opposite to the elevating emotions which belong to this species of poetry. Terror and compassion are the proper subjects of tragedy; but as the epic is of larger extent, it were too much, if, after the difficulties and troubles which commonly abound in the progress of the poem, the author should bring them all at last to an unfortunate conclusion. We know not that any author of name has held this course except *Lucan*; for in the *Paradise Lost*, as Adam's deceiver is at last crushed, and he himself restored to the favour of his maker, Milton's hero must be considered as finally successful.

83
Different kinds of dramatic poetry.

We have no occasion to say more of the epic, considered as peculiarly adapted to certain subjects, and to be conducted according to a certain plan. But as dramatic subjects are more complex, it is necessary to take a narrower view of them. They are either the light and the gay, or the grave and affecting, incidents of human life. The former constitute the subject of comedy, and the latter of tragedy.

As great and serious objects command more attention than little and ludicrous ones; as the fall of a hero interests the public more than the marriage of a private person; tragedy has been always held a more dignified entertainment than comedy. The first thing required of the tragic poet is, that he pitch upon some moving and interesting story, and that he conduct it in a natural and probable manner. For we must observe, that the natural and probable are more essential to tragic than even to epic poetry. Admiration is excited by the wonderful; but passion can be raised only by the impressions of nature and truth upon the mind.

84
Subjects best suited to tragedy.

The subject best fitted for tragedy is where a man has himself been the cause of his misfortune; not so as to be deeply guilty, nor altogether innocent: the misfortune must be occasioned by a fault incident to human nature, and therefore in some degree venial. Such misfortunes call forth the social affections, and warmly interest the spectator. An accidental misfortune, if not extremely singular, doth not greatly move our pity: the person who suffers, being innocent, is freed from the greatest of all torments, that anguish of mind which is occasioned by remorse. An atrocious criminal, on the other hand, who brings misfortunes upon himself, excites little pity, for a different reason: his remorse, it is true, aggravates his distress, and swells the first emotions of pity; but then our hatred of him as a criminal blending with pity, blunts its edge considerably. Misfortunes that are not innocent, nor highly criminal, partake the advantages of each extreme: they are attended with remorse to embitter the distress, which raises our pity to a great height; and the slight indignation we have at a venial fault detracts not sensibly from our pity. The happiest of all subjects accordingly for raising pity, is where a man of integrity falls into a great misfortune by doing an action that is innocent, but which, by some singular means, is conceived by him to be criminal: his remorse aggravates his distress; and our compassion, unrestrained by indignation, knows no bounds. Pity comes thus to be the ruling passion of a pathetic tragedy; and, by proper representation, may be raised to a height scarce exceeded by any thing felt in real life. A moral tragedy takes in a larger field; as it not only exercises our pity, but raises another passion, which, though selfish, deserves to be cherished equally with the social affection. The passion we have in view is fear or terror; for when a misfortune is the natural consequence of some wrong bias in the temper, every spectator who is conscious of such a bias in himself takes the alarm, and dreads his falling into the same misfortune: and by the emotion of fear or terror, frequently reiterated in a variety of moral tragedies, the spectators are put upon their guard against the disorders of passion.

The commentators upon Aristotle, and other critics, have been much gravelled about the account given of tragedy by that author: "That by means of pity and terror, it refines or purifies in us all sorts of passion." But no one who has a clear conception of the end and effects of a good tragedy, can have any difficulty about Aristotle's meaning: Our pity is engaged for the persons represented; and our terror is upon our own account. Pity indeed is here made to stand for all the sympathetic emotions, because of these it is the capital. There can be no doubt, that our sympathetic emotions are refined or improved by daily exercise; and in what manner our other passions are refined by terror, has been just now said. One thing is certain, that no other meaning can justly be given to the foregoing doctrine than that now mentioned; and that it was really Aristotle's meaning, appears from his 13th chapter, where he delivers several propositions conformable to the doctrine as here explained. These, at the same time, we take liberty to mention; because, so far as authority can go, they confirm the foregoing reasoning about subjects proper for tragedy. The first proposition is, That it being the province of tragedy to excite pity and terror, an innocent person falling into adversity ought never to be the subject. This proposition is a necessary consequence of his doctrine as explained: a subject of that nature may indeed excite pity and terror; but the former in an inferior degree, and the latter in no degree for moral instruction. The second proposition is, That the history of a wicked person in a change from misery to happiness ought not to be represented; which excites neither terror nor compassion, nor is agreeable in any respect. The third is, That the misfortunes of a wicked person ought not to be represented: such representation may be agreeable in some measure upon a principle of justice; but it will not move our pity; nor any degree of terror, except in those of the same vicious disposition with the person represented. The last proposition is, That the only character fit for representation lies in the middle, neither eminently good nor eminently bad; where the misfortune is not the effect of deliberate vice, but of some involuntary fault, as our author expresses it. The only objection we find to Aristotle's account of tragedy, is, that he confines it within too narrow bounds, by refusing admittance to the pathetic kind: for if terror be essential to tragedy, no representation deserves that name but the moral kind, where the misfortunes exhibited are caused by a wrong balance of mind, or some disorder in the internal constitution: such misfortunes always suggest moral instruction; and by such misfortunes only can terror be excited for our improvement.

Thus Aristotle's four propositions above-mentioned relate solely to tragedies of the moral kind. Those of the pathetic kind are not confined within so narrow limits: subjects fitted for the theatre are not in such plenty as to make us reject innocent misfortunes which rouse our sympathy, though they inculcate no moral. With respect indeed to the subjects of that kind, it may be doubted, whether the conclusion ought not always to be fortunate. Where a person of integrity is represented as suffering to the end under misfortunes purely accidental, we depart discontented, and with some obscure sense of injustice: for seldom is man so submissive to Providence, as not to revolt against the tyranny and vexations of blind chance; he will be tempted to say, this ought not to be. We give for an example the *Romeo and Juliet* of Shakespeare, where the fatal catastrophe is occasioned by Friar Laurence's coming to the monument a minute too late; we are vexed at the unlucky chance, and go away dissatisfied. Such impressions, which ought not to be cherished, are a sufficient reason for excluding stories of this kind from the theatre.

85
The improper use of destiny in the ancient tragedies.

The misfortunes of a virtuous person, arising from necessary causes, or a chain of unavoidable circumstances, as they excite a notion of destiny, are equally unsatisfactory to the human mind. A metaphysician in his closet may reason himself into the belief of fate, or what in modern language is called *philosophical necessity*; but the feelings of the heart revolt against that doctrine; and we have the confession of the two ablest philosophers by whom it was ever maintained, that men conduct themselves through life as if their will were absolutely free, and their actions no part of a chain of necessary causes and effects. As no man goes to the theatre to study metaphysics, or to divest himself of the common feelings of humanity, it is impossible, whatever be his philosophical creed, that he should contemplate without horror and disgust an innocent person suffering by mere destiny. A tragedy of uncommon merit in every other respect may indeed be endured, nay perhaps admired, though such be its catastrophe; because no work of man was ever perfect; and because, where imperfections are unavoidable, a multitude of excellencies may be allowed to cover one fault: but we believe the misery of an innocent person resulting from a chain of unavoidable circumstances has never been considered as a beauty by minds unperverted by a false philosophy. "It must be acknowledged * that the subjects of the ancient Greek tragedies were frequently founded on mere destiny and inevitable misfortunes. In the course of the drama many moral sentiments occurred; but the only instruction which the fable conveyed was, that reverence was due to the gods, and submission to the decrees of fate. Modern tragedy has aimed at a higher object, by becoming more the theatre of passion; pointing out to men the consequences of their own misconduct, showing the direful effects which ambition, jealousy, love, resentment, and other such strong emotions, when misguided or left unrestrained, produce upon human life. An Othello, hurried by jealousy to murder his innocent wife; a Jaffier ensnared by resentment and want to engage in a conspiracy, and then stung with remorse and involved in ruin; a Siffredi, through the deceit which he employs for public-spirited ends, bringing destruction on all whom he loved: these, and such as these, are the examples which Tragedy now displays to public view; and by means of which it inculcates on men the proper government of their passions."

86
How it is used in the tragedy of the Robbers.

There is indeed one singular drama, in which destiny is employed in a manner very different from that in which it was used by the poets of Greece and Rome. It is Schiller's Tragedy of the Robbers, of which "the hero, endowed by nature (as the translator of the piece observes) with the most generous feelings, animated by the highest sense of honour, and susceptible of the warmest affections of the heart, is driven by the perfidy of a brother, and the supposed inhumanity of his father, into a state of confirmed misanthropy and despair." He wishes that he "could blow the trumpet of rebellion through all nature; that he could extinguish with one mortal blow the viperous race of men; and that he could so strike as to destroy the germ of existence." In this situation he is hurried on to the perpetration of a series of crimes, which find from their very magnitude and atrocity a recommendation to his distempered mind. Sensible all the while of his own guilt, and suffering for that guilt the severest pangs of remorse, he yet believes himself an instrument of vengeance in the hand of the Almighty for the punishment of the crimes of others. In thus accomplishing the dreadful destiny which is prescribed for him, he feels a species of gloomy satisfaction, at the same time that he considers himself as doomed to the performance of that part in life which is to consign his memory to infamy and his soul to perdition. After burning a town, he exclaims, "O God of vengeance! am I to blame for this? Art thou to blame, O Father of Heaven! when the instruments of thy wrath, the pestilence, flood, and famine overwhelm at once the righteous and the guilty? Who can command the flames to stay their course, to destroy only the noxious vermin, and spare the fertile field?" yet with the same breath he accuses himself of extreme criminality for "presumptuously wielding the sword of the Most High!" He frequently laments in the most affecting manner the loss of his innocence, wishes that "he could return into the womb that bare him, that he hung an infant at the breast, that he were born a beggar, the meanest hind, a peasant of the field." He considers himself as the outcast of Heaven, and finally rejected by the Father of mercy; yet he tells the band of robbers whom he commanded, that the "Almighty honoured them as agents in his hands to execute his wonderous purposes; employed them as his angels to execute his stern decrees, and pour the vials of

* Blair.

Of the Epopee and Drama.

of his wrath;" and in a very solemn prayer, he supposes that "the God who ruleth over all had *decreed* that he should become the chief of these foul murderers."

"It will be allowed, says the translator, that the imagination could not have conceived a spectacle more deeply interesting, more powerfully affecting to the mind of man, than that of a human being thus characterised and acting under such impressions. The compassionate interest which the mind feels in the emotions or sufferings of the guilty person, is not diminished by the observation, that he acts under an impression of inevitable destiny; on the contrary, there is something in our nature which leads us the more to compassionate the instrument of those crimes, that we see him consider himself as bound to guilt by fetters, which he has the constant wish, but not the strength, to break."

This is indeed true: we sympathise with the hero of the Robbers, not only on account of his exalted sentiments and his inflexible regard to the abstract principles of honour and justice, but much more for that disorder of intellect which makes him *suppose* "his destiny fixed and unalterable," at the very time that he is torn with remorse for the perpetration of those crimes by which he believed it to be fulfilling. Destiny, however, is not in this tragedy exhibited as real, but merely as the phantom of a distempered though noble mind. Had the poet represented his hero as in *fact decreed by God*, or *bound by fate*, to head a band of foul murderers, and to commit a series of the most atrocious crimes; though our pity for him might not have been lessened, the impressions of the whole piece on the mind could have been only those of horror and disgust at what would have appeared to us the unequal ways of providence.

87 Whether the subject of tragedy should have its foundation in truth.

The Tragedy of the Robbers is a striking instance of the justness of Dr Blair's criticism, in opposition to that of Lord Kames. His lordship holds that it is essential to a good tragedy, that its principal facts be borrowed from history; because a mixture of known truth with the fable tends to delude us into a conviction of the reality of the whole. The Doctor considers this as a matter of no great consequence; for "it is proved by experience, that a fictitious tale, if properly conducted, will melt the heart as much as any real history;" this observation is verified in the Robbers. It is indeed a very irregular drama, and perhaps could not be acted on a British theatre. But although the whole is known to be a fiction, we believe there are few effusions of human genius which more powerfully excite the emotions of terror and pity. Truth is indeed congenial to the mind; and when a subject proper for tragedy occurs in history or tradition, it is perhaps better to adopt it than to invent one which has no such foundation. But in choosing a subject which makes a figure in history, greater precaution is necessary than where the whole is a fiction. In the latter case, the author is under no restraint other than that the characters and incidents be just copies of nature. But where the story is founded on truth, no circumstances must be added, but such as connect naturally with what are known to be true; history may be supplied, but must not be contradicted. Further, the subject chosen must be distant in time, or at least in place; for the familiarity of recent persons and events ought to be avoided. Familiarity ought more especially to be avoided in an epic poem, the peculiar character of which is dignity and elevation: modern manners make but a poor figure in such a poem. Their familiarity unqualifies them for a lofty subject. The dignity of them will be better understood in future ages, when they are no longer familiar.

After Voltaire, no writer, it is probable, will think of rearing an epic poem upon a recent event in the history of his own country. But an event of that kind is perhaps not altogether unqualified for tragedy: it was admitted in Greece; and Shakespeare has employed it successfully in several of his pieces. One advantage it possesses above fiction, that of more readily engaging our belief, which tends above any other particular to raise our sympathy. The scene of comedy is generally laid at home: familiarity is no objection; and we are peculiarly sensible of the ridicule of our own manners. 88

How a tragedy should be divided into acts; and how many acts it should have. *Elem. of Criticism*, ch. 22.

After a proper subject is chosen, the dividing it into parts requires some art. The conclusion of a book in an epic poem, or of an act in a play, cannot be altogether arbitrary; nor be intended for so slight a purpose as to make the parts of equal length. The supposed pause at the end of every book, and the real pause at the end of every act, ought always to coincide with some pause in the action. In this respect, a dramatic or epic poem ought to resemble a sentence or period in language, divided into members that are distinguished from each other by proper pauses; or it ought to resemble a piece of music, having a full close at the end, preceded by imperfect closes that contribute to the melody. The division of every play into *five* acts has no other foundation than common practice, and the authority of Horace (D). It is a division purely arbitrary; there is nothing in the nature of the composition which fixes this number rather than any other; and it had been much better if no such number had been ascertained. But, since it is ascertained, every act in a dramatic poem ought to close with some incident that makes a pause in the action; for otherwise there can be no pretext for interrupting the representation. It would be absurd to break off in the very heat of action; against which every one would exclaim: the absurdity still remains where the action relents, if it be not actually suspended for some time. This rule is also applicable to an epic poem: though in it a deviation from the rule is less remarkable; because it is in the reader's power to hide the absurdity, by proceeding instantly to another book. The first book of Paradise Lost ends without any close, perfect or imperfect: it breaks off abruptly, where Satan, seated on his throne, is prepared to harangue the convocated host of the fallen angels; and the second book begins with the speech. Milton seems to have copied the Æneid, of which the two first books are divided much in the same

(D) *Neve minor, neu sit quinto productior actu*
Fabula. De Arte Poetica.

If you would have your play deserve success,
Give it five acts complete, nor more nor less. *Francis.*

Of the Epopee and Drama.

same manner. Neither is there any proper pause at the end of the seventh book of Paradise Lost, nor at the end of the eleventh. In the Iliad little attention is given to this rule.

89 The object of comedy.

Besides tragedy, dramatic poetry comprehends comedy and farce. These are sufficiently distinguished from tragedy by their general spirit and strain. "While pity and terror, and the other strong passions, form the province of the tragic muse, the chief or rather sole instrument of comedy and farce is ridicule." These two species of composition are so perpetually running into each other, that we shall not treat of them separately; since what is now known by the name of *farce* differs in nothing essential from what was called the *old comedy* among the Greeks. "Comedy proposes for its object ‡ neither the great sufferings nor the great crimes of men; but their follies and slighter vices, those parts of their character which raise in beholders a sense of impropriety, which expose them to be censured and laughed at by others, or which render them troublesome in civil society.

‡ *Blair's Lectures.*

"The subjects of tragedy are not limited to any age or country; but the scene and subject of comedy should always be laid in our own country, and in our own times. The reason is obvious: those decorums of behaviour, those lesser discriminations of character, which afford subject for comedy, change with the differences of countries and times; and can never be so well understood by foreigners as by natives. The comic poet, who aims at correcting improprieties and follies of behaviour, should 'catch the manners living as they rise.' It is not his business to amuse us with a tale of other times; but to give us pictures taken from among ourselves; to satirize reigning and present vices; to exhibit to the age a faithful copy of itself, with its humours, its follies, and its extravagancies.

90 Comedy of two kinds.

"Comedy may be divided into two kinds: comedy of *character*, and comedy of *intrigue* The former is the more valuable species; because it is the business of comedy to exhibit the prevailing manners which mark the character of the age in which the scene is laid: yet there should be always as much intrigue as to give us something to wish and something to fear. The incidents should so succeed one another, as to produce striking situations, and to fix our attention; while they afford at the same time a proper field for the exhibition of character. The action in comedy, though it demands the poet's care in order to render it animated and natural, is a less significant and important part of the performance than the action in tragedy: as in comedy it is what men say, and how they behave, that draws our attention, rather than what they perform or what they suffer.

91 The common faults of comedy.

"In the management of characters, one of the most common faults of comic writers is the carrying of them too far beyond life. Wherever ridicule is concerned, it is indeed extremely difficult to hit the precise point where true wit ends and buffoonery begins. When the miser in Plautus, searching the person whom he suspects of having stolen his casket, after examining first his right hand and then his left, cries out, *ostende etiam tertiam*—'show me your third hand,' there is no one but must be sensible of the extravagance. Certain degrees of exaggeration are allowed to the comedian, but there are limits set to it by nature and good taste; and supposing the miser to be ever so much engrossed by his jealousy and his suspicions, it is impossible to conceive any man in his wits suspecting another of having more than two hands."

It appears from the plays of Aristophanes which remain, that the characters in the old comedy of Athens were almost always overcharged. They were likewise direct and avowed satires against particular persons, who were brought upon the stage by name. "The ridicule employed in them is extravagant, the wit for the most part buffoonish and farcical, the raillery biting and cruel, and the obscenity that reigns in them is gross and intolerable. They seem to have been composed merely for the mob." Yet of these abominable dramas, an excellent critic * has affirmed, with too much truth, that what is now called *farce* is nothing more than the shadow. The characters in genuine comedy are not those of particular and known persons, but the general characters of the age and nation; which it requires no small skill to distinguish clearly and naturally from each other. In attempting this, poets are too apt to contrast characters and introduce them always in pairs; which gives an affected air to the whole piece. The perfection of art is to conceal art. "A masterly writer will give us his characters distinguished rather by such shades of diversity as are commonly found in society, than marked with such strong oppositions as are rarely brought into actual contrast in any of the circumstances of real life."

* *Hurd.*

92 The style of comedy.

The style of comedy ought to be pure, elegant, and lively, very seldom rising higher than the ordinary tone of polite conversation; and upon no occasion descending into vulgar, mean, and gross expressions; and in one word, action and character being the fundamental parts of every epic and dramatic composition, the sentiments and tone of language ought to be subservient to these, so as to appear natural and proper for the occasion.

§ 2. *Respective peculiarities of the Epopee and Drama.*

93 Machinery can have no place in a drama, nor

In a theatrical entertainment, which employs both the eye and the ear, it would be a gross absurdity to introduce upon the stage superior beings in a visible shape. There is no place for such objection in an *epic poem*; and Boileau, with many other critics, declares strongly for that sort of machinery in an epic poem. But waving authority, which is apt to impose upon the judgement, let us draw what light we can from reason. We may in the first place observe, that this matter is but indistinctly handled by critics: the poetical privilege of animating insensible objects for enlivening a description, is very different from what is termed *machinery*, where deities, angels, devils, or other supernatural powers, are introduced as real personages, mixing in the action, and contributing to the catastrophe; and yet these two things are constantly jumbled together in reasoning. The former is founded on a natural principle: but nothing is more unnatural than the latter. Its effects, at the same time, are deplorable. First, it gives an air of fiction to the whole; and prevents that impression of reality which is requisite to interest our affections, and to move our passions; which of itself is sufficient to explode machinery, whatever entertainment it may afford to readers of a fantastic taste or irregular imagination. And, next, were it possible, by disguising the fiction, to delude us into a notion of reality, an insuperable objection would still remain, which is, that the aim or end of an

94 Has it a good effect in the higher epic.

Of the Epopee.

an epic poem can never be attained in any perfection where machinery is introduced; for an evident reason, that virtuous emotions cannot be raised successfully but by the actions of those who are endued with passions and affections like our own, that is, by human actions; and as for moral instruction, it is clear, that none can be drawn from beings who act not upon the same principles with us. A fable in Æsop's manner is no objection to this reasoning: his lions, bulls, and goats, are truly men under disguise; they act and feel in every respect as human beings; and the moral we draw is founded on that supposition. Homer, it is true, introduces the gods into his fable: but the religion of his country authorised that liberty; it being an article in the Grecian creed, that the gods often interpose visibly and bodily in human affairs. It must however be observed, that Homer's deities do no honour to his poems; fictions that trangress the bounds of nature, seldom have a good effect; they may inflame the imagination for a moment, but will not be relished by any person of a correct taste. They may be of some use to the lower rank of writers; but an author of genius has much finer materials, of Nature's production, for elevating his subject, and making it interesting.

One would be apt to think, that Boileau, declaring for the Heathen deities, intended them only for embellishing the diction: but unluckily he banishes angels and devils, who undoubtedly make a figure in poetic language, equal to the Heathen deities. Boileau, therefore, by pleading for the latter in opposition to the former, certainly meant, if he had any distinct meaning, that the Heathen deities may be introduced as actors. And, in fact, he himself is guilty of that glaring absurdity, where it is not so pardonable as in an epic poem: In his ode upon the taking of Namur, he demands with a most serious countenance, whether the walls were built by Apollo or Neptune: and in relating the passage of the Rhine, *anno* 1672, he describes the god of that river as fighting with all his might to oppose the French monarch; which is confounding fiction with reality at a strange rate. The French writers in general run into this error: wonderful the effect of custom, entirely to hide from them how ridiculous such fictions are.

That this is a capital error in *Gierusalemme Liberata*, Tasso's greatest admirers must acknowledge: a situation can never be intricate, nor the reader ever in pain about the catastrophe, so long as there is an angel, devil, or magician, to lend a helping hand. Voltaire, in his essay upon epic poetry, talking of the *Pharsalia*, observes judiciously, "That the proximity of time, the notoriety of events, the character of the age, enlightened and political, joined with the solidity of Lucan's subject, deprived him of poetical fiction." Is it not amazing, that a critic who reasons so justly with respect to others, can be so blind with respect to himself? Voltaire, not satisfied to enrich his language with images drawn from invisible and superior beings, introduces them into the action: in the sixth canto of the *Henriade*, St Louis appears in person, and terrifies the soldiers; in the seventh canto, St Louis sends the god of Sleep to Henry; and, in the tenth, the demons of Discord, Fanaticism, War, &c. assist Aumale in a single combat with Turenne, and are driven away by a good angel brandishing the sword of God. To blend such fictitious personages in the same action with mortals, makes a bad figure at any rate; and is intolerable in a history so recent as that of Henry IV. But perfection is not the lot of man.

Of the Epopee.

But perhaps the most successful weapon that can be employed upon this subject is ridicule. Addison has applied this in an elegant manner: "Whereas the time of a general peace is, in all appearance, drawing near; being informed that there are several ingenious persons who intend to show their talents on so happy an occasion, and being willing, as much as in me lies, to prevent that effusion of nonsense which we have good cause to apprehend; I do hereby strictly require every person who shall write on this subject, to remember that he is a Christian, and not to sacrifice his catechism to his poetry. In order to it, I do expect of him, in the first place, to make his own poem, without depending upon Phœbus for any part of it, or calling out for aid upon any of the Muses by name. I do likewise positively forbid the sending of Mercury with any particular message or dispatch relating to the peace; and shall by no means suffer Minerva to take upon her the shape of any plenipotentiary concerned in this great work. I do further declare, that I shall not allow the Destinies to have had a hand in the deaths of the several thousands who have been slain in the late war; being of opinion that all such deaths may be well accounted for by the Christian system of powder and ball. I do therefore strictly forbid the Fates to cut the thread of man's life upon any pretence whatsoever, unless it be for the sake of rhyme. And whereas I have good reason to fear, that Neptune will have a great deal of business on his hands in several poems which we may now suppose are upon the anvil, I do also prohibit his appearance, unless it be done in metaphor, simile, or any very short allusion; and that even here he may not be permitted to enter, but with great caution and circumspection. I desire that the same rule may be extended to his whole fraternity of Heathen gods; it being my design to condemn every poem to the flames in which Jupiter thunders, or exercises any other act of authority which does not belong to him. In short, I expect that no Pagan agent shall be introduced, or any fact related which a man cannot give credit to with a good conscience. Provided always, that nothing herein contained shall extend, or be construed to extend, to several of the female poets in this nation, who shall still be left in full possession of their gods and goddesses, in the same manner as if this paper had never been written." *Spect.* n° 523.

The marvellous is indeed so much promoted by machinery, that it is not wonderful to find it embraced by the bulk of writers, and perhaps of readers. If indulged at all, it is generally indulged to excess. Homer introduceth his deities with no greater ceremony than his mortals; and Virgil has still less moderation: a pilot spent with watching cannot fall asleep and drop into the sea by natural means: one bed cannot receive the two lovers Æneas and Dido, without the immediate interposition of superior powers. The ridiculous in such fictions must appear even through the thickest veil of gravity and solemnity.

Angels and devils serve equally with Heathen deities as materials for figurative language; perhaps better among Christians, because we believe in them, and not in

Of the Epopee.

in Heathen deities. But every one is sensible, as well as Boileau, that the invisible powers in our creed make a much worse figure as actors in a modern poem than the invisible powers in the Heathen creed did in ancient poems; the cause of which is not far to seek. The Heathen deities, in the opinion of their votaries, were beings elevated one step only above mankind, subject to the same passions, and directed by the same motives; therefore not altogether improper to mix with men in an important action. In our creed, superior beings are placed at such a mighty distance from us, and are of a nature so different, that with no propriety can we appear with them upon the same stage: man, a creature much inferior, loses all dignity in the comparison.

95 An historical poem admits of allegory, &c. under proper restrictions.

There can be no doubt that an historical poem admits the embellishment of allegory as well as of metaphor, simile, or other figure. Moral truth, in particular, is finely illustrated in the allegorical manner: it amuses the fancy to find abstract terms, by a sort of magic, metamorphosed into active beings; and it is delightful to trace a general proposition in a pictured event. But allegorical beings should be confined within their own sphere, and never be admitted to mix in the principal action, nor to co-operate in retarding or advancing the catastrophe; which would have a still worse effect than invisible powers: for the impression of real existence, essential to an epic poem, is inconsistent with that figurative existence which is essential to an allegory; and therefore no method can more effectually prevent the impression of reality than the introduction of allegorical beings co-operating with those whom we conceive to be really existing. The love-episode in the Henriade (canto 9.), insufferable by the discordant mixture of allegory with real life, is copied from that of Rinaldo and Armida in the *Gierusalemme Liberata*, which hath no merit to intitle it to be copied. An allegorical object, such as Fame in the Æneid, and the Temple of Love in the Henriade, may find place in a description: but to introduce Discord as a real personage, imploring the assistance of Love as another real personage, to enervate the courage of the hero, is making these figurative beings act beyond their sphere, and creating a strange jumble of truth and fiction. The allegory of Sin and Death in the Paradise Lost is possibly not generally relished; though it is not entirely of the same nature with what we have been condemning; in a work comprehending the atchievements of superior beings there is more room for fancy than where it is confined to human actions.

What is the true notion of an episode? or how is it to be distinguished from the principal action? Every incident that promotes or retards the catastrophe must be part of the principal action. This clears the nature of an episode; which may be defined, "An incident

96 Episode defined.

connected with the principal action, but contributing neither to advance nor retard it." The descent of Æneas into hell does not advance nor retard the catastrophe, and therefore is an episode. The story of Nisus and Euryalus, producing an alteration in the affairs of the contending parties, is a part of the principal action. The family-scene in the sixth book of the Iliad is of the same nature; for by Hector's retiring from the field of battle to visit his wife, the Grecians had opportunity to breathe, and even to turn upon the Trojans. The unavoidable effect of an episode according to this definition must be, to break the unity of action; and therefore it ought never to be indulged unless to unbend the mind after the fatigue of a long narration. An episode, when such is its purpose, requires the following conditions: it ought to be well connected with the principal action; it ought to be lively and interesting; it ought to be short; and a time ought to be chosen when the principal action relents (E).

97 What constitutes a good episode.

In the following beautiful episode, which closes the second book of Fingal, all these conditions are united.

"Comal was a son of Albion; the chief of an hundred hills. His deer drunk of a thousand streams; and a thousand rocks replied to the voice of his dogs. His face was the mildness of youth; but his hand the death of heroes. One was his love, and fair was she! the daughter of mighty Conloch. She appeared like a sunbeam among women, and her hair was like the wing of the raven. Her soul was fixed on Comal, and she was his companion in the chace. Often met their eyes of love, and happy were their words in secret. But Gormal loved the maid, the chief of gloomy Ardven. He watched her lone steps on the heath, the foe of unhappy Comal.

"One day, tired of the chace, when the mist had concealed their friends, Comal and the daughter of Conloch met in the cave of Ronan. It was the wonted haunt of Comal. Its sides were hung with his arms; a hundred shields of thongs were there, a hundred helms of sounding steel. Rest here, said he, my love Galvina, thou light of the cave of Ronan: a deer appears on Mora's brow; I go, but soon will return. I fear, said she, dark Gormal my foe: I will rest here; but soon return, my love.

"He went to the deer of Mora. The daughter of Conloch, to try his love, clothed her white side with his armour, and strode from the cave of Ronan. Thinking her his foe, his heart beat high, and his colour changed. He drew the bow: the arrow flew: Galvina fell in blood. He ran to the cave with hasty steps, and called the daughter of Conloch. Where art thou, my love? but no answer.——He marked, at length, her heaving heart beating against the mortal arrow. O Conloch's daughter, is it thou!—he sunk upon her breast.

"The hunters found the hapless pair. Many and silent were his steps round the dark dwellings of his love. The fleet of the ocean came: he fought, and the strangers fell: he searched for death over the field; but who could kill the mighty Comal? Throwing away his shield, an arrow found his manly breast. He sleeps with his Galvina: their green tombs are seen by the mariner when he bounds on the waves of the north."

Next, upon the peculiarities of a *dramatic poem*. And the

(E) Homer's description of the shield of Achilles is properly introduced at a time when the action relents, and the reader can bear an interruption. But the author of Telemachus describes the shield of that young hero in the heat of battle; a very improper time for an interruption.

Of the Drama.

98 Double plot in a drama seldom successful.

the first we shall mention is a double plot: one of which must resemble an episode in an epic poem; for it would distract the spectator, instead of entertaining him, if he were forced to attend at the same time to two capital plots equally interesting. And even supposing it an under-plot like an episode, it seldom hath a good effect in tragedy, of which simplicity is a chief property; for an interesting subject that engages our affections, occupies our whole attention, and leaves no room for any separate concern. Variety is more tolerable in comedy; which pretends only to amuse, without totally occupying the mind. But even there, to make a double plot agreeable, is no slight effort of art: the under-plot ought not to vary greatly in its tone from the principal; for discordant emotions are unpleasant when jumbled together; which, by the way, is an insuperable objection to tragi-comedy. Upon that account the Provok'd Husband deserves censure; all the scenes that bring the family of the Wrongheads into action, being ludicrous and farcical, are in a very different tone from the principal scenes, displaying severe and bitter expostulations between Lord Townley and his lady. The same objection touches not the double plot of the Careless Husband; the different subjects being sweetly connected, and having only so much variety as to resemble shades of colours harmoniously mixed. But this is not all. The under-plot ought to be connected with that which is principal, so much at least as to employ the same persons: the under-plot ought to occupy the intervals or pauses of the principal action; and both ought to be concluded together. This is the case of the Merry Wives of Windsor.

99 Violent action ought not to be represented.

Violent action ought never to be represented on the stage. While the dialogue goes on, a thousand particulars concur to delude us into an impression of reality; genuine sentiments, passionate language, and persuasive gesture: the spectator, once engaged, is willing to be deceived, loses sight of himself, and without scruple enjoys the spectacle as a reality. From this absent state he is roused by violent action; he wakes as from a pleasing dream; and, gathering his senses about him, finds all to be a fiction. Horace delivers the same rule; and founds it upon the same reason:

> Ne pueros coram populo Medea trucidet;
> Aut humana palam coquat exta nefarius Atreus;
> Aut in avem Progne vertatur, Cadmus in anguem:
> Quodcumque ostendis mihi sic, incredulus odi.

The French critics join with Horace in excluding blood from the stage; but overlooking the most substantial objection, they urge only that it is barbarous and shocking to a polite audience. The Greeks had no notion of such delicacy, or rather effeminacy; witness the murder of Clytemnestra by her son Orestes, passing behind the scene, as represented by Sophocles: her voice is heard calling out for mercy, bitter expostulations on his part, loud shrieks upon her being stabbed, and then a deep silence. An appeal may be made to every person of feeling, whether this scene be not more horrible than if the deed had been committed in sight of the spectators upon a sudden gust of passion. If Corneille, in representing the affair between Horatius and his sister, upon which the murder ensues behind the scene, had no other view but to remove from the spectators a shocking action, he was guilty of a capital mistake; for murder in cold blood, which in some measure was the case as represented, is more shocking to a polite audience, even where the conclusive stab is not seen, than the same act performed in their presence by violent and unpremeditated passion, as suddenly repented of as committed. Addison's observation is just †, That no part of this incident ought to have been represented, but reserved for a narrative, with every alleviating circumstance in favour of the hero.

† Spectator, N° 44.

100 The proper conduct of the dialogue.

A few words upon the dialogue, which ought to be so conducted as to be a true representation of nature. We talk not here of the sentiments nor of the language (which are treated elsewhere): but of what properly belongs to dialogue-writing; where every single speech, short or long, ought to arise from what is said by the former speaker, and furnish matter for what comes after till the end of the scene. In this view, all the speeches from first to last represent so many links of one regular chain. No author, ancient or modern, possesses the art of dialogue equal to Shakespeare. Dryden, in that particular, may justly be placed as his opposite. He frequently introduces three or four persons speaking upon the same subject, each throwing out his own notions separately, without regarding what is said by the rest: take for an example the first scene of Aurenzebe. Sometimes he makes a number club in relating an event, not to a stranger, supposed ignorant of it, but to one another, for the sake merely of speaking: of which notable sort of dialogue we have a specimen in the first scene of the first part of the Conquest of Granada. In the second part of the same tragedy, scene second, the King, Abenamar, and Zulema, make their separate observations, like so many soliloquies, upon the fluctuating temper of the mob: a dialogue so uncouth puts one in mind of two shepherds in a pastoral excited by a prize to pronounce verses alternately, each in praise of his own mistress.

This manner of dialogue-writing, beside an unnatural air, has another bad effect: it stays the course of the action, because it is not productive of any consequence. In Congreve's comedies, the action is often suspended to make way for a play of wit.

No fault is more common among writers than to prolong a speech after the impatience of the person to whom it is addressed ought to prompt him or her to break in. Consider only how the impatient actor is to behave in the mean time. To express his impatience in violent action without interrupting would be unnatural; and yet to dissemble his impatience, by appearing cool where he ought to be highly inflamed, would be no less so.

Rhyme being unnatural and disgustful in dialogue, is happily banished from our theatre: the only wonder is that it ever found admittance, especially among a people accustomed to the more manly freedom of Shakespeare's dialogue. By banishing rhyme, we have gained so much as never once to dream that there can be any further improvement. And yet, however suitable blank verse may be to elevated characters and warm passions, it must appear improper and affected in the mouths of the lower sort. Why then should it be a rule, That every scene in tragedy must be in blank verse? Shakespeare, with great judgment, has followed a different rule; which is, to intermix prose with verse, and only to employ the latter where it is required by the importance or dignity of the subject. Familiar thoughts and ordinary facts ought to be expressed in plain language: to hear, for example,

5 a

The three Unities.

a footman deliver a simple message in blank verse must appear ridiculous to every one who is not biassed by custom. In short, that variety of characters and of situations, which is the life of a play, requires not only a suitable variety in the sentiments, but also in the diction.

§ 3. *The Three Unities.*

When we consider the chain of causes and effects in the material world, independent of purpose, design, or thought, we find a number of incidents in succession, without beginning, middle, or end: every thing that happens is both a cause and an effect; being the effect of what goes before, and the cause of what follows: one incident may affect us more, another less; but all of them are links in the universal chain: the mind, in viewing these incidents, cannot rest or settle ultimately upon any one; but is carried along in the train without any close.

101 In what the unity of action consists.

But when the intellectual world is taken under view, in conjunction with the material, the scene is varied. Man acts with deliberation, will, and choice: he aims at some end; glory, for example, or riches, or conquest, the procuring happiness to individuals, or to his country in general: he proposes means, and lays plans to attain the end proposed. Here are a number of facts or incidents leading to the end in view, the whole composing one chain by the relation of cause and effect. In running over a series of such facts or incidents, we cannot rest upon any one; because they are presented to us as means only, leading to some end: but we rest with satisfaction upon the end or ultimate event; because there the purpose or aim of the chief person or persons is accomplished. This indicates the beginning, the middle, and the end, of what Aristotle calls *an entire action* *. The story naturally begins with describing those circumstances which move the person who acts the principal part to form a plan, in order to compass some desired event; the prosecution of that plan, and the obstructions, carry the reader into the heat of action; the middle is properly where the action is the most involved; and the end is where the event is brought about, and the plan accomplished.

* *Poet.* c. 6.

We have given the foregoing example of a plan crowned with success, because it affords the clearest conception of a beginning, a middle, and an end, in which consists *unity* of action; and indeed stricter unity cannot be imagined than in that case. But an action may have unity, or a beginning, middle, and end, without so intimate a relation of parts; as where the catastrophe is different from what is intended or desired, which frequently happens in our best tragedies. In the Æneid, the hero, after many obstructions, makes his plan effectual. The Iliad is formed upon a different model: it begins with the quarrel between Achilles and Agamemnon; goes on to describe the several effects produced by that cause; and ends in a reconciliation. Here is unity of action, no doubt, a beginning, a middle, and an end; but inferior to that of the Æneid, which will thus appear. The mind hath a propensity to go forward in the chain of history; it keeps always in view the expected event; and when the incidents or under-parts are connected by their relation to the event, the mind runs sweetly and easily along them. This pleasure we have in the Æneid. It is not altogether so pleasant to connect, as in the Iliad, effects by their common cause; for such connection forces the mind to a continual retrospect: looking backward is like walking backward.

Elem. of Criticism.

102 Unity of action a capital beauty.

If unity of action be a capital beauty in fable imitative of human affairs, a plurality of unconnected fables must be a capital deformity. For the sake of variety, we indulge an under-plot that is connected with the principal: but two unconnected events are extremely unpleasant, even where the same actors are engaged in both. Ariosto is quite licentious in that particular: he carries on at the same time a plurality of unconnected stories. His only excuse is, that his plan is perfectly well adjusted to his subject; for every thing in the *Orlando Furioso* is wild and extravagant.

Though to state facts in the order of time is natural, yet that order may be varied for the sake of conspicuous beauties. If, for example, a noted story, cold and simple in its first movements, be made the subject of an epic poem, the reader may be hurried into the heat of action; reserving the preliminaries for a conversation-piece, if thought necessary: and that method, at the same time, hath a peculiar beauty from being dramatic. But a privilege that deviates from nature ought to be sparingly indulged; and yet romance-writers make no difficulty of presenting to the reader, without the least preparation, unknown persons engaged in some arduous adventure equally unknown. In Cassandra, two personages, who afterwards are discovered to be the heroes of the fable, start up completely armed upon the banks of the Euphrates, and engage in a single combat.

A play analysed is a chain of connected facts, of which each scene makes a link. Each scene, accordingly, ought to produce some incident relative to the catastrophe or ultimate event, by advancing or retarding it. A scene that produceth no incident, and for that reason may be termed *barren*, ought not to be indulged, because it breaks the unity of action: a barren scene can never be intitled to a place, because the chain is complete without it. In the Old Bachelor, the 3d scene of act 2. and all that follow to the end of that act, are mere conversation-pieces, productive of no consequence. The 10th and 11th scenes, act 3. Double Dealer, and the 10th, 11th, 12th, 13th, and 14th scenes, act 1. Love for Love, are of the same kind. Neither is The Way of the World entirely guiltless of such scenes. It will be no justification that they help to display characters: it were better, like Dryden in his *dramatis personæ*, to describe characters beforehand, which would not break the chain of action. But a writer of genius has no occasion for such artifice: he can display the characters of his personages much more to the life in sentiment and action. How successfully is this done by Shakespeare! in whose works there is not to be found a single barren scene.

Upon the whole, it appears, that all the facts in an historical fable ought to have a mutual connection, by their common relation to the grand event or catastrophe. And this relation, in which the *unity* of action consists, is equally essential to epic and dramatic compositions.

103 Whether unity of time and of place be essential.

How far the unities of time and of place are essential, is a question of greater intricacy. These unities were strictly observed in the Greek and Roman theatres; and they are inculcated by the French and English critics as essential to every dramatic composition. In theory these

The three Unities. these unities are also acknowledged by our best poets, though their practice seldom corresponds: they are often forced to take liberties, which they pretend not to justify, against the practice of the Greeks and Romans, and against the solemn decision of their own countrymen. But in the course of this inquiry it will be made evident, that in this article we are under no necessity to copy the ancients; and that our critics are guilty of a mistake, in admitting no greater latitude of place and time than was admitted in Greece and Rome.

Indeed the unities of place and time are not, by the most rigid critics, required in a narrative poem. In such composition, if it pretend to copy nature, these unities would be absurd; because real events are seldom confined within narrow limits either of place or of time: and yet we can follow history, or an historical fable, through all its changes, with the greatest facility: we never once think of measuring the real time by what is taken in reading; nor of forming any connection between the place of action and that which we occupy.

We are aware, that the drama differs so far from the epic as to admit different rules. It will be observed, "That an historical fable, intended for reading solely, is under no limitation of time or of place more than a genuine history; but that a dramatic composition cannot be accurately represented unless it be limited, as its representation is, to one place and to a few hours; and therefore that no fable can be admitted but what has these properties, because it would be absurd to compose a piece for representation that cannot be justly represented." This argument has at least a plausible appearance; and yet one is apt to suspect some fallacy, considering that no critic, however strict, has ventured to confine the unities of place and of time within so narrow bounds.

A view of the Grecian drama, compared with our own, may perhaps relieve us from this dilemma: if they be differently constructed, as shall be made evident, it is possible that the foregoing reasoning may not be equally applicable to both.

104 They were essential to the Greek drama, but All authors agree, that tragedy in Greece was derived from the hymns in praise of Bacchus, which were sung in parts by a chorus. Thespis, to relieve the singers, and for the sake of variety, introduced one actor, whose province it was to explain historically the subject of the song, and who occasionally represented one or other personage. Eschylus, introducing a second actor, formed the dialogue; by which the performance became dramatic; and the actors were multiplied when the subject represented made it necessary. But still the chorus, which gave a beginning to tragedy, was considered as an essential part. The first scene, generally, unfolds the preliminary circumstances that lead to the grand event; and this scene is by Aristotle termed the *prologue*. In the second scene, where the action properly begins, the chorus is introduced, which, as originally, continues upon the stage during the whole performance: the chorus frequently makes one in the dialogue; and when the dialogue happens to be suspended, the chorus, during the interval, is employed in singing. Sophocles adheres to this plan religiously. Euripides is not altogether so correct. In some of his pieces it becomes necessary to remove the chorus for a little time: but when that unusual step is risked, matters are so ordered as not to interrupt the representation: the chorus never leave the stage of their own accord, but at the command of some principal personage, who constantly waits their return.

Thus the Grecian drama is a continued representation without any interruption; a circumstance that merits attention. A continued representation without a pause affords not opportunity to vary the place of action, nor to prolong the time of the action beyond that of the representation. To a representation so confined in place and time, the foregoing reasoning is strictly applicable: a real or feigned action, that is brought to a conclusion after considerable intervals of time and frequent changes of place, cannot accurately be copied in a representation that admits no latitude in either. Hence it is, that the unities of place and of time, were, or ought to have been, strictly observed in the Greek tragedies; which is made necessary by the very constitution of their drama, for it is absurd to compose a tragedy that cannot be justly represented.

Modern critics, who for our drama pretend to establish rules founded on the practice of the Greeks, are guilty of an egregious blunder. The unities of place and of time were in Greece, as we see, a matter of necessity, not of choice; and it is easy to show, that if we submit to such fetters, it must be from choice, not necessity. This will be evident upon taking a view of the constitution of our drama, which differs widely from that of Greece; whether more or less perfect, is a different point, to be handled afterward. By dropping the chorus, opportunity is afforded to divide the representation by intervals of time, during which the stage is evacuated and the spectacle suspended. This qualifies our drama for subjects spread through a wide space both of time and of place: the time supposed to pass during the suspension of the representation is not measured by the time of the suspension; and any place may be supposed, as it is not in sight: by which means, many subjects can justly be represented in our theatres, that were excluded from those of ancient Greece. This doctrine may be illustrated, by comparing a modern play to a set of historical pictures; let us suppose them five in number, and the resemblance will be complete: each of the pictures resembles an act in one of our plays: there must necessarily be the strictest unity of place and of time in each picture; and the same necessity requires these two unities during each act of a play, because during an act there is no interruption in the spectacle. Now, when we view in succession a number of such historical pictures, let it be, for example, the history of Alexander by Le Brun, we have no difficulty to conceive, that months or years have passed between the events exhibited in two different pictures, though the interruption is imperceptible in passing our eye from the one to the other; and we have as little difficulty to conceive a change of place, however great: in which view, there is truly no difference between five acts of a modern play and five such pictures. Where the representation is suspended, we can with the greatest facility suppose any length of time or any change of place: the spectator, it is true, may be conscious, that the real time and place are not the same with what are employed in the representation; but this is a work of reflection; and by the same reflection he may also be conscious, that Garrick is not King Lear, that the playhouse is not Dover cliffs, nor the noise he hears thunder and lightning. In a word, after an interruption of the representation, it is not more

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more difficult for a spectator to imagine a new place, or a different time, than, at the commencement of the play, to imagine himself at Rome, or in a period of time two thousand years back. And indeed, it is abundantly ridiculous, that a critic, who is willing to hold candle-light for sun-shine, and some painted canvasses for a palace or a prison, should affect so much difficulty in imagining a latitude of place or of time in the fable, beyond what is necessary in the representation.

106 Great latitude in time, however not to be indulged,

There are, it must be acknowledged, some effects of great latitude in time that ought never to be indulged in a composition for the theatre: nothing can be more absurd, than at the close to exhibit a full-grown person who appears a child at the beginning: the mind rejects, as contrary to all probability, such latitude of time as is requisite for a change so remarkable. The greatest change from place to place hath not altogether the same bad effect: in the bulk of human affairs place is not material; and the mind, when occupied with an interesting event, is little regardful of minute circumstances: these may be varied at will, because they scarce make any impression.

107 Nor in place.

At the same time, it is not here meant to justify liberty without any reserve. An unbounded licence with relation to place and time, is faulty, for a reason that seems to have been overlooked, which is, that it seldom fails to break the unity of action; in the ordinary course of human affairs, single events, such as are fit to be represented on the stage, are confined to a narrow spot, and generally employ no great extent of time: we accordingly seldom find strict unity of action in a dramatic composition, where any remarkable latitude is indulged in these particulars. It may even be admitted, that a composition which employs but one place, and requires not a greater length of time than is necessary for the representation, is so much the more perfect; because the confining an event within so narrow bounds, contributes to the unity of action, and also prevents that labour, however slight, which the mind must undergo in imagining frequent changes of place, and many intervals of time. But still we must insist, that such limitation of place and time as was necessary in the Grecian drama, is no rule to us; and therefore, that though such limitation adds one beauty more to the composition, it is at best but a refinement, which may justly give place to a thousand beauties more substantial. And we may add, that it is extremely difficult, if not impracticable, to contract within the Grecian limits any fable so fruitful of incidents in number and variety as to give full scope to the fluctuation of passion.

Elem. of Criticism, ch. 23.

It may now appear, that critics who put the unities of place and of time upon the same footing with the unity of action, making them all equally essential, have not attended to the nature and constitution of the modern drama. If they admit an interrupted representation, with which no writer finds fault, it is absurd to reject its greatest advantage, that of representing many interesting subjects excluded from the Grecian stage. If there needs must be a reformation, why not restore the ancient chorus and the ancient continuity of action? There is certainly no medium; for to admit an interruption without relaxing from the strict unities of place and of time, is in effect to load us with all the inconveniences of the ancient drama, and at the same time to with-hold from us its advantages.

And therefore the only proper question is, Whether our model be or be not a real improvement? This indeed may fairly be called in question; and in order to a comparative trial, some particulars must be premised. When a play begins, we have no difficulty to adjust our imagination to the scene of action, however distant it be in time or in place; because we know that the play is a representation only. The case is very different after we are engaged: it is the perfection of representation to hide itself, to impose on the spectator, and to produce in him an impression of reality, as if he were spectator of a real event; but any interruption annihilates that impression, by rousing him out of his waking dream, and unhappily restoring him to his senses. So difficult it is to support the impression of reality, that much slighter interruptions than the interval between two acts are sufficient to dissolve the charm: in the 5th act of the *Mourning Bride*, the three first scenes are in a room of state, the fourth in a prison; and the change is operated by shifting the scene, which is done in a trice: but however quick the transition may be, it is impracticable to impose upon the spectators so as to make them conceive that they are actually carried from the palace to the prison; they immediately reflect, that the palace and prison are imaginary, and that the whole is a fiction.

108 Whether our drama be preferable to that of Greece.

From these premises, one will naturally be led, at first view, to pronounce the frequent interruptions in the modern drama to be an imperfection. It will occur, "That every interruption must have the effect to banish the dream of reality, and with it to banish our concern, which cannot subsist while we are conscious that all is a fiction; and therefore, that in the modern drama, sufficient time is not afforded for fluctuation and swelling of passion, like what is afforded in that of Greece, where there is no interruption." This reasoning, it must be owned, has a specious appearance: but we must not become faint-hearted upon the first repulse; let us rally our troops for a second engagement.

On the Greek stage, whatever may have been the case on the Roman, the representation was never interrupted, and the division by acts was totally unknown. The word *act* never once occurs in Aristotle's Poetics, in which he defines exactly every part of the drama, and divides it into the beginning, the middle, and the end. At certain intervals indeed the actors retired; but the stage was not then left empty, nor the curtain let fall; for the chorus continued and sung. Neither do these songs of the chorus divide the Greek tragedies into five portions, similar to our acts; though some of the commentators have endeavoured to force them into this office. But it is plain, that the intervals at which the chorus sung are extremely unequal and irregular, suited to the occasion and the subject; and would divide the play sometimes into three, sometimes into seven or eight acts.

As practice has now established a different plan on the modern stage, has divided every play into five acts, and made a total pause in the representation at the end of each act, the question to be considered is, Whether the plan of the ancient or of the modern drama is best qualified for making a deep impression on the mind? That the preference is due to the plan of the modern drama, will be evident from the following considerations. If it be indeed true, as the advocates for the three unities allege, that the audience is deluded into the belief

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of the reality of a well-acted tragedy, it is certain that this delusion cannot be long supported; for when the spirits are exhausted by close attention, and by the agitation of passion, an uneasiness ensues, which never fails to banish the waking dream. Now supposing the time that a man can employ with strict attention without wandering to be no greater than is requisite for a single act (a supposition that cannot be far from truth), it follows, that a continued representation of longer endurance than an act, instead of giving scope to fluctuation and swelling of passion, would overstrain the attention, and produce a total absence of mind. In this respect, the four pauses have a fine effect: for by affording to the audience a seasonable respite when the impression of reality is gone, and while nothing material is in agitation, they relieve the mind from its fatigue; and consequently prevent a wandering of thought at the very time possibly of the most interesting scenes.

In one article, indeed, the Grecian model has greatly the advantage: its chorus, during an interval, not only preserves alive the impressions made upon the audience, but also prepares their hearts finely for new impressions. In our theatres, on the contrary, the audience, at the end of every act, being left to trifle time away, lose every warm impression; and they begin the next act cool and unconcerned, as at the commencement of the representation. This is a gross malady in our theatrical representations; but a malady that luckily is not incurable: to revive the Grecian chorus, would be to revive the Grecian slavery of place and time; but we can figure a detached chorus coinciding with a pause in the representation, as the ancient chorus did with a pause

109 An improvement of the modern drama suggested *Elem. of Criticism*, ch. 23.

in the principal action. What objection, for example, can there lie against music between the acts, vocal and instrumental, adapted to the subject? Such detached chorus, without putting us under any limitation of time or place, would recruit the spirits, and would preserve entire the tone, if not the tide, of passion: the music, after an act, should commence in the tone of the preceding passion, and be gradually varied till it accord with the tone of the passion that is to succeed in the next act. The music and the representation would both of them be gainers by their conjunction; which will thus appear. Music that accords with the present tone of mind, is, on that account, doubly agreeable; and accordingly, though music singly hath not power to raise a passion, it tends greatly to support a passion already raised. Further, music prepares us for the passion that follows, by making cheerful, tender, melancholy, or animated impressions, as the subject requires. Take for an example the first scene of the *Mourning Bride*, where soft music, in a melancholy strain, prepares us for Almeria's deep distress. In this manner, music and representation support each other delightfully: the impression made upon the audience by the representation, is a fine preparation for the music that succeeds; and the impression made by the music, is a fine preparation for the representation that succeeds. It appears evident, that by some such contrivance, the modern drama may be improved, so as to enjoy the advantage of the ancient chorus without its slavish limitation of place and time. But to return to the comparison between the ancient and the modern drama.

The numberless improprieties forced upon the Greek dramatic poets by the constitution of their drama, may be sufficient, one should think, to make us prefer the modern drama, even abstracting from the improvement proposed. To prepare the reader for this article, it

110 The modern drama preferable to the ancient.

must be premised, that as in the ancient drama the place of action never varies, a place necessarily must be chosen to which every person may have access without any improbability. This confines the scene to some open place, generally the court or area before a palace; which excludes from the Grecian theatre transactions within doors, though these commonly are the most important. Such cruel restraint is of itself sufficient to cramp the most pregnant invention; and accordingly the Greek writers, in order to preserve unity of place, are reduced to woful improprieties. In the *Hippolytus* of Euripides (act 1. sc. 6.), Phedra, distressed in mind and body, is carried without any pretext from her palace to the place of action; is there laid upon a couch, unable to support herself upon her limbs; and made to utter many things improper to be heard by a number of women who form the chorus: and what is still more improper, her female attendant uses the strongest intreaties to make her reveal the secret cause of her anguish; which at last Phedra, contrary to decency and probability, is prevailed upon to do in presence of that very chorus (act 2. sc. 2.) Alcestes, in Euripides, at the point of death, is brought from the palace to the place of action, groaning and lamenting her untimely fate (act 2. sc. 1.) In the *Trachiniæ* of Sophocles (act. 2.), a secret is imparted to Dejanira, the wife of Hercules, in presence of the chorus. In the tragedy of *Iphigenia*, the messenger employed to inform Clytemnestra that Iphigenia was sacrificed, stops short at the place of action, and with a loud voice calls the queen from her palace to hear the news. Again, in the *Iphigenia in Tauris* (act 4.), the necessary presence of the chorus forces Euripides into a gross absurdity, which is to form a secret in their hearing; and, to disguise the absurdity, much court is paid to the chorus, not one woman but a number, to engage them to secrecy. In the *Medea* of Euripides, that princess makes no difficulty, in presence of the chorus, to plot the death of her husband, of his mistress, and of her father the king of Corinth, all by poison: it was necessary to bring Medea upon the stage; and there is but one place of action, which is always occupied by the chorus. This scene closes the second act; and in the end of the third, she frankly makes the chorus her confidents in plotting the murder of her own children. Terence, by identity of place, is often forced to make a conversation within doors be heard on the open street: the cries of a woman in labour are there heard distinctly.

111 Inconveniences of the plan of the ancient drama.

The Greek poets are not less hampered by unity of time than by that of place. In the *Hippolytus* of Euripides, that prince is banished at the end of the 4th act; and in the first scene of the following act, a messenger relates to Theseus the whole particulars of the death of Hippolytus by the sea-monster: that remarkable event must have occupied many hours; and yet in the representation it is confined to the time employed by the chorus upon the song at the end of the 4th act. The inconsistency is still greater in the *Iphigenia in Tauris* (act 5. sc. 4.): the song could not exhaust half an hour; and yet the incidents supposed to have happened during that time could not naturally have been transacted in less than half a day.

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The Greek artists are forced, not less frequently, to transgress another rule, derived also from a continued representation. The rule is, that as a vacuity, however momentary, interrupts the representation, it is necessary that the place of action be constantly occupied. Sophocles, with regard to that rule as well as to others, is generally correct; but Euripides cannot bear such restraint; he often evacuates the stage, and leaves it empty for others. Iphigenia in Tauris, after pronouncing a soliloquy in the first scene, leaves the place of action, and is succeeded by Orestes and Pylades: they, after some conversation, walk off; and Iphigenia re-enters, accompanied with the chorus. In the Alcestes, which is of the same author, the place of action is void at the end of the third act. It is true, that to cover the irregularity, and to preserve the representation in motion, Euripides is careful to fill the stage without loss of time: but this still is an interruption, and a link of the chain broken: for during the change of the actors, there must be a space of time, during which the stage is occupied by neither set. It makes indeed a more remarkable interruption, to change the place of action as well as the actors; but that was not practicable upon the Grecian stage.

It is hard to say upon what model Terence has formed his plays. Having no chorus, there is a pause in the representation at the end of every act: but advantage is not taken of the cessation, even to vary the place of action; for the street is always chosen, where every thing passing may be seen by every person; and by that choice, the most sprightly and interesting parts of the action, which commonly pass within doors, are excluded; witness the last act of the *Eunuch*. He hath submitted to the like slavery with respect to time. In a word, a play with a regular chorus, is not more confined in place and time than his plays are. Thus a zealous sectary follows implicitly ancient forms and ceremonies, without once considering whether their introductive cause be still subsisting. Plautus, of a bolder genius than Terence, makes good use of the liberty afforded by an interrupted representation: he varies the place of action upon all occasions, when the variation suits his purpose.

Elem. of Criticism, ch. 23.

111 No change of time or place to be admitted but between the acts.

The intelligent reader will by this time understand, that we plead for no change of place in our plays but after an interval, nor for any latitude in point of time but what falls in with an interval. The unities of place and time ought to be strictly observed during each act; for during the representation there is no opportunity for the smallest deviation from either. Hence it is an essential requisite, that during an act the stage be always occupied; for even a momentary vacuity makes an interval or interruption. Another rule is no less essential: it would be a gross breach of the unity of action to exhibit upon the stage two separate actions at the same time; and therefore, to preserve that unity, it is necessary that each personage introduced during an act be linked to those in possession of the stage, so as to join all in one action. These things follow from the very conception of an act, which admits not the slightest interruption: the moment the representation is intermitted, there is an end of that act; and we have no other notion of a new act, but where, after a pause or interval, the representation is again put in motion. French writers, generally speaking, are correct in this particular. The English, on the contrary, are so irregular as scarce to deserve a criticism: actors not only succeed each other in the same place without connection, but, what is still less excusable, they frequently succeed each other in different places. This change of place in the same act ought never to be indulged; for, beside breaking the unity of the act, it has a disagreeable effect: after an interval, the imagination adapts itself to any place that is necessary, as readily as at the commencement of the play; but during the representation we reject change of place. From the foregoing censure must be excepted the *Mourning Bride* of Congreve, where regularity concurs with the beauty of sentiment and of language, to make it one of the most complete pieces England has to boast of. It is to be acknowledged, however, that in point of regularity this elegant performance is not altogether unexceptionable. In the four first acts, the unities of place and time are strictly observed: but in the last act, there is a capital error with respect to unity of place; for in the three first scenes of that act, the place of action is a room of state, which is changed to a prison in the fourth scene: the chain also of the actors is broken; as the persons introduced in the prison are different from those who made their appearance in the room of state. This remarkable interruption of the representation makes in effect two acts instead of one: and therefore, if it be a rule that a play ought not to consist of more acts than five, this performance is so far defective in point of regularity. It may be added, that, even admitting six acts, the irregularity would not be altogether removed, without a longer pause in the representation than is allowed in the acting; for more than a momentary interruption is requisite for enabling the imagination readily to fall in with a new place, or with a wide space of time. In *The Way of the World*, of the same author, unity of place is preserved during every act, and a stricter unity of time during the whole play than is necessary.

§ 4. *Of the Opera.*

Of the Opera.

113 The opera, a drama represented by music.

An opera is a drama represented by music. This entertainment was invented at Venice. An exhibition of this sort requires a most brilliant magnificence, and an expence truly royal. The drama must necessarily be composed in verse; for as operas are sung and accompanied with symphonies, they must be in verse to be properly applicable to music. To render this entertainment still more brilliant, it is ornamented with dances and ballettes, with superb decorations, and surprising machinery. The dresses of the actors, of those who assist in the chorus, and of the dancers, being all in the most splendid and elegant taste, contribute to render the exhibition highly sumptuous. But notwithstanding this union of arts and pleasures at an immense expence, and notwithstanding a most dazzling pageantry, an opera appears, in the eyes of many people of taste, but as a magnificent absurdity, seeing that nature is never there from the beginning to the end. It is not our business here, however, to determine between the different tastes of mankind.

The method of expressing our thoughts by singing and music is so little natural, and has something in it so forced and affected, that it is not easy to conceive how

Of the Opera.

How it could come into the minds of men of genius to represent any human action, and, what is more, a serious or tragic action, any otherwise than by speech. We have, it is true, operas in English by Addison, &c. in Italian by Metastasio, in French by M. Quinault, Fontenelle, &c. the subjects of which are so grave and tragic, that one might call them musical tragedies, and real *chefs-d'œuvres* in their kind. But though we are highly satisfied and greatly affected on reading them, and are much pleased with seeing them represented, yet the spectator is, perhaps, more charmed with the magnificence of the sight and the beauty of the music, than moved with the action and the tragical part of the performance. We are not, however, of that order of critics who strive to prove, that mankind act wrong in finding pleasure in an object with which they are really pleased; who blame a lover for thinking his mistress charming, when her features are by no means regular; and who are perpetually applying the rules of logic to the works of genius: we make these observations merely in order to examine if it be not possible to augment the pleasures of a polite people, by making the opera something more natural, more probable, and more consonant to reason.

Bielfeld's Elem. of Erudition.

114 Should take its subject not from history but from fable and enchantment.

We think, therefore, that the poet should never, or at least very rarely, choose a subject from history, but from fable or mythology, or from the regions of enchantment. Every rational mind is constantly shocked to hear a mutilated hero trill out, from the slender pipe of a chaffinch, *To arms! To arms!* and in the same tone animate his soldiers, and lead them to the assault; or harangue an assembly of grave senators, and sometimes a whole body of people. Nothing can be more burlesque than such exhibitions; and a man must be possessed of a very uncommon sensibility to be affected by them. But as we know not what was the language of the gods, and their manner of expressing themselves, we are at liberty in that case to form what illusions we please, and to suppose that they sung to distinguish themselves from mortals. Besides, all the magic of decorations and machinery become natural, and even necessary, in these kinds of subjects; and therefore readily afford opportunity for all the pomp of these performances. The chorus, the dances, the ballettes, the symphonies and dresses, may likewise be all made to correspond with such subjects: nothing is here affected, absurd, or unnatural. Whoever is possessed of genius, and is well acquainted with mythology, will there find an inexhaustible source of subjects highly diversified, and quite proper for the drama of an opera.

We shall not speak here of that sort of music which appears to us the most proper for such a drama, and of the several alterations of which we think it susceptible, in order to make it more complete, and to adapt it to a more pathetic, more noble, and more natural expression, as well in the recitatives as in the airs and chorus. (See MUSIC). We have only here to consider the business of the poet. He should never lose sight of nature, even in the midst of the greatest fiction. A god, a demi-god, a renowned hero, such for example as Renaud in *Armida*, a fairy, a genie, a nymph, or fury, &c. should constantly be represented according to the characters we give them, and never be made to talk the language of a fop or a *petite maitresse*. The

115 And should represent its characters as consistent.

recitative, which is the ground-work of the dialogue, requires verses that are free and not regular, such as with a simple cadence approach the nearest to common language. The airs should not be forced into the piece, nor improperly placed for the sake of terminating a scene, or to display the voice of a performer: they should express some sentiment, or some precept, short and striking, or tender and affecting; or some simile lively and natural; and they should arise of themselves from a monologue, or from a scene between two persons: prolixity should here be particularly avoided, especially when such an air makes part of a dialogue; for nothing is more insipid or disgustful than the countenances of the other actors who appear at the same time, whose silence is quite unmeaning, and who know not what to do with their hands and feet while the singer is straining his throat. The verse of all the airs should be of the lyric kind, and should contain some poetic image, or paint some noble passion, which may furnish the composer with an opportunity of displaying his talents, and of giving a lively and affecting expression to the music. A phrase that is inanimated can never have a good effect in the performance, but must become insipid and horribly tedious in the air. The trite similies of the Italians, of a stream that flows, or a bird that flies, &c. are no longer sufferable. The same thing may be said with regard to the chorus, which should be equally natural and well adapted: it is here sometimes a whole people, sometimes the inhabitants of a peculiar country, and sometimes warriors, nymphs, or priests, &c. who raise their voice to demand justice, to implore favour, or render a general homage. The action itself will furnish the poet of genius with ideas, words, and the manner of disposing them.

Lastly, the opera being a performance calculated less to satisfy the understanding than to charm the ear and affect the heart, and especially to strike the sight, the poet should have a particular attention to that object, should be skilled in the arts of a theatre, should know how to introduce combats, ballettes, feasts, games, pompous entries, solemn processions, and such marvellous incidents as occur in the heavens, upon earth, in the sea, and even in the infernal regions: but all these matters demand a strong character, and the utmost precision in the execution: for otherwise, the comic being a near neighbour to the sublime, they will easily become ridiculous. The unity of action must certainly be observed in such a poem, and all the incidental episodes must concur to the principal design; otherwise it would be a monstrous chaos. It is impossible, however, scrupulously to observe the unity of time and place: though the liberty, which reason allows the poet in this respect, is not without bounds; and the less use he makes of it, the more perfect his poem will be. It is not perhaps impossible so to arrange the objects, that, in changing the decorations, the painter may constantly make appear some part of the principal decoration which characterises the situation of the scene, as the corner of a palace, at the end of a garden, or some avenue that leads to it, &c. But all this is liable to difficulties, and even to exceptions; and the art of the painter must concur in such case with that of the poet. For the rest, all the operas of Europe are at least one third too long; especially the Italian. The unity of action requires brevity; and satiety is inseparable from a diversion

116 Unity of action necessary to the opera.

Of Lyric Poetry.

version that lasts full four hours, and sometimes longer.

They have indeed endeavoured to obviate this inconvenience by dividing an opera into three, and even into five acts; but experience proves, that this division, though judicious, is still not sufficient to relieve the wearied attention.

Sect. II. *Of Lyric Poetry.*

117 Origin of the ode.

The ode is very ancient, and was probably the first species of poetry. It had its source, we may suppose, from the heart, and was employed to express, with becoming fervour and dignity, the grateful sense man entertained of the blessings which daily flowed from God the fountain of all goodness: hence their harvest hymns, and other devotional compositions of that kind.

But in process of time it was employed, not only to praise the Almighty for bounties received, but to solicit his aid in time of trouble; as is plain from the odes written by king David and others, and collected by the Jewish Sanhedrim into the book of Psalms, to be sung at their fasts, festivals, and on other solemn occasions. Nor was this practice confined to the Israelites only: other nations had their songs of praise and petitions of this sort, which they preferred to their deities in time of public prosperity and public distress, as well as to those heroes who distinguished themselves in arms. Even the American Indians, whose notions of religion are extremely confined, have their war-songs, which they sing to this day.

It is reasonable to suppose that the awful purpose to which the ode was applied, gave rise among the ancients to the custom of invoking the muses; and that the poets, in order to raise their sentiments and language, so as to be acceptable to their deities, thought it expedient to solicit some divine assistance. Hence poets are said to have been inspired, and hence an unbounded liberty has been given to the ode; for the lyric poet, fired, as it were, with his subject, and borne away on the wings of gratitude, disdains grammatical niceties and common

118 Its freedom.

modes of speech, and often soars above rule, though not above reason. This freedom, however, consists chiefly in sudden transitions, bold digressions, and lofty excursions. For the ancient poets, and even Pindar, the most daring and lofty of them all, has in his sublimest flights, and amidst all his rapture, preserved harmony, and often uniformity in his versification: but so great is the variety of his measures, that the traces of sameness are in a manner lost; and this is one of the excellencies for which that poet is admired, and which, though seemingly devoid of art, requires so much that he has seldom been imitated with success.

The ancients in their odes indulged such a liberty of fancy, that some of their best poets not only make bold excursions and digressions, but, having in their flights started some new and noble thought, they frequently pursue it, and never more return to their subject. But this loose kind of ode, which seems to reject all method, and in which the poet, having just touched upon his subject, immediately diverts to another, we should think blameable, were it lawful to call in question the authority of those great men who were our preceptors in this art. We may venture to affirm, however, that these compositions stand in no degree of comparison with other odes of theirs; in which, after wandering from the subject in pursuit of new ideas arising from some of its adjuncts, and ranging wantonly, as it were, through a variety of matter, the poet is from some other circumstance led naturally to his subject again; and, like a bee, having collected the essence of many different flowers, returns home, and unites them all in one uniform pleasing sweet.

119 The subjects of the ode.

The ode among the ancients signified no more than a song: but with the moderns, the ode and the song are considered as different compositions; the ode being usually employed in grave and lofty subjects, and seldom sung but on solemn occasions.

The subjects most proper for the ode and song, Horace has pointed out in a few elegant lines.

Gods, heroes, conquerors, *Olympic* crowns,
Love's pleasing cares, and the free joys of wine,
Are proper subjects for the lyric song.

To which we may add, that happiness, the pleasures of a rural life, and such parts of morality as afford lessons for the promotion of our felicity, and reflections on the conduct of life, are equally suitable to the ode. This both *Pindar* and *Horace* were so sensible of, that many of their odes are seasoned with these moral sentences and reflections.

But who can number ev'ry sandy grain
Wash'd by *Sicilia*'s hoarse-resounding main?
Or who can *Theron*'s gen'rous works express,
And tell how many hearts his bounteous virtues bless?

Ode to Theron.

And in another Olympic ode, inscribed by the same poet to Diagoras of Rhodes (and in such esteem, that it was deposited in the temple of Minerva, written in letters of gold), Pindar, after exalting them to the skies, concludes with this lesson in life:

Yet as the gales of fortune various blow,
To-day tempestuous, and to-morrow fair,
Due bounds, ye Rhodians, let your transports know;
Perhaps to-morrow comes a storm of care.

West's Pindar.

The man resolv'd and steady to his trust,
Inflexible to ill, and obstinately just,
May the rude rabble's insolence despise,
Their senseless clamours and tumultuous cries;
The tyrant's fierceness he beguiles,
And the stern brow and the harsh voice defies,
And with superior greatness smiles.
Not the rough whirlwind, that deforms
Adria's black gulph, and vexes it with storms,
The stubborn virtue of his soul can move;
Nor the red arm of angry Jove,
That flings the thunder from the sky,
And gives it rage to roar, and strength to fly.
Should the whole frame of nature round him break,
In ruin and confusion hurl'd,
He unconcern'd would hear the mighty crack,
And stand secure amidst a falling world.

Horace.

Of Lyric Poetry.

M. Despreaux has given us a very beautiful and just description of the ode in these lines.

L'Ode avec plus d'éclat, & non moins d'énergie
Elevant jusqu'au ciel son vol ambitieux,
Entretient dans vers commerce avec les Dieux.
Aux Athletes dans Pise elle ouvre la barriere,
Chante un vainqueur poudreux au bout de la carriere;
Mene Achille sanglant au bords du Simoïs
Ou fait flechir l'Escaut sous le joug de Louis.
Tantôt comme une abeille ardente à son ouvrage
Elle s'en va de fleurs dèpouiller le rivage:
Elle peint les festins, les danses & les ris,
Vante un baiser cueilli sur les levres d'Iris,
Qui mollement résiste & par un doux caprice
Quelquefois le refuse, afin qu'on le ravisse.
Son style impetueux souvent marche au hasard.
Chez elle un beau desordre est un effet de l'art,
Loin ces rimeurs craintifs, dont l'esprit plegmatique
Garde dans ses fureurs un ordre didactique:
Qui chantant d'un heros les progrès éclatans,
Maigres historiens, suivront l'ordre des temps.
Apollon de son feu leur fut tonjours avare, &c.

The lofty ode demands the strongest fire,
For there the muse all Phœbus must inspire:
Mounting to heav'n in her ambitious flight,
Amongst the gods and heroes takes delight;
Of Pisa's wrestlers tells the sinewy force,
And sings the dusty conqueror's glorious course;
To Simois' banks now fierce Achilles sends,
Beneath the Gallic yoke now Escaut bends:
Sometimes she flies, like an industrious bee,
And robs the flow'rs by nature's chemistry;
Describes the shepherds dances, feasts, and bliss,
And boasts from Phillis to surprise a kiss,
When gently she resists with feign'd remorse,
That what she grants may seem to be by force.
Her generous style will oft at random start,
And by a brave disorder show her art;
Unlike those fearful poets whose cold rhyme
In all their raptures keeps exactest time,
Who sing the illustrious hero's mighty praise,
Dry journalists, by terms of weeks and days;
To these, Apollo, thrifty of his fire,
Denies a place in the Pierian choir, &c.

SOAMES.

The variety of subjects, which are allowed the *lyric* poet, makes it necessary to consider this species of poetry under the following heads, viz. the *sublime* ode, the *lesser* ode, and the *song*. We shall begin with the lowest, and proceed to that which is more eminent.

120 The song.

I. *Songs* are little poetical compositions, usually set to a tune, and frequently sung in company by way of entertainment and diversion. Of these we have in our language a great number; but, considering that number, not many which are excellent; for, as the Duke of Buckingham observes,

Though nothing seems more easy, yet no part
Of poetry requires a nicer art.

The song admits of almost any subject; but the greatest part of them turn either upon *love*, *contentment*, or the *pleasures* of a *country life*, and *drinking*. Be the subject, however, what it will, the verses should be easy, natural, and flowing, and contain a certain harmony, so that poetry and music may be agreeably united. In these compositions, as in all others, obscene and profane expressions should be carefully avoided, and indeed every thing that tends to take off that respect which is due to religion and virtue, and to encourage vice and immorality. As the best songs in our language are already in every hand, it would seem superfluous to insert examples. For further precepts, however, as well as select examples, in this species of composition, we may refer the reader to the elegant *Essay on Song Writing*, by Mr Aikin.

121 The distinguishing character of the lesser ode.

II. The *lesser ode*. The distinguishing character of this is sweetness; and as the pleasure we receive from this sort of poem arises principally from its soothing and affecting the passions, great regard should be paid to the language as well as to the thoughts and numbers.

Th' expression should be easy, fancy high;
Yet that not seem to creep, nor this to fly:
No words transpos'd, but in such order all,
As, though hard wrought, may seem by chance to fall.

D. Buckingham's Essay.

The style, indeed, should be easy: but it may be also florid and figurative. It solicits delicacy, but disdains affectation. The thoughts should be natural, chaste, and elegant; and the numbers various, smooth, and harmonious. A few examples will sufficiently explain what we mean.

Longinus has preserved a fragment of Sappho, an ancient Greek poetess, which is in great reputation amongst the critics, and has been so happily translated by Mr Philips as to give the English reader a just idea of the spirit, ease, and elegance of that admired author; and show how exactly she copied nature. To enter into the beauties of this ode, we must suppose a lover sitting by his mistress, and thus expressing his passion:

122 The Sapphic ode.

Blest as th' immortal gods is he,
The youth who fondly sits by thee,
And sees and hears thee all the while
Softly speak, and sweetly smile.
'Twas this depriv'd my soul of rest,
And rais'd such tumults in my breast;
For while I gaz'd, in transport tost,
My breath was gone, my voice was lost.
My bosom glow'd, the subtle flame
Ran quick through all my vital frame:
O'er my dim eyes a darkness hung;
My ears with hollow murmurs rung.
In dewy damps my limbs were chill'd;
My blood with gentle horrors thrill'd;
My feeble pulse forgot to play;
I fainted, sunk, and dy'd away.

After this instance of the Sapphic ode, it may not be improper to speak of that sort of ode which is called *Anacreontic*; being written in the manner and taste of Anacreon, a Greek poet, famous for the delicacy of his wit, and the exquisite, yet easy and natural, turn of his poesy. We have several of his odes still extant, and many modern ones in imitation of him, which are mostly composed in verses of seven syllables, or three feet and a half.

123 The Anacreontic ode.

We shall give the young student one or two examples of his manner from Mr Fawkes's excellent translation.

Of Lyric Poetry.

The following ode on the power of gold, which had been often attempted but with little succefs, this gentleman has tranflated very happily.

Love's a pain that works our wo;
Not to love is painful too:
But, alas! the greateft pain
Waits the love that meets difdain.
What avails ingenuous worth,
Sprightly wit, or noble birth?
All thefe virtues ufelefs prove;
Gold alone engages love.
May he be completely curft,
Who the fleeping mifchief firft
Wak'd to life, and, vile before,
Stamp'd with worth the fordid ore.
Gold creates in brethren ftrife;
Gold deftroys the parent's life;
Gold produces civil jars,
Murders, maffacres, and wars;
But the worft effect of gold,
Love, alas! is bought and fold.

His ode on the vanity of riches is of a piece with the above, and conveys a good leffon to thofe who are over anxious for wealth.

If the treafur'd gold could give
Man a longer term to live,
I'd employ my utmoft care
Still to keep, and ftill to fpare;
And, when death approach'd, would fay,
'Take thy fee, and walk away.'
But fince riches cannot fave
Mortals from the gloomy grave,
Why fhould I myfelf deceive,
Vainly figh, and vainly grieve?
Death will furely be my lot,
Whether I am rich or not.
Give me freely while I live
Generous wines, in plenty give
Soothing joys my life to cheer,
Beauty kind, and friends fincere;
Happy! could I ever find
Friends fincere, and beauty kind.

But two of the moft admired, and perhaps the moft imitated, of Anacreon's odes, are that of Mars wounded by one of the darts of Love, and Cupid ftung by a Bee; both which are wrought up with fancy and delicacy, and are tranflated with elegance and fpirit.—Take that of Cupid ftung by a bee.

Once as Cupid, tir'd with play,
On a bed of rofes lay,
A rude bee, that flept unfeen,
The fweet breathing buds between,
Stung his finger, cruel chance!
With its little pointed lance.
Straight he fills the air with cries,
Weeps, and fobs, and runs, and flies;
'Till the god to Venus came,
Lovely, laughter-loving dame:
Then he thus began to plain;
"Oh! undone——I die with pain——
"Dear mamma, a ferpent fmall,
"Which a bee the ploughmen call,
"Imp'd with wings, and arm'd with dart,
"Oh!—has ftung me to the heart."
Venus thus reply'd, and fmil'd:
'Dry thofe tears for fhame! my child;
'If a bee can wound fo deep,
'Caufing Cupid thus to weep,
'Think, O think! what cruel pains
'He that's ftung by thee fuftains.'

124 Imitations of Anacreon and

Among the moft fuccefsful of this poet's Englifh imitators may be reckoned Dr Johnfon and Mr Prior. The following ode on *Evening* by the former of thefe writers has, if we miftake not, the very fpirit and air of Anacreon.

Evening now from purple wings
Sheds the grateful gifts fhe brings;
Brilliant drops bedeck the mead;
Cooling breezes fhake the reed;
Shake the reed, and curl the ftream
Silver'd o'er with Cynthia's beam;
Near the chequer'd lonely grove
Hears, and keeps thy fecrets, Love.
Stella, thither let us ftray!
Lightly o'er the dewy way.
Phœbus drives his burning car
Hence, my lovely Stella, far:
In his ftead the queen of night
Round us pours a lambent light;
Light that feems but juft to fhow
Breafts that beat, and cheeks that glow:
Let us now, in whifper'd joy,
Evening's filent hours employ;
Silence beft, and confcious fhades,
Pleafe the hearts that love invades:
Other pleafures give them pain;
Lovers all but love difdain.

But of all the imitations of the playful bard of Greece that we have ever met with, the moft perfect is the following Anacreontic by the regent Duke of Orleans.

I.
Je fuis né pour les plaifirs;
Bien fou qui s'en paffe:
Je ne veux pas les choifir;
Souvent le choix m'embarraffe:
Aime t'on? J'aime foudain;
Bois t'on? J'ai le verre à la main;
Je tiens par tout ma place.

II.
Dormir eft un temps perdu;
Faut il qu'on s'y livre?
Sommeil, prends ce qui t'eft du;
Mais attends que je fois yvre:
Saifis moi dans cet inftant;
Fais moi dormir promptement;
Je fuis preffé de vivre.

III.
Mais fi quelque objet charmant,
Dans un fonge aimable,
Vient d'un plaifir feduifant
M'offrir l'image agréable;
Sommeil, allons doucement;
L'erreur eft en ce moment
Un bonheur veritable.

Tranflation

Of Lyric Poetry.

Translation of the Regent's Anacreontic (E).

Frolic and free, for pleasure born,
The self-denying fool I scorn:
The proffer'd joy I ne'er refuse;
'Tis oft-times troublesome to chuse.
Lov'st thou, my friend? I love at sight:
Drink'st thou? this bumper does thee right.
At random with the stream I flow,
And play my part where'er I go.

Great God of Sleep, since we must be
Oblig'd to give some hours to thee,
Invade me not till the full bowl
Glows in my cheek, and warms my soul.
Be *that* the only time to snore,
When I can love and drink no more:
Short, very short, then be thy reign;
For I'm in haste to live again.

But, O! if melting in my arms,
In some soft dream, with all her charms,
The nymph belov'd should then surprise,
And grant what waking she denies;
Then prithee, gentle Slumber, stay;
Slowly, ah slowly, bring the day:
Let no rude noise my bliss destroy;
Such sweet delusion's real joy.

125 Sappho. We have mentioned Prior as an imitator of Anacreon; but the reader has by this time had a sufficient specimen of Anacreontics. The following *Answer to Cloe jealous*, which was written when Prior was sick, has much of the elegant tenderness of Sappho.

Yes, fairest proof of beauty's pow'r,
  Dear idol of my panting heart,
Nature points this my fatal hour:
  And I have liv'd: and we must part.
While now I take my last adieu,
  Heave thou no sigh, nor shed a tear;
Lest yet my half-clos'd eye may view
  On earth an object worth its care.
From jealousy's tormenting strife
  For ever be thy bosom freed;
That nothing may disturb thy life,
  Content I hasten to the dead.
Yet when some better-fated youth
  Shall with his am'rous parly move thee,
Reflect one moment on his truth
  Who, dying, thus persists to love thee.

There is much of the softness of Sappho, and the sweetness of Anacreon and Prior, in the following ode, which is ascribed to the late unfortunate Dr Dodd; and was written in compliment to a lady, who, being sick, had sent the author a moss rose-bud, instead of making his family a visit. This piece is particularly to be esteemed for the just and striking moral with which it is pointed.

The slightest of favours bestow'd by the fair,
With rapture we take, and with triumph we wear:
But a moss-woven rose-bud, Eliza, from thee,
A well-pleasing gift to a monarch would be.
—Ah! that illness, too cruel, forbidding should stand,
And refuse me the gift from thy own lovely hand!
With joy I receive it, with pleasure will view,
Reminded of thee, by its odour and hue:
"Sweet rose, let me tell thee, tho' charming thy bloom,
Tho' thy fragrance excels Seba's richest perfume;
Thy breath to Eliza's no fragrance hath in't,
And but dull is thy bloom to her cheek's blushing tint.
Yet, alas! my fair flow'r, that bloom will decay,
And all thy lov'd beauties soon wither away;
Tho' pluck'd by her hand, to whose touch, we must own,
Harsh and rough is the cygnet's most delicate down:"
Thou too, snowy hand; nay, I mean not to preach;
But the rose, lovely moralist, suffer to teach.
"Extol not, fair maiden, thy beauties o'er mine;
They too are short-liv'd, and they too must decline;
And small, in conclusion, the diff'rence appears,
In the bloom of few days, or the bloom of few years!
But remember a virtue the rose hath to boast,
—Its fragrance remains when its beauties are lost!"

We come now to those odes of the more florid and figurative kind, of which we have many in our language that deserve particular commendation. Mr Warton's Ode to Fancy has been justly admired by the best judges; for though it has a distant resemblance of Milton's L'Allegro and Il Penseroso, yet the work is original; the thoughts are mostly new and various, and the language and numbers elegant, expressive, and harmonious. 126 Odes more florid and figurative.

O parent of each lovely muse,
Thy spirit o'er my soul diffuse!
O'er all my artless songs preside,
My footsteps to thy temple guide!
To offer at thy turf-built shrine
In golden cups no costly wine,
No murder'd fatling of the flock,
But flow'rs and honey from the rock.
O nymph, with loosely flowing hair,
With buskin'd leg, and bosom bare;
Thy waist with myrtle-girdle bound,
Thy brows with Indian feathers crown'd;
Waving in thy snowy hand
An all-commanding magic wand,
Of pow'r to bid fresh gardens blow
'Mid cheerless Lapland's barren snow:
Whose rapid wings thy flight convey,
Through air, and over earth and sea;
While the vast various landscape lies
Conspicuous to thy piercing eyes.
O lover of the desert, hail!
Say, in what deep and pathless vale,
Or on what hoary mountain's side,
'Midst falls of water, you reside;
'Midst broken rocks, a rugged scene,
With green and grassy dales between;
'Midst forests dark of aged oak,
Ne'er echoing with the woodman's stroke;

Where

(E) We give this translation, both because of its excellence and because it is said to have been the production of no less a man than the late Lord Chatham.

Where never human art appear'd,
Nor ev'n one ſtraw-roof'd cott was rear'd;
Where Nature ſeems to ſit alone,
Majeſtic on a craggy throne.
Tell me the path, ſweet wand'rer! tell,
To thy unknown ſequeſter'd cell,
Where woodbines cluſter round the door,
Where ſhells and moſs o'erlay the floor,
And on whoſe top an hawthorn blows,
Amid whoſe thickly-woven boughs
Some nightingale ſtill builds her neſt,
Each ev'ning warbling thee to reſt.
Then lay me by the haunted ſtream,
Wrapt in ſome wild poetic dream;
In converſe while methinks I rove
With Spenſer through a fairy grove;
Till ſuddenly awak'd, I hear
Strange whiſper'd muſic in my ear;
And my glad ſoul in bliſs is drown'd
By the ſweetly ſoothing ſound!
Me, goddeſs, by the right-hand lead,
Sometimes through the yellow mead;
Where Joy and white-rob'd Peace reſort,
And Venus keeps her feſtive court;
Where Mirth and Youth each ev'ning meet,
And lightly trip with nimble feet,
Nodding their lily-crowned heads,
Where Laughter roſe-lip'd Hebe leads;
Where Echo walks ſteep hills among,
Liſt'ning to the ſhepherd's ſong.
Yet not theſe flow'ry fields of joy
Can long my penſive mind employ;
Haſte, Fancy, from the ſcenes of Folly,
To meet the matron Melancholy!
Goddeſs of the tearful eye,
That loves to fold her arms and ſigh.
Let us with ſilent footſteps go
To charnels, and the houſe of wo;
To Gothic churches, vaults, and tombs,
Where each ſad night ſome virgin comes,
With throbbing breaſt and faded cheek,
Her promis'd bridegroom's urn to ſeek:
Or to ſome abbey's mould'ring tow'rs,
Where, to avoid cold wint'ry ſhow'rs,
The naked beggar ſhivering lies,
While whiſtling tempeſts round her riſe,
And trembles leſt the tott'ring wall
Should on her ſleeping infants fall.
  Now let us louder ſtrike the lyre,
For my heart glows with martial fire;
I feel, I feel, with ſudden heat,
My big tumultuous boſom beat;
The trumpet's clangors pierce my ear,
A thouſand widows ſhrieks I hear:
Give me another horſe, I cry;
Lo, the baſe Gallic ſquadrons fly!
Whence is this rage? – what ſpirit, ſay,
To battle hurries me away?
'Tis Fancy, in her fiery car,
Tranſports me to the thickeſt war;
There whirls me o'er the hills of ſlain,
Where tumult and deſtruction reign;
Where, mad with pain, the wounded ſteed,
Tramples the dying and the dead;
Where giant Terror ſtalks around,
With ſullen joy ſurveys the ground,
And, pointing to th' enſanguin'd field,
Shakes his dreadful gorgon ſhield!
O guide me from this horrid ſcene
To high-arch'd walks and alleys green,
Which lovely Laura ſeeks, to ſhun
The fervors of the mid-day ſun.
The pangs of abſence, O remove,
For thou can'ſt place me near my love;
Can'ſt fold in viſionary bliſs,
And let me think I ſteal a kiſs;
While her ruby lips diſpenſe
Luſcious nectar's quinteſſence!
When young-ey'd Spring profuſely throws
From her green lap the pink and roſe;
When the ſoft turtle of the dale
To Summer tells her tender tale;
When Autumn cooling caverns ſeeks,
And ſtains with wine his jolly cheeks;
When Winter, like poor pilgrim old,
Shakes his ſilver beard with cold;
At ev'ry ſeaſon let my ear
Thy ſolemn whiſpers, Fancy, hear.
O warm enthuſiaſtic maid!
Without thy powerful, vital aid,
That breathes an energy divine,
That gives a ſoul to ev'ry line,
Ne'er may I ſtrive with lips profane,
To utter an unhallow'd ſtrain;
Nor dare to touch the ſacred ſtring,
Save when with ſmiles thou bid'ſt me ſing.
O hear our pray'r, O hither come
From thy lamented Shakeſpeare's tomb,
On which thou lov'ſt to ſit at eve,
Muſing o'er thy darling's grave.
O queen of numbers, once again
Animate ſome choſen ſwain,
Who, fill'd with unexhauſted fire,
May boldly ſmite the ſounding lyre;
Who with ſome new, unequall'd ſong,
May riſe above the rhyming throng;
O'er all our liſt'ning paſſions reign,
O'erwhelm our ſouls with joy and pain;
With terror ſhake, with pity move,
Rouze with revenge, or melt with love.
O deign t'attend his evening walk,
With him in groves and grottoes talk;
Teach him to ſcorn, with frigid art,
Feebly to touch th' enraptur'd heart;
Like lightning, let his mighty verſe
The boſom's inmoſt foldings pierce;
With native beauties win applauſe,
Beyond cold critics ſtudied laws:
O let each muſe's fame increaſe!
O bid Britannia rival Greece!

The following ode, written by Mr Smart on the 5th of December (being the birth-day of a beautiful young lady), is much to be admired for the variety and harmony of the numbers, as well as for the beauty of the thoughts, and the elegance and delicacy of the compliment. It has great fire, and yet great ſweetneſs, and is the happy iſſue of genius and judgment united.

 Hail

Of Lyric Poetry.

Hail eldest of the monthly train,
  Sire of the winter drear,
December! in whose iron reign
  Expires the chequer'd year.
Hush all the blust'ring blasts that blow,
And proudly plum'd in silver snow,
  Smile gladly on this blest of days;
The livery'd clouds shall on thee wait,
And Phœbus shine in all his state
  With more than summer rays.
Though jocund June may justly boast
  Long days and happy hours;
Though August be Pomona's host,
  And May be crown'd with flow'rs:
Tell June his fire and crimson dies,
By Harriot's blush, and Harriot's eyes,
  Eclips'd and vanquish'd, fade away;
Tell August, thou canst let him see
A richer, riper fruit than he,
  A sweeter flow'r than May.

117 A pastoral and elegiac ode.

The ensuing ode, written by Mr Collins on the death of Mr Thomson, is of the pastoral and elegiac kind, and both picturesque and pathetic. To perceive all the beauties of this little piece, which are indeed many, we must suppose them to have been delivered on the river Thames near Richmond.

In yonder grave a Druid lies,
  Where slowly winds the stealing wave;
The year's best sweets shall duteous rise
  To deck its poet's silvan grave!
In yon deep bed of whisp'ring reeds
  His airy harp * shall now be laid,
That he, whose heart in sorrow bleeds,
  May love through life the soothing shade.
Then maids and youths shall linger here,
  And, while its sounds at distance swell,
Shall sadly seem in pity's ear
  To hear the woodland pilgrim's knell.
Remembrance oft shall haunt the shore,
  When Thames in summer wreaths is drest,
And oft suspend the dashing oar,
  To bid his gentle spirit rest!
And oft as ease and health retire
  To breezy lawn, or forest deep,
The friend shall view yon whitening spire †,
  And 'mid the varied landscape weep.
But thou, who own'st that earthy bed,
  Ah! what will ev'ry dirge avail?
Or tears, which love and pity shed,
  That mourn beneath the gliding sail?
Yet lives there one, whose heedless eye,
  Shall scorn thy pale shrine glimm'ring near?
With him, sweet bard, may fancy die,
  And joy desert the blooming year.
But thou, lorn stream, whose sullen tide
  No sedge-crown'd sisters now attend,
Now waft me from the green hill's side,
  Whose cold turf hides the buried friend.
And see, the fairy valleys fade,
  Dim night has veil'd the solemn view!
Yet once again, dear parted shade,
  Meek nature's child, again adieu!
The genial meads, assign'd to bless
  Thy life, shall mourn thy early doom;
Their hinds, and shepherd girls, shall dress,
  With simple hands, thy rural tomb.
Long, long, thy stone and pointed clay
  Shall melt the musing Briton's eyes;
O vales and wild woods, shall he say,
  In yonder grave your Druid lies!

* The harp of Æolus.

† Richmond church.

118 The hymn.

Under this species of the ode, notice ought to be taken of those written on divine subjects, and which are usually called *hymns*. Of these we have many in our language, but none perhaps that are so much admired as Mr Addison's. The beauties of the following hymn are too well known, and too obvious, to need any commendation; we shall only observe, therefore, that in this hymn (intended to display the power of the Almighty) he seems to have had a psalm of David in his view, which says, that "the heavens declare the glory of God, and the firmament sheweth his handywork."

  The spacious firmament on high,
With all the blue etherial sky,
And spangled heav'ns, a shining frame,
Their great original proclaim:
Th' unwearied sun, from day to day,
Does his Creator's pow'r display,
And publishes to ev'ry land
The work of an Almighty hand.
  Soon as the ev'ning shades prevail,
The moon takes up the wond'rous tale,
And nightly to the list'ning earth
Repeats the story of her birth:
While all the stars that round her burn,
And all the planets in their turn,
Confirm the tidings as they roll,
And spread the truth from pole to pole.
  What tho' in solemn silence all
Move round the dark terrestrial ball?
What tho' nor real voice or sound
Amid their radiant orb be found?
In reason's ear they all rejoice,
And utter forth a glorious voice,
For ever singing, as they shine,
"The hand that made us is divine."

The following pastoral hymn is a version of the 23d *Psalm* by Mr Addison; the peculiar beauties of which have occasioned many translations; but we have seen none that is so poetical and perfect as this. And in justice to Dr Boyce, we must observe, that the music he has adapted to it is so sweet and expressive, that we know not which is to be most admired, the poet or the musician.

The Lord my pasture shall prepare,
And feed me with a shepherd's care;
His presence shall my wants supply,
And guard me with a watchful eye;
My noon-day walks he shall attend,
And all my midnight hours defend.
When in the sultry glebe I faint,
Or on the thirsty mountain pant,
To fertile vales and dewy meads
My weary wand'ring steps he leads;
Where peaceful rivers soft and slow
Amid the verdant landscape flow.
Tho' in the paths of death I tread,
With gloomy horrors overspread,

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My ſteadfaſt heart ſhall fear no ill:
For thou, O Lord, art with me ſtill;
Thy friendly crook ſhall give me aid,
And guide me through the dreadful ſhade.
Tho' in a bare and rugged way,
Through devious lonely wilds I ſtray,
Thy bounty ſhall my pains beguile:
The barren wilderneſs ſhall ſmile,
With ſudden greens and herbage crown'd;
And ſtreams ſhall murmur all around.

129 The ſublime ode.

III. We are now to ſpeak of thoſe odes which are of the ſublime and noble kind, and diſtinguiſhed from others by their elevation of thought and diction, as well by the variety or irregularity of their numbers as the frequent tranſitions and bold excurſions with which they are enriched.

To give the young ſtudent an idea of the ſudden and frequent tranſitions, digreſſions, and excurſions, which are admitted into the odes of the ancients, we cannot do better than refer him to the celebrated ſong or ode of Moſes; which is the oldeſt that we know of, and was penned by that divine author immediately after the children of Iſrael croſſed the Red-Sea.

At the end of this ſong, we are told, that "Miriam the propheteſs, the ſiſter of Aaron, took a timbrel in her hand, and all the women went out after her with timbrels and with dances. And Miriam anſwered them, Sing ye to the Lord, for he hath triumphed glorioufly; the horſe and his rider hath he thrown into the ſea."

From this laſt paſſage it is plain, that the ancients very early called in muſic to the aid of poetry; and that their odes were uſually ſung, and accompanied with their lutes, harps, lyres, timbrels, and other inſtruments: nay, ſo eſſential, and in ſuch reputation, was muſic held by the ancients, that we often find in their lyric poets, addreſſes or invocations to the harp, the lute, or the lyre; and it was probably owing to the frequent uſe made of the laſt-mentioned inſtrument with the ode, that this ſpecies of writing obtained the name of *Lyric poetry*.

This ode, or hymn, which ſome believe was compoſed by Moſes in Hebrew verſe, is incomparably better than any thing the heathen poets have produced of the kind, and is by all good judges conſidered as a maſter-piece of ancient eloquence. The thoughts are noble and ſublime: the ſtyle is magnificent and expreſſive: the figures are bold and animated: the tranſitions and excurſions are ſudden and frequent: but they are ſhort, and the poet, having digreſſed for a moment, returns immediately to the great object that excited his wonder, and elevated his ſoul with joy and gratitude. The images fill the mind with their greatneſs, and ſtrike the imagination in a manner not to be expreſſed.

If there be any thing that in ſublimity approaches to it, we muſt look for it in the eaſt, where perhaps we ſhall find nothing ſuperior to the following Hindoo hymn to *Narrayna*, or "the ſpirit of God," taken, as Sir William Jones informs us, from the writings of the ancient Bramins.

Spirit of ſpirits, who, through every part
Of ſpace expanded, and of endleſs time,
Beyond the reach of lab'ring thought ſublime,
Badſt uproar into beauteous order ſtart;
Before heav'n was, thou art.
Ere ſpheres beneath us roll'd, or ſpheres above,
Ere earth in firmamental æther hung,
Thou ſat'ſt alone, till, through thy myſtic love,
Things unexiſting to exiſtence ſprung,
And grateful deſcant ſung.
Omniſcient Spirit, whoſe all-ruling pow'r
Bids from each ſenſe bright emanations beam;
Glows in the rainbow, ſparkles in the ſtream,
Smiles in the bud, and gliſten's in the flow'r
That crowns each vernal bow'r;
Sighs in the gale, and warbles in the throat
Of every bird that hails the bloomy ſpring,
Or tells his love in many a liquid note,
Whilſt envious artiſts touch the rival ſtring,
Till rocks and foreſts ring;
Breathes in rich fragrance from the Sandal grove,
Or where the precious muſk-deer playful rove;
In dulcet juice, from cluſt'ring fruit diſtils,
And burns ſalubrious in the taſteful clove:
Soft banks and verd'rous hills
Thy preſent influence fills;
In air, in floods, in caverns, woods, and plains,
Thy will inſpirits all, thy ſovereign Maya reigns.
Blue cryſtal vault, and elemental fires,
That in th' ethereal fluid blaze and breathe;
Thou, toſſing main, whoſe ſnaky branches wreathe
This penſile orb with intertwiſting gyres;
Mountains, whoſe lofty ſpires,
Preſumptuous, rear their ſummits to the ſkies,
And blend their em'rald hue with ſapphire light;
Smooth meads and lawns, that glow with varying dyes
Of dew-beſpangled leaves and bloſſoms bright,
Hence! vaniſh from my ſight
Deluſive pictures! unſubſtantial ſhows!
My ſoul abſorb'd one only Being knows,
Of all perceptions one abundant ſource,
Whence ev'ry object, ev'ry moment flows:
Suns hence derive their force,
Hence planets learn their courſe;
But ſuns and fading worlds I view no more;
God only I perceive; God only I adore (F).

130 The Pindaric ode.

We come now to the *Pindaric ode*, which (if we except the hymns in the Old Teſtament, the pſalms of king David, and ſuch hymns of the Hindoos as that juſt quoted) is the moſt exalted part of Lyric poetry; and was ſo called from *Pindar*, an ancient Greek poet, who is celebrated for the boldneſs of his flights, the impetuoſity of his ſtyle, and the ſeeming wildneſs and irregularity that runs through his compoſitions, and which are ſaid to be the effect of the greateſt art. See PINDAR.

The odes of Pindar were held in ſuch high eſtimation by the ancients, that it was fabled, in honour of their ſweetneſs, that the bees, while he was in the cradle, brought

(F) For the philoſophy of this ode, which repreſents the Deity as the ſoul of the world, or rather as the only Being (the τὸ ἓν of the Greeks), ſee METAPHYSICS, n° 269. and PHILOSOPHY, n° 6.

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brought honey to his lips: nor did the victors at the Olympic and other games think the crown a sufficient reward for their merit, unless their atchievements were celebrated in Pindar's songs; most wisely presaging, that the first would decay, but the other endure for ever.

This poet did not always write his odes in the same measure, or with the same intention with regard to their being sung. For the ode inscribed to Diagoras (the concluding stanza of which we inserted at the beginning of this section) is in heroic measure, and all the stanzas are equal: there are others also, as Mr West observes, made up of *strophes* and *antistrophes*, without any *epode;* and some composed of *strophes* only, of different lengths and measures: but the greatest part of his odes are divided into *strophe*, *antistrophe*, and *epode;* in order, as Mr Congreve conjectures, to their being sung, and addressed by the performers to different parts of the audience. "They were sung (says he) by a chorus, and adapted to the lyre, and sometimes to the lyre and pipe. They consisted oftenest of three stanzas. The first was called the *strophe*, from the version or circular motion of the singers in that stanza from the right hand to the left. The second stanza was called the *antistrophe*, from the contraversion of the chorus; the singers in performing that, turning from the left hand to the right, contrary always to their motion in the *strophe*. The third stanza was called the *epode* (it may be as being the after-song), which they sung in the middle, neither turning to one hand nor the other. But Dr West's* friend is of opinion, that the performers also danced one way while they were singing the *strophe*, and danced back as they sung the *antistrophe*, till they came to the same place again, and then standing still they sung the *epode*. He has translated a passage from the *Scholia* on *Hephæstion*, in proof of his opinion; and observes, that the dancing the *strophe* and *antistrophe* in the same space of ground, and we may suppose the same space of time also, shows why those two parts consisted of the same length and measure.

*Vid. *Pref. to West's Pindar.*

As the various measures of Pindar's odes have been the means of so far misleading some of our modern poets, as to induce them to call compositions Pindaric odes, that were not written in the method of Pindar, it is necessary to be a little more particular on this head, and to give an example from that poet, the more effectually to explain his manner; which we shall take from the translation of Dr West.

The eleventh Nemean Ode.

This ode is inscribed to Aristagoras, upon occasion of his entering on his office of president or governor of the island of Tenedos: so that, although it is placed among the Nemean odes, it has no sort of relation to those games, and is indeed properly an inauguration ode, composed to be sung by a chorus at the sacrifices and the feasts made by Aristagoras and his colleagues, in the town-hall, at the time of their being invested with the magistracy, as is evident from many expressions in the first *strophe* and *antistrophe*.

Argument.

Pindar opens this ode with an invocation to Vesta (the goddess who presided over the courts of justice, and whose statue and altar were for that reason placed in the town halls, or *Prytaneums*, as the Greeks called them), beseeching her to receive favourably Aristagoras and his colleagues, who were then coming to offer sacrifices to her, upon their entering on their office of Prytans or magistrates of Tenedos; which office continuing for a year, he begs the goddess to take Aristagoras under her protection during that time, and to conduct him to the end of it without trouble or disgrace. From Aristagoras, Pindar turns himself in the next place to his father Arcesilas, whom he pronounces happy, as well upon account of his son's merit and honour, as upon his own great endowments and good fortune; such as beauty, strength, courage, riches, and glory, resulting from his many victories in the games. But lest he should be too much puffed up with these praises, he reminds him at the same time of his mortality, and tells him that his clothing of flesh is perishable, that he must e'er long be clothed with earth, the *end of all things:* and yet, continues he, it is but justice to praise and celebrate the worthy and deserving, who from good citizens ought to receive all kinds of honour and commendation; as Aristagoras, for instance, who hath rendered both himself and his country illustrious by the many victories he hath obtained, to the number of sixteen, over the neighbouring youth, in the games exhibited in and about his own country. From whence, says the poet, I conclude he would have come off victorious even in the Pythian and Olympic games, had he not been restrained from engaging in those famous lists by the too timid and cautious love of his parents. Upon which he falls into a moral reflection upon the vanity of man's hopes and fears; by the former of which they are oftentimes excited to attempts beyond their strength, which accordingly issue in their disgrace; as, on the other hand, they are frequently restrained, by unreasonable and ill-grounded fears, from enterprises, in which they would in all probability have come off with honour. This reflection he applies to Aristagoras, by saying it was very easy to foresee what success he was like to meet with, who both by father and mother was descended from a long train of great and valiant men. But here again, with a very artful turn of flattery to his father Arcesilas, whom he had before represented as strong and valiant, and famous for his victories in the games, he observes that every generation, even of a great and glorious family, is not equally illustrious any more than the fields and trees are every year equally fruitful; that the gods had not given mortals any certain tokens by which they might foreknow when the *rich years of virtue should succeed:* whence it comes to pass, that men, out of self-conceit and presumption, are perpetually laying schemes, and forming enterprises, without previously consulting prudence or wisdom, whose *streams*, says he, lie remote and out of the common road. From all which he infers, that it is better to moderate our desires, and set bounds to our avarice and ambition; with which moral precept he concludes the ode.

Strophe I.

Daughter of Rhea! thou, whose holy fire
Before the awful seat of justice flames!
Sister of heav'n's almighty sire!
Sister of Juno, who coequal claims
With Jove to share the empire of the gods!
O virgin Vesta! to thy dread abodes,

Lo!

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Lo! Ariftagoras directs his pace!
Receive and near thy facred fceptre place
Him, and his colleagues, who, with honeft zeal,
O'er Tenedos prefide, and guard the public weal.

ANTISTROPHE I.

And lo! with frequent off'rings, they adore
Thee*, firft invok'd in ev'ry folemn pray'r!
To thee unmix'd libations pour,
And fill with od'rous fumes the fragrant air.
Around in feftive fongs the hymning choir
Mix the melodious voice and founding lyre,
While ftill, prolong'd with hofpitable love,
Are folemniz'd the rites of genial Jove:
Then guard him, Vefta, through his long career,
And let him clofe in joy his minifterial year.

* It was ufual in all folemn facrifices and prayers to begin with invoking Vefta.

EPODE I.

But hail, Arcefilas! all hail
To thee, blefs'd father of a fon fo great!
Thou whom on fortune's higheft fcale
The favourable hand of heav'n hath fet,
Thy manly form with beauty hath refin'd,
And match'd that beauty with a valiant mind.
Yet let not man too much prefume,
Tho' grac'd with beauty's faireft bloom;
Tho' for fuperior ftrength renown'd;
Tho' with triumphal chaplets crown'd:
Let him remember, that, in flefh array'd,
Soon fhall he fee that mortal veftment fade;
Till loft, imprifon'd in the mould'ring urn,
To earth, the end of all things, he return.

STROPHE II.

Yet fhould the worthy from the public tongue
Receive their recompenfe of virtuous praife;
By ev'ry zealous patriot fung,
And deck'd with ev'ry flow'r of heav'nly lays.
Such retribution in return for fame,
Such, Ariftagoras, thy virtues claim,
Claim from thy country; on whofe glorious brows
The wreftler's chaplet ftill unfaded blows;
Mix'd with the great Pancratiaftic crown,
Which from the neighb'ring youth thy early valour won.

ANTISTROPHE II.

And (but his timid parents' cautious love,
Difturbing ever his too forward hand,
Forbad their tender fon to prove
The toils of Pythia or Olympia's fands),
Now by the Gods I fwear, his valorous might
Had 'fcap'd victorious in each bloody fight;
And from Caftalia†, or where dark with fhade
The mount of Saturn ‡ rears its olive head,
Great and illuftrious home had he return'd;
While, by his fame eclips'd, his vanquifh'd foes had [mourn'd.

† A river, upon whofe banks the Pythian games were exhibited.

‡ A fmall hill planted with olives, that over-looked the Stadium at Olympia.

EPODE II.

Then his triumphal treffes bound
With the dark verdure of th' Olympic grove,
With joyous banquets had he crown'd
The great quinquennial feftival of Jove;
And cheer'd the folemn pomp with choral lays,
Sweet tribute, which the mufe to virtue pays.

But, fuch is man's prepoft'rous fate!
Now, with o'er-weening pride elate,
Too far he aims his fhaft to throw,
And ftraining burfts his feeble bow:
Now pufillanimous deprefs'd with fear,
He checks his virtue in the mid career;
And of his ftrength diftruftful, coward flies
The conteft, tho' empow'rd to gain the prize.

STROPHE III.

But who could err in prophefying good
Of him, whofe undegenerating breaft
Swells with a tide of Spartan blood,
From fire to fire in long fucceffion trac'd
Up to Pifander; who in days of yore
From old Amyclæ to the Lefbian fhore
And Tenedos, colleagu'd in high command
With great Oreftes, led th' Æolian band?
Nor was his mother's race lefs ftrong and brave,
Sprung from a ftock that grew on fair* Ifmenus' wave.

* Ifmenus was a river of Bœotia, of which country was Menalippus, the anceftor of Ariftagoras by the mother's fide.

ANTISTROPHE III.

Tho' for long intervals obfcur'd, again
Oft-times the feeds of lineal worth appear.
For neither can the furrow'd plain
Full harvefts yield with each returning year;
Nor in each period will the pregnant bloom
Inveft the fmiling tree with rich perfume.
So, barren often, and inglorious, pafs
The generations of a noble race;
While nature's vigour, working at the root,
In after-ages fwells, and bloffoms into fruit.

EPODE III.

Nor hath Jove giv'n us to foreknow
When the rich years of virtue fhall fucceed:
Yet bold and daring on we go,
Contriving fchemes of many a mighty deed;
While hope, fond inmate of the human mind,
And felf-opinion, active, rafh, and blind,
Hold up a falfe illufive ray,
That leads our dazzled feet aftray
Far from the fprings, where, calm and flow,
The fecret ftreams of wifdom flow.
Hence fhould we learn our ardour to reftrain,
And limit to due bounds the thirft of gain.
To rage and madnefs oft that paffion turns,
Which with forbidden flames defpairing burns.

131 Diftinguifhing characters of it.

From the above fpecimen, and from what we have already faid on this fubject, the reader will perceive, that odes of this fort are diftinguifhed by the happy tranfitions and digreffions which they admit, and the furprifing yet natural returns to the fubject. This requires great judgment and genius; and the poet who would excel in this kind of writing, fhould draw the plan of his poem, in manner of the argument we have above inferted, and mark out the places where thofe elegant and beautiful fallies and wanderings may be made, and where the returns will be eafy and proper.

Pindar, it is univerfally allowed, had a poetical and fertile imagination, a warm and enthufiaftic genius, a bold and figurative expreffion, and a concife and fententious ftyle: but it is generally fuppofed that many of thofe pieces which procured him fuch extravagant praifes

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praises and extraordinary testimonies of esteem from the ancients are lost; and if they were not, it would be perhaps impossible to convey them into our language; for beauties of this kind, like plants of an odoriferous and delicate nature, are not to be transplanted into another clime without losing much of their fragrance or essential quality.

132 Modern odes commonly called Pindaric.

With regard to those compositions which are usually called *Pindaric odes*, (but which ought rather to be distinguished by the name of *irregular odes*), we have many in our language that deserve particular commendation: and the criticism Mr Congreve has given us on that subject, has too much asperity and too great latitude; for if other writers have, by mistaking Pindar's measures, given their odes an improper title, it is a crime, one would think, not so dangerous to the commonwealth of letters as to deserve such severe reproof. Beside which, we may suppose that some of these writers did not deviate from Pindar's method through ignorance, but by choice; and that as their odes were not to be performed with both singing and dancing, in the manner of Pindar's, it seemed unnecessary to confine the first and second stanzas to the same exact numbers as was done in his strophes and antistrophes. The poet therefore had a right to indulge himself with more liberty: and we cannot help thinking, that the ode which Mr Dryden has given us, intitled, *Alexander's Feast*, or *the Power of Music*, is altogether as valuable in loose and wild numbers, as it could have been if the stanzas were more regular, and written in the manner of Pindar. In this ode there is a wonderful sublimity of thought, a loftiness and sweetness of expression, and a most pleasing variety of numbers.

'Twas at the royal feast, for Persia won
By Philip's warlike son,
Aloft, in awful state,
The god-like hero sate
On his imperial throne:
His valiant peers were plac'd around:
Their brows with roses and with myrtles bound,
(So should desert in arms be crown'd:)
The lovely Thais by his side
Sat like a blooming eastern bride,
In flow'r of youth and beauty's pride.
Happy, happy, happy pair!
None but the brave,
None but the brave,
None but the brave deserve the fair.
Chor. *Happy, happy*, &c.

Timotheus, plac'd on high
Amid the tuneful quire,
With flying fingers touch'd the lyre:
The trembling notes ascend the sky,
And heav'nly joys inspire.
The song began from Jove,
Who left his blissful seats above,
(Such is the pow'r of mighty love!)
A dragon's fiery form bely'd the God:
Sublime on radiant spires he rode,
When he to fair Olympia press'd;
And while he sought her snowy breast:
Then round her slender waist he curl'd,
And stamp'd an image of himself, a sov'reign of the world.
The list'ning crowd admire the lofty sound.
A present deity, they shout around;
A present deity, the vaulted roofs rebound:
With ravish'd ears
The monarch hears,
Assumes the God,
Affects to nod,
And seems to shake the spheres.
Chor. *With ravish'd ears*, &c.

The praise of Bacchus then the sweet musician sung;
Of Bacchus ever fair and ever young:
The jolly God in triumph comes;
Sound the trumpets, beat the drums:
Flush'd with a purple grace,
He shows his honest face:
Now give the hautboys breath; he comes, he comes!
Bacchus, ever fair and young,
Drinking joys did first ordain:
Bacchus' blessings are a treasure,
Drinking is the soldier's pleasure:
Rich the treasure,
Sweet the pleasure:
Sweet the pleasure after pain.
Chor. *Bacchus' blessings*, &c.

Sooth'd with the sound, the king grew vain,
Fought all his battles o'er again;
And thrice he routed all his foes, and thrice he slew the slain.
The master saw the madness rise;
His glowing cheeks, his ardent eyes;
And while he heav'n and earth defy'd,
Chang'd his hand, and check'd his pride.
He chose a mournful muse
Soft pity to infuse:
He sung Darius great and good,
By too severe a fate,
Fallen, fallen, fallen, fallen,
Fallen from his high estate,
And welt'ring in his blood;
Deserted at his utmost need,
By those his former bounty fed,
On the bare earth expos'd he lies,
With not a friend to close his eyes.
With down-cast looks the joyless victor sat,
Revolving in his alter'd soul
The various turns of chance below;
And now and then a sigh he stole,
And tears began to flow.
Cho. *Revolving*, &c.

The mighty master smil'd to see
That love was in the next degree:
'Twas but a kindred sound to move;
For pity melts the mind to love,
Softly sweet, in Lydian measures:
Soon he sooth'd his soul to pleasures.
War, he sung, is toil and trouble;
Honour but an empty bubble,
Never ending, still beginning,
Fighting still, and still destroying.
If the world be worth thy winning,
Think, O think, it worth enjoying.
Lovely Thais sits beside thee,
Take the good the gods provide thee.
The many rend the skies with loud applause;
So love was crown'd, but music won the cause.
The prince, unable to conceal his pain,
Gaz'd

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Gaz'd on the fair,
Who caus'd his care,
And sigh'd and look'd, sigh'd and look'd,
Sigh'd and look'd, and sigh'd again:
At length with love and wine at once oppress'd,
The vanquish'd victor sunk upon her breast.
Chor. *The prince*, &c.
Now strike the golden lyre again;
A louder yet, and yet a louder strain.
Break his bands of sleep asunder,
And rouse him, like a rattling peal of thunder.
Hark! hark! the horrid sound
Has rais'd up his head,
As awake from the dead,
And amaz'd he stares round.
Revenge, revenge, Timotheus cries,
See the furies arise:
See the snakes that they rear,
How they hiss in their hair,
And the sparkles that flash from their eyes;
Behold a ghastly band,
Each a torch in his hand!
Those are Grecian ghosts that in battle were slain,
And unbury'd remain,
Inglorious on the plain.
Give the vengeance due
To the valiant crew.
Behold how they toss their torches on high,
How they point to the Persian abodes,
And glitt'ring temples of their hostile gods.
The princes applaud with a furious joy;
And the king seiz'd a flambeau, with zeal to destroy;
Thais led the way
To light him to his prey,
And, like another Helen, she fir'd another Troy.
Chor. *And the king seiz'd*, &c.
Thus long ago,
While organs yet were mute;
Timotheus, to his breathing flute,
And sounding lyre,
Could swell the soul to rage, or kindle soft desire.
At last divine Cecilia came,
Inventress of the vocal frame;
The sweet enthusiast, from her sacred store,
Enlarg'd the former narrow bounds,
And added length to solemn sounds,
With nature's mother-wit, and arts unknown before.
Let old Timotheus yield the prize
Or both divide the crown;
He rais'd a mortal to the skies;
She drew an angel down.
Grand chor. *At last*, &c.

There is another poem by Dryden, on the death of Mrs Anne Killegrew, a young lady eminent for her skill in poetry and painting, which a great critic * has pronounced to be "undoubtedly the noblest ode that our language has ever produced." He owns, that as a whole it may perhaps be inferior to *Alexander's Feast*; but he affirms that the first stanza of it is superior to any single part of the other. This famous stanza, he says, flows with a torrent of enthusiasm: *Fervet immensusque ruit.* How far this criticism is just, the public must determine.

* *Dr Johnson.*

I.

Thou youngest virgin-daughter of the skies,
Made in the last promotion of the bless'd;
Whose palms, new-pluck'd from Paradise,
In spreading branches more sublimely rise,
Rich with immortal green above the rest;
Whether, adopted to some neighb'ring star,
Thou roll'st above us, in thy wand'ring race,
Or in procession fix'd and regular,
Mov'd with the heav'n's majestic pace;
Or, call'd to more superior bliss,
Thou tread'st with seraphims the vast abyss:
Whatever happy region is thy place,
Cease thy celestial song a little space;
Thou wilt have time enough for hymns divine,
Since heaven's eternal year is thine.
Hear then a mortal muse thy praise rehearse
In no ignoble verse;
But such as thy own voice did practise here,
When thy first fruits of poesy were giv'n
To make thyself a welcome inmate there;
While yet a young probationer,
And candidate of heav'n.

II.

If by traduction came thy mind,
Our wonder is the less to find
A soul so charming from a stock so good;
Thy father was transfus'd into thy blood,
So wert thou born into a tuneful strain,
An early, rich, and inexhausted vein.
But if thy pre-existing soul
Was form'd at first with myriads more,
It did through all the mighty poets roll,
Who Greek or Latin laurels wore,
And was that Sappho last which once it was before.
If so, then cease thy flight, O heaven-born mind!
Thou hast no dross to purge from thy rich ore,
Nor can thy soul a fairer mansion find,
Than was the beauteous frame she left behind:
Return to fill or mend the choir of thy celestial kind.

III.

May we presume to say, that, at thy birth,
New joy was sprung in heav'n, as well as here on earth?
For sure the milder planets did combine
On thy auspicious horoscope to shine,
An e'en the most malicious were in trine.
Thy brother-angels at thy birth
Strung each his lyre, and tun'd it high,
That all the people of the sky
Might know a poetess was born on earth.
And then, if ever, mortal ears
Had heard the music of the spheres.
And if no clust'ring swarm of bees
On thy sweet mouth distill'd their golden dew,
'Twas that such vulgar miracles
Heav'n had not leisure to renew:
For all thy bless'd fraternity of love
Solemniz'd there thy birth, and kept thy holy day above.

IV.

O gracious God! how far have we
Profan'd thy heav'nly gift of poesy?
Made prostitute and profligate the Muse,
Debas'd to each obscene and impious use,

Whose

Of Lyric Poetry.

Whose harmony was first ordain'd above
For tongues of angels, and for hymns of love?
O wretched we! why were we hurry'd down
This lubrique and adult'rate age,
(Nay added fat pollutions of our own)
T'increase the streaming ordures of the stage!
What can we say t'excuse our second fall?
Let this thy vestal, Heav'n, atone for all:
Her Arethusian stream remains unsoil'd,
Unmix'd with foreign filth, and undefil'd;
Her wit was more than man, her innocence a child.

V.

Art she had none, yet wanted none;
For nature did that want supply:
So rich in treasures of her own,
She might our boasted stores defy:
Such noble vigour did her verse adorn,
That it seem'd borrow'd where 'twas only born.
Her morals, too, were in her bosom bred,
By great examples daily fed,
What in the best of books, her father's life she read.
And to be read herself, she need not fear;
Each test, and every light, her Muse will bear,
Tho' Epictetus with his lamp were there.
E'en love (for love sometimes her Muse express'd)
Was but a lambent flame which play'd about her breast,
Light as the vapours of a morning dream,
So cold herself, while she such warmth express'd,
'Twas Cupid bathing in Diana's stream.

VI.

Born to the spacious empire of the Nine,
One would have thought she should have been content
To manage well that mighty government;
But what can young ambitious souls confine?
To the next realm she stretch'd her sway,
For *Painture* near adjoining lay,
A plenteous province and alluring prey.
A *Chamber of Dependencies* was fram'd,
(As conquerors will never want pretence,
When arm'd, to justify th'offence)
And the whole fief, in right of poetry, she claim'd.
The country open lay without defence:
For poets frequent inroads there had made,
And perfectly could represent
The shape, the face, with ev'ry lineament,
And all the large domains which the *dumb sister* sway'd.
All bow'd beneath her government,
Receiv'd in triumph wheresoe'er she went.
Her pencil drew whate'er her soul design'd,
And oft the happy draught surpass'd the image in her mind.
The sylvan scenes of herds and flocks,
And fruitful plains and barren rocks,
Of shallow brooks that flow'd so clear,
The bottom did the top appear;
Of deeper too, and ampler floods,
Which, as in mirrors, show'd the woods:
Of lofty trees, with sacred shades,
And perspectives of pleasant glades,
Where nymphs of brightest form appear,
And shaggy satyrs standing near,
Which them at once admire and fear.
The ruins too of some majestic piece,
Boasting the power of ancient Rome or Greece,
Whose statues, freezes, columns, broken lie,
And, though defac'd, the wonder of the eye;
What nature, art, bold fiction, e'er durst frame,
Her forming hand gave feature to the name.
So strange a concourse ne'er was seen before,
But when the peopl'd ark the whole creation bore.

VII.

The scene then chang'd, with bold erected look
Our martial king the sight with rev'rence struck:
For not content t'express his outward part
Her hand call'd out the image of his heart:
His warlike mind, his soul devoid of fear,
His high-designing thoughts were figur'd there,
As when, by magic, ghosts are made appear.
Our phoenix queen was pourtray'd too so bright,
Beauty alone could beauty take so right:
Her dress, her shape, her matchless grace,
Were all observ'd, as well as heav'nly face.
With such a peerless majesty she stands,
As in that day she took the crown from sacred hands;
Before a train of heroines was seen,
In beauty foremost, as in rank, the queen.
Thus nothing to her genius was denied,
But like a ball of fire the further thrown,
Still with a greater blaze she shone,
And her bright soul broke out on ev'ry side.
What next she had design'd, Heav'n only knows:
To such immod'rate growth her conquest rose,
That fate alone its progress could oppose.

VIII.

Now all those charms, that blooming grace,
The well proportion'd shape, and beauteous face,
Shall never more be seen by mortal eyes;
In earth the much lamented virgin lies.
Nor wit nor piety could fate prevent;
Nor was the cruel *Destiny* content
To finish all the murder at a blow,
To sweep at once her life and beauty too;
But, like a harden'd felon, took a pride
To work more mischievously slow,
And plunder'd first, and then destroy'd.
O double sacrilege on things divine,
To rob the relick, and deface the shrine!
But thus Orinda died:
Heav'n, by the same disease, did both translate;
As equal were their souls, so equal was their fate

IX.

Meantime her warlike brother on the seas
His waving streamers to the winds displays,
And vows for his return, with vain devotion, pays.
Ah generous youth! that wish forbear,
The winds too soon will waft thee here!
Slack all thy sails, and fear to come,
Alas, thou know'st not, thou art wreck'd at home!
No more shalt thou behold thy sister's face,
Thou hast already had her last embrace.
But look aloft, and if thou kenn'st from far,
Among the Pleiads a new-kindled star,
If any sparkles than the rest more bright,
'Tis she that shines in that propitious light.

X.

When in mid-air the golden trump shall sound,
To raise the nations under ground;
When in the valley of Jehoshaphat,
The judging God shall close the book of fate;
And there the last *assizes* keep
For those who wake and those who sleep:

When

When rattling bones together fly
  From the four corners of the sky;
When sinews o'er the skeletons are spread,
Those cloth'd with flesh, and life inspires the dead;
The sacred poets first shall hear the sound,
  And foremost from the tomb shall bound,
For they are cover'd with the lightest ground;
And straight with in-born vigour, on the wing,
Like mounting larks to the new morning sing.
There thou, sweet saint, before the quire shalt go
As harbinger of heav'n, the way to show,
The way which thou so well hast learnt below.

That this is a fine ode, and not unworthy of the genius of Dryden, must be acknowledged; but that it is the noblest which the English language has produced, or that any part of it runs with the torrent of enthusiasm which characterizes *Alexander's Feast*, are positions which we feel not ourselves inclined to admit. Had the critic by whom it is so highly praised, inspected it with the eye which scanned the odes of Gray, we cannot help thinking that he would have perceived some parts of it to be tediously minute in description, and others not very perspicuous at the first perusal. It may perhaps, upon the whole, rank as high as the following ode by Collins on the Popular Superstitions of the Highlands of Scotland; but to a higher place it has surely no claim.

I.

Home, thou return'st from Thames, whose Naiads long
  Have seen thee ling'ring with a fond delay,
  Mid those soft friends, whose hearts some future day,
Shall melt, perhaps, to hear thy tragic song,
Go, not unmindful of that cordial youth (G)
  Whom, long endear'd, thou leav'st by Lavant's side;
Together let us wish him lasting truth,
  And joy untainted with his destin'd bride.
Go! nor regardless, while these numbers boast
  My short-liv'd bliss, forget my social name;
But think, far off, how, on the southern coast,
  I met thy friendship with an equal flame!
* whose. Fresh to that soil thou turn'st, *where* * ev'ry vale
  Shall prompt the poet, and his song demand:
To thee thy copious subjects ne'er shall fail;
  Thou need'st but take thy pencil to thy hand,
And paint what all believe who own thy genial land.

II.

There must thou wake perforce thy Doric quill;
  'Tis fancy's land to which thou sett'st thy feet;
  Where still, 'tis said, the Fairy people meet,
Beneath each birken shade, on mead or hill.
There, each trim lass, that skims the milky store,
  To the swart tribes their creamy bowl allots;
By night they sip it round the cottage-door,
  While airy minstrels warble jocund notes.
There, ev'ry herd, by sad experience, knows,
  How, wing'd with Fate, their elf-shot arrows fly,
When the sick ewe her summer food foregoes,
  Or, stretch'd on earth, the heart-smit heifers lie.
Such airy beings awe th' untutor'd swain:
  Nor thou, tho' learn'd, his homelier thoughts neglect:
Let thy sweet Muse the rural faith sustain;
  These are the themes of simple, sure effect,
That add new conquests to her boundless reign,
  And fill, with double force, her heart-commanding [strain.

III.

Ev'n yet preserv'd, how often may'st thou hear,
  Where to the pole the Boreal mountains run,
  Taught by the father to his list'ning son,
Strange lays, whose pow'r had charm'd a Spenser's ear.
At ev'ry pause, before thy mind possest,
  Old Runic bards shall seem to rise around,
With uncouth lyres in many-colour'd vest,
  Their matted hair with boughs fantastic crown'd:
Whether thou bid'st the well-taught hind repeat
  The choral dirge that mourns some chieftain brave,
When ev'ry shrieking maid her bosom beat,
  And strew'd with choicest herbs his scented grave;
Or whether sitting in the shepherd's shiel (H),
  Thou hear'st some sounding tale of war's alarms, ‡ bony.
When, at the bugle's call, with fire and steel,
  The sturdy clans pour'd forth their *brawny* ‡ swarms,
And hostile brothers met to prove each other's arms.

IV. § sits.

'Tis thine to sing how framing hideous spells,
  In Sky's lone isle the gifted wizzard-*seer* §,
  Lodg'd in the wintry cave with Fate's fell spear (I),
Or in the depth of Uist's dark forest dwells:
  How they whose sight such dreary dreams engross,
With their own visions oft astonish'd droop, ‡ embodied.
  When, o'er the wat'ry strath, or quaggy moss,
They see the gliding ghosts *unbodied* ‡ troop. † piercing.
  Or, if in sports, or on the festive green,
Their *destin'd* † glance some fated youth descry,
  Who now, perhaps, in lusty vigour seen,
And rosy health, shall soon lamented die.
  For them the viewless forms of air obey;
Their bidding heed, and at their beck repair.
  They know what spirit brews the stormful day,
And heartless, oft like moody madness, stare
To see the phantom train their secret work prepare.

V.

To monarchs dear (K), some hundred miles astray,
  Oft have they seen Fate give the fatal blow!
  The seer in Sky shriek'd as the blood did flow
When headless Charles warm on the scaffold lay!

 As

(G) A gentleman of the name of *Barrow*, who introduced Home to Collins.

(H) A summer hut, built in the high part of the mountains, to tend their flocks in the warm season, when the pasture is fine.

(I) Waiting in wintery cave his wayward fits.

(K) Of this beautiful ode two copies have been printed: one by Dr Carlyle, from a manuscript which he acknowledges to be mutilated; another by an editor who seems to hope that a nameless somebody will be believed, when he declares, that "he discovered a *perfect copy* of this admirable ode among some old papers in the concealed drawers of a bureau left him by a relation." The present age has been already too much amused with pretended discoveries of poems in the bottoms of *old chests*, to pay full credit to an assertion of this kind, even though the

Of Lyric Poetry.

As Boreas threw his young Aurora (L) forth,
In the first year of the first George's reign,
And battles rag'd in welkin of the North,
They mourn'd in air, fell, fell rebellion, slain!
And as of late they joy'd in Preston's fight,
Saw at sad Falkirk all their hopes near crown'd!
They rav'd divining through their second-sight (M),
Pale, red Culloden, where these hopes were drown'd!
Illustrious William (N)! Britain's guardian name!
One William sav'd us from a tyrant's stroke;
He, for a sceptre, gain'd heroic fame,
But thou, more glorious, Slavery's chain hast broke,
To reign a private man, and bow to Freedom's yoke!

VI.

These, too, thou'lt sing! for well thy magic muse
Can to the topmost heav'n of grandeur soar!
Or stoop to wail the swain that is no more!
Ah, homely swains! your homeward steps ne'er loose;
Let not dank *Will* (O) mislead you to the heath:
Dancing in mirky night, o'er fen and lake,
He glows, to draw you downward to your death,
In his bewitch'd, low, marshy, willow brake!
What though far off, from some dark dell espied,
His glimm'ring mazes cheer th' excursive sight,
Yet turn, ye wand'rers, turn your steps aside,
Nor trust the guidance of that faithless light;
For watchful, lurking, 'mid th' unrustling reed,
At those mirk hours the wily monster lies,
And listens oft to hear the passing steed,
And frequent round him rolls his sullen eyes,
If chance his savage wrath may some weak wretch surprise.

VII.

Ah, luckless swain, o'er all unblest, indeed!
Whom late bewilder'd in the dank, dark fen,
Far from his flocks, and smoking hamlet, then!
To that sad spot * *where hums the sedgy weed*.

* his wayward fate shall lead.

On him, enrag'd, the fiend, in angry mood,
Shall never look with pity's kind concern,
But instant, furious, raise the whelming flood
O'er its drown'd banks, forbidding all return!
Or, if he meditate his wish'd escape,
To some dim hill that seems uprising near,
To his faint eye, the grim and grisly shape,
In all its terrors clad, shall wild appear.
Meantime the wat'ry surge shall round him rise,
Pour'd sudden forth from ev'ry swelling source!
What now remains but tears and hopeless sighs?
His fear-shook limbs have lost their youthly force,
And down the waves he floats, a pale and breathless corse!

VIII.

For him in vain his anxious wife shall wait,
Or wander forth to meet him on his way;
For him in vain, at to-fall of the day,
His babes shall linger at th' unclosing gate!
Ah, ne'er shall he return! Alone, if night,
Her travell'd limbs in broken slumbers steep!
With drooping willows drest, his mournful sprite
Shall visit sad, perchance, her silent sleep:
Then he, perhaps, with moist and wat'ry hand,
Shall fondly seem to press her shudd'ring cheek,
And with his blue-swoln face before her stand,
And, shiv'ring cold, these piteous accents speak:
"Pursue, dear wife, thy daily toils pursue,
"At dawn or dusk, industrious as before;
"Nor e'er of me one * *helpless* thought renew,
"While I lie welt'ring on the ozier'd shore,
"Drown'd by the kelpie's † wrath, nor e'er shall aid thee more!"

* hapless.
† the water fiend.

IX.

Unbounded is thy range; with varied *skill* *
Thy muse may, like those feath'ry tribes which spring
From their rude rocks, extend her skirting wing
Round the moist marge of each cold Hebrid isle,
To

* style.

the scene of discovery be laid in a *bureau*. As the ode of the anonymous editor differs, however, very little from that of Dr Carlyle, and as what is affirmed by a GENTLEMAN *may* be true, though "he chooses not at present to publish his name," we have inserted into our work the copy which pretends to be perfect, noting at the bottom or margin of the page the different readings of Dr Carlyle's edition. In the Doctor's manuscript, which appeared to have been nothing more than the *prima cura*, or first sketch of the poem, the fifth stanza and half of the sixth were wanting; and to give a continued context, he prevailed with Mr M'Kenzie, the ingenious author of the *Man of Feeling*, to fill up the chasm. This he did by the following beautiful lines, which we cannot help thinking much more happy than those which occupy their place in the copy said to be perfect:

"Or on some bellying rock that shades the deep,
They view the lurid signs that cross the sky,
Where in the west the brooding tempests lie;
And hear their first, faint, rustling pennons sweep.
Or in the arched cave, where deep and dark
The broad unbroken billows heave and swell,
In horrid musings wrapt, they sit to mark
The lab'ring moon; or list the nightly yell
Of that dread spirit, whose gigantic form
The seer's entranced eye can well survey,
Through the dim air who guides the driving storm,
And points the wretched bark its destin'd prey.
Or him who hovers on his flagging wing,
O'er the dire whirlpool, that in ocean's waste,
Draws instant down whate'er devoted thing
The falling breeze within its reach hath plac'd ——
The distant seaman hears, and flies with trembling haste.

Or if on land the fiend exerts his sway,
Silent he broods o'er quicksand, bog, or fen,
Far from the shelt'ring roof and haunts of men,
When witched darkness shuts the eye of day,
And shrouds each star that wont to cheer the night;
Or if the drifted snow perplex the way,
With treach'rous gleam he lures the fated wight
And leads him flound'ring on and quite astray."

(L) By young Aurora, Collins undoubtedly meant the first appearance of the northern lights, which is commonly said to have happened about the year 1715.

(M) Second-sight is the term that is used for the divination of the Highlanders.

(N) The late duke of Cumberland, who defeated the Pretender at the battle of Culloden.

(O) A fiery meteor, called by various names, such as *Will with the Wisp*, *Jack with the Lanthorn*, &c. It hovers in the air over marshy and fenny places.

Of Lyric Poetry.

To that hoar pile (P) which still its ruin shows:
In whose small vaults a pigmy-folk is found,
Whose bones the delver with his spade upthrows,
And culls them, wond'ring, from the hallow'd ground!
Or thither (Q), where beneath the show'ry west,
The mighty kings of three fair realms are laid:
Once foes, perhaps, together now they rest,
No slaves revere them, and no wars invade:
Yet frequent now, at midnight solemn hour,
The rifted mounds their yawning cells unfold,
And forth the monarchs stalk with sov'reign pow'r
In pageant robes; and, wreath'd with sheeny gold,
And on their twilight tombs aerial council hold.

X.

But, oh! o'er all, forget not Kilda's race,
On whose bleak rocks, which brave the wasting tides,
Fair Nature's daughter, Virtue, yet abides.
Go! just, as they, their blameless manners trace!
Then to my ear transmit some gentle song,
Of those whose lives are yet sincere and plain,
Their bounded walks the rugged cliffs along,
And all their prospect but the wint'ry main.
With sparing temp'rance at the needful time,
They drain the scented spring; or, hunger-prest,
Along th' Atlantic rock, undreading, climb,
And of its eggs despoil the Solan's nest *.
Thus, blest in primal innocence, they live,
Suffic'd, and happy with that frugal fare
Which tasteful toil and hourly danger give.
Hard is their shallow soil, and bleak and bare;
Nor ever vernal bee was heard to murmur there!

* See *Bird-catching*, p. 237. and *Pelicanus*, n° 3.

XI.

Nor need'st thou blush that such false themes engage
Thy gentle mind, of fairer stores possest;
For not alone they touch the village breast,
But fill'd in elder time th' historic page.
There, Shakespeare's self, with every garland crown'd,
Flew to those fairy climes his fancy sheen (R),
In musing hour; his wayward sisters found,
And with their terrors dress'd the magic scene.
From them he sung, when, 'mid his bold design,
Before the Scot, afflicted, and aghast!
The shadowy kings of Banquo's fated line,
Thro' the dark cave in gleamy pageant pass'd.
Proceed! nor quit the tales which, simply told,
Could once so well my answ'ring bosom pierce;
Proceed, in forceful sounds, and colours bold,
The native legends of thy land rehearse;
To such adapt thy lyre, and suit thy pow'rful verse.

XII.

In scenes like these, which, daring to depart
From sober truth, are still to nature true,
And call forth fresh delight to fancy's view,
Th' heroic muse employ'd her Tasso's art!
How have I trembl'd, when, at Tancred's stroke,
Its gushing blood the gaping cypress pour'd,
When each live plant with mortal accents spoke,
And the wild blast upheav'd the vanish'd sword!
How have I sat, when pip'd the pensive wind,
To hear his harp by British Fairfax strung!
Prevailing poet! whose undoubting mind,
Believ'd the magic wonders which he sung!
Hence, at each sound, imagination glows!
Hence, at each picture, vivid life starts here! (S)
Hence his warm lay with softest sweetness flows!
Melting it flows, pure, *murm'ring* *, strong, and clear,
And fills th' impassion'd heart, and wins th' harmonious [ear!

XIII.

All hail, ye scenes that o'er my soul prevail!
Ye *splendid* † friths and lakes, which, far away,
Are by smooth Annan ‡ fill'd, or past'ral Tay ‡,
Or Don's ‡ romantic springs, at distance, hail!
The time shall come, when I, perhaps, may tread
Your lowly *glens* §, o'erhung with spreading broom;
Or o'er your stretching heaths, by fancy led,
Or o'er your mountains creep, in awful gloom! (T)
Then will I dress once more the faded bow'r,
Where Jonson (U) sat in Drummond's *classic* * shade;
Or crop, from Tiviotdale, each lyric flow'r,
And mourn, on Yarrow's banks, *where Willy's laid* †!
Meantime, ye pow'rs that on the plains which bore
The cordial youth, on Lothian's plains (X), attend!
Where'er *Home dwells* ‡, on hill, or lowly moor,
To him I *loose* §, your kind protection lend, [friend!
And, touch'd with love like mine, preserve my absent

* numerous.
† spacious.
‡ Three rivers in Scotland.
§ valleys.
* social.
† the widowed maid!
‡ he dwells.
§ lose.

Dr Johnson, in his life of Collins, informs us, that Dr Warton and his brother, who had seen this ode in the author's possession, thought it superior to his other works. The taste of the Wartons will hardly be questioned; but we are not sure that the following *Ode to the Passions* has much less merit, though it be merit of a different kind, than the Ode on the Superstitions of the Highlands:

When Music, heav'nly maid, was young,
While yet in early Greece she sung,
The Passions oft, to hear her shell,
Throng'd around her magic cell,
Exulting, trembling, raging, fainting,
Possest beyond the Muse's painting;
By turns they felt the glowing mind
Disturb'd, delighted, rais'd, refin'd.
Till once, 'tis said, when all were fir'd,
Fill'd with fury, rapt, inspir'd,
From the supporting myrtles round
They snatch'd her instruments of sound:
And as they oft had heard apart
Sweet lessons of her forceful art,

Each,

(P) One of the Hebrides is called the *Isle of Pigmies*, where it is reported, that several miniature bones of the human species have been dug up in the ruins of a chapel there.

(Q) Icolmkill, one of the Hebrides, where many of the ancient Scottish, Irish, and Norwegian kings, are said to be interred.

(R) This line wanting in Dr Carlyle's edition.

(S) This line wanting in Dr Carlyle's edition.

(T) This line wanting in Dr Carlyle's edition.

(U) Ben Jonson paid a visit on foot in 1619 to the Scotch poet Drummond, at his seat of Hawthornden, within seven miles of Edinburgh.

(X) Barrow, it seems, was at the university of Edinburgh, which is in the county of Lothian.

Of Lyric Poetry.

Each, for madness rul'd the hour,
Would prove his own expressive power.

First Fear his hand, its skill to try,
Amid the chords bewilder'd laid,
And back recoil'd, he knew not why,
Ev'n at the sound himself had made.

Next Anger rush'd; his eyes on fire,
In lightnings own'd his secret stings;
In one rude clash he struck the lyre,
And swept with hurried hand the strings.

With woeful measures wan Despair—
Low sullen sounds his grief beguil'd;
A solemn, strange, and mingled air;
'Twas sad by fits, by starts 'twas wild.

But thou, O Hope! with eyes so fair,
What was thy delighted measure?
Still it whisper'd promis'd pleasure,
And bade the lovely scenes at distance hail!—
Still would her touch the strain prolong,
And from the rocks, the woods, the vale,
She call'd on Echo still through all her song;
And where her sweetest theme she chose,
A soft responsive voice was heard at every close,
And Hope enchanted smil'd, and wav'd her golden hair.

And longer had she sung;—but, with a frown,
Revenge impatient rose;
He threw his blood-stain'd sword in thunder down,
And, with a withering look,
The war-denouncing trumpet took,
And blew a blast so loud and dread,
Were ne'er prophetic sounds so full of woe.
And ever and anon he beat
The doubling drum with furious heat;
And though sometimes, each dreary pause between,
Dejected Pity at his side
Her soul-subduing voice applied,
Yet still he kept his wild unalter'd mien,
While each strain'd ball of sight seem'd bursting from [his head.

Thy numbers, Jealousy, to nought were fix'd,
Sad proof of thy distressful state;
Of differing themes the veering song was mix'd;
And now it courted Love, now raving call'd on Hate.

With eyes up-rais'd, as one inspir'd,
Pale Melancholy sat retir'd,
And from her wild sequester'd seat,
In notes by distance made more sweet,
Pour'd through the mellow horn her pensive soul,
And dashing soft from rocks around,
Bubbling runnels join'd the sound;
Through glades and glooms the mingled measure stole,
Or o'er some haunted streams with fond delay,
Round an holy calm diffusing,
Love of peace, and lonely musing,
In hollow murmurs died away.

But O! how alter'd was its sprightlier tone!
When Cheerfulness, a nymph of healthiest hue,
Her bow across her shoulder flung,
Her buskins gemm'd with morning dew,
Blew an inspiring air, that dale and thicket rung,
The hunter's call to Faun and Dryad known;
The oak-crown'd sisters, and their chaste-ey'd queen,
Satyrs and sylvan boys were seen,
Peeping from forth their alleys green;
Brown Exercise rejoic'd to hear,
And Sport leapt up, and seiz'd his beechen spear.

Last came Joy's ecstatic trial;
He, with viny crown advancing,
First to the lively pipe his hand addrest,
But soon he saw the brisk awakening viol,
Whose sweet entrancing voice he lov'd the best.
They would have thought who heard the strain,
They saw in Tempe's vale her native maids,
Amidst the festal sounding shades,
To some unwearied minstrel dancing,
While, as his flying fingers kiss'd the strings,
Love fram'd with Mirth a gay fantastic round:
Loose were her tresses seen, her zone unbound
And he, amidst his frolic play,
As if he would the charming air repay,
Shook thousand odours from his dewy wings.

O Music! sphere-descended maid,
Friend of pleasure, wisdom's aid,
Why, Goddess, why to us denied?
Lay'st thou thy ancient lyre aside?
As in that lov'd Athenian bower,
You learn'd an all-commanding power:
Thy mimic soul, O Nymph endear'd,
Can well recal what then it heard.
Where is thy native simple heart,
Devote to virtue, fancy, art?
Arise, as in that elder time,
Warm, energic, chaste, sublime!
Thy wonders, in that god-like age,
Fill thy recording sister's page—
'Tis said, and I believe the tale,
Thy humblest reed could more prevail,
Had more of strength, diviner rage,
Than all which charms this laggard age;
Ev'n all at once together found
Cæcilia's mingled world of sound—
O! bid our vain endeavours cease,
Revive the just designs of Greece,
Return in all thy simple state!
Confirm the tales her son's relate.

We shall conclude this section, and these examples, with Gray's *Progress of Poesy*, which, in spite of the severity of Johnson's criticism, certainly ranks high among the odes which pretend to sublimity. The first stanza, when examined by the frigid rules of grammatical criticism, is certainly not faultless; but its faults will be overlooked by every reader who has any portion of the author's fervor:

I. 1.

Awake, Æolian lyre, awake,
And give to rapture all thy trembling strings,
From Helicon's harmonious springs
A thousand rills their mazy progress take:
The laughing flowers, that round them blow,
Drink life and fragrance as they flow.
Now the rich stream of music winds along,
Deep, majestic, smooth, and strong,
Thro' verdant vales, and Ceres' golden reign:
Now rolling down the steep amain,
Headlong, impetuous, see it pour:
The rocks, and nodding groves, rebellow to the roar.

Oh!

Of Lyric Poetry.

I. 2.

Oh! Sovereign of the willing ſoul,
Parent of ſweet and ſolemn-breathing airs,
Enchanting ſhell! the ſullen cares,
And frantic paſſions, hear thy ſoft controul,
On Thracia's hills the lord of war
Has curb'd the fury of his car,
And dropp'd his thirſty lance at thy command.
Perching on the ſceptred hand
Of Jove, thy magic lulls the feather'd king
With ruffled plumes, and flagging wing:
Quench'd in dark clouds of ſlumber lie
The terror of his beak, and lightnings of his eye.

I. 3.

Thee the voice, the dance, obey,
Temper'd to thy warbled lay:
O'er Idalia's velvet-green
The roſy-crowned loves are ſeen.
On Cytherea's day,
With antic ſports, and blue-ey'd pleaſures,
Friſking light in frolic meaſures;
Now purſuing, now retreating,
Now in circling troops they meet;
To briſk notes, in cadence beating,
Glance their many-twinkling feet.
Slow melting ſtrains their queen's approach declare:
Where'er ſhe turns, the graces homage pay.
With arms ſublime, that float upon the air,
In gliding ſtate ſhe wins her eaſy way:
O'er her warm cheek, and riſing boſom, move
The bloom of young deſire, and purple light of love.

II. 1.

Man's feeble race what ills await;
Labour, and penury, the racks of pain,
Diſeaſe, and ſorrow's weeping train,
And death, ſad refuge from the ſtorms of fate!
The fond complaint, my ſong, diſprove,
And juſtify the laws of Jove.
Say, has he giv'n in vain the heav'nly muſe?
Night, and all her ſickly dews,
Her ſpectres wan, and birds of boding cry,
He gives to range the dreary ſky;
Till down the eaſtern cliffs afar
Hyperion's march they ſpy, and glitt'ring ſhafts of war.

II. 2.

In climes beyond the ſolar road,
Where ſhaggy forms o'er ice-built mountains roam,
The Muſe has broke the twilight-gloom,
To cheer the ſhiv'ring native's dull abode.
And oft, beneath the od'rous ſhade
Of Chili's boundleſs foreſts laid,
She deigns to hear the ſavage youth repeat,
In looſe numbers wildly ſweet,
Their feather-cinctur'd chiefs, and duſky loves.
Her track, where'er the goddeſs roves,
Glory purſue, and gen'rous ſhame,
Th' unconquerable mind, and freedom's holy flame.

II. 3.

Woods, that wave o'er Delphi's ſteep,
Iſles, that crown th' Ægean deep,
Fields, that cool Iliſſus laves,
Or where Mæander's amber waves
In ling'ring lab'rinths creep,
How do your tuneful echoes languiſh
Mute, but to the voice of anguiſh!
Where each old poetic mountain
Inſpiration breath'd around;
Ev'ry ſhade and hallow'd fountain
Murmur'd deep a ſolemn ſound:
Till the ſad nine, in Greece's evil hour,
Left their Parnaſſus for the Latian plains.
Alike they ſcorn the pomp of tyrant power,
And coward vice that revels in her chains.
When Latium had her lofty ſpirit loſt,
They ſought, oh Albion! next thy ſea-encircled coaſt.

III. 1.

Far from the ſun, and ſummer-gale,
In thy green lap was nature's* darling laid,
What time, where lucid Avon ſtray'd,
To him the mighty mother did unveil
Her awful face: the dauntleſs child
Stretch'd forth his little arms, and ſmil'd.
This pencil take (ſhe ſaid) whoſe colours clear
Richly paint the vernal year:
Thine too theſe golden keys, immortal boy!
This can unlock the gates of joy;
Of horror that, and thrilling fears,
Or ope the ſacred ſource of ſympathetic tears.

* Shakeſpear.

III. 2.

Nor ſecond he †, that rode ſublime
Upon the ſeraph-wings of ecſtaſy,
The ſecrets of th' abyſs to ſpy.
He paſs'd the flaming bounds of place and time:
The living throne, the ſapphire blaze,
Where angels tremble while they gaze,
He ſaw; but, blaſted with exceſs of light,
Clos'd his eyes in endleſs night.
Behold, where Dryden's leſs preſumptuous car,
Wide o'er the fields of glory bear
Two courſers of ethereal race,
With necks in thunder cloth'd, and long-reſounding [pace.

† Milton.

III. 3.

Hark, his hands the lyre explore!
Bright-ey'd fancy, hov'ring o'er,
Scatters from her pictur'd urn
Thoughts that breathe, and words that burn.
But ah! 'tis heard no more—
Oh! Lyre divine, what daring ſpirit
Wakes thee now? tho' he inherit
Nor the pride, nor ample pinion,
That the Theban eagle bear,
Sailing with ſupreme dominion
Through the azure deep of air:
Yet oft before his infant eyes would run
Such forms as glitter in the Muſe's ray,
With orient hues, unborrow'd of the ſun:
Yet ſhall he mount, and keep his diſtant way
Beyond the limits of a vulgar fate,
Beneath the good how far—but far above the great.

Sect. III. *Of the Elegy.*

133 The elegy.

The *Elegy* is a *mournful* and *plaintive*, but yet ſweet and engaging, kind of poem. It was firſt invented to bewail the death of a friend; and afterwards uſed to expreſs the complaints of lovers, or any other melancholy ſubject. In proceſs of time, not only matters of grief, but joy, wiſhes, prayers, expoſtulations, reproaches, admonitions, and almoſt every other ſubject, were admitted into elegy; however, funeral lamentations and affairs of love

4

Elegy.

love seem most agreeable to its character, which is gentleness and tenuity.

The plaintive elegy, in mournful state,
Dishevell'd weeps the stern decrees of fate:
Now paints the lover's torments and delights;
Now the nymph flatters, threatens, or invites.
But he, who would these passions well express,
Must more of love than poetry possess.
I hate those lifeless writers whose forc'd fire
In a cold style describes a hot desire;
Who sigh by rule, and, raging in cold blood,
Their sluggish muse spur to an am'rous mood.
Their ecstasies insipidly they feign;
And always pine, and fondly hug their chain;
Adore their prison, and their suff'rings bless;
Make sense and reason quarrel as they please.
'Twas not of old in this affected tone,
That smooth Tibullus made his am'rous moan;
Or tender Ovid, in melodious strains,
Of love's dear art the pleasing rules explains.
You, who in elegy would justly write,
Consult your heart; let that alone endite.

[*From the French of* Despreux.] Soames.

234 How to be made.

The plan of an elegy, as indeed of all other poems, ought to be made before a line is written; or else the author will ramble in the dark, and his verses have no dependance on each other. No *epigrammatic points* or conceits, none of those *fine things* which most people are so fond of in every sort of poem, can be allowed in this, but must give place to nobler beauties, those of *nature* and the *passions*. Elegy rejects whatever is facetious, satirical, or majestic, and is content to be plain, decent, and unaffected; yet in this humble state is she sweet and engaging, elegant and attractive. This poem is adorned with frequent *commiserations*, *complaints*, *exclamations*, *addresses to things or persons*, short and proper *digressions*, *allusions*, *comparisons*, *prosopopœias* or feigned persons, and sometimes with short *descriptions*. The diction ought to be free from any *harshness*; *neat*, *easy*, *perspicuous*, *expressive of the manners*, *tender*, and *pathetic*; and the numbers should be *smooth* and *flowing*, and captivate the ear with their uniform sweetness and delicacy.

Of elegies on the subject of death, that by Mr Gray, written in a country church-yard, is one of the best that has appeared in our language, and may be justly esteemed a masterpiece. But being so generally known, it would be superfluous to insert it here.

On the subject of love, we shall give an example from the elegies of Mr Hammond.

Let others boast their heaps of shining gold,
  And view their fields with waving plenty crown'd,
Whom neighb'ring foes in constant terror hold,
  And trumpets break their slumbers, never sound:
While, calmly poor, I trifle life away,
  Enjoy sweet leisure by my cheerful fire,
No wanton hope my quiet shall betray,
  But cheaply bless'd I'll scorn each vain desire.
With timely care I'll sow my little field,
  And plant my orchard with its master's hand;
Nor blush to spread the hay, the hook to wield,
  Or range my sheaves along the sunny land.
If late at dusk, while carelessly I roam,
  I meet a strolling kid or bleating lamb,
Under my arm I'll bring the wand'rer home,
  And not a little chide its thoughtless dam.
What joy to hear the tempest howl in vain,
  And clasp a fearful mistress to my breast?
Or lull'd to slumber by the beating rain,
  Secure and happy sink at last to rest.
Or if the sun in flaming Leo ride,
  By shady rivers indolently stray,
And, with my Delia walking side by side,
  Hear how they murmur, as they glide away.
What joy to wind along the cool retreat,
  To stop and gaze on Delia as I go!
To mingle sweet discourse with kisses sweet,
  And teach my lovely scholar all I know!
Thus pleas'd at heart, and not with fancy's dream,
  In silent happiness I rest unknown;
Content with what I am, not what I seem,
  I live for Delia and myself alone.
Ah foolish man! who, thus of her possess'd,
  Could float and wander with ambition's wind,
And, if his outward trappings spoke him blest,
  Not heed the sickness of his conscious mind.
With her I scorn the idle breath of praise,
  Nor trust to happiness that's not our own;
The smile of fortune might suspicion raise,
  But here I know that I am lov'd alone.
Stanhope, in wisdom as in wit divine,
  May rise and plead Britannia's glorious cause,
With steady rein his eager wit confine,
  While manly sense the deep attention draws.
Let Stanhope speak his list'ning country's wrongs,
  My humble voice shall please one partial maid;
For her alone I pen my tender song,
  Securely sitting in his friendly shade.
Stanhope shall come, and grace his rural friend;
  Delia shall wonder at her noble guest,
With blushing awe the riper fruit commend,
  And for her husband's patron cull the best.
Her's be the care of all my little train,
  While I with tender indolence am blest,
The favourite subject of her gentle reign,
  By love alone distinguish'd from the rest.
For her I'll yoke my oxen to the plough,
  In gloomy forests tend my lonely flock,
For her a goat-herd climb the mountain's brow,
  And sleep extended on the naked rock.
Ah! what avails to press the stately bed,
  And far from her 'midst tasteless grandeur weep,
By marble fountains lay the pensive head,
  And, while they murmur, strive in vain to sleep!
Delia alone can please and never tire,
  Exceed the paint of thought in true delight;
With her, enjoyment wakens new desire,
  And equal rapture glows thro' ev'ry night.
Beauty and worth in her alike contend
  To charm the fancy, and to fix the mind;
In her, my wife, my mistress, and my friend,
  I taste the joys of sense and reason join'd.
On her I'll gaze when others loves are o'er,
  And dying press her with my clay-cold hand—
Thou weep'st already, as I were no more,
  Nor can that gentle breast the thought withstand.
Oh! when I die, my latest moments spare,
  Nor let thy grief with sharper torments kill;
Wound not thy cheeks, nor hurt that flowing hair;
  Tho' I am dead, my soul shall love thee still.

Oh quit the room, oh quit the deathful bed,
Or thou wilt die, so tender is thy heart!
Oh leave me, DELIA! ere thou see me dead,
These weeping friends will do thy mournful part.
Let them, extended on the decent bier,
Convey the corse in melancholy state,
Thro' all the village spread the tender tear,
While pitying maids our wond'rous love relate.

SECT. IV. *Of the Pastoral.*

THIS poem takes its name from the Latin word *pastor*, a "shepherd;" the subject of it being something in the pastoral or rural life; and the persons, interlocutors, introduced in it, either shepherds or other rustics.

135 The pastoral, These poems are frequently called *eclogues*, which signifies "select or choice pieces;" though some account for this name in a different manner. They are also called *bucolicks*, from Βουκολος, "a herdsman."

136 Why it generally pleases. This kind of poem, when happily executed, gives great delight; nor is it a wonder, since innocence and simplicity generally please: to which let us add, that the scenes of pastorals are usually laid in the country, where both poet and painter have abundant matter for the exercise of genius, such as enchanting prospects, purling streams, shady groves, enamelled meads, flowery lawns, rural amusements, the bleating of flocks, and the music of birds; which is of all melody the most sweet and pleasing, and calls to our mind the wisdom and taste of Alexander, who, on being importuned to hear a man that imitated the notes of the nightingale, and was thought a great curiosity, replied, that *he had had the happiness of hearing the nightingale herself.*

137 Its characters and The character of the pastoral consists in simplicity, brevity, and delicacy; the two first render an eclogue *natural*, and the last *delightful*. With respect to nature, indeed, we are to consider, that as a pastoral is an image of the ancient times of innocence and undesigning plainness, we are not to describe shepherds as they really are at this day, but as they may be conceived then to have been, when the best of men, and even princes, followed the employment. For this reason, an air of piety should run through the whole poem; which is visible in the writings of antiquity.

To make it natural with respect to the present age, some knowledge in rural affairs should be discovered, and that in such a manner as if it was done by chance rather than by design; lest by too much pains to seem natural, that simplicity be destroyed from whence arises the delight; for what is so engaging in this kind of poesy proceeds not so much from the idea of a country life itself, as in exposing only the best part of a shepherd's life, and concealing the misfortunes and miseries which sometimes attend it. Besides, the subject must contain some particular beauty in itself, and each eclogue present a scene or prospect to our view enriched with variety: which variety is in a great measure obtained by frequent comparisons drawn from the most agreeable objects of the country; by interrogations to things inanimate; by short and beautiful digressions; and by elegant turns on the words, which render the numbers more sweet and pleasing. To this let us add, that the connections must be negligent, the narrations and descriptions short, and the periods concise.

Riddles, parables, proverbs, antique phrases, and superstitious fables, are fit materials to be intermixed with this kind of poem. They are here, when properly applied, very ornamental; and the more so, as they give our modern compositions the air of the ancient manner of writing.

The style of the pastoral ought to be humble, yet pure; neat, but not florid; easy, and yet lively: and the numbers should be smooth and flowing. 138 Style.

This poem in general should be short, and ought never much to exceed 100 lines; for we are to consider that the ancients made these sort of compositions their amusement, and not their business: but however short they are, every eclogue must contain a plot or fable, which must be simple and one; but yet so managed as to admit of short digressions. Virgil has always observed this.——We shall give the plot or argument of his first pastoral as an example. Meliboeus, *an unfortunate shepherd, is introduced with* Tityrus, *one in more fortunate circumstances; the former addresses the complaint of his sufferings and banishment to the latter, who enjoys his flocks and folds in the midst of the public calamity, and therefore expresses his gratitude to the benefactor from whom this favour flowed: but* Meliboeus *accuses fortune, civil wars, and bids adieu to his native country.* This is therefore a dialogue.

But we are to observe, that the poet is not always obliged to make his eclogue *allegorical*, and to have real persons represented by the fictitious characters introduced; but is in this respect entirely at his own liberty.

Nor does the nature of the poem require it to be always carried on by way of dialogue; for a shepherd may with propriety sing the praises of his love, complain of her inconstancy, lament her absence, her death, &c. and address himself to groves, hills, rivers, and such like rural objects, even when alone.

We shall now give an example from each of those authors who have eminently distinguished themselves by this manner of writing, and introduce them in the order of time in which they were written.

Theocritus, who was the father or inventor of this kind of poetry, has been deservedly esteemed by the best critics; and by some, whose judgment we cannot dispute, preferred to all other pastoral writers, with perhaps the single exception of the tender and delicate Gesner. We shall insert his third *idyllium*, not because it is the best, but because it is within our compass. 139 Examples of the pastoral from Theocritus.

To Amaryllis, lovely nymph, I speed,
Meanwhile my goats upon the mountains feed.
O Tityrus, tend them with assiduous care,
Lead them to crystal springs and pastures fair,
And of the ridgling's butting horns beware.
Sweet Amaryllis, have you then forgot
Our secret pleasures in the conscious grott,
Where in my folding arms you lay reclin'd?
Blest was the shepherd, for the nymph was kind.
I whom you call'd *your Dear, your Love*, so late,
Say, am I now the object of your hate?
Say, is my form displeasing to your sight?
This cruel love will surely kill me quite.
Lo! ten large apples, tempting to the view,
Pluck'd from your favourite tree, where late they grew.
Accept this boon, 'tis all my present store;
To-morrow will produce as many more.

Pastoral.

Meanwhile these heart-consuming pains remove,
And give me gentle pity for my love.
Oh! was I made by some transforming power
A bee to buzz in your sequester'd bow'r!
To pierce your ivy shade with murmuring sound,
And the light leaves that compass you around.
I know thee, Love, and to my sorrow find,
A god thou art, but of the savage kind;
A lioness sure suckled the fell child,
And with his brothers nurst him in the wild;
On me his scorching flames incessant prey,
Glow in my bones, and melt my soul away.
Ah, nymph, whose eyes destructive glances dart,
Fair is your face, but flinty is your heart:
With kisses kind this rage of love appease;
For me, fond swain! ev'n empty kisses please.
Your scorn distracts me, and will make me tear
The flow'ry crown I wove for you to wear,
Where roses mingle with the ivy-wreath,
And fragrant herbs ambrosial odours breathe.
Ah me! what pangs I feel; and yet the fair
Nor sees my sorrows nor will hear my pray'r.
I'll doff my garments, since I needs must die,
And from yon rock that points its summit high,
Where patient Alpis snares the finny fry,
I'll leap, and, though perchance I rise again,
You'll laugh to see me plunging in the main.
By a prophetic poppy-leaf I found
Your chang'd affection, for it gave no sound,
Though in my hand struck hollow as it lay,
But quickly wither'd like your love away.
An old witch brought sad tidings to my ears,
She who tells fortunes with the sieve and sheers;
For leasing barley in my fields of late,
She told me, I should love, and you should hate!
For you my care a milk-white goat supply'd,
Two wanton kids run frisking at her side;
Which oft the nut-brown maid, Erithacis,
Has begg'd and paid before-hand with a kiss;
And since you thus my ardent passion slight,
Her's they shall be before to-morrow night.
My right eye itches; may it lucky prove,
Perhaps I soon shall see the nymph I love;
Beneath yon pine I'll sing distinct and clear,
Perhaps the fair my tender notes shall hear;
Perhaps may pity my melodious moan;
She is not metamorphos'd into stone.
  Hippomenes, provok'd by noble strife,
To win a mistress, or to lose his life,
Threw golden fruit in Atalanta's way:
The bright temptation caus'd the nymph to stay;
She look'd, she languish'd, all her soul took fire,
She plung'd into the gulph of deep desire.
  To Pyle from Othrys sage Melampus came,
He drove the lowing herd, yet won the dame;
Fair Pero blest his brother Bias' arms,
And in a virtuous race diffus'd unfading charms.
  Adonis fed his cattle on the plain,
And sea-born Venus lov'd the rural swain;
She mourn'd him wounded in the fatal chace,
Nor dead dismiss'd him from her warm embrace.
Though young Endymion was by Cynthia blest,
I envy nothing but his lasting rest.
Jasion slumb'ring on the Cretan plain
Ceres once saw, and blest the happy swain
With pleasures too divine for ears profane.
  My head grows giddy, love affects me sore;
Yet you regard not; so I'll sing no more——
Here will I put a period to my care—
Adieu, false nymph, adieu ungrateful fair;
Stretch'd near the grotto, when I've breath'd my last,
My corse will give the wolves a rich repast,
As sweet to them as honey to your taste.

FAWKES.

Virgil succeeds Theocritus, from whom he has in some places copied, and always imitated with success. As a specimen of his manner, we shall introduce his first pastoral, which is generally allowed to be the most perfect.

MELIBOEUS and TITYRUS.

140 Virgil.

Mel. Beneath the shade which beechen boughs diffuse,
You, Tityrus, entertain your sylvan muse.
Round the wide world in banishment we roam,
Forc'd from our pleasing fields and native home;
While stretch'd at ease you sing your happy loves,
And Amyrillis fills the shady groves.
Tit. These blessings, friend, a deity bestow'd;
For never can I deem him less than god.
The tender firstlings of my woolly breed
Shall on his holy altar often bleed.
He gave me kine to graze the flow'ry plain,
And so my pipe renew'd the rural strain.
Mel. I envy not your fortune; but admire,
That while the raging sword and wasteful fire
Destroy the wretched neighbourhood around,
No hostile arms approach your happy ground.
Far diff'rent is my fate; my feeble goats
With pains I drive from their forsaken cotes:
And this you see I scarcely drag along,
Who yeaning on the rocks has left her young,
The hope and promise of my falling fold,
My loss by dire portents the gods foretold;
For, had I not been blind, I might have seen
Yon riven oak, the fairest on the green,
And the hoarse raven on the blasted bough
By croaking from the left presag'd the coming blow.
But tell me, Tityrus, what heav'nly pow'r
Preserv'd your fortunes in that fatal hour?
Tit. Fool that I was, I thought imperial Rome
Like Mantua, where on market-days we come,
And thither drive our tender lambs from home.
So kids and whelps their sires and dams express;
And so the great I measur'd by the less:
But country-towns, compar'd with her, appear
Like shrubs when lofty cypresses are near.
Mel. What great occasion call'd you hence to Rome?
Tit. Freedom, which came at length, tho' slow to come:
Nor did my search of liberty begin
Till my black hairs were chang'd upon my chin;
Nor Amaryllis would vouchsafe a look,
Till Galatea's meaner bonds I broke.
Till then a helpless, hopeless, homely swain,
I sought not freedom, nor aspir'd to gain:
Tho' many a victim from my folds was bought,
And many a cheese to country markets brought,
Yet all the little that I got I spent,
And still return'd as empty as I went.
Mel. We stood amaz'd to see your mistress mourn,
Unknowing that she pin'd for your return;
We wonder'd why she kept her fruit so long,
For whom so late th' ungather'd apples hung:

But

Pastoral.

But now the wonder ceases, since I see
She kept them only, Tityrus, for thee:
For thee the bubbling springs appear'd to mourn,
And whisp'ring pines made vows for thy return.
Tit. What should I do? while here I was enchain'd,
No glimpse of godlike liberty remain'd;
Nor could I hope in any place but there
To find a god so present to my pray'r.
There first the youth of heav'nly birth I view'd,
For whom our monthly victims are renew'd.
He heard my vows, and graciously decreed
My grounds to be restor'd my former flocks to feed.
Mel. O fortunate old man! whose farm remains
For you sufficient, and requites your pains,
Though rushes overspread the neighb'ring plains,
Tho' here the marshy grounds approach your fields,
And there the soil a stony harvest yields.
Your teeming ewes shall no strange meadows try,
Nor fear a rot from tainted company.
Behold yon bord'ring fence of sallow trees
Is fraught with flow'rs, the flow'rs are fraught with [bees:
The busy bees, with a soft murm'ring strain,
Invite to gentle sleep the lab'ring swain:
While from the neighb'ring rock with rural songs
The pruner's voice the pleasing dream prolongs;
Stock-doves and turtles tell their am'rous pain,
And, from the lofty elms, of love complain.
Tit. Th' inhabitants of seas and skies shall change,
And fish on shore and stags in air shall range,
The banish'd Parthian dwell on Arar's brink,
And the blue German shall the Tigris drink;
Ere I, forsaking gratitude and truth,
Forget the figure of that godlike youth.
Mel. But we must beg our bread in climes unknown,
Beneath the scorching or the freezing zone;
And some to fair Oaxis shall be sold,
Or try the Libyan heat or Scythian cold;
The rest among the Britons be confin'd,
A race of men from all the world disjoin'd.
O! must the wretched exiles ever mourn?
Nor after length of rolling years return?
Are we condemn'd by Fate's unjust decree,
No more our houses and our homes to see?
Or shall we mount again the rural throne,
And rule the country, kingdoms once our own?
Did we for these barbarians plant and sow,
On these, on these, our happy fields bestow?
Good heav'n, what dire effects from civil discord flow!
Now let me graft my pears, and prune the vine;
The fruit is theirs, the labour only mine.
Farewel my pastures, my paternal stock!
My fruitful fields, and my more fruitful flock!
No more, my goats, shall I behold you climb
The steepy cliffs, or crop the flow'ry thyme;
No more extended in the grot below,
Shall see you browzing on the mountain's brow
The prickly shrubs, and after on the bare
Lean down the deep abyss and hang in air!
No more my sheep shall sip the morning dew;
No more my song shall please the rural crew:
Adieu, my tuneful pipe! and all the world, adieu!
Tit. This night, at least, with me forget your care;
Chesnuts and curds and cream shall be your fare:
The carpet-ground shall be with leaves o'er-spread,
And boughs shall weave a cov'ring for your head:
For see yon sunny hill the shade extends,
And curling smoke from cottages ascends.

DRYDEN.

Spenser was the first of our countrymen who acquired any considerable reputation by this method of writing. We shall insert his sixth eclogue, or that for June, which is allegorical, as will be seen by the

ARGUMENT. "Hobbinol, from a description of the pleasures of the place, excites Colin to the enjoyment of them. Colin declares himself incapable of delight, by reason of his ill success in love, and his loss of Rosalind, who had treacherously forsaken him for Menalcas another shepherd. By Tityrus (mentioned before in Spenser's second eclogue, and again in the twelfth) is plainly meant Chaucer, whom the author sometimes professed to imitate. In the person of Colin is represented the author himself; and Hobbinol's inviting him to leave the hill country, seems to allude to his leaving the North, where, as is mentioned in his life, he had for some time resided."

241 Spenser.

Hob. Lo! Colin, here the place, whose pleasant sight
From other shades hath wean'd my wand'ring mind:
Tell me, what wants me here, to work delight?
The simple air, the gentle warbling wind,
So calm, so cool, as nowhere else I find:
The grassy ground with dainty daisies dight,
The bramble-bush, where birds of every kind
To th' water's fall their tunes attemper right.
Col. O! happy Hobbinol, I bless thy state,
That paradise hast found which Adam lost.
Here wander may thy flock early or late,
Withouten dread of wolves to been ytost;
Thy lovely lays here mayst thou freely boast:
But I, unhappy man! whom cruel fate,
And angry gods, pursue from coast to coast,
Can nowhere find to shroud my luckless pate.
Hob. Then if by me thou list advised be,
Forsake the soil that so doth thee bewitch:
Leave me those hills, where harbroughnis to see,
Nor holly-bush, nor brere, nor winding ditch;
And to the dales resort, where shepherds rich,
And fruitful flocks been everywhere to see:
Here no night-ravens lodge, more black than pitch,
Nor elvish ghosts, nor ghastly owls do flee.
But friendly fairies met with many graces,
And light-foot nymphs can chace the ling'ring night,
With heydeguies, and trimly trodden traces;
Whilst sisters nine, which dwell on Parnass' height,
Do make them music, for their more delight;
And Pan himself to kiss their crystal faces,
Will pipe and dance, when Phœbe shineth bright:
Such peerless pleasures have we in these places.
Col. And I whilst youth, and course of careless years,
Did let me walk withouten links of love,
In such delights did joy amongst my peers:
But riper age such pleasures doth reprove,
My fancy eke from former follies move
To strayed steps: for time in passing wears
(As garments doen, which waxen old above)
And draweth new delights with hoary hairs.
Though couth I sing of love, and tune my pipe
Unto my plaintive pleas in verses made:
Though would I seek for queen-apples unripe
To give my Rosalind, and in sommer shade

Pastoral.

Dight gawdy girlonds was my common trade,
To crown her golden locks: but years more ripe,
And loss of her, whose love as life I wayde,
Those weary wanton toys away did wipe.
Hob. Colin, to hear thy rhymes and roundelays,
Which thou wert wont on wasteful hills to sing,
I more delight, than lark in sommer days:
Whose echo made the neighbour groves to ring,
And taught the birds, which in the lower spring
Did shroud in shady leaves from sunny rays,
Frame to thy song their cheerful cheriping,
Or hold their peace, for shame of thy sweet lays.
I saw Calliope with muses moe,
Soon as thy oaten pipe began to sound,
Their ivory lutes and tamburins forego,
And from the fountain, where they sate around,
Ren after hastily thy silver sound.
But when they came, where thou thy skill didst show,
They drew aback, as half with shame confound,
Shepherd to see, them in their art out-go.
Col. Of muses, Hobbinol, I con no skill,
For they been daughters of the highest Jove,
And holden scorn of homely shepherds quill:
For sith I heard that Pan with Phœbus strove
Which him to much rebuke and danger drove,
I never list presume to Parnass' hill,
But piping low, in shade of lowly grove,
I play to please myself, albeit ill.
Nought weigh I, who my song doth praise or blame,
Ne strive to win renown, or pass the rest:
With shepherds sits not follow flying fame,
But feed his flocks in fields, where falls him best.
I wot my rimes been rough, and rudely drest;
The fitter they, my careful case to frame:
Enough is me to paint out my unrest,
And pour my piteous plaints out in the same.
The God of shepherds, Tityrus, is dead,
Who taught me homely, as I can, to make:
He, whilst he liv'd, was the sovereign head
Of shepherds all, that been with love ytake.
Well couth he wail his woes, and lightly slake
The flames which love within his heart had bred,
And tell us merry tales to keep us wake,
The while our sheep about us safely fed.
Now dead he is, and lieth wrapt in lead,
(O why should death on him such outrage show!)
And all his passing skill with him is fled,
The fame whereof doth daily greater grow.
But if on me some little drops would flow
Of that the spring was in his learned hed,
I soon would learn these woods to wail my woe,
And teach the trees their trickling tears to shed.
Then should my plaints, caus'd of discourtesee,
As messengers of this my painful flight,
Fly to my love, wherever that she be,
And pierce her heart with point of worthy wight;
As she deserves, that wrought so deadly spight.
And thou, Menalcas, that by treachery
Didst underfong my lass to wax so light,
Should'st well be known for such thy villany.
But since I am not, as I wish I were,
Ye gentle shepherds, which your flocks do feed,
Whether on hills or dales, or other where,
Bear witness all of this so wicked deed:
And tell the lass, whose flower is woxe a weed,
And faultless faith is turn'd to faithless feere,
That she the truest shepherd's heart made bleed,
That lives on earth, and loved her most dear.
Hob. O! careful Colin, I lament thy case,
Thy tears would make the hardest flint to flow!
Ah! faithless Rosalind, and void of grace,
That art the root of all this rueful woe!
But now is time, I guess, homeward to go;
Then rise, ye blessed flocks, and home apace,
Lest night with stealing steps do you foreslo,
And wet your tender lambs that by you trace.

By the following eclogue the reader will perceive that Mr Philips has, in imitation of Spenser, preserved in his pastorals many antiquated words, which, though they are discarded from polite conversation, may naturally be supposed still to have place among the shepherds and other rustics in the country. We have made choice of his second eclogue, because it is brought home to his own business, and contains a complaint against those who had spoken ill of him and his writings.

THENOT, COLINET. 143 Philips.

Th. Is it not Colinet I lonesome see
Leaning with folded arms against the tree?
Or is it age of late bedims my sight?
'Tis Colinet, indeed, in woful plight.
Thy cloudy look, why melting into tears,
Unseemly, now the sky so bright appears?
Why in this mournful manner art thou found,
Unthankful lad, when all things smile around?
Or hear'st not lark and linnet jointly sing,
Their notes blithe-warbling to salute the spring?
Co. Tho' blithe their notes, not so my wayward fate;
Nor lark would sing, nor linnet, in my state.
Each creature, Thenot, to his task is born;
As they to mirth and music, I to mourn.
Waking, at midnight, I my woes renew,
My tears oft mingling with the falling dew.
Th. Small cause, I ween, has lusty youth to plain;
Or who may then the weight of eld sustain,
When every slackening nerve begins to fail,
And the load presseth as our days prevail?
Yet though with years my body downward tend,
As trees beneath their fruit in autumn bend,
Spite of my snowy head and icy veins,
My mind a cheerful temper still retains:
And why should man, mishap what will, repine,
Sour every sweet, and mix with tears his wine?
But tell me then; it may relieve thy woe,
To let a friend thine inward ailment know.
Co. Idly 'twill waste thee, Thenot, the whole day,
Should'st thou give ear to all my grief can say.
Thine ewes will wander; and the heedless lambs,
In loud complaints, require their absent dams.
Th. See Lightfoot; he shall tend them close: and I,
'Tween whiles, across the plain will glance mine eye.
Co. Where to begin I know not, where to end.
Does there one smiling hour my youth attend?
Though few my days, as well my follies show,
Yet are those days all clouded o'er with wo:
No happy gleam of sunshine doth appear,
My low'ring sky and wint'ry months to cheer.
My piteous plight in yonder naked tree,
Which bears the thunder-scar too plain, I see:
Quite destitute it stands of shelter kind,
The mark of storms, and sport of every wind:

The

Pastoral.

The riven trunk feels not the approach of spring;
Nor birds among the leafless branches sing:
No more, beneath thy shade, shall shepherds throng
With jocund tale, or pipe, or pleasing song.
Ill-fated tree! and more ill-fated I!
From thee, from me, alike the shepherds fly.
Th. Sure thou in hapless hour of time wast born,
When blightning mildews spoil the rising corn,
Or blasting winds o'er blossom'd hedge-rows pass,
To kill the promis'd fruits, and scorch the grass;
Or when the moon, by wizard charm'd, foreshows,
Blood-stain'd in foul eclipse, impending woes.
Untimely born, ill luck betides thee still.
Co. And can there, Thenot, be a greater ill?
Th. Nor fox, nor wolf, nor rot among our sheep:
From these good shepherd's care his flock may keep:
Against ill luck, alas! all forecast fails;
Nor toil by day, nor watch by night, avails.
Co. Ah me, the while! ah me, the luckless day!
Ah luckless lad! befits me more to say.
Unhappy hour! when fresh in youthful bud,
I left, Sabrina fair, thy silv'ry flood.
Ah silly I! more silly than my sheep,
Which on thy flow'ry banks I wont to keep.
Sweet are thy banks; oh, when shall I once more
With ravish'd eyes review thine amell'd shore?
When, in the crystal of thy waters, scan
Each feature faded, and my colour wan?
When shall I see my hut, the small abode
Myself did raise and cover o'er with sod?
Small though it be, a mean and humble cell,
Yet is there room for peace and me to dwell.
Th. And what enticement charm'd thee far away
From thy lov'd home, and led thy heart astray?
Co. A lewd desire strange lands and swains to know.
Ah me! that ever I should covet wo.
With wand'ring feet unblest, and fond of fame,
I sought I know not what besides a name.
Th. Or, sooth to say, didst thou not hither rome
In search of gains more plenty than at home?
A rolling stone is ever bare of moss;
And, to their cost, green years old proverbs cross.
Co. Small need there was, in random search of gain,
To drive my pining flock athwart the plain
To distant Cam. Fine gain at length, I trow,
To hoard up to myself such deal of wo!
My sheep quite spent through travel and ill fare,
And like their keeper ragged grown and bare,
The damp cold green sward for my nightly bed,
And some slaunt willow's trunk to rest my head.
Hard is to bear of pinching cold the pain;
And hard is want to the unpractis'd swain;
But neither want, nor pinching cold, is hard,
To blasting storms of calumny compar'd:
Unkind as hail it falls; the pelting show'r
Destroys the tender herb and budding flow'r.
Th. Slander we shepherds count the vilest wrong:
And what wounds sorer than an evil tongue?
Co. Untoward lads, the wanton imps of spite
Make mock of all the ditties I endite.
In vain, O Colinet, thy pipe, so shrill,
Charms every vale, and gladdens every hill:
In vain thou seek'st the coverings of the grove,
In the cool shade to sing the pains of love:
Sing what thou wilt, ill-nature will prevail;
And every elf hath skill enough to rail.
But yet, though poor and artless be my vein,
Menalcas seems to like my simple strain:
And while that he delighteth in my song,
Which to the good Menalcas doth belong,
Nor night nor day shall my rude music cease;
I ask no more, so I Menalcas please.
Th. Menalcas, lord of these fair fertile plains,
Preserves the sheep, and o'er the shepherds reigns:
For him our yearly wakes and feasts we hold,
And choose the fairest firstlings from the fold;
He, good to all who good deserves, shall give
Thy flock to feed, and thee at ease to live,
Shall curb the malice of unbridled tongues,
And bounteously reward thy rural songs.
Co. First then shall lightsome birds forget to fly,
The briny ocean turn to pastures dry,
And every rapid river cease to flow,
Ere I unmindful of Menalcas grow.
Th. This night thy care with me forget, and fold
Thy flock with mine, to ward th' injurious cold.
New milk, and clouted cream, mild cheese and curd,
With some remaining fruit of last year's hoard,
Sall be our ev'ning fare; and, for the night,
Sweet herbs and moss, which gentle sleep invite:
And now behold the sun's departing ray,
O'er yonder hill, the sign of ebbing day:
With songs the jovial hinds return from plow;
And unyok'd heifers, loitering homeward, low.

Mr Pope's Pastorals next appeared, but in a different dress from those of Spenser and Philips; for he has discarded all antiquated words, drawn his swains more modern and polite, and made his numbers exquisitely harmonious: his eclogues therefore may be called *better poems*, but not better pastorals. We shall insert the eclogue he has inscribed to Mr Wycherly, the beginning of which is in imitation of Virgil's first pastoral.

Beneath the shade a spreading beech displays, 143 Pope.
Hylas and Ægon sung their rural lays:
This mourn'd a faithless, that an absent love,
And Delia's name and Doris fill'd the grove.
Ye Mantuan nymphs, your sacred succour bring;
Hylas and Ægon's rural lays I sing.
Thou, whom the nine with Plautus' wit inspire,
The art of Terence, and Menander's fire:
Whose sense instructs us, and whose humour charms,
Whose judgment sways us, and whose spirit warms!
Oh, skill'd in nature! see the hearts of swains,
Their artless passions, and their tender pains.
Now setting Phœbus shone serenely bright,
And fleecy clouds were streak'd with purple light;
When tuneful Hylas, with melodious moan,
Taught rocks to weep, and made the mountains groan.
Go, gentle gales, and bear my sighs away!
To Delia's ear the tender notes convey.
As some sad turtle his lost love deplores,
And with deep murmurs fills the sounding shores;
Thus, far from Delia, to the winds I mourn,
Alike unheard, unpity'd, and forlorn.
Go, gentle gales, and bear my sighs along!
For her the feather'd quires neglect their song;
For her, the limes their pleasing shades deny;
For her, the lilies hang their head and die.

Pastoral.

Ye flow'rs, that droop, forsaken by the spring;
Ye birds, that left by summer cease to sing;
Ye trees, that fade when autumn-heats remove;
Say, is not absence death to those who love?
Go, gentle gales, and bear my sighs away!
Curs'd be the fields that cause my Delia's stay:
Fade ev'ry blossom, wither ev'ry tree,
Die ev'ry flow'r and perish all but she.
What have I said? where'er my Delia flies,
Let spring attend, and sudden flow'rs arise;
Let opening roses knotted oaks adorn,
And liquid amber drop from ev'ry thorn.
Go, gentle gales, and bear my sighs along!
The birds shall cease to tune their ev'ning song,
The winds to breathe, the waving woods to move,
And streams to murmur, ere I cease to love.
Not bubbling fountains to the thirsty swain,
Not balmy sleep to lab'rers faint with pain,
Not show'rs to larks, or sunshine to the bee,
Are half so charming as thy sight to me.
Go, gentle gales, and bear my sighs away!
Come, Delia, come! ah, why this long delay?
Through rocks and caves the name of Delia sounds;
Delia, each cave and echoing rock rebounds.
Ye pow'rs, what pleasing frenzy sooths my mind!
Do lovers dream, or is my Delia kind?
She comes, my Delia comes!—now cease, my lay;
And cease, ye gales to bear my sighs away!
Next Ægon sung, while Windsor groves admir'd;
Rehearse, ye muses, what yourselves inspir'd.
Resound, ye hills, resound my mournful strain!
Of perjur'd Doris, dying, I complain:
Here where the mountains, less'ning as they rise,
Lose the low vales, and steal into the skies;
While lab'ring oxen, spent with toil and heat,
In their loose traces from the field retreat;
While curling smokes from village-tops are seen,
And the fleet shades glide o'er the dusky green.
Resound, ye hills, resound my mournful lay!
Beneath yon poplar oft we pass'd the day:
Oft on the rind I carv'd her am'rous vows,
While she with garlands hung the bending boughs:
The garlands fade, the boughs are worn away;
So dies her love, and so my hopes decay.
Resound, ye hills, resound my mournful strain!
Now bright Arcturus glads the teeming grain;
Now golden fruits in loaded branches shine,
And grateful clusters, swell with floods of wine;
Now blushing berries paint the yellow grove:
Just Gods! shall all things yield returns but love?
Resound, ye hills, resound my mournful lay!
The shepherds cry, "Thy flocks are left a prey."——
Ah! what avails it me the flocks to keep,
Who lost my heart, while I preserv'd my sheep?
Pan came, and ask'd, what magic caus'd my smart,
Or what ill eyes malignant glances dart?
What eyes but hers, alas! have pow'r to move?
And is there magic but what dwells in love?
Resound, ye hills, resound my mournful strains!
I'll fly from shepherds, flocks, and flow'ry plains.——
From shepherds, flocks, and plains, I may remove,
Forsake mankind, and all the world—but love!
I know thee, Love! wild as the raging main,
More fell than tygers on the Libyan plain:
Thou wert from Ætna's burning entrails torn,
Got by fierce whirlwinds, and in thunder born.
Resound, ye hills, resound my mournful lay!
Farewel, ye woods, adieu the light of day!
One leap from yonder cliff shall end my pains.
No more, ye hills, no more resound my strains!
Thus sung the shepherds till th' approach of night,
The skies yet blushing with departing light,
When falling dews with spangles deck'd the glade,
And the low sun had lengthen'd ev'ry shade.

To these pastorals, which are written agreeably to the taste of antiquity, and the rules above prescribed, we shall beg leave to subjoin another that may be called *burlesque pastoral*, wherein the ingenious author, Mr Gay, has ventured to deviate from the beaten road, and described the shepherds and ploughmen of our own time and country, instead of those of the golden age, to which the modern critics confine the pastoral. His six pastorals, which he calls the *Shepherd's Week*, are a beautiful and lively representation of the manners, customs, and notions of our rustics. We shall insert the first of them, intitled *The Squabble*, wherein two clowns try to outdo each other in singing the praises of their sweethearts, leaving it to a third to determine the controversy. The persons named are *Lobbin Clout*, *Cuddy*, and *Cloddipole*.

144 Gay.

Lob. Thy younglings, Cuddy, are but just awake;
No throstle shrill the bramble-bush forsake;
No chirping lark the welkin sheen * invokes;
No damsel yet the swelling udder strokes;
O'er yonder hill does scant † the dawn appear;
Then why does Cuddy leave his cott so rear ‡?
Cud. Ah Lobbin Clout! I ween ‖ my plight is guest;
For *he that loves, a stranger is to rest.*
If swains belye not, thou hast prov'd the smart,
And Blouzalinda's mistress of thy heart.
This rising tear betokeneth well thy mind;
Those arms are folded for thy Blouzalind.
And well, I trow, our piteous plights agree;
Thee Blouzalinda smites, Buxoma me.
Lob. Ah Blouzalind! I love thee more by half,
Than deer their fawns, or cows the new-fall'n calf.
Woe worth the tongue, may blisters sore it gall,
That names *Buxoma Blouzalind* withal!
Cud. Hold, witless Lobbin Clout, I thee advise,
Lest blisters sore on thy own tongue arise.
Lo yonder Cloddipole, the blithsome swain,
The wisest lout of all the neighb'ring plain!
From Cloddipole we learnt to read the skies,
To know when hail will fall or winds arise.
He taught us erst * the heifer's tail to view,
When stuck aloft, that show'rs would straight ensue:
He first that useful secret did explain,
That pricking corns foretold the gath'ring rain.
When swallows fleet soar high and sport in air,
He told us that the welkin would be clear.
Let Cloddipole then hear us twain rehearse,
And praise his sweetheart in alternate verse.
I'll wager this same oaken staff with thee,
That Cloddipole shall give the prize to me.
Lob. See this tobacco-pouch, that's lin'd with hair,
Made of the skin of sleekest fallow-deer:
This pouch, that's tied with tape of reddest hue,
I'll wager, that the prize shall be my due.

* Shining or bright sky.
† Scarce.
‡ Early.
‖ Conceive.

* Formerly.

Pastoral.

Cud. Begin thy carrols, then, thou vaunting slouch;
Be thine the oaken staff, or mine the pouch.
Lob. My Blouzalinda is the blithest lass,
Than primrose sweeter, or the clover-grass.
Fair is the king-cup that in meadow blows,
Fair is the daisy that beside her grows;
Fair is the gilly-flow'r of gardens sweet;
Fair is the marygold, for pottage meet:
But Blouzalind's than gilly-flow'r more fair,
Than daisy, marygold, or king-cup rare.
Cud. My brown Buxoma is the featest maid
That e'er at wake delightsome gambol play'd;
Clean as young lambkins, or the goose's down,
And like the goldfinch in her Sunday gown.
The witless lamb may sport upon the plain,
The frisking kid delight the gaping swain;
The wanton calf may skip with many a bound,
And my cur Tray play deftest † feats around:
But neither lamb, nor kid, nor calf, nor Tray,
Dance like Buxoma on the first of May.
Lob. Sweet is my toil when Blouzalind is near;
Of her bereft, 'tis winter all the year.
With her no sultry summer's heat I know;
In winter, when she's nigh, with love I glow.
Come, Blouzalinda, ease thy swain's desire,
My summer's shadow, and my winter's fire!
Cud. As with Buxoma once I work'd at hay,
E'en noon-tide labour seem'd an holiday;
And holidays, if haply she were gone,
Like worky-days I wish'd would soon be done.
Eftsoons ‡, O sweetheart kind, my love repay,
And all the year shall then be holiday.
Lob. As Blouzalinda, in a gamesome mood,
Behind a hay-cock loudly laughing stood,
I slily ran and snatch'd a hasty kiss;
She wip'd her lips, nor took it much amiss.
Believe me, Cuddy, while I'm bold to say,
Her breath was sweeter than the ripen'd hay.
Cud. As my Buxoma, in a morning fair,
With gentle finger stroak'd her milky care,
I quaintly ‖ stole a kiss; at first, 'tis true,
She frown'd, yet after granted one or two.
Lobbin, I swear, believe who will my vows,
Her breath by far excell'd the breathing cows.
Lob. Leek to the Welch, to Dutchmen butter's dear,
Of Irish swains potatoes are the cheer;
Oats for their feasts the Scottish shepherds grind,
Sweet turnips are the food of Blouzalind:
While she loves turnips, butter I'll despise,
Nor leeks, nor oatmeal, nor potatoes prize.
Cud. In good roast beef my landlord sticks his knife,
The capon fat delights his dainty wife;
Pudding our parson eats, the squire loves hare;
But white-pot thick is my Buxoma's fare.
While she loves white-pot, capon ne'er shall be,
Nor hare, nor beef, nor pudding, food for me.
Lob. As once I play'd at blind man's buff, it hapt
About my eyes the towel thick was wrapt:
I miss'd the swains, and seiz'd on Blouzalind;
True speaks that ancient proverb, Love is blind.
Cud. As at hot-cockles once I laid me down,
And felt the weighty hand of many a clown;
Buxoma gave a gentle tap, and I
Quick rose, and read soft mischief in her eye.
Lob. On two near elms the slacken'd cord I hung;
Now high, now low, my Blouzalinda swung;
With the rude wind her rumpled garment rose,
And show'd her taper leg and scarlet hose.
Cud. Across the fallen oak the plank I laid,
And myself pois'd against the tott'ring maid!
High leapt the plank, and down Buxoma fell;
I spy'd—but faithful sweethearts never tell.
Lob. This riddle, Cuddy, if thou canst, explain,
This wily riddle puzzles every swain:
What flow'r is that which bears the virgin's name,
The richest metal joined with the same * ?
Cud. Answer, thou carle, and judge this riddle right,
I'll frankly own thee for a cunning wight:
What flow'r is that which royal honour craves,
Adjoin the virgin, and 'tis strown on graves † ?
Clod. Forbear, contending louts, give o'er your strains;
An oaken staff each merits for his pains.
But see the sun-beams bright to labour warn,
And gild the thatch of goodman Hodge's barn.
Your herds for want of water stand a-dry;
They're weary of your songs—and so am I.

† Nimbleft.

‡ Very soon.

‖ Waggishly.

* Marygold.

† Rosemary.

We have given the rules usually laid down for pastoral writing, and exhibited some examples written on this plan; but we have to observe, that this poem may take very different forms. It may appear either as a comedy or as a ballad. As a pastoral comedy, there is perhaps nothing which possesses equal merit with Ramsay's *Gentle Shepherd*, and we know not where to find in any language a rival to the *Pastoral Ballad* of Shenstone. That the excellence of this poem is great can hardly be questioned, since it compelled a critic, who was never lavish of his praise, and who on all occasions was ready to vilify the pastoral, to express himself in terms of high encomium. "In the first part (says he) are two passages, to which if any mind denies its sympathy, it has no acquaintance with love or nature:

145 Shenstone.

I priz'd every hour that went by,
  Beyond all that had pleas'd me before;
But now they are past, and I sigh,
  And I grieve that I priz'd them no more.
When forc'd the fair nymph to forego,
  What anguish I felt in my heart!
Yet I thought—but it might not be so,
  'Twas with pain that she saw me depart.
She gaz'd, as I slowly withdrew,
  My path I could hardly discern;
So sweetly she bade me adieu,
  I thought that she bade me return.

"In the second (continues the same critic) this passage has its prettiness, though it be not equal to the former:"

I have found out a gift for my fair;
  I have found where the wood-pigeons breed:
But let me that plunder forbear,
  She would say 'twas a barbarous deed:
For he ne'er could be true, she averr'd,
  Who could rob a poor bird of its young;
And I lov'd her the more when I heard
  Such tenderness fall from her tongue.

Sect. V. *Of Didactic or Preceptive Poetry.*

146 Origin and use of didactic poetry.

The method of writing precepts in verse, and embellishing them with the graces of poetry, had its rise, we may suppose, from a due consideration of the frailties

Didactic.

ties and perverseness of human nature; and was intended to engage the affections, in order to improve the mind and amend the heart.

Didactic or preceptive poetry, has been usually employed either to illustrate and explain our moral duties, our philosophical inquiries, our business and pleasures; or in teaching the art of criticism or poetry itself. It may be adapted, however, to any other subject; and may in all cases, where instruction is designed, be employed to good purpose. Some subjects, indeed, are more proper than others, as they admit of more poetical ornaments, and give a greater latitude to genius: but whatever the subject is, those precepts are to be laid down that are the most useful; and they should follow each other in a natural easy method, and be delivered in the most agreeable engaging manner. What the prose writer tells you ought to be done, the poet often conveys under the form of a narration, or shows the necessity of in a description; and by representing the action as done, or doing, conceals the precept that should enforce it. The poet likewise, instead of telling the whole truth, or laying down all the rules that are requisite, selects such parts only as are the most pleasing, and communicates the rest indirectly, without giving us an open view of them; yet takes care that nothing shall escape the reader's notice with which he ought to be acquainted. He discloses just enough to lead the imagination into the parts that are concealed; and the mind, ever gratified with its own discoveries, is complimented with exploring and finding them out; which, though done with ease, seems so considerable, as not to be obtained but in consequence of its own adroitness and sagacity.

147
Rules to be observed in its composition.

But this is not sufficient to render didactic poetry always pleasing: for where precepts are laid down one after another, and the poem is of considerable length, the mind will require some recreation and refreshment by the way; which is to be procured by seasonable moral reflections, pertinent remarks, familiar similies, and descriptions naturally introduced, by allusions to ancient histories or fables, and by short and pleasant digressions and excursions into more noble subjects, so aptly brought in, that they may seem to have a remote relation, and be of a piece with the poem. By thus varying the form of instruction, the poet gives life to his precepts, and awakens and secures our attention, without permitting us to see by what means we are thus captivated: and his art is the more to be admired, because it is so concealed as to escape the reader's observation.

The style, too, must maintain a dignity suitable to the subject, and every part be drawn in such lively colours, that the things described may seem as if presented to the reader's view.

But all this will appear more evident from example; and though entire poems of this kind are not within the compass of our design, we shall endeavour to select such passages as will be sufficient to illustrate the rules we have here laid down.

We have already observed, that, according to the usual divisions, there are four kinds of didactic poems, viz. those that respect our moral duties, our philosophical speculations, our business and pleasures, or that give precepts for poetry and criticism.

I. On the first subject, indeed, we have scarce any thing that deserves the name of poetry, except Mr Pope's *Essay on Man*, his *Ethic Epistles*, Blackmore's *Creation*, and part of Young's *Night Thoughts*; to which therefore we refer as examples.

II. Those preceptive poems that concern philosophical speculations, though the subject is so pregnant with matter, affords such a field for fancy, and is so capable of every decoration, are but few. Lucretius is the most considerable among the ancients who has written in this manner; among the moderns we have little else but small detached pieces, except the poem called *Anti-Lucretius*, which has not yet received an English dress; Dr Akenside's *Pleasures of the Imagination*, and Dr Darwin's *Botanic Garden*; which are all worthy of our admiration. Some of the small pieces in this department are also well executed; and there is one entitled the *Universe*, written by Mr Baker, from which we shall borrow an example.

The author's scheme is in some measure coincident with Mr Pope's, so far especially as it tends to restrain the pride of man, with which design it was professedly written.

The passage we have selected is that respecting the planetary system.

148
Examples in didactic poetry.

Unwise! and thoughtless! impotent! and blind!
Can wealth, or grandeur, satisfy the mind?
Of all those pleasures mortals most admire,
Is there one joy sincere, that will not tire?
Can love itself endure? or beauty's charms
Afford that bliss we fancy in its arms?—
Then, let thy soul more glorious aims pursue:
Have thy CREATOR and his works in view.
Be these thy study: hence thy pleasures bring:
And drink large draughts of wisdom from its spring;
That spring, whence perfect joy, and calm repose,
And blest content, and peace eternal, flows.
Observe how regular the planets run,
In stated times, their courses round the Sun.
Diff'rent their bulk, their distance, their career,
And diff'rent much the compass of their year:
Yet all the same eternal laws obey,
While God's unerring finger points the way.
First Mercury, amidst full tides of light,
Rolls next the sun, through his small circle bright.
All that dwell here must be refin'd and pure:
Bodies like ours such ardour can't endure:
Our earth would blaze beneath so fierce a ray,
And all its marble mountains melt away.
Fair Venus, next, fulfils her larger round,
With softer beams, and milder glory crown'd.
Friend to mankind, she glitters from afar,
Now the bright ev'ning, now the morning star.
More distant still, our earth comes rolling on,
And forms a wider circle round the sun:
With her the moon, companion ever dear!
Her course attending through the shining year.
See, Mars, alone, runs his appointed race,
And measures out, exact, the destin'd space:
Nor nearer does he wind, nor farther stray,
But finds the point whence first he roll'd away.
More yet remote from day's all-cheering source,
Vast Jupiter performs his constant course:
Four friendly moons, with borrow'd lustre, rise,
Bestow their beams divine, and light his skies.
Farthest and last, scarce warm'd by Phœbus' ray,
Through his vast orbit Saturn wheels away.

How

Didactic.

How great the change could we be wafted there!
How slow the seasons! and how long the year!
One moon, on us, reflects its cheerful light:
There, five attendants brighten up the night.
Here, the blue firmament bedeck'd with stars;
There, over-head, a lucid arch appears.
From hence, how large, how strong, the sun's bright ball!
But seen from thence, how languid and how small! —
When the keen north with all its fury blows,
Congeals the floods, and forms the fleecy snows,
'Tis heat intense to what can there be known:
Warmer our poles than is its burning zone.
 Who there inhabit must have other pow'rs,
Juices, and veins, and sense, and life, than ours.
One moment's cold, like theirs, would pierce the bone,
Freeze the heart-blood, and turn us all to stone.
 Strange and amazing must the diff'rence be
'Twixt this dull planet and bright Mercury:
Yet reason says, nor can we doubt at all,
Millions of beings dwell on either ball,
With constitutions fitted for that spot,
Where Providence, all-wise, has fix'd their lot.
 Wondrous art thou, O God, in all thy ways!
Their eyes to thee let all thy creatures raise;
Adore thy grandeur, and thy goodness praise.
 Ye sons of men! with satisfaction know,
God's own right hand dispenses all below:
Nor good nor evil does by chance befall;
He reigns supreme, and he directs it all.
 At his command, affrighting human-kind,
Comets drag on their blazing lengths behind:
Nor, as we think, do they at random rove,
But, in determin'd times, through long ellipses move.
And tho' sometimes they near approach the sun,
Sometimes beyond our system's orbit run;
Throughout their race they act their Maker's will,
His pow'r declare, his purposes fulfil.

III. Of those preceptive poems that treat of the business and pleasures of mankind, Virgil's *Georgics* claim our first and principal attention. In these he has laid down the rules of husbandry in all its branches with the utmost exactness and perspicuity, and at the same time embellished them with all the beauties and graces of poetry. Though his subject was husbandry, he has delivered his precepts, as Mr Addison observes, not with the simplicity of a ploughman, but with the address of a poet: the meanest of his rules are laid down with a kind of grandeur; *and he breaks the clods, and tosses about the dung, with an air of gracefulness*. Of the different ways of conveying the same truth to the mind, he takes that which is pleasantest; and this chiefly distinguishes poetry from prose, and renders Virgil's rules of husbandry more delightful and valuable than any other.

These poems, which are esteemed the most perfect of the author's works, are, perhaps, the best that can be proposed for the young student's imitation in this manner of writing; for the whole of his *Georgics* is wrought up with wonderful art, and decorated with all the flowers of poetry.

IV. Of those poems which give precepts for the recreations and pleasures of a country life, we have several in our own language that are justly admired. As the most considerable of those diversions, however, are finely treated by Mr Gay in his *Rural Sports*, we particularly refer to that poem.

We should here treat of those preceptive poems that teach the art of poetry itself, of which there are many that deserve particular attention; but we have anticipated our design, and rendered any farther notice of them in a manner useless, by the observations we have made in the course of this treatise. We ought however to remark, that Horace was the only poet among the ancients who wrote precepts for poetry in verse; at least his epistle to the Pisos is the only piece of the kind that has been handed down to us; and that is so perfect, it seems almost to have precluded the necessity of any other. Among the moderns we have several that are justly admired; as Boileau, Pope, &c.

Poets who write in the preceptive manner should take care to choose such subjects as are worthy of their muse, and of consequence to all mankind; for to bestow both parts and pains to teach people trifles that are unworthy of their attention, is to the last degree ridiculous.

Among poems of the useful and interesting kind, Dr Armstrong's *Art of Preserving Health* deserves particular recommendation, as well in consideration of the subject, as of the elegant and masterly manner in which he has treated it; for he has made those things, which are in their own nature dry and unentertaining, perfectly agreeable and pleasing, by adhering to the rules observed by Virgil and others, in the conduct of these poems.

149 Its proper style.

With regard to the style or dress of these poems, it should be so rich as to hide the nakedness of the subject, and the barrenness of the precepts should be lost in the lustre of the language. "It ought to abound in the most bold and forcible metaphors, the most glowing and picturesque epithets; it ought to be elevated and enlivened by pomp of numbers and majesty of words, and by every figure that can lift a language above the vulgar and current expressions." (*Warton on Didactic Poetry.*) One may add, that in no kind of poetry (not even in the sublime ode) is beauty of expression so much to be regarded as in this. For the epic writer should be very cautious of indulging himself in too florid a manner of expression, especially in the dramatic parts of his fable, where he introduces dialogue: and the writer of tragedy cannot fall into so nauseous and unnatural an affectation, as to put laboured descriptions, pompous epithets, studied phrases, and high-flown metaphors, into the mouths of his characters. But as the didactic poet speaks in his own person, it is necessary and proper for him to use a brighter colouring of style, and to be more studious of ornament. And this is agreeable to an admirable precept of Aristotle, which no writer should ever forget,—"That diction ought most to be laboured in the unactive, that is, the descriptive, parts of a poem, in which the opinions, manners, and passions of men are not represented; for too glaring an expression obscures the manners and the sentiments."

We have already observed that any thing in nature may be the subject of this poem. Some things however will appear to more advantage than others, as they give a greater latitude to genius, and admit of more poetical ornaments. Natural history and philosophy are copious subjects. Precepts in these might be be decorated with all the flowers in poetry; and, as Dr Trapp obſerves, how can poetry be better employed, or more agreeably to its nature and dignity, than in celebrating the works of the great Creator, and deſcribing the nature and generation of animals, vegetables, and minerals; the revolutions of the heavenly bodies; the motions of the earth; the flux and reflux of the ſea; the cauſe of thunder, lightning, and other meteors; the attraction of the magnet; the gravitation, coheſion, and repulſion of matter; the impulſive motion of light; the ſlow progreſſion of ſounds; and other amazing phenomena of nature? Moſt of the arts and ſciences are alſo proper ſubjects for this poem; and none are more ſo than its two ſiſter arts, painting and muſic. In the former, particularly, there is room for the moſt entertaining precepts concerning the diſpoſal of colours; the arrangement of lights and ſhades; the ſecret attractives of beauty; the various ideas which make up the one; the diſtinguiſhing between the attitudes proper to either ſex, and every paſſion; the repreſenting proſpects of buildings, battles, or the country; and laſtly, concerning the nature of imitation, and the power of painting. What a boundleſs field of invention is here? What room for deſcription, compariſon, and poetical fable? How eaſy the tranſition, at any time, from the draught to the original, from the ſhadow to the ſubſtance? and from hence, what noble excurſions may be made into hiſtory, into panegyric upon the greateſt beauties or heroes of the paſt or preſent age?

Sect. VI. *Of the Epiſtle.*

150
The character of the epiſtle.

This ſpecies of writing, if we are permitted to lay down rules from the examples of our beſt poets, admits of great latitude, and ſolicits ornament and decoration: yet the poet is ſtill to conſider, that the true character of the epiſtle is eaſe and elegance; nothing therefore ſhould be forced or unnatural, laboured, or affected, but every part of the compoſition ſhould breathe an eaſy, polite, and unconſtrained freedom.

It is ſuitable to every ſubject; for as the epiſtle takes place of diſcourſe, and is intended as a ſort of diſtant converſation, all the affairs of life and reſearches into nature may be introduced. Thoſe, however, which are fraught with compliment or condolence, that contain a deſcription of places, or are full of pertinent remarks, and in a familiar and humorous way deſcribe the manners, vices, and follies of mankind, are the beſt; becauſe they are moſt ſuitable to the true character of epiſtolary writing, and (buſineſs ſet apart) are the uſual ſubjects upon which our letters are employed.

All farther rules and directions are unneceſſary; for this kind of writing is better learned by example and practice than by precept. We ſhall therefore, in conformity to our plan, ſelect a few epiſtles for the reader's imitation; which, as this method of writing has of late much prevailed, may be beſt taken, perhaps, from our modern poets.

The following letter from Mr Addiſon to Lord Halifax, contains an elegant deſcription of the curioſities and places about Rome, together with ſuch reflections on the ineſtimable bleſſings of liberty as muſt give pleaſure to every Briton, eſpecially when he ſees them thus placed in direct oppoſition to the baneful influence of ſlavery and oppreſſion, which are ever to be ſeen among the miſerable inhabitants of thoſe countries.

151
Examples in epiſtolary poetry from Addiſon.

While you, my lord, the rural ſhades admire,
And from Britannia's public poſts retire,
Nor longer, her ungrateful ſons to pleaſe,
For their advantage ſacrifice your eaſe;
Me into foreign realms my fate conveys,
Through nations fruitful of immortal lays,
Where the ſoft ſeaſon and inviting clime
Conſpire to trouble your repoſe with rhime.

For whereſoe'er I turn my raviſh'd eyes,
Gay gilded ſcenes and ſhining proſpects riſe,
Poetic fields encompaſs me around,
And ſtill I ſeem to tread on claſſic ground;
For here the muſe ſo oft her harp has ſtrung,
That not a mountain rears its head unſung,
Renown'd in verſe each ſhady thicket grows,
And ev'ry ſtream in heav'nly numbers flows.

How am I pleas'd to ſearch the hills and woods
For riſing ſprings and celebrated floods;
To view the Nar, tumultuous in his courſe,
And trace the ſmooth Clitumnus to his ſource;
To ſee the Mincia draw its wat'ry ſtore
Through the long windings of a fruitful ſhore,
And hoary Albula's infected tide
O'er the warm bed of ſmoking ſulphur glide!

Fir'd with a thouſand raptures, I ſurvey
Eridanus thro' flow'ry meadows ſtray,
The king of floods! that, rolling o'er the plains,
The tow'ring Alps of half their moiſture drains,
And, proudly ſwoln with a whole winter's ſnows,
Diſtributes wealth and plenty where he flows.

Sometimes, miſguided by the tuneful throng,
I look for ſtreams immortaliz'd in ſong,
That loſt in ſilence and oblivion lie,
(Dumb are their fountains and their channels dry)
Yet run for ever by the muſe's ſkill,
And in the ſmooth deſcription murmur ſtill.

Sometimes to gentle Tiber I retire,
And the fam'd river's empty ſhores admire,
That, deſtitute of ſtrength, derives its courſe
From thirſty urns, and an unfruitful ſource;
Yet ſung ſo often in poetic lays,
With ſcorn the Danube and the Nile ſurveys;
So high the deathleſs muſe exalts her theme!
Such was the Boyn, a poor inglorious ſtream,
That in Hibernian vales obſcurely ſtray'd,
And unobſerv'd in wild meanders play'd;
Till, by your lines, and Naſſau's ſword renown'd,
Its riſing billows through the world reſound,
Where'er the hero's godlike acts can pierce,
Or where the fame of an immortal verſe.

Oh cou'd the muſe my raviſh'd breaſt inſpire
With warmth like yours, and raiſe an equal fire,
Unnumber'd beauties in my verſe ſhould ſhine,
And Virgil's Italy ſhould yield to mine!

See how the golden groves around me ſmile,
That ſhun the coaſts of Britain's ſtormy iſle,
Or when tranſplanted and preſerv'd with care,
Curſe the cold clime, and ſtarve in northern air.
Here kindly warmth their mounting juice ferments
To nobler taſtes, and more exalted ſcents:
Ev'n the rough rocks with tender myrtles bloom,
And trodden weeds ſend out a rich perfume.

Epistle.

Bear me, some god, to Baia's gentle seats,
Or cover me in Umbria's green retreats;
Where western gales eternally reside,
And all the seasons lavish all their pride:
Blossoms, and fruits, and flow'rs together rise,
And the whole year in gay confusion lies.
Immortal glories in my mind revive,
And in my soul a thousand passions strive,
When Rome's exalted beauties I descry
Magnificent in piles of ruin lie.
An amphitheatre's amazing height
Here fills my eye with terror and delight,
That on its public shows unpeopled Rome,
And held uncrowded nations in its womb:
Here pillars rough with sculpture pierce the skies;
And here the proud triumphal arches rise,
Where the old Romans deathless acts display'd,
Their base degenerate progeny upbraid:
Whole rivers here forsake the fields below,
And wond'ring at their height thro' airy channels flow.
Still to new scenes my wand'ring muse retires;
And the dumb show of breathing rocks admires;
Where the smooth chissel all its force has shown,
And soften'd into flesh the rugged stone.
In solemn silence, a majestic band,
Heroes, and gods, and Roman consuls stand,
Stern tyrants, whom their cruelties renown,
And emperors in Parian marble frown;
While the bright dames, to whom they humbly su'd,
Still show the charms that their proud hearts subdu'd.
Fain would I Raphael's godlike art rehearse,
And show th' immortal labours in my verse,
Where from the mingled strength of shade and light
A new creation rises to my sight,
Such heav'nly figures from his pencil flow,
So warm with life his blended colours glow.
From theme to theme with secret pleasure tost,
Amidst the soft variety I'm lost.
Here pleasing airs my ravish'd soul confound
With circling notes and labyrinths of sound;
Here domes and temples rise in distant views,
And opening palaces invite my muse.
How has kind heav'n adorn'd the happy land,
And scatter'd blessings with a wasteful hand!
But what avail her unexhausted stores,
Her blooming mountains, and her sunny shores,
With all the gifts that heav'n and earth impart,
The smiles of nature, and the charms of art,
While proud oppression in her valleys reigns,
And tyranny usurps her happy plains?
The poor inhabitant beholds in vain
The red'ning orange and the swelling grain:
Joyless he sees the growing oils and wines,
And in the myrtle's fragrant shade repines:
Starves, in the midst of nature's bounty curst,
And in the loaded vineyard dies for thirst.
O liberty, thou goddess heav'nly bright,
Profuse of bliss, and pregnant with delight!
Eternal pleasures in thy presence reign,
And smiling plenty leads thy wanton train;
Eas'd of her load, subjection grows more light,
And poverty looks cheerful in thy sight;
Thou mak'st the gloomy face of nature gay,
Giv'st beauty to the sun, and pleasure to the day.
Thee, goddess, thee, Britannia's isle adores;
How has she oft exhausted all her stores,
How oft in fields of death thy presence sought,
Nor thinks the mighty prize too dearly bought!
On foreign mountain may the sun refine
The grape's soft juice, and mellow it to wine,
With citron groves adorn a distant soil,
And the fat olive swell with floods of oil:
We envy not the warmer clime, that lies
In ten degrees of more indulgent skies,
Nor at the coarseness of our heav'n repine,
Tho' o'er our heads the frozen Pleiads shine:
'Tis liberty that crowns Britannia's isle, [smile.
And makes her barren rocks and her bleak mountains
Others with tow'ring piles may please the sight,
And in their proud aspiring domes delight;
A nicer touch to the stretch'd canvas give,
Or teach their animated rocks to live:
'Tis Britain's care to watch o'er Europe's fate,
And hold in balance each contending state,
To threaten bold presumptuous kings with war,
And answer her afflicted neighbour's pray'r.
The Dane and Swede, rous'd up by fierce alarms,
Bless the wise conduct of her pious arms:
Soon as her fleets appear, their terrors cease,
And all the northern world lies hush'd in peace.
Th' ambitious Gaul beholds with secret dread
Her thunder aim'd at his aspiring head,
And fain her godlike sons would disunite
By foreign gold, or by domestic spite;
But strives in vain to conquer or divide,
Whom Nassau's arms defend and counsels guide.
Fir'd with the name, which I so oft have found
The distant climes and diff'rent tongues resound,
I bridle in my struggling muse with pain,
That longs to launch into a bolder strain.
But I've already troubled you too long,
Nor dare attempt a more advent'rous song:
My humble verse demands a softer theme,
A painted meadow, or a purling stream;
Unfit for heroes; whom immortal lays,
And lines like Virgil's, or like yours, should praise.

There is a fine spirit of freedom, and love of liberty, displayed in the following letter from Lord Lyttleton to Mr Pope; and the message from the shade of Virgil, which is truly poetical, and justly preceptive, may prove an useful lesson to future bards.

From Rome, 1730. 152 Lyttleton.

IMMORTAL bard! for whom each muse has wove
The fairest garlands of the Aonian grove;
Preserv'd, our drooping genius to restore,
When Addison and Congreve are no more;
After so many stars extinct in night,
The darken'd age's last remaining light!
To thee from Latian realms this verse is writ,
Inspir'd by memory of ancient wit:
For now no more these climes their influence boast,
Fall'n is their glory, and their virtue lost;
From tyrants, and from priests, the muses fly,
Daughters of reason and of liberty.
Nor Baiæ now nor Umbria's plain they love,
Nor on the banks of Nar or Mincia rove;
To Thames's flow'ry borders they retire,
And kindle in thy breast the Roman fire.

Epistle.

So in the shades, where cheer'd with summer rays
Melodious linnets warbled sprightly lays,
Soon as the faded, falling leaves complain
Of gloomy winter's inauspicious reign,
No tuneful voice is heard of joy or love,
But mournful silence saddens all the grove.
Unhappy Italy! whose alter'd state
Has felt the worst severity of fate:
Not that barbarian hands her fasces broke,
And bow'd her haughty neck beneath their yoke;
Nor that her palaces to earth are thrown,
Her cities desert, and her fields unsown;
But that her ancient spirit is decay'd,
That sacred wisdom from her bounds is fled,
That there the source of science flows no more,
Whence its rich streams supply'd the world before.
Illustrious names! that once in Latium shin'd,
Born to instruct and to command mankind;
Chiefs, by whose virtue mighty Rome was rais'd,
And poets, who those chiefs sublimely prais'd!
Oft I the traces you have left explore,
Your ashes visit, and your urns adore;
Oft kiss, with lips devout, some mould'ring stone,
With ivy's venerable shade o'ergrown;
Those hallow'd ruins better pleas'd to see,
Than all the pomp of modern luxury.
As late on Virgil's tomb fresh flow'rs I strow'd,
While with th' inspiring muse my bosom glow'd,
Crown'd with eternal bays, my ravish'd eyes
Beheld the poet's awful form arise:
Stranger, he said, whose pious hand has paid
These grateful rites to my attentive shade,
When thou shalt breathe thy happy native air,
To Pope this message from his master bear.
Great bard, whose numbers I myself inspire,
To whom I gave my own harmonious lyre,
If high exalted on the throne of wit,
Near me and Homer thou aspire to sit,
No more let meaner satire dim the rays
That flow majestic from thy noble bays.
In all the flow'ry paths of Pindus stray:
But shun that thorny, that unpleasing way;
Nor, when each soft engaging muse is thine,
Address the least attractive of the nine.
Of thee more worthy were the task to raise
A lasting column to thy country's praise,
To sing the land, which yet alone can boast
That liberty corrupted Rome has lost;
Where science in the arms of peace is laid,
And plants her palm beneath the olive's shade.
Such was the theme for which my lyre I strung,
Such was the people whose exploits I sung;
Brave, yet refin'd, for arms and arts renown'd,
With diff'rent bays by Mars and Phœbus crown'd,
Dauntless opposers of tyrannic sway,
But pleas'd a mild AUGUSTUS to obey.
If these commands submissive thou receive,
Immortal and unblam'd thy name shall live;
Envy to black Cocytus shall retire,
And howl with furies in tormenting fire;
Approving time shall consecrate thy lays,
And join the patriot's to the poet's praise.

The following letter from Mr Philips to the earl of Dorset is entirely descriptive; but is one of those descriptions which will be ever read with delight.

Epistle.

153 Philips, and

Copenhagen, March 9. 1709.

FROM frozen climes, and endless tracts of snow,
From streams which northern winds forbid to flow,
What present shall the muse to Dorset bring,
Or how, so near the pole, attempt to sing?
The hoary winter here conceals from sight
All pleasing objects which to verse invite.
The hills and dales, and the delightful woods,
The flow'ry plains, and silver-streaming floods,
By snow disguis'd, in bright confusion lie,
And with one dazzling waste fatigue the eye.
No gentle breathing breeze prepares the spring,
No birds within the desert region sing:
The ships, unmov'd, the boist'rous winds defy,
While rattling chariots o'er the ocean fly.
The vast Leviathan wants room to play,
And spout his waters in the face of day:
The starving wolves along the main sea sprowl,
And to the moon in icy valleys howl.
O'er many a shining league the level main
Here spreads itself into a glassy plain:
There solid billows of enormous size,
Alps of green ice, in wild disorder rise.
And yet but lately have I seen, ev'n here,
The winter in a lovely dress appear.
Ere yet the clouds let fall the treasur'd snow,
Or winds began through hazy skies to blow,
At ev'ning a keen eastern breeze arose,
And the descending rain unsully'd froze;
Soon as the silent shades of night withdrew,
The ruddy morn disclos'd at once to view
The face of nature in a rich disguise,
And brighten'd ev'ry object to my eyes:
For ev'ry shrub, and ev'ry blade of grass,
And ev'ry pointed thorn, seem'd wrought in glass;
In pearls and rubies rich the hawthorns show,
While through the ice the crimson berries glow.
The thick sprung reeds, which watery marshes yield,
Seem'd polish'd lances in a hostile field.
The stag in limpid currents with surprise,
Sees crystal branches on his forehead rise:
The spreading oak, the beech, and tow'ring pine,
Glaz'd over, in the freezing æther shine.
The frighted birds the rattling branches shun,
Which wave and glitter in the distant sun.
When if a sudden gust of wind arise,
The brittle forest into atoms flies,
The crackling woods beneath the tempest bends,
And in a spangled shower the prospect ends:
Or, if a southern gale the region warm,
And by degrees unbend the wint'ry charm,
The traveller a miry country sees,
And journey sad beneath the dropping trees:
Like some deluded peasant Merlin leads
Thro' fragrant bow'rs and thro' delicious meads,
While here enchanted gardens to him rise,
And airy fabrics there attract his eyes,
His wandering feet the magic paths pursue,
And while he thinks the fair illusion true,
The trackless scenes disperse in fluid air,
And woods, and wilds, and thorny ways appear;
A tedious road the weary wretch returns,
And, as he goes, the transient vision mourns.

The great use of medals is properly described in the ensuing elegant epistle from Mr Pope to Mr Addison; and

Epistle. and the extravagant passion which some people entertain only for the colour of them, is very agreeably and very justly ridiculed.

154 Pope. See the wild waste of all devouring years!
How Rome her own sad sepulchre appears!
With nodding arches, broken temples spread!
The very tombs now vanish like their dead!
Imperial wonders rais'd on nations spoil'd,
Where mix'd with slaves the groaning martyr toil'd!
Huge theatres, that now unpeopled woods,
Now drain'd a distant country of her floods!
Fanes, which admiring gods with pride survey,
Statues of men, scarce less alive than they!
Some felt the silent stroke of mould'ring age,
Some hostile fury, some religious rage;
Barbarian blindness, Christian zeal conspire,
And papal piety, and Gothic fire.
Perhaps, by its own ruin sav'd from flame,
Some bury'd marble half preserves a name:
That name the learn'd with fierce disputes pursue,
And give to Titus old Vespasian's due.
Ambition sigh'd: She found it vain to trust
The faithless column and the crumbling bust;
Huge moles, whose shadow stretch'd from shore to shore,
Their ruins perish'd, and their place no more!
Convinc'd, she now contracts her vast design,
And all her triumphs shrink into a coin.
A narrow orb each crowded conquest keeps,
Beneath her palm here sad Judæa weeps;
Now scantier limits the proud arch confine,
And scarce are seen the prostrate Nile or Rhine;
A small Euphrates through the piece is roll'd,
And little eagles wave their wings in gold.
The medal, faithful to its charge of fame,
Through climes and ages bears each form and name:
In one short view subjected to our eye,
Gods, emp'rors, heroes, sages, beauties, lie.
With sharpen'd sight pale antiquaries pore,
Th' inscription value, but the rust adore.
This the blue varnish, that the green endears,
The sacred rust of twice ten hundred years!
To gain Pescennius one employs his schemes,
One grasps a Cecrops in ecstatic dreams.
Poor Vadius, long with learned spleen devour'd,
Can taste no pleasure since his shield was scour'd:
And Curio, restless by the fair one's side,
Sighs for an Otho, and neglects his bride.
Their's is the vanity, the learning thine:
Touch'd by thy hand, again Rome's glories shine;
Her gods and god-like heroes rise to view,
And all her faded garlands bloom anew.
Nor blush these studies thy regard engage;
These pleas'd the fathers of poetic rage;
The verse and sculpture bore an equal part,
And art reflected images to art.
Oh when shall Britain, conscious of her claim,
Stand emulous of Greek and Roman fame?
In living medals see her wars enroll'd,
And vanquish'd realms supply recording gold?
Here, rising bold, the patriot's honest face;
There, warriors frowning in historic brass?
Then future ages with delight shall see
How Plato's, Bacon's, Newton's, looks agree;
Or in fair series laurell'd bards be shown,
A Virgil there, and here an Addison.
Then shall thy CRAGGS (and let me call him mine)
On the cast ore, another Pollio shine;
With aspect open shall erect his head,
And round the orb in lasting notes be read,
"Statesman, yet friend to truth! of soul sincere,
"In action faithful, and in honour clear;
"Who broke no promise, serv'd no private end,
"Who gain'd no title, and who lost no friend;
"Ennobled by himself, by all approv'd,
"Prais'd, wept, and honour'd, by the muse he lov'd."

Epistle. We have already observed, that the essential, and indeed the true characteristic of epistolary writing, is ease; and on this account, as well as others, the following letter from Mr Pope to Miss Blount is to be admired.

To Miss BLOUNT, on her leaving the Town after the Coronation.

As some fond virgin, whom her mother's care
Drags from the town to wholesome country air;
Just when she learns to roll a melting eye,
And hear a spark, yet think no danger nigh;
From the dear man unwilling she must sever,
Yet takes one kiss before she parts for ever:
Thus from the world fair Zephalinda flew,
Saw others happy, and with sighs withdrew:
Not that their pleasures caus'd her discontent;
She sigh'd, not that they stay'd, but that she went.
She went, to plain-work, and to purling brooks,
Old-fashion'd halls, dull aunts, and croaking rooks:
She went from op'ra, park, assembly, play,
To morning-walks, and pray'rs three hours a-day;
To part her time 'twixt reading and bohea,
To muse, and spill her solitary tea,
Or o'er cold coffee trifle with the spoon,
Count the slow clock, and dine exact at noon;
Divert her eyes with pictures in the fire,
Hum half a tune, tell stories to the 'squire;
Up to her godly garret after seven,
There starve and pray, for that's the way to heav'n.
Some 'squire, perhaps, you take delight to rack;
Whose game is whisk, whose trea.'s a toast in sack;
Who visits with a gun, presents you birds,
Then gives a smacking buss, and cries,—no words!
Or with his hound comes hollowing from the stable,
Makes love with nods, and knees beneath a table;
Whose laughs are hearty, tho' his jests are coarse,
And loves you best of all things—but his horse.
In some fair ev'ning, on your elbow laid,
You dream of triumphs in the rural shade;
In pensive thought recal the fancy'd scene,
See coronations rise on every green;
Before you pass th' imaginary sights
Of lords, and earls, and dukes, and garter'd knights,
While the spread fan o'ershades your closing eyes:
Then give one flirt, and all the vision flies.
Thus vanish sceptres, coronets, and balls,
And leave you in lone woods, or empty walls!
So when your slave, at some dear idle time,
(Not plagu'd with head-achs, or the want of rhyme)
Stands in the streets, abstracted from the crew,
And while he seems to study, thinks of you;
Just when his fancy points your sprightly eyes,
Or sees the blush of soft Parthenia rise,

Gay

Descriptive.

Gay pats my shoulder, and you vanish quite,
Streets, chairs, and coxcombs, rush upon my sight;
Vex'd to be still in town, I knit my brow,
Look sour, and hum a tune, as you may now.

Sect. VII. *Of Descriptive Poetry.*

155 Descriptive poetry.

Descriptive poetry is of universal use, since there is nothing in nature but what may be described. As poems of this kind, however, are intended more to delight than to instruct, great care should be taken to make them agreeable. Descriptive poems are made beautiful by similies properly introduced, images of feigned persons, and allusions to ancient fables or historical facts; as will appear by a perusal of the best of these poems, especially Milton's *L'Allegro* and *Il Penseroso*, Denham's *Cooper Hill*, and Pope's *Windsor Forest*. Every body being in possession of Milton's works, we forbear inserting the two former; and the others are too long for our purpose. That inimitable poem, *The Seasons*, by Mr Thomson, notwithstanding some parts of it are didactic, may be also with propriety referred to this head.

Sect. VIII. *Of Allegorical Poetry.*

156 Origin of allegorical poetry.

Could truth engage the affections of mankind in her native and simple dress, she would require no ornament or aid from the imagination; but her delicate light, though lovely in itself, and dear to the most discerning, does not strike the senses of the multitude so as to secure their esteem and attention: the poets therefore dressed her up in the manner in which they thought she would appear the most amiable, and called in allegories and airy disguises as her auxiliaries in the cause of virtue.

157 Its character.

An allegory is a fable or story, in which, under the disguise of imaginary persons or things, some real action or instructive moral is conveyed to the mind. Every allegory therefore has two senses, the one literal and the other mystical; the first has been aptly enough compared to a dream or vision, of which the last is the true meaning or interpretation.

From this definition of allegorical poetry the reader will perceive that it gives great latitude to genius, and affords such a boundless scope for invention, that the poet is allowed to soar beyond all creation; to give life and action to virtues, vices, passions, diseases, and natural and moral qualities; to raise floating islands, enchanted palaces, castles, &c. and to people them with the creatures of his own imagination.

The poet's eye, in a fine frenzy rolling,
Doth glance from heav'n to earth, from earth to heav'n;
And, as imagination bodies forth
The forms of things unknown, the poet's pen
Turns them to shape, and gives to airy nothing
A local habitation and a name. Shakespeare.

But whatever is thus raised by the magic of his mind must be visionary and typical, and the mystical sense must appear obvious to the reader, and inculcate some moral or useful lesson in life; otherwise the whole will be deemed rather the effects of a distempered brain, than the productions of real wit and genius. The poet, like Jason, may sail to parts unexplored, but will meet with no applause if he returns without a golden fleece; for these romantic reveries would be unpardonable but for the mystical meaning and moral that is thus artfully and agreeably conveyed with them, and on which account only the allegory is indulged with a greater liberty than any other sort of writing.

Allegorical.

The ancients justly considered this sort of allegory as the most essential part of poetry; for the power of raising images of things not in being, giving them a sort of life and action, and presenting them as it were before the eyes, was thought to have something in it like creation: but then, in such compositions, they always expected to find a meaning couched under them of consequence; and we may reasonably conclude, that the allegories of their poets would never have been handed down to us, had they been deficient in this respect.

158 Essentials of a just fable.

As the *fable* is the part immediately offered to the reader's consideration, and intended as an agreeable vehicle to convey the moral, it ought to be bold, lively, and surprising, that it may excite curiosity and support attention; for if the fable be spiritless and barren of invention, the attention will be disengaged, and the moral, however useful and important in itself, will be little regarded.

There must likewise be a justness and propriety in the fable, that is, it must be closely connected with the subject on which it is employed; for notwithstanding the boundless compass allowed the imagination in these writings, nothing absurd or useless is to be introduced. In epic poetry some things may perhaps be admitted for no other reason but to surprise, and to raise what is called the *wonderful*, which is as necessary to the epic as the *probable*; but in allegories, however wild and extravagant the fable and the persons introduced, each must correspond with the subject they are applied to, and, like the members of a well-written simile, bear a due proportion and relation to each other: for we are to consider, that the allegory is a sort of extended or rather multiplied simile, and therefore, like that, should never lose the subject it is intended to illustrate. Whence it will appear, that genius and fancy are here insufficient without the aid of taste and judgment: these first, indeed, may produce a multitude of ornaments, a wilderness of sweets; but the last must be employed to accommodate them to reason, and to arrange them so as to produce pleasure and profit.

But it is not sufficient that the fable be correspondent with the subject, and have the properties above described; for it must also be consistent with itself. The poet may invent what story he pleases, and form any imaginary beings that his fancy shall suggest; but here, as in dramatic writings, when persons are once introduced, they must be supported to the end, and all speak and act in character: for notwithstanding the general licence here allowed, some order must be observed; and however wild and extravagant the characters, they should not be absurd. To this let me add, that the whole must be clear and intelligible; for the "fable (as Mr Hughes observes) being designed only to clothe and adorn the moral, but not to hide it, should resemble the draperies we admire in some of the ancient statues, in which the folds are not too many nor too thick, but so judiciously ordered, that the shape and beauty of the limbs may be seen through them."—But this will more obviously appear from a perusal of the

Allegorical. the best compositions of this class; such as Spenser's Fairy Queen, Thomson's Castle of Indolence, Addison and Johnson's beautiful allegories in the Spectator and Rambler, &c. &c.

The word *allegory* has been used in a more extensive sense than that in which we have here applied it: for all writings, where the moral is conveyed under the cover of borrowed characters and actions, by which other characters and actions (that are real) are represented, have obtained the name of *allegories;* though the fable or story contains nothing that is visionary or romantic, but is made up of real or historical persons, and of actions either probable or possible. But these writings should undoubtedly be distinguished by some other name, because the literal sense is consistent with right reason, and may convey an useful moral, and satisfy the reader, without putting him under the necessity of seeking for another.

Some of the ancient critics, as Mr Addison observes, were fond of giving the works of their poets this second or concealed meaning, though there was no apparent necessity for the attempt, and often but little show of reason in the application. Thus the Iliad and Odyssey of Homer are said to be fables of this kind, and that the gods and heroes introduced are only the affections of the mind represented in a visible shape and character. They tell us, says he, that Achilles in the first Iliad represents anger, or the irascible part of human nature: that upon drawing his sword against his superior, in a full assembly, Pallas (which, say they, is another name for reason) checks and advises him on the occasion, and at her first appearance touches him upon the head; that part of the man being looked upon as the seat of reason. In this sense, as Mr Hughes has well observed, the whole Æneis of Virgil may be said to be an allegory, if you suppose Æneas to represent Augustus Cæsar, and that his conducting the remains of his countrymen from the ruins of Troy, to a new settlement in Italy, is an emblem of Augustus's forming a new government out of the ruins of the aristocracy, and establishing the Romans, after the confusion of the civil war, in a peaceable and flourishing condition. However ingenious this coincidence may appear, and whatever design Virgil had in view, he has avoided a particular and direct application, and so conducted his poem, that it is perfect without any allegorical interpretation; for whether we consider Æneas or Augustus as the hero, the morals contained are equally instructive. And indeed it seems absurd to suppose, that because the epic poets have introduced some allegories into their works, every thing is to be understood in a mystical manner, where the sense is plain and evident without any such application. Nor is the attempt that Tasso made to turn his Jerusalem into a mystery, any particular recommendation of the work: for notwithstanding he tells us, in what is called the *allegory*, printed with it, that the Christian army represents man, the city of Jerusalem civil happiness, Godfrey the understanding, Rinaldo and Tancred the other powers of the soul, and that the body is typified by the common soldiers and the like; yet the reader will find himself as little delighted as edified by the explication: for the mind has little pleasure in an allegory that cannot be opened without a key made by the hand of the same artist; and indeed every allegory that is so dark, and, as it were, inexplicable, loses its very essence, and becomes an enigma or riddle, that is left to be interpreted by every crude imagination. Allegorical.

159 The ancient parable.

This last species of writing, whether called an *allegory*, or by any other name, is not less eminent and useful; for the introducing of real or historical persons may not abridge or lessen either our entertainment or instruction. In these compositions we often meet with an uncommon moral conveyed by the fable in a new and entertaining manner; or with a known truth so artfully decorated, and placed in such a new and beautiful light, that we are amazed how any thing so charming and useful should so long have escaped our observation. Such, for example, are many of Johnson's pieces published in the Rambler under the title of *Eastern Stories*, and by Hawkesworth in the Adventurer.

The ancient parables are of this species of writing: and it is to be observed, that those in the New Testament have a most remarkable elegance and propriety; and are the most striking, and the most instructive, for being drawn from objects that are familiar.—The more striking, because, as the things are seen, the moral conveyed becomes the object of our senses, and requires little or no reflection:—the more instructive, because every time they are seen, the memory is awakened, and the same moral is again exhibited with pleasure to the mind, and accustoms it to reason and dwell on the subject. So that this method of instruction improves nature, as it were, into a book of life; since every thing before us may be so managed, as to give lessons for our advantage. Our Saviour's parables of the sower and the seed, of the tares, of the mustard-seed, and of the leaven (Matthew xiii.), are all of this kind, and were obviously taken from the harvest just ripening before him; for *his disciples plucked the ears of corn and did eat, rubbing them in their hands.* See the articles ALLEGORY, and METAPHOR *and Allegory*, in the general alphabet.

SECT. IX. *Of Fables.*

160 The apologue or fable.

No method of instruction has been more ancient, more universal, and probably none more effectual, than that by apologue or fable. In the first ages, amongst a rude and fierce people, this perhaps was the only method that would have been borne; and even since the progress of learning has furnished other helps, the fable, which at first was used through necessity, is retained from choice, on account of the elegant happiness of its manner, and the refined address with which, when well conducted, it insinuates its moral.

As to the actors in this little drama, the fabulist has authority to press into his service every kind of existence under heaven; not only beasts, birds, insects, and all the animal creation; but flowers, shrubs, trees, and all the tribe of vegetables. Even mountains, fossils, minerals, and the inanimate works of nature, discourse articulately at his command, and act the part which he assigns them. The virtues, vices, and every property of beings, receive from him a local habitation and a name. In short, he may personify, bestow life, speech, and action, on whatever he thinks proper.

It it easy to imagine what a source of novelty and variety this must open to a genius capable of conceiving and of employing these ideal persons in a proper manner; what an opportunity it affords him to diver-

Of Fables. sify his images, and to treat the fancy with changes of objects, while he strengthens the understanding, or regulates the passions, by a succession of truths. To raise beings like these into a state of action and intelligence, gives the fabulist an undoubted claim to that first character of the poet, a *creator*.

161 Rules for its construction.

When these persons are once raised, we must carefully enjoin them proper tasks, and assign them sentiments and language suitable to their several natures and respective properties. A raven should not be extolled for her voice, nor a bear be represented with an elegant shape. It were a very obvious instance of absurdity, to paint a hare cruel, or a wolf compassionate. An ass were but ill qualified to be general of an army, though he may well enough serve, perhaps, for one of the trumpeters. But so long as popular opinion allows to the lion magnanimity, rage to the tiger, strength to the mule, cunning to the fox, and buffoonery to the monkey; why may not they support the characters of an Agamemnon, Achilles, Ajax, Ulysses, and Thersites? The truth is, when moral actions are with judgment attributed to the brute creation, we scarce perceive that nature is at all violated by the fabulist. He appears at most to have only translated their language. His lions, wolves, and foxes, behave and argue as those creatures would, had they originally been endowed with the human faculties of speech and reason.

But greater art is yet required whenever we personify inanimate beings. Here the copy so far deviates from the great lines of nature, that, without the nicest care, reason will revolt against the fiction. However, beings of this sort, managed ingeniously and with address, recommend the fabulist's invention by the grace of novelty and of variety. Indeed the analogy between things natural and artificial, animate and inanimate, is often so very striking, that we can, with seeming propriety, give passions and sentiments to every individual part of existence. Appearance favours the deception. The vine may be enamoured of the elm; her embraces testify her passion. The swelling mountain may, naturally enough, be delivered of a mouse. The gourd may reproach the pine, and the sky-rocket insult the stars. The axe may solicit a new handle of the forest; and the moon, in her female character, request a fashionable garment. Here is nothing incongruous; nothing that shocks the reader with impropriety. On the other hand, were the axe to desire a periwig, and the moon petition for a new pair of boots, probability would then be violated, and the absurdity become too glaring.

The most beautiful fables that ever were invented may be disfigured by the language in which they are clothed. Of this poor Æsop, in some of his English dresses, affords a melancholy proof. The ordinary style of fable should be familiar, but also elegant.

162 The proper style of fable.

The familiar, says Mr La Motte, is the general tone or accent of fable. It was thought sufficient, on its first appearance, to lend the animals our most common language. Nor indeed have they any extraordinary pretensions to the sublime; it being requisite they should speak with the same simplicity that they behave.

The familiar also is more proper for insinuation than the elevated; this being the language of reflection, as the former is the voice of sentiment. We guard ourselves against the one, but lie open to the other; and instruction will always the most effectually sway us, when it appears least jealous of its rights and privileges.

The familiar style, however, that is here required, notwithstanding that appearance of ease which is its character, is perhaps more difficult to write than the more elevated or sublime. A writer more readily perceives when he has risen above the common language, than he perceives, in speaking this language, whether he has made the choice that is most suitable to the occasion: and it is, nevertheless, upon this happy choice that all the charms of the familiar depend. Moreover, the elevated style deceives and seduces, although it be not the best chosen; whereas the familiar can procure itself no sort of respect, if it be not easy, natural, just, delicate, and unaffected. A fabulist must therefore bestow great attention upon his style; and even labour it so much the more, that it may appear to have cost him no pains at all.

The authority of Fontaine justifies these opinions in regard to style. His fables are perhaps the best examples of the genteel familiar, as Sir Roger L'Estrange affords the grossest of the indelicate and low. When we read, that "while the frog and the mouse were disputing it at swords-point, down comes a kite powdering upon them in the interim, and gobbets up both together to part the fray;" and "where the fox reproaches a bevy of jolly gossipping wenches making merry over a dish of pullets, that if he but peeped into a hen-roost, they always made a bawling with their dogs and their bastards; while you yourselves (says he) can lie stuffing your guts with your hens and capons, and not a word of the pudding:" This may be familiar; but it is also coarse and vulgar, and cannot fail to disgust a reader that has the least degree of taste or delicacy.

The style of fable then must be simple and familiar; and it must likewise be correct and elegant. By the former, we mean, that it should not be loaded with figure and metaphor; that the disposition of words be natural, the turn of sentences easy, and their construction unembarrassed. By elegance, we would exclude all coarse and provincial terms; all affected and puerile conceits; all obsolete and pedantic phrases. To this we would adjoin, as the word perhaps implies, a certain finishing polish, which gives a grace and spirit to the whole; and which, though it have always the appearance of nature, is almost ever the effect of art.

But notwithstanding all that has been said, there are some occasions on which it is allowable, and even expedient, to change the style. The language of a fable must rise or fall in conformity to the subject. A lion, when introduced in his regal capacity, must hold discourse in a strain somewhat more elevated than a country-mouse. The lioness then becomes his queen, and the beasts of the forest are called his subjects: a method that offers at once to the imagination both the animal and the person he is designed to represent. Again, the buffoon-monkey should avoid that pomp of phrase, which the owl employs as her best pretence to wisdom.

7

Satire. wisdom. Unless the style be thus judiciously varied, it will be impossible to preserve a just distinction of character.

Descriptions, at once concise and pertinent, add a grace to fable; but are then most happy when included in the action: whereof the fable of Boreas and the Sun affords us an example. An epithet well chosen is often a description in itself; and so much the more agreeable, as it the less retards us in our pursuit of the catastrophe.

Lastly, little strokes of humour when arising naturally from the subject, and incidental reflections when kept in due subordination to the principal, add a value to these compositions. These latter, however, should be employed very sparingly, and with great address; be very few, and very short: it is scarcely enough that they naturally spring out of the subject; they should be such as to appear necessary and essential parts of the fable. And when these embellishments, pleasing in themselves, tend to illustrate the main action, they then afford that nameless grace remarkable in Fontaine and some few others, and which persons of the best discernment will more easily conceive than they can explain.

Sect. X. *Of Satire.*

163 Origin of Satire.

This kind of poem is of very ancient date, and (if we believe Horace) was introduced, by way of interlude, by the Greek dramatic poets in their tragedies, to relieve the audience, and take off the force of those strokes which they thought too deep and affecting. In those satirical interludes, the scene was laid in the country; and the persons were rural deities, satyrs, country peasants, and other rustics.

The first Tragedians found that serious style
Too grave for their uncultivated age,
And so brought wild and naked Satyrs in
(Whose motion, words, and shape, were all a farce)
As oft as decency wou'd give them leave;
Because the mad, ungovernable rout,
Full of confusion and the fumes of wine,
Lov'd such variety and antic tricks.

Roscommon's Horace.

The satire we now have is generally allowed to be of Roman invention. It was first introduced without the decorations of scenes and action; but written in verses of different measures by Ennius, and afterwards moulded into the form we now have it by Lucilius, whom Horace has imitated, and mentions with esteem. This is the opinion of most of the critics, and particularly of Boileau, who says,

Lucilius led the way, and, bravely bold,
To Roman vices did the mirror hold;
Protected humble goodness from reproach,
Show'd worth on foot, and rascals in a coach.
Horace his pleasing wit to this did add,
That none, uncensur'd, might be fools or mad:
And Juvenal, with rhetorician's rage,
Scourg'd the rank vices of a wicked age;
Tho' horrid truths thro' all his labours shine,
In what he writes there's something of divine.

Our satire, therefore, may be distinguished into two kinds; the *jocose*, or that which makes sport with vice and folly, and sets them up to ridicule; and the *serious*, or that which deals in asperity, and is severe and acrimonious. Horace is a perfect master of the first, and Juvenal much admired for the last. The one is facetious, and smiles: the other is angry, and storms. The foibles of mankind are the object of one; but crimes of a deeper dye have engaged the other. They both agree, however, in being pungent and biting: and from a due consideration of the writings of these authors, who are our masters in this art, we may define satire to be, A free, (and often jocose), witty, and sharp poem, wherein the follies and vices of men are lashed and ridiculed in order to their reformation. Its subject is whatever deserves our contempt or abhorrence, (including every thing that is ridiculous and absurd, or scandalous and repugnant to the golden precepts of religion and virtue.) Its manner is *invective*; and its end, *shame*. So that satire may be looked upon as the physician of a distempered mind, which it endeavours to cure by bitter and unsavoury, or by pleasant and salutary, applications. 164 Definition of it.

165 Qualities of a good satirist.

A good satirist ought to be a man of wit and address, sagacity and eloquence. He should also have a great deal of good-nature, as all the sentiments which are beautiful in this way of writing must proceed from that quality in the author. It is good-nature produces that disdain of all baseness, vice, and folly, which prompts the poet to express himself with such smartness against the errors of men, but without bitterness to their persons. It is this quality that keeps the mind even, and never lets an offence unseasonably throw the satirist out of his character.

In writing satire, care should be taken that it be true and general; that is, levelled at abuses in which numbers are concerned: for the personal kind of satire, or lampoon, which exposes particular characters, and affects the reputation of those at whom it is pointed, is scarce to be distinguished from scandal and defamation. The poet also, whilst he is endeavouring to correct the guilty, must take care not to use such expressions as may corrupt the innocent: he must therefore avoid all obscene words and images that tend to debase and mislead the mind. Horace and Juvenal, the chief satirists among the Romans, are faulty in this respect, and ought to be read with caution.

166 Proper style of satire.

The style proper for satire is sometimes grave and animated, inveighing against vice with warmth and earnestness; but that which is pleasant, sportive, and, with becoming raillery, banters men out of their bad dispositions, has generally the best effect, as it seems only to play with their follies, though it omits no opportunity of making them feel the lash. The verses should be smooth and flowing, and the language manly, just, and decent.

Of well-chose words some take not care enough,
And think they should be as the subject rough:
But satire must be more exactly made,
And sharpest thoughts in smoothest words convey'd.

Duke of *Bucks's Essay.*

Satires, either of the *jocose* or *serious* kind, may be written in the epistolary manner, or by way of dialogue. Horace, Juvenal, and Persius, have given us examples of of both. Nay, some of Horace's satires may, without incongruity, be called *epistles*, and his epistles *satires*. But this is obvious to every reader.

Of the facetious kind, the second satire of the second book of Horace imitated by Mr Pope, and Swift's verses on his own death, may be referred to as examples.

As to those satires of the serious kind, for which Juvenal is so much distinguished, the characteristic properties of which are, morality, dignity, and severity; a better example cannot be mentioned than the poem entitled *London*, written in imitation of the third satire of Juvenal, by Dr Johnson, who has kept up to the spirit and force of the original.

Nor must we omit to mention Dr Young's *Love of Fame the Universal Passion*, in seven satires; which, though characteristical, abound with morality and good sense. The characters are well selected, the ridicule is high, and the satire well pointed and to the purpose.

We have already observed, that personal satire approaches too near defamation, to deserve any countenance or encouragement. Dryden's *Mack Flecknoe* is for this reason exceptionable, but as a composition it is inimitable.

167 Benefits of well-conducted satire.

We have dwelt thus long on the present subject, because there is reason to apprehend, that the benefits arising from well-conducted satire have not been sufficiently considered. A satire may often do more service to the cause of religion and virtue than a sermon; since it gives pleasure, at the same time that it creates fear or indignation, and conveys its sentiments in a manner the most likely to captivate the mind.

Of all the ways that wisest men could find
To mend the age and mortify mankind,
Satire well writ has most successful prov'd,
And cures, because the remedy is lov'd.

Duke of *Bucks's Essay*.

But to produce the desired effect, it must be jocose, free, and impartial, though severe. The satirist should always preserve good-humour; and, however keen he cuts, should cut with kindness. When he loses temper, his weapons will be inverted, and the ridicule he threw at others will retort with contempt upon himself: for the reader will perceive that he is angry and hurt, and consider his satire as the effect of malice, not of judgement; and that it is intended rather to wound persons than reform manners.

Rage you must hide, and prejudice lay down:
A satyr's smile is sharper than his frown.

The best, and indeed the only, method to expose vice and folly effectually, is to turn them to ridicule, and hold them up for public contempt; and as it most offends these objects of satire, so it least hurts ourselves. One passion frequently drives out another; and as we cannot look with indifference on the bad actions of men (for they must excite either our wrath or contempt), it is prudent to give way to that which most offends vice and folly, and least affects ourselves; and to sneer and laugh, rather than be angry and scold.

Burlesque poetry, which is chiefly used by way of drollery and ridicule, falls properly to be spoken of under the head of satire. An excellent example of this kind is a poem in blank verse, intitled *The Splendid Shilling*, written by Mr John Philips, which, in the opinion of one of the best judges of the age, is the finest burlesque in the English language. In this poem the author has handled a low subject in the lofty style and numbers of Milton; in which way of writing Mr Philips has been imitated by several, but none have come up to the humour and happy turn of the original. When we read it, we are betrayed into a pleasure that we could not expect; though, at the same time, the sublimity of the style, and gravity of the phrase, seem to chastise that laughter which they provoke.

168 Burlesque poetry.—Splendid Shilling.—Hudibras.

There is another sort of verse and style, which is most frequently made use of in treating any subject in a ludicrous manner, viz. that which is generally called *Hudibrastic*, from Butler's admirable poem intitled *Hudibras*. Almost every one knows, that this poem is a satire upon the authors of our civil dissensions in the reign of king Charles I. wherein the poet has, with abundance of wit and humour, exposed and ridiculed the hypocrisy or blind zeal of those unhappy times. In short, it is a kind of burlesque epic poem, which, for the oddity of the rhymes, the quaintness of the similies, the novelty of the thoughts, and that fine raillery which runs through the whole performance, is not to be paralleled.

Sect. XI. *Of the Epigram.*

169 Character of the epigram.

The *epigram is a little poem, or composition in verse, treating of one thing only, and whose distinguishing characters are* brevity, beauty, and point.

The word *epigram* signifies "inscription;" for epigrams derive their origin from those inscriptions placed by the ancients on their statues, temples, pillars, triumphal arches, and the like; which, at first, were very short, being sometimes no more than a single word; but afterwards, increasing their length, they made them in verse, to be the better retained by the memory. This short way of writing came at last to be used upon any occasion or subject; and hence the name of *epigram* has been given to any little copy of verses, without regard to the original application of such poems.

Its usual limits are from two to 20 verses, though sometimes it extends to 50; but the shorter, the better it is, and the more perfect, as it partakes more of the nature and character of this kind of poem: besides, the epigram, being only a single thought, ought to be expressed in a little compass, or else it loses its force and strength.

The beauty required in an epigram is an harmony and apt agreement of all its parts, a sweet simplicity, and polite language.

The point is a sharp, lively, unexpected turn of wit, with which an epigram ought to be concluded. There are some critics, indeed, who will not admit the point in an epigram; but require that the thought be equally diffused through the whole poem, which is usually the practice of Catullus, as the former is that of Martial. It is allowed there is more delicacy in the manner of Catullus; but the point is more agreeable to the general taste, and seems to be the chief characteristic of the epigram.

170 Of what subjects it admits.

This sort of poem admits of all manner of subjects, provided that brevity, beauty, and point, are preserved;

Epigram. ved; but it is generally employed either in praise or satire.

Though the best epigrams are said to be such as are comprised in two or four verses, we are not to understand it as if none can be perfect which exceed those limits. Neither the ancients nor moderns have been so scrupulous with respect to the length of their epigrams; but, however, brevity in general is always to be studied in these compositions.

171 Examples of English epigrams remarkable for their delicacy, and

For examples of good epigrams in the English language, we shall make choice of several in the different tastes we have mentioned; some remarkable for their delicate turn and simplicity of expression; and others for their salt and sharpness, their equivocating pun, or pleasant allusion. In the first place, take that of Mr Pope, said to be written on a glass with the earl of Chesterfield's diamond-pencil.

Accept a miracle, instead of wit;
See two dull lines by Stanhope's pencil writ.

The beauty of this epigram is more easily seen than described; and it is difficult to determine, whether it does more honour to the poet who wrote it, or to the nobleman for whom the compliment is designed.—The following epigram of Mr Prior is written in the same taste, being a fine encomium on the performance of an excellent painter.

On a Flower, painted by Varelst.

When fam'd Varelst this little wonder drew,
Flora vouchsaf'd the growing work to view:
Finding the painter's science at a stand,
The goddess snatch'd the pencil from his hand,
And, finishing the piece, she smiling said,
Behold one work of mine which ne'er shall fade.

Another compliment of this delicate kind he has made Mr Howard in the following epigram.

Venus *Mistaken.*

When Chloe's picture was to Venus shown;
Surpris'd, the goddess took it for her own.
And what, said she, does this bold painter mean?
When was I bathing thus, and naked seen?
Pleas'd Cupid heard, and check'd his mother's pride:
And who's blind now, mamma? the urchin cry'd.
'Tis Chloe's eye, and cheek, and lip, and breast:
Friend Howard's genius fancy'd all the rest.

Most of Mr Prior's epigrams are of this delicate cast, and have the thought, like those of Catullus, diffused through the whole. Of this kind is his address

To Chloe *Weeping.*

See, whilst thou weep'st, fair Chloe, see
The world in sympathy with thee.
The cheerful birds no longer sing,
Each drops his head, and hangs his wing.
The clouds have bent their bosom lower,
And shed their sorrow in a show'r.
The brooks beyond their limits flow,
And louder murmurs speak their wo:
The nymphs and swains adopt thy cares;
They heave thy sighs, and weep thy tears.
Fantastic nymph! that grief should move
Thy heart obdurate against love.
Strange tears! whose pow'r can soften all
But that dear breast on which they fall.

Epigram.

The epigram written on the leaves of a fan by Dr Atterbury, late bishop of Rochester, contains a pretty thought, expressed with ease and conciseness, and closed in a beautiful manner.

On a Fan.

Flavia the least and slightest toy
Can with resistless art employ.
This fan in meaner hands would prove
An engine of small force in love:
Yet she, with graceful air and mien,
Not to be told or safely seen,
Directs its wanton motion so,
That it wounds more than Cupid's bow,
Gives coolness to the matchless dame,
To ev'ry other breast a flame.

We shall now select some epigrams of the biting and satirical kind, and such as turn upon the *pun* or *equivoque*, as the French call it: in which sort the point is more conspicuous than in those of the former character. 172 For their point.

The following distich is an admirable epigram, having all the necessary qualities of one, especially point and brevity.

On a Company of bad Dancers *to good Music.*

How ill the motion with the music suits!
So Orpheus fiddled, and so danc'd the brutes.

This brings to mind another epigram upon a bad fiddler, which we shall venture to insert merely for the humour of it, and not for any real excellence it contains.

To a bad Fiddler.

Old Orpheus play'd so well, he mov'd Old Nick;
But thou mov'st nothing but thy fiddle-stick.

One of Martial's epigrams, wherein he agreeably rallies the foolish vanity of a man who hired people to make verses for him, and published them as his own, has been thus translated into English:

Paul, so fond of the name of a poet is grown,
With gold he buys verses, and calls them his own.
Go on, master Paul, nor mind what the world says,
They are surely his own for which a man pays.

Some bad writer having taken the liberty to censure Mr Prior, the poet very wittily lashed his impertinence in this epigram:

While faster than his costive brain indites,
Philo's quick hand in flowing letters writes,
His case appears to me like honest Teague's,
When he was run away with by his legs.
Phœbus, give Philo o'er himself command;
Quicken his senses, or restrain his hand:
Let him be kept from paper, pen, and ink;
So he may cease to write, and learn to think.

Mr Wesley has given us a pretty epigram, alluding to a well-known text of Scripture, on the setting up a monument in Westminster Abbey, to the memory of the ingenious Mr Butler, author of *Hudibras.*

 While

Epitaph.

While Butler, needy wretch, was yet alive,
No generous patron would a dinner give.
See him when starv'd to death, and turn'd to dust,
Presented with a monumental bust!
The poet's fate is here in emblem shown;
He ask'd for *Bread*, and he receiv'd a *Stone*.

We shall close this section with an epigram written on the well-known story of Apollo and Daphne, by Mr Smart.

When Phœbus was am'rous and long'd to be rude,
Miss Daphne cry'd Pish! and ran swift to the wood;
And rather than do such a naughty affair,
She became a fine laurel to deck the god's hair.
The nymph was, no doubt, of a cold constitution;
For, sure, to turn tree was an odd resolution!
Yet in this she behav'd like a true modern spouse,
For she fled from his arms to distinguish his brows.

Sect. XII. *Of the Epitaph.*

173 Character of the epitaph.

These compositions generally contain some eulogium of the virtues and good qualities of the deceased, and have a turn of seriousness and gravity adapted to the nature of the subject. Their elegance consists in a nervous and expressive brevity; and sometimes they are closed with an epigrammatic point. In these compositions, no mere epithet (properly so called) should be admitted; for here illustration would impair the strength, and render the sentiment too diffuse and languid. Words that are synonymous are also to be rejected.

Though the true characteristic of the epitaph is seriousness and gravity, yet we may find many that are jocose and ludicrous: some likewise have true metre and rhyme; while others are between prose and verse, without any certain measure, though the words are truly poetical; and the beauty of this last sort is generally heightened by an apt and judicious antithesis. We shall give examples of each.

The following epitaph on Sir Philip Sydney's sister, the countess of Pembroke, said to be written by the famous Ben Jonson, is remarkable for the noble thought with which it concludes.

174 Epitaphs in verse, with remarks upon them.

On Mary *Countess-dowager of* Pembroke.

Underneath this noble marble hearse,
Lies the subject of all verse,
Sidney's sister, Pembroke's mother:
Death, ere thou hast kill'd another
Fair, and learn'd, and good as she,
Time shall throw a dart at thee.

Take another epitaph of Ben Jonson's, on a beautiful and virtuous lady, which has been deservedly admired by very good judges.

Underneath this stone doth lie
As much virtue as could die;
Which when alive did vigour give
To as much beauty as could live.

The following epitaph by Dr Samuel Johnson, on a musician much celebrated for his performance, will bear a comparison with these, or perhaps with any thing of the kind in the English language.

Epitaph.

Philips! whose touch harmonious could remove
The pangs of guilty pow'r and hapless love,
Rest here, distrest by poverty no more;
Find here that calm thou gav'st so oft before;
Sleep undisturb'd within this peaceful shrine,
Till angels wake thee with a note like thine.

It is the just observation of an eminent critic, that the best subject for epitaphs is private virtue; virtue exerted in the same circumstances in which the bulk of mankind are placed, and which, therefore, may admit of many imitators. He that has delivered his country from oppression, or freed the world from ignorance and error, besides that he stands in no need of monumental panegyric, can excite the emulation of a very small number. The bare name of such men answers every purpose of a long inscription, because their atchievements are universally known, and their fame is immortal.—But the virtues of him who has repelled the temptations of poverty, and disdained to free himself from distress at the expence of his honour or his conscience, as they were practised in private, are fit to be told, because they may animate multitudes to the same firmness of heart and steadiness of resolution. On this account, there are few epitaphs of more value than the following, which was written by Pope on Mrs Corbet, who died of a cancer in her breast.

Here rests a woman, good without pretence,
Blest with plain reason, and with sober sense:
No conquest she, but o'er herself desir'd;
No arts essay'd, but not to be admir'd.
Passion and pride were to her soul unknown,
Convinc'd that virtue only is our own.
So unaffected, so compos'd a mind,
So firm, yet soft, so strong, yet so refin'd,
Heav'n, as its purest gold, by tortures try'd;
The saint sustain'd it, but the woman dy'd.

This epitaph, as well as the second quoted from Ben Jonson, has indeed one fault; the name is omitted. The end of an epitaph is to convey some account of the dead; and to what purpose is any thing told of him whose name is concealed? The name, it is true, may be inscribed by itself upon the stone; but such a shift of the poet is like that of an unskilful painter, who is obliged to make his purpose known by adventitious help.

Amongst the epitaphs of a punning and ludicrous cast, we know of none prettier than that which is said to have been written by Mr Prior on himself, wherein he is pleasantly satirical upon the folly of those who value themselves upon account of the long series of ancestors through which they can trace their pedigree.

Nobles and heralds, by your leave,
Here lie the bones of Matthew Prior,
The son of Adam and of Eve:
Let Bourbon or Nassau go higher.

The following epitaph on a miser contains a good caution and an agreeable raillery.

Reader, beware immod'rate love of pelf:
Here lies the worst of thieves, who robb'd himself.

But Dr Swift's epitaph on the same subject is a masterpiece of the kind.

Beneath

Epitaph.

Beneath this verdant hillock lies
Demer, the wealthy and the wiſe.
His heirs, that he might ſafely reſt,
Have put his carcaſe in a cheſt:
The very cheſt, in which, they ſay,
His other Self, his money, lay.
And if his heirs continue kind
To that dear ſelf he left behind,
I dare believe that four in five
Will think his better half alive.

We ſhall give but one example more of this kind, which is a merry epitaph on an old fiddler, who was remarkable (we may ſuppoſe) for beating time to his own muſic.

On STEPHEN *the Fiddler.*

Stephen and time are now both even;
Stephen beat time, now time's beat Stephen.

175 Epitaphs in proſe encomiaſtic and

We are come now to that ſort of epitaph which rejects rhyme, and has no certain and determinate meaſure; but where the diction muſt be pure and ſtrong, every word have weight, and the antitheſis be preſerved in a clear and direct oppoſition. We cannot give a better example of this ſort of epitaph than that on the tomb of Mr Pulteney in the cloiſters of Weſtminſter-abbey.

Reader,
If thou art a BRITON,
Behold this Tomb with Reverence and Regret:
Here lie the Remains of
DANIEL PULTENEY,
The kindeſt Relation, the trueſt Friend,
The warmeſt Patriot, the worthieſt Man.
He exerciſed Virtues in this Age,
Sufficient to have diſtinguiſh'd him even in the beſt.
Sagacious by Nature,
Induſtrious by Habit,
Inquiſitive with Art;
He gain'd a complete Knowledge of the State of Britain,
Foreign and domeſtic;
In moſt the backward Fruit of tedious Experience,
In him the early acquiſition of undiſſipated Youth.
He ſerv'd the Court ſeveral Years:
Abroad, in the auſpicious Reign of Queen Anne;
At home, in the Reign of that excellent prince K. George I.
He ſerved his Country always,
At Court independent,
In the Senate unbiaſs'd,
At every Age, and in every Station:
This was the bent of his generous Soul,
This the buſineſs of his laborious Life.
Public Men, and Public Things,
He judged by one conſtant Standard,
The True Intereſt of Britain:
He made no other Diſtinction of Party,
He abhorred all other.
Gentle, humane, diſintereſted, beneficent,
He created no Enemies on his own Account:
Firm, determin'd, inflexible,
He feared none he could create in the Cauſe of Britain.
Reader,
In this Misfortune of thy Country lament thy own:
For know,
The Loſs of ſo much private Virtue
Is a public calamity.

Epitaph. 176 Satirical.

That poignant ſatire, as well as extravagant praiſe, may be conveyed in this manner, will be ſeen by the following epitaph written by Dr Arbuthnot on Francis Chartres; which is too well known, and too much admired, to need our commendation.

HERE continueth to rot
The Body of FRANCIS CHARTRES,
Who with an INFLEXIBLE CONSTANCY,
And INIMITABLE UNIFORMITY of Life,
PERSISTED,
In ſpite of AGE and INFIRMITIES,
In the Practice of EVERY HUMAN VICE,
Excepting PRODIGALITY and HYPOCRISY:
His inſatiable AVARICE exempted him from the firſt,
His matchleſs IMPUDENCE from the ſecond.
Nor was he more ſingular
In the undeviating *Pravity* of his *Manners*,
Than ſucceſsful
In *Accumulating* WEALTH:
For, without TRADE or PROFESSION,
Without TRUST of PUBLIC MONEY,
And without BRIBE-WORTHY Service,
He acquired, or more properly created,
A MINISTERIAL ESTATE.
He was the only Perſon of his Time
Who could CHEAT without the Maſk of HONESTY
Retain his Primæval MEANNESS
When poſſeſſed of TEN THOUSAND a-year;
And having daily deſerved the GIBBET for what he *did*,
Was at laſt condemn'd to it for what he *could* not *do*.
Oh indignant reader!
Think not his Life uſeleſs to Mankind;
PROVIDENCE conniv'd at his execrable deſigns,
To give to After-ages
A conſpicuous PROOF and EXAMPLE
Of how ſmall Eſtimation is EXORBITANT WEALTH
In the Sight of GOD,
By His beſtowing it on the moſt UNWORTHY of ALL MORTALS.

We ſhall conclude this ſpecies of poetry with a droll and ſatirical epitaph written by Mr Pope, which we tranſcribed from a monument in Lord Cobham's gardens at Stow in Buckinghamſhire.

To the Memory
of
SIGNIOR FIDO,
An *Italian* of good extraction;
Who came into *England*,
Not to bite us, like moſt of his Countrymen,
But to gain an honeſt Livelihood.
He hunted not after Fame,
Yet acquir'd it;
Regardleſs of the Praiſe of his Friends,
But moſt ſenſible of their Love,
Though he liv'd amongſt the Great,
He neither learnt nor flatter'd any Vice.
He was no Bigot,
Though he doubted of none of the 39 Articles.
And, if to follow Nature,
And to reſpect the laws of Society,
Be Philoſophy,
He was a perfect Philoſopher,
A faithful Friend,
An agreeable Companion,

Versification.

A loving Husband,
Distinguish'd by a numerous offspring,
All which he liv'd to see take good Courses.
In his old Age he retired
To the house of a Clergyman in the country,
Where he finished his earthly Race,
And died an Honour and an Example to the whole Species.

Reader,
This Stone is guiltless of Flattery;
For he to whom it is inscrib'd
Was not a MAN,
But a
GRE-HOUND.

PART III. ON VERSIFICATION.

ON this subject it is meant to confine our inquiry to Latin or Greek hexameters, and to French and English heroic verse; as the observations we shall have occasion to make, may, with proper variations, be easily transferred to the composition of other sorts of verse.

177 Essentials of verse.

Before entering upon particulars, it must be premised in general, that to verse of every kind five things are of importance. 1st, The number of syllables that compose a line. 2d, The different lengths of syllables, *i. e.* the difference of time taken in pronouncing. 3d, The arrangement of these syllables combined in words. 4th, The pauses or stops in pronouncing. 5th, Pronouncing syllables in a high or a low tone. The three first mentioned are obviously essential to verse: if any of them be wanting, there cannot be that higher degree of melody which distinguisheth verse from prose. To give a just notion of the fourth, it must be observed, that pauses are necessary for three different purposes: one, to separate periods, and members of the same period, according to the sense: another, to improve the melody of verse: and the last, to afford opportunity for drawing breath in reading. A pause of the first kind is variable, being long or short, frequent or less frequent, as the sense requires. A pause of the second kind, being determined by the melody, is in no degree arbitrary. The last sort is in a measure arbitrary, depending on the reader's command of breath. But as one cannot read with grace, unless, for drawing breath, opportunity be taken of a pause in the sense or in the melody, this pause ought never to be distinguished from the others; and for that reason shall be laid aside. With respect then to the pauses of sense and of melody, it may be affirmed without hesitation, that their coincidence in verse is a capital beauty: but as it cannot be expected, in a long work especially, that every line should be so perfect; we shall afterward have occasion to see, that, unless the reader be uncommonly skilful, the pause necessary for the sense must often, in some degree, be sacrificed to the verse-pause, and the latter sometimes to the former.

178 Regulation of pauses

The pronouncing syllables in a high or low tone contributes also to melody. In reading, whether verse or prose, a certain tone is assumed, which may be called the *key-note*; and in that tone the bulk of the words are sounded. Sometimes to humour the sense, and sometimes the melody, a particular syllable is sounded in a higher tone, and this is termed *accenting a syllable*, or gracing it with an accent. Opposed to the accent is the cadence, which, however, being entirely regulated by the sense, hath no peculiar relation to verse. The cadence is a falling of the voice below the key-note at the close of every period; and so little is it essential to verse, that in correct reading the final syllable of every line is accented, that syllable only excepted which closes the period, where the sense requires a cadence.

Though the five requisites above mentioned enter the composition of every species of verse, they are however governed by different rules, peculiar to each species. Upon quantity only, one general observation may be premised, because it is applicable to every species of verse. That syllables, with respect to the time taken in pronouncing, are long or short; two short syllables, with respect to time, being precisely equal to a long one. These two lengths are essential to verse of all kinds; and to no verse, it is believed, is a greater variety of time necessary in pronouncing syllables. The voice indeed is frequently made to rest longer than usual upon a word that bears an important signification; but this is done to humour the sense, and is not necessary for melody. A thing not more necessary for melody occurs with respect to accenting, similar to that now mentioned: A word signifying any thing humble, low, or dejected, is naturally, in prose as well as in verse, pronounced in a tone below the key-note.

179 Quantity.

We are now sufficiently prepared for particulars; beginning with Latin or Greek hexameter, which are the same. The observations upon this species of verse will come under the four following heads; number, arrangement, pause, and accent; for as to quantity, what is observed above may suffice.

180 Hexameter verses of the Greeks and Romans consist of what feet.

I. HEXAMETER LINES, as to time, are all of the same length; being equivalent to the time taken in pronouncing twelve long syllables or twenty-four short. An hexameter line may consist of seventeen syllables; and when regular and not spondaic it never has fewer than thirteen: whence it follows, that where the syllables are many, the plurality must be short; where few, the plurality must be long.

This line is susceptible of much variety as to the succession of long and short syllables. It is, however, subjected to laws that confine its variety within certain limits: and for ascertaining these limits, grammarians have invented a rule by dactyles and spondees, which they denominate *feet*.

Among the ancient Greeks and Romans, these feet regulated the pronunciation, which they are far from doing among us; of which the reason will be discovered from the explanation that we shall give of the English accent. We shall at present content ourselves with pointing out the difference between our pronunciation and that of the Romans in the first line of Virgil's eclogues, where it is scarcely credible how much we pervert the quantity.

Tit'yre tú pat ulæ rec'ubans sub teg'mine fági.

It will be acknowledged by every reader who has an ear, that we have placed the accentual marks upon every syllable, and the letter of every syllable, that an Englishman

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lishman marks with the *ictus* of his voice when he recites the line. But, as will be seen presently, a syllable which is pronounced with the stress of the voice upon a consonant is uttered in the shortest time possible. Hence it follows, that in this verse, as recited by us, there are but two long syllables, *tú* and *fú*; though it is certain, that, as recited by a Roman, it contained no fewer than eight long syllables.

Tītyrĕ | tŭ pătŭ|lāē rĕcŭ|bāns sŭb | tĕgmĭnĕ | fāgī.

But though to pronounce it in this manner with the voice dwelling on the vowel of each long syllable would undoubtedly be correct, and preserve the true movement of the verse, yet to an English ear, prejudiced in behalf of a different movement, it sounds so very uncouth, that Lord Kames has pronounced the true feet of the Greek and Roman verses extremely artificial and complex; and has substituted in their stead the following rules, which he thinks more simple and of more easy application. 1st, The line must always commence with a long syllable, and close with two long preceded by two short. 2d, More than two short can never be found together, nor fewer than two. And, 3d, Two long syllables which have been preceded by two short cannot also be followed by two short. These few rules fulfil all the conditions of a hexameter line with relation to order or arrangement. For these again a single rule may be substituted, which has also the advantage of regulating more affirmatively the construction of every part. To put this rule into words with perspicuity, a hint is taken from the twelve long syllables that compose an hexameter line, to divide it into twelve equal parts or portions, being each of them one long syllable or two short. The rule then is: "The 1st, 3d, 5th, 7th, 9th, 11th, and 12th portions, must each of them be one long syllable; the 10th must always be two short syllables; the 2d, 4th, 6th, and 8th, may either be one long or two short." Or to express the thing still more shortly, "The 2d, 4th, 6th, and 8th portions may be one long syllable or two short; the 10th must be two short syllables; all the rest must consist each of one long syllable." This fulfils all the conditions of an hexameter line, and comprehends all the combinations of dactyles and spondees that this line admits.

Elem. of Criticism. ch. xviii. sect. 4.

181
Pauses in hexameter considered with respect to melody and

Next in order comes the pause. At the end of every hexameter line, every one must be sensible of a complete close or full pause; the cause of which follows. The two long syllables preceded by two short, which always close an hexameter line, are a fine preparation for a pause: for long syllables, or syllables pronounced slow, resembling a slow and languid motion tending to rest, naturally incline the mind to rest, or, which is the same, to pause; and to this inclination the two preceding short syllables contribute, which, by contrast, make the slow pronunciation of the final syllables the more conspicuous. Beside this complete close or full pause at the end, others are also requisite for the sake of melody; of which two are clearly discoverable, and perhaps there may be more. The longest and most remarkable succeeds the 5th portion: the other, which, being shorter and more faint, may be called the *semipause*, succeeds the 8th portion. So striking is the pause first mentioned, as to be distinguished even by the rudest ear: the monkish rhymes are evidently built upon it; in which, by an invariable rule, the final word always chimes with that which immediately precedes the pause:

De planctu cudo || metrum cum carmine nudo
Mingere cum bumbis || res est saluberrima lumbis.

The difference of time in the pause and semipause occasions another difference not less remarkable; that it is lawful to divide a word by a semipause, but never by a pause, the bad effect of which is sensibly felt in the following examples:

Effusus labor, at||que inmitis rupta Tyranni
Again:
Observans nido im||plumes detraxit; at illa
Again:
Loricam quam De||moleo detraxerat ipse

The dividing a word by a semipause has not the same bad effect:

Jamque pedem referens || casus e|vaserat omnes.
Again:
Qualis populea || mœrens Philo|mela sub umbra
Again:
Ludere que vellem || calamo per|misit agresti.

Lines, however, where words are left entire, without being divided even by a semipause, run by that means much the more sweetly.

Nec gemere aërea || cessabit | turtur ab ulmo.
Again:
Quadrupedante putrem || sonitu quatit | ungula campum.
Again:
Eurydicen toto || referebant | flumine ripæ.

The reason of these observations will be evident upon the slightest reflection. Between things so intimately connected in reading aloud as are sense and sound, every degree of discord is unpleasant: and for that reason it is a matter of importance to make the musical pauses coincide as much as possible with those of sense; which is requisite more especially with respect to the pause, a deviation from the rule being less remarkable in a semipause. Considering the matter as to melody solely, it is indifferent whether the pauses be at the end of words or in the middle; but when we carry the sense along, it is disagreeable to find a word split into two by a pause, as if there were really two words: and though the disagreeableness here be connected with the sense only, it is by an easy transition of perceptions transferred to the sound; by which means we conceive a line to be harsh and grating to the ear, when in reality it is only so to the understanding.

To the rule that fixes the pause after the 5th portion there is one exception and no more. If the syllable succeeding the 5th portion be short, the pause is sometimes postponed to it:

Pupillis quos dura || premit custodia matrum
Again:
In terras oppressa || gravi sub religione
Again:
Et quorum pars magna || fui; quis talia fando

This contributes to diversify the melody; and, where the words are smooth and liquid, is not ungraceful; as in the following examples:

Formosam

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Formosam resonare || doces Amaryllida sylvas

Again:

Agricolas, quibus ipsa || procul discordibus armis

If this pause, placed as aforesaid after the short syllable, happen also to divide a word, the melody by these circumstances is totally annihilated. Witness the following line of Ennius, which is plain prose:

Romæ mœnia terru||it impiger | Hannibal armis.

182 Sense. Hitherto the arrangement of the long and short syllables of an hexameter line and its different pauses have been considered with respect to melody: but to have a just notion of hexameter verse, these particulars must also be considered with respect to sense. There is not perhaps in any other sort of verse such latitude in the long and short syllables; a circumstance that contributes greatly to that richness of melody which is remarkable in hexameter verse, and which made Aristotle pronounce that an epic poem in any other verse would not succeed*. One defect, however, must not be dissembled, that the same means which contribute to the richness of the melody render it less fit than several other sorts for a narrative poem. There cannot be a more artful contrivance, as above observed, than to close an hexameter line with two long syllables preceded by two short: but unhappily this construction proves a great embarrassment to the sense; which will thus be evident. As in general there ought to be a strict concordance between the thought and the words in which it is dressed; so, in particular, every close in the sense ought to be accompanied with a close in the sound. In prose this law may be strictly observed, but in verse the same strictness would occasion insuperable difficulties. Willing to sacrifice to the melody of verse some share of the concordance between thought and expression, we freely excuse the separation of the musical pause from that of the sense during the course of a line; but the close of an hexameter line is too conspicuous to admit this liberty: for which reason there ought always to be some pause in the sense at the end of every hexameter line, were it but such a pause as is marked by a comma; and for the same reason there ought never to be a full close in the sense but at the end of a line, because there the melody is closed. An hexameter line, to preserve its melody, cannot well admit any great relaxation; and yet, in a narrative poem, it is extremely difficult to adhere strictly to the rule even with these indulgences. Virgil, the chief of poets for versification, is forced often to end a line without any close in the sense, and as often to close the sense during the running of a line; though a close in the melody during the movement of the thought, or a close in the thought during the movement of the melody, cannot be agreeable.

* Poet. cap. 25.

183 Observations on the accent. The accent, to which we proceed, is not less essential than the other circumstances above handled. By a good ear it will be discerned, that in every line there is one syllable distinguishable from the rest by a capital accent: That syllable, being the seventh portion, is invariably long

Nec bene promeritis || capitûr nec | tangitur ira

Again:

Non sibi sed toto || genitûm se | credere mundo

Again:

Qualis spelunca || subitô com|mota columba

In these examples the accent is laid upon the last syllable of a word; which is favourable to the melody in the following respect, that the pause, which for the sake of reading distinctly must follow every word, gives opportunity to prolong the accent. And for that reason, a line thus accented has a more spirited air than when the accent is placed on any other syllable. Compare the foregoing lines with the following.

Alba neque Assyrio || fucâtur | lana veneno

Again:

Panditur interea || domus ômnipo|tentis Olympi

Again:

Olli sedato || respôndit | corde Latinus.

In lines where the pause comes after the short syllable succeeding the 5th portion, the accent is displaced, and rendered less sensible: it seems to be split into two, and to be laid partly on the 5th portion, and partly on the 7th, its usual place; as in

Nuda genu, nodôque || sinûs col|lecta fluentes.

Again:

Formosam resonâre || docês Amar|yllida sylvas.

Beside this capital accent, slighter accents are laid upon other portions; particularly upon the 4th, unless where it consists of two short syllables; upon the 9th, which is always a long syllable; and upon the 11th, where the line concludes with a monosyllable. Such conclusion, by the by, impairs the melody, and for that reason is not to be indulged unless where it is expressive of the sense. The following lines are marked with all the accents.

Ludere quæ vêllem calamô permisit agresti

Again:

Et duræ quêrcus sudâbunt rôscida mella

Again:

Parturiunt môntes, nascêtur ridiculûs mus.

182 Order and arrangement do not constitute the whole melody of an hexameter verse. Reflecting upon the melody of hexameter verse, we find, that order or arrangement doth not constitute the whole of it: for when we compare different lines, equally regular as to the succession of long and short syllables, the melody is found in very different degrees of perfection; which is not occasioned by any particular combination of dactyles and spondees, or of long and short syllables, because we find lines where dactyles prevail, and lines where spondees prevail, equally melodious. Of the former take the following instance:

Æneadum genitrix hominum divumque voluptas.

Of the latter:

Molli paulatim flavescet campus arista.

What can be more different as to melody than the two following lines, which, however, as to the succession of long and short syllables, are constructed precisely in the same manner?

Spond. Dact. Spond. Spond. Dact. Spond.
Ad talos stola dimissa et circumdata palla. *Hor.*

Spond. Dact. Spond. Spond. Dact. Spond.
Placatumque nitet diffuso lumine cœlum. *Lucret.*

In the former, the pause falls in the middle of a word, which is a great blemish, and the accent is disturbed by a harsh elision of the vowel *a* upon the particle *et*. In the latter, the pauses and the accent are all of them distinct

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distinct and full: there is no elision: and the words are more liquid and sounding. In these particulars consists the beauty of an hexameter line with respect to melody; and by neglecting these, many lines in the satires and epistles of Horace are less agreeable than plain prose; for they are neither the one nor the other in perfection. To draw melody from these lines, they must be pronounced without relation to the sense: it must not be regarded that words are divided by pauses, nor that harsh elisions are multiplied. To add to the account, prosaic low-sounding words are introduced; and, which is still worse, accents are laid on them. Of such faulty lines take the following instances:

Candida rectaque sit, munda hactenus sit neque longa.

Jupiter exclamat simul atque audirit; at in se

Custodes, lectica, ciniflones, parasitæ

Optimus est modulator, ut Alfenus Vafer omni

Nunc illud tantum quæram, meritone tibi sit.

These observations on pauses and semi-pauses, and on the structure of an hexameter line, are doubtless ingenious; but it is by no means certain that a strict attention to them would assist any man in the writing of such verses as would have been pleasing to a Roman ear. Many of his Lordship's rules have no other foundation than what rests on our improper mode of accenting Latin words; which to Virgil or Lucretius would probably have been as offensive as the Scotch accent is to a native of Middlesex.

II. Next in order comes ENGLISH HEROIC VERSE; which shall be examined under the heads of *number*, *accent*, *quantity*, *movement*, and *pause*. These have been treated in so clear and masterly a manner by Sheridan in his Art of Reading, that we shall have little more to do than abridge his doctrine, and point out the few instances in which attachment to a system and partiality to his native tongue seem to have betrayed him into error, or at least made him carry to an extreme what is just only when used with moderation.

"Numbers, in the strict sense of the word*, whether with regard to poetry or music, consist in certain impressions made on the ear at stated and regular distances. The lowest species of numbers is a *double* stroke of the same note or sound, repeated a certain number of times, at equal distances. The repetition of the same *single* note in a continued series, and exactly at equal distances, like the tickling of a clock, has in it nothing numerous; but the same note, *twice* struck a certain number of times, with a pause between each *repetition* of double the time of that between the *strokes*, is numerous. The reason is, that the pleasure arising from *numbers*, consists in the observation of *proportion*; now the repetition of the same note, in exactly the *same intervals*, will admit of no proportion. But the same note *twice* struck, with the pause of *one* between the two strokes, and repeated again at the distance of a pause equal to *two*, admits of the proportional measurement in the pauses of *two* to *one*, to which time can be beaten, and is the lowest and simplest species of numbers. It may be exemplified on the drum, as tu'm-tu'm--tu'm-tu'm--tu'm-tu'm, &c.

* *Art of Reading*, vol ii.

"The next progression of numbers is, when the same note is repeated, but in such a way as that one makes a more sensible impression on the ear than the other, by being more forcibly struck, and therefore having a greater degree of loudness; as ti-tu'm--ti-tu'm; or, tu'm ti--tu'm-ti: or when two weak notes precede a more forcible one, as ti-ti-tu'm--ti-ti-tu'm; or when the weak notes follow the forcible one, tu'm-ti-ti--tu'm-ti-ti.

"In the first and lowest species of numbers which we have mentioned, as the notes are exactly the same in every respect, there can be no proportion observed but in the time of the pauses. In the second, which rises in a degree just above the other, though the notes are still the same, yet there is a diversity to be observed in their respective loudness and softness, and therefore a measurable proportion of the quantity of sound. In them we must likewise take into consideration the order of the notes, whether they proceed from strong to weak, or from weak to strong; for this diversity of order occasions a great difference in the impressions made upon the ear, and in the effects produced upon the mind. To express the diversity of order in the notes in all its several kinds, the common term *movement* may be used, as the term *measure* will properly enough express the different proportions of time both in the pauses and in the notes."

For it is to be observed, that all notes are not of the same length or on the same key. In poetry, as well as in music, notes may be high or low, flat or sharp; and some of them may be prolonged at pleasure. "Poetic numbers are indeed founded upon the very same principles with those of the musical kind, and are governed by similar laws (see MUSIC). Proportion and order are the sources of the pleasure which we receive from both; and the beauty of each depends upon a due observation of the laws of measure and movement. The essential difference between them is, that the matter of the one is articulate, that of the other inarticulate sounds: but syllables in the one correspond to notes in the other; poetic feet to musical bars; and verses to strains; in a word, they have all like properties, and are governed by laws of the same kind.

"From what has been said, it is evident, that the *essence* of numbers consists in certain impressions made on the mind through the ear at stated and regular distances of time, with an observation of a relative proportion in those distances; and that the other circumstances of long or short in syllables, or diversity of notes in uttering them, are *not* essentials but only *accidents* of poetic numbers. Should this be questioned, the objector might be silenced by having the experiment tried on a drum, on which, although it is incapable of producing long or short, high or low notes, there is no kind of metre which may not be beat. That, therefore, which regulates the series and movement of the impressions given to the ear by the recitation of an English verse, must, when properly disposed, constitute the essence of English poetic numbers; but it is the accent which particularly impresses the sound of certain syllables or letters upon the ear; for in every word there is a syllable or letter accented. The necessity and use of the accent, as well in prose as in verse, we shall therefore proceed to explain.

"As words may be formed of various numbers of syllables, from one up to eight or nine*, it was necessary that there should be some peculiar mark to distinguish

* *Art of Reading*, vol. i.

guish words from disjointed syllables, otherwise speech would be nothing but a continued succession of syllables conveying no ideas. This distinction of one word from another might be made by a perceptible pause at the end of each in speaking, analagous to the distance made between them in writing and in printing. But these pauses would make discourse disgustingly tedious; and though they might render words sufficiently distinct, they would make the meaning of sentences extremely confused. Words might also be distinguished from each other, and from a collection of detached syllables, by an *elevation* or *depression* of the voice upon one syllable of each word; and this, as is well known to the learned, was the practice of the Greeks and Romans. But the English tongue has for this purpose adopted a mark of the easiest and simplest kind, which is called *accent*. By accent is meant, a certain stress of the voice, upon a particular letter of a syllable, which distinguishes it from the rest, and at the same time distinguishes the syllable itself to which it belongs from the other syllables which compose the word. Thus, in the word *hab'it*, the accent upon the *b* distinguishes that letter from the others, and the first syllable from the last; add more syllables to it, and it will still do the same, as *hab'itable*. In the word *accep't*, the *p* is the distinguished letter, and the syllable which contains it the distinguished syllable; but if we add more syllables to it, as in the word *ac'ceptable*, the seat of the accent is changed to the first syllable, of which *c* is the distinguished letter. Every word in our language of more syllables than one has one of the syllables distinguished from the rest in this manner, and every monosyllable has a letter. Thus, in the word *hat'* the *t* is accented, in *háte* the vowel *a*, in *cub'* the *b*, and in *cúbe* the *u*: so that as articulation is the essence of syllables, accent is the essence of words; which without it would be nothing more than a mere succession of syllables."

We have said, that it was the practice of the Greeks and Romans to elevate or depress their voice upon one syllable of each word. In this elevation or depression consisted their accent; but the English accent consists in the mere stress of the voice, without any change of note. "Among the Greeks, all syllables were pronounced either in a high, low, or middle note; or else in a union of the high and low by means of the intermediate. The middle note, which was exactly at an equal distance between the high and the low, was that in which the unaccented syllables were pronounced. But every word had one letter, if a monosyllable; or one syllable, if it consisted of more than one, distinguished from the rest; either by a note of the voice perceptibly higher than the middle note, which was called the *acute accent*; or by a note perceptibly, and in an equal proportion, lower than the middle one, which was called the *grave accent*; or by an union of the acute and grave on one syllable, which was done by the voice passing from the acute, through the middle note, in continuity down to the grave, which was called the *circumflex*."

"Now in pronouncing English words, it is true that one syllable is always distinguished from the rest, but it is not by any perceptible elevation or depression of the voice, any high or low note, that it is done, but merely by dwelling longer upon it, or by giving it a more forcible stroke. When the stress or accent is on the vowel, we dwell longer on that syllable than on the rest; as, in the words *glóry*, *fáther*, *hóly*. When it is on the consonant, the voice, passing rapidly over the vowel, gives a smarter stroke to the consonant, which distinguishes that syllable from others, as in the words *bat'tle*, *hab'it*, *bar'row*."

Having treated so largely of *accent* and *quantity*, the next thing to be considered in verse will be quickly discussed; for in English it depends wholly on the seat of the accent. "When the accent or stress is on the vowel, the syllable is necessarily long, because the accent cannot be made without dwelling on the vowel a longer time than usual. When it is on the consonant, the syllable is short; because the accent is made by passing rapidly over the vowel, and giving a smart stroke of the voice to the following consonant. Thus the words *add*, *led'*, *bid'*, *cub'*, are all short, the voice passing quickly over the vowel to the consonant; but for the contrary reason, the words *áll*, *láid*, *bíde*, *cúbe*, are long; the accent being on the vowels, on which the voice dwells some time before it takes in the sound of the consonant."

"Obvious as this point is, it has wholly escaped the observation of many an ingenious and learned writer. Lord Kames affirms*, that accenting is confined in English heroic verse to the long syllables; for a short syllable (says he) is not capable of an accent: and Dr Forster, who ought to have understood the nature of the English accent better than his Lordship, asks, whether we do not 'employ more time in uttering the *first* syllables of *heavily*, *hastily*, *quickly*, *slowly*; and the *second* in *solicit*, *mistaking*, *researches*, *delusive*, than in the *others*?' To this question Mr Sheridan replies†, that "in some of these words we certainly do as the Doctor supposes; in *hástily*, *slówly*, *mistáking*, *delúsive*, for instance; where the accent being on the vowels renders their sound long: but in all the others, *heav'-ily*, *quick'-ly*, *solis'-it*, *re-sear'-ches*, where the accent is on the consonant, the syllables *heav'*, *quick'*, *lis'*, *ser'*, are pronounced as rapidly as possible, and the vowels are all short. In the Scotch pronunciation (continues he) they would indeed be all reduced to an equal quantity, as thus; *hái-vily*, *háis-tily*, *quéek-ly*, *slów-ly*, *so-lée-cit*, *re-sáir-ches*, *de-lú-sive*. But here we see that the four short syllables are changed into four long ones of a different sound, occasioned by their placing the seat of the accent on the vowels instead of the consonants: thus instead of *hev'* they say *háiv*; for *quick'*, *quéek*; for *lis'*, *léece*; and for *ser'*, *sáir*.

* El. of Crit. vol. ii.

† Art of Reading, vol. ii.

"It appears therefore, that the quantity of English syllables is adjusted by one easy and simple rule; which is, that when the seat of the accent is on a vowel, the syllable is long; when on a consonant, short; and that all unaccented syllables are short. Without a due observation of quantity in reciting verses there will be no poetic numbers; yet in composing English verses the poet need not pay the least attention to the quantity of his syllables, as measure and movement will result from the observation of other laws, which are now to be explained.

It has been affirmed by a writer* of great authority among the critics, that in English heroic verse every line consists of ten syllables, five short and five long; from which there are but two exceptions, both of them

* Lord Kames.

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rare. The first is, where each line of a couplet is made eleven syllables, by an additional short syllable at the end.

> Thére héroes wit's are kep't in pond'rous vâses,
> And beaus' in snuff-boxes and tweezer-cases.

The other exception, he says, concerns the second line of a couplet, which is sometimes stretched out to twelve syllables, termed an *Alexandrine line*.

> A needless Alexandrine ends the song,
> That, like a wounded snake, drags its slow length along.

After what has been just said, it is needless to stop for the purpose of pointing out the ingenious author's mistake respecting long and short syllables. Every attentive reader of what has been already laid down, must perceive, that in the first line of the former couplet, though there are no fewer than six accented syllables when it is properly read, yet of these there are but three that are long, *viz.* those which have the accent on the vowel. Our business at present is, to show the falsity of the rule which restrains the heroic line to ten syllables; and this we shall do by producing lines of a greater number.

> And the shrill sounds ran echoing through the wood.

This line, though it consists of eleven syllables, and has the last of those accented, or, as Lord Kames would say, long, is yet undoubtedly a heroic verse of very fine sound. Perhaps the advocates for the rule may contend, that the vowel *o* in echoing ought to be struck out by an apostrophe; but as no one reads,

> And the shrill sounds ran ech'ing through the wood,

it is surely very absurd to omit in writing what cannot be omitted in utterance. The two following lines have each eleven syllables, of which not one can be suppressed in recitation.

> Their glittering textures of the filmy dew,
> The great hierarchal standard was to move.

Mr Sheridan quotes as a heroic line,

> O'er many a frozen, many a fiery Alp;

and observes what a monstrous line it would appear, if pronounced,

> O'er man' a frozen, man' a fi'ry Alp,

instead of that noble verse, which it certainly is, when all the thirteen syllables are distinctly uttered. He then produces a couplet, of which the former line has fourteen, and the latter twelve syllables.

> And many an amorous, many a humorous lay,
> Which many a bard had chaunted many a day.

That this is a couplet of very fine sound cannot be controverted; but we doubt whether the numbers of it or of the other quoted line of thirteen syllables be truly heroic. To our ears at least there appears a very perceptible difference between the movement of these verses and that of the verses of Pope or Dryden; and we think, that, though such couplets or single lines may, for the sake of variety or expression, be admitted into a heroic poem, yet a poem wholly composed of them would not be considered as heroic verse. It has a much greater resemblance to the verse of Spenser, which is now broke into two lines, of which the first has eight and the second six syllables. Nothing, however, seems to be more evident, from the other quoted instances, than that a heroic line is not confined to the syllables, and that it is not by the number of syllables that an English verse is to be measured.

But if a heroic verse in our tongue be not composed, as in French, of a certain number of syllables, how is it formed? We answer by feet, as was the hexameter line of the ancients; though between their feet and ours there is at the same time a great difference. The poetic feet of the Greeks and Romans are formed by quantity, those of the English by stress or accent. "Though these terms are in continual use, and in the mouths of all who treat of poetic numbers, very confused and erroneous ideas are sometimes annexed to them. Yet as the knowledge of the peculiar genius of our language with regard to poetic numbers and its characteristical difference from others in that respect, depends upon our having clear and precise notions of those terms, it will be necessary to have them fully explained. The general nature of them has been already sufficiently laid open, and we have now only to make some observations on their particular effects in the formation of metre.

"No scholar is ignorant that quantity is a term which relates to the length or the shortness of syllables, and that a long syllable is double the length of a short one. Now the plain meaning of this is, that a long syllable takes up double the time in sounding that a short one does; a fact of which the ear alone can be the judge. When a syllable in Latin ends with a consonant, and the subsequent syllable commences with one, every school-boy knows that the former is long, to use the technical term, by the law of *position*. This rule was in pronunciation strictly observed by the Romans, who always made such syllables long by dwelling on the vowels; whereas the very reverse is the case with us, because a quite contrary rule takes place in English words so constructed, as the accent or stress of the voice is in such cases always transferred to the consonant, and the preceding vowel being rapidly passed over, that syllable is of course short.

"The Romans had another rule of prosody, that when one syllable ending with a vowel, was followed by another beginning with a vowel, the former syllable was pronounced short; whereas in English there is generally an accent in that case on the former syllable, as in the word *pious*, which renders the syllable long. Pronouncing Latin therefore by our own rule, as in the former case, we make those syllables short which were sounded long by them; so in the latter, we make those syllables long which with them were short. We say *ar'ma* and *virum'que*, instead of *árma* and *virúmque*; *scio and tiius*, instead of *sció* and *tuus'*.

"Having made these preliminary observations, we proceed now to explain the nature of poetic feet. Feet in verse correspond to bars in music: a certain number of syllables connected form a foot in the one, as a certain number of notes make a bar in the other. They are called feet, because it is by their aid that the voice as it were steps along through the verse in a measured pace; and it is necessary that the syllables which mark this regular movement of the voice should in some

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measure be distinguished from the others. This distinction, as we have already observed, was made among the ancient Romans, by dividing their syllables into long and short, and ascertaining their quantity by an exact proportion of time in sounding them; the long being to the short as two to one; and the long syllables, being thus the more important, marked the movement of the verse. In English, syllables are divided into accented and unaccented; and the accented syllables being as strongly distinguished from the unaccented, by the peculiar stress of the voice upon them, are as capable of marking the movement, and pointing out the regular paces of the voice, as the long syllables were by their quantity among the Romans. Hence it follows, that our accented syllables corresponding to their long ones, and our unaccented to their short, in the structure of poetic feet, an accented syllable followed by one unaccented in the same foot will answer to their *trochee;* and preceded by an unaccented one, to their *iambus:* and so with the rest.

"All feet used in poetry consist either of two or three syllables; and the feet among the ancients were denominated from the number and quantity of their syllables. The measure of quantity was the short syllable, and the long one in time was equal to two short. A foot could not consist of less than two times, because it must contain at least two syllables; and by a law respecting numbers, which is explained elsewhere (see MUSIC), a poetic foot would admit of no more than four of those times. Consequently the poetic feet were necessarily reduced to eight; four of two syllables, and four of three. Those of two syllables must either consist of two short, called a *pyrrhic;* two long, called a *spondee;* a long and a short, called a *trochee;* or a short and a long, called an *iambus.* Those of three syllables were, either three short, a *tribrach;* a long and two short, a *dactyl;* a short, long, and short, an *amphibrach;* or two short and a long, an *anapæst* (Y).

We are now sufficiently prepared for considering what feet enter into the composition of an English heroic verse.

The Greeks and Romans made use of but two feet in the structure of their hexameters; and the English heroic may be wholly composed of one foot, viz. the *iambic*, which is therefore the foot most congenial to that species of verse. Our poetry indeed abounds with verses into which no other foot is admitted. Such as,

The pow'rs | gave éar | and gránted hálf | his práy'r,
The rest' | the wínds | dispérs'd | in emp|ty áir.

Our heroic line, however, is not wholly restrained to the use of this foot. In the opinion of Mr Sheridan it admits all the eight before enumerated; and it certainly excludes none, unless perhaps the *tribrach.* It is known to every reader of English poetry, that some of the finest heroic verses in our language begin with a *trochee;* and that Pope, the smoothest of all our versifiers, was remarkable for his use of this foot, as is evident from the following example, where four succeeding lines out of six have a trochaic beginning.

Her lively looks a sprightly mind disclose,
Quick as | her eyes | and as unfix'd as those:
Favours | to none | to all she smiles extends,
Oft she | rejects | but never once offends.
Bright as | the sun | her eyes the gazers strike,
And like the sun she shines on all alike.

The use of this foot, however, is not necessarily confined to the beginning of a line. Milton frequently introduces it into other parts of the verse; of which take the following instances:

That all | was lost' | back' to | the thick'et slunk—
Of Eve | whose eye | dárted contágious fire.

The last line of the following couplet begins with a *pyrrhic:*

She said, | and melting as in tears she lay,
In ă | soft silver stream dissolv'd away;

But this foot is introduced likewise with very good effect into other parts of the verse, as

Print on | thy lip' | and tŏ | thy heart | be prest.|
The phantom flies me | as ŭnkind as you.
Leaps o'er the fence with ease | intŏ | the fold.
And thĕ | shrill sounds | ran echoing through the wood.

In this last line we see that the first foot is a *pyrrhic*, and the second a *spondee;* but in the next the two first feet are *spondees.*

Hills peep | o'er hills | and Alps | on Alps | arise.

In the following verse a trochee is succeeded by two spondees, of which the former is a genuine spondee by quantity, and the latter equivalent to a spondee by accent.

Sée thĕ | bóld yōūth | stráin up the threat'ning steep.

We shall now give some instances of lines containing both the *pyrrhic* and the *spondee*, and then proceed to the consideration of the other four feet.

That ŏn | wēāk wīngs | from far pursues your flight.
Thrŏ' thĕ | fair scene | roll slow | the ling'ring streams.
On hĕr | white breast | a sparkling cross she wore.

Of the four trissyllabic feet, the first, of which we shall give instances in heroic lines, is the *dactyl;* as

Murmuring, | and with | him fled | the shades | of night.
Hovering

(Y) For the convenience of the less learned reader we shall here subjoin a scheme of poetic feet, using the marks (- ∪) in use among the Latin grammarians to denote the genuine feet by quantity; and the following marks (' ∪) to denote the English feet by accent which answer to those.

	Roman	English		Roman	English
Trochee	- ∪	' ∪	Dactyl	- ∪ ∪	' ∪ ∪
Iambus	∪ -	∪ '	Amphibrach	∪ - ∪	∪ ' ∪
Spondee	- -	' '	Anapæst	∪ ∪ -	∪ ∪ '
Pyrrhic	∪ ∪	∪ ∪	Tribrach	∪ ∪ ∪	∪ ∪ ∪

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Hovering | on wing | un'der | the cape | of hell.
Tim'orous | and slothful yet he pleased the ear.
Of truth | in word | mightier | than they | in arms.

Of the *anapæst* a single instance shall suffice; for except by Milton it is not often used.

The great | hierar|chal standard was to move.

The *amphibrach* is employed in the four following verses, and in the three last with a very fine effect.

With wheels | yet hóver ing o'er the ocean brim
Rous'd from their slumber on | thăt fiĕ|ry | couch.
While the | prŏmis cŭ ous crowd stood yet aloof.
Throws his steep flight | in mány | ăn ai|ry whirl.

Having thus sufficiently proved that the English heroic verse admits of all the feet except the *tribrach*, it may be proper to add, that from the nature of our accent we have duplicates of these feet, viz. such as are formed by quantity, and such as are formed by the mere *ictus* of the voice; an opulence peculiar to our tongue, and which may be the source of a boundless variety. But as feet formed of syllables which have the *accent* or *ictus* on the consonant are necessarily pronounced in less time than similar feet formed by quantity, it may be objected, that the measure of a whole line, constructed in the former manner, must be shorter than that of another line constructed in the latter; and that the intermixture of verses of such different measures in the same poem must have a bad effect on the melody, as being destructive of proportion. This objection would be well-founded, were not the time of the short accented syllables compensated by a small pause at the end of each word to which they belong, as is evident in the following verse:

Then rus'|tling crack'|ling crash|ing thun'|der down.

This line is formed of iambics by accent upon consonants, except the last syllable; and yet by means of these soft pauses or rests, the measure of the whole is equal to that of the following, which consists of pure iambics by quantity.

O'er heaps | of ru|in stalk'd | the state|ly hind.

Movement, of so much importance in versification, regards the order of syllables in a foot, measure their quantity. The order of syllables respects their progress from short to long or from long to short, as in the Greek and Latin languages; or from strong to weak or weak to strong, *i. e.* from accented or unaccented syllables, as in our tongue. It has been already observed, that an English heroic verse may be composed wholly of iambics; and experience shows that such verses have a fine melody. But as the stress of the voice, in repeating verses of pure iambics, is regularly on every second syllable, such uniformity would disgust the ear in any long succession, and therefore such changes were sought for as might introduce the pleasure of variety without prejudice to melody; or which might even contribute to its improvement. Of this nature was the introduction of the trochee to form the first foot of an heroic verse, which experience has shown us is so far from spoiling the melody, that in many cases it heightens it. This foot, however, cannot well be admitted into any other part of the verse without prejudice to the melody, because it interrupts and stops the usual movement by another directly opposite. But though it be excluded with regard to pure melody, it may often be admitted into any part of the verse with advantage to expression, as is well known to the readers of Milton.

"The next change admitted for the sake of variety, without prejudice to melody, is the intermixture of pyrrhics and spondees; in which two impressions in the one foot make up for the want of one in the other; and two long syllables compensate two short, so as to make the sum of the quantity of the two feet equal to two iambics. That this may be done without prejudice to the melody, take the following instances:

On hĕr | whīte brēāst | a sparkling cross she wore.—
Nŏr thĕ | dēēp trāct | of hell—say first what cause.—

This intermixture may be employed *ad libitum*, in any part of the line; and sometimes two spondees may be placed together in one part of the verse, to be compensated by two pyrrhics in another; of which Mr Sheridan quotes the following lines as instances:

Stōōd rūl'd | stōōd vāst | ĭnfĭn|ĭtūde | confined.
Shē āll | nīght lōng | hĕr ămō|rŏus dēs|cant sung.

That the former is a proper example, will not perhaps be questioned; but the third foot in the latter is certainly no pyrrhic. As it is marked here and by him, it is a tribrach; but we appeal to our English readers, if it ought not to have been marked an amphibrach by accent, and if the fourth foot be not an iambus. To us the feet of the line appear to be as follow:

Shē āll | nīght lōng | hĕr am'ŏ|rŏus des'|cănt sung.

It is indeed a better example of the proper use of the amphibrach than any which he has given, unless perhaps the two following lines:

Up to | thĕ fiĕ|ry con'căve tow'er|ing high
Thrōws hĭs | stēēp flight | ĭn man'y̆ | ăn ai|ry whirl.

That in these three lines the introduction of the amphibrach does not hurt the melody, will be acknowledged by every person who has an ear; and those who have not, are not qualified to judge. But we appeal to every man of taste, if the two amphibrachs succeeding each other in the last line do not add much to the expression of the verse. If this be questioned, we have only to change the movement to the common iambic, and we shall discover how feeble the line will become.

Throws his | steep flight | in man'y ai|ry whirls.

This is simple description, instead of that magical power of numbers which to the imagination produces the object itself, *whirling* as it were round an axis.

Having thus shown that the iambus, spondee, pyrrhic, and amphibrach, by accent, may be used in our measure with great latitude; and that the trochee may at all times begin the line, and in some cases with advantage to the melody; it now remains only to add, that the dactyl, having the same movement, may be introduced in the place of the trochee; and the anapæst in the place of the iambus. In proof of this, were not the article swelling in our hands, we could adduce many instances which would show what an inexhaustible fund of riches, and what an immense variety of materials, are prepared for us, "to build the lofty rhime." But we hasten.

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hasten to the next thing to be considered in the art of versifying, which is known by the name of *pauses*.

"Of the poetic pauses there are two sorts, the *cesural* and the *final*. The cesural divides the verse into equal or unequal parts; the final closes it. In a verse there may be two or more cesural pauses, but it is evident that there can be but one final. As the final pause concerns the reader more than the writer of verses, it has been seldom treated of by the critics. Yet as it is this final pause which in many cases distinguishes verse from prose, it cannot be improper in the present article to show how it ought to be made. Were it indeed a law of our versification, that every line should terminate with a stop in the sense, the boundaries of the measure would be fixed, and the nature of the final pause could not be mistaken. But nothing has puzzled the bulk of readers, or divided their opinions, more than the manner in which those verses ought to be recited, where the sense does not close with the line; and whose last words have a necessary connection with those that begin the subsequent verse. "Some (says Mr Sheridan) who see the necessity of pointing out the metre, pronounce the last word of each line in such a note as usually accompanies a comma, in marking the smallest member of a sentence. Now this is certainly improper, because it makes that appear to be a complete member of a sentence which is an incomplete one; and by disjoining the sense as well as the words, often confounds the meaning. Others again, but these fewer in number, and of the more absurd kind, drop their voice at the end of every line, in the same note which they use in marking a full stop; to the utter annihilation of the sense. Some readers (continues our author) of a more enthusiastic kind, elevate their voices at the end of all verses to a higher note than is ever used in the stops which divide the meaning. But such a continued repetition of the same high note becomes disgusting by its monotony, and gives an air of chanting to such recitation. To avoid these several faults, the bulk of readers have chosen what they think a safer course, which is that of running the lines one into another without the least pause, where they find none in the sense; but by this mode of recitation they reduce poetry to something worse than prose, to verse run mad.

But it may be asked, if this final pause must be marked neither by an elevation nor by a depression of the voice, how is it to be marked at all? To which Mr Sheridan replies, by making no change whatever in the voice before it. This will sufficiently distinguish it from the other pauses, the comma, semicolon, &c. because some change of note, by raising or depressing the voice, always precedes them, whilst the voice is here only suspended.

Now this pause of suspension is the very thing wanting to preserve the melody at all times, without interfering with the sense. For it perfectly marks the bound of the metre: and being made only by a suspension, not by a change of note in the voice, it never can affect the sense; because the sentential stops, or those which affect the sense, being all made with a change of note, where there is no such change, the sense cannot be affected. Nor is this the only advantage gained to numbers by this stop of suspension. It also prevents the monotony at the end of lines; which, however pleasing to a rude, is disgusting to a delicate, ear. For as this stop has no peculiar note of its own, but always takes that which belongs to the preceding word, it changes continually with the matter, and is as various as the sense.

Having said all that is necessary with regard to the final, we proceed now to consider the cesural, pause. To these two pauses it will be proper to give the denomination of *musical*, to distinguish them from the comma, semicolon, colon, and full stop, which may be called *sentential pauses*; the office of the former being to mark the melody, as that of the latter is to point out the sense. The cesural, like the final pause, sometimes coincides with the sentential; and sometimes takes place where there is no stop in the sense. In this last case, it is exactly of the same nature, and governed by the same laws with the pause of suspension, which we have just described.

The cesure, though not essential, is however a great ornament to verse, as it improves and diversifies the melody, by a judicious management in varying its situation; but it discharges a still more important office than this. Were there no cesure, verse could aspire to no higher ornament than that of simple melody; but by means of this pause there is a new source of delight opened in poetic numbers, correspondent in some sort to harmony in music. This takes its rise from that act of the mind which compares the relative proportions that the members of a verse thus divided bear to each other, as well as to those in the adjoining lines. In order to see this matter in a clear light, let us examine what effect the cesure produces in single lines, and afterwards in comparing contiguous lines with each other.

With regard to the place of the cesure, Mr Pope and others have expressly declared, that no line appeared musical to their ears, where the cesure was not after the fourth, fifth, or sixth syllable of the verse. Some have enlarged its empire to the third and seventh syllables; whilst others have asserted that it may be admitted into any part of the line.

"There needs but a little distinguishing (says Mr Sheridan) to reconcile these different opinions. If melody alone is to be considered, Mr Pope is in the right when he fixes its seat in or as near as may be to the middle of the verse. To form lines of the first melody, the cesure must either be at the end of the second or of the third foot, or in the middle of the third between the two. Of this movement take the following examples:

1. Of the cesure at the end of the second foot.

> Our plenteous streams || a various race supply;
> The bright-ey'd perch || with fins of Tyrian dye;
> The silver eel || in shining volumes roll'd;
> The yellow carp || in scales bedrop'd with gold.

2. At the end of the third foot.

> With tender billet-doux || he lights the pyre,
> And breathes three amorous sighs || to raise the fire.

3. Between the two, dividing the third foot.

> The fields are ravish'd || from the industrious swains,
> From men their cities, || and from gods their fanes.

These lines are certainly all of a fine melody, yet they are not quite upon an equality in that respect. Those which have the cesure in the middle are of the first order;

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der; those which have it at the end of the second foot are next; and those which have the pause at the end of the third foot the last. The reason of this preference it may not perhaps be difficult to assign.

In the pleasure arising from comparing the proportion which the parts of a whole bear to each other, the more easily and distinctly the mind perceives that proportion, the greater is the pleasure. Now there is nothing which the mind more instantaneously and clearly discerns, than the division of a whole into two equal parts, which alone would give a superiority to lines of the first order over those of the other two. But this is not the only claim to superiority which such lines possess. The cesure being in them always on an unaccented, and the final pause on an accented, syllable, they have a mixture of variety and equality of which neither of the other orders can boast, as in these orders the cesural and final pauses are both on accented syllables.

In the division of the other two species, if we respect quantity only, the proportion is exactly the same, the one being as two to three, and the other as three to two; but it is the order or movement which here makes the difference. In lines where the cesure bounds the second foot, the smaller portion of the verse is first in order, the greater last; and this order is reversed in lines which have the cesure at the end of the third foot. Now, as the latter part of the verse leaves the strongest and most lasting impression on the ear, where the larger portion belongs to the latter part of the line, the impression must in proportion be greater; the effect in sound being the same as that produced by a climax in sense, where one part rises above another.

Having shown in what manner the cesure improves and diversifies the melody of verse, we shall now treat of its more important office, by which it is the chief source of harmony in numbers. But, first, it will be necessary to explain what we mean by the term *harmony*, as applied to verse.

Melody in music regards only the effects produced by successive sounds; and harmony, strictly speaking, the effects produced by different co-existing sounds, which are found to be in concord. Harmony, therefore, in this sense of the word, can never be applied to poetic numbers, of which there can be only one reciter, and consequently the sounds can only be in succession. When therefore we speak of the harmony of verse, we mean nothing more than an effect produced by an action of the mind in comparing the different members of verse already constructed according to the laws of melody with each other, and perceiving a due and beautiful proportion between them.

The first and lowest perception of this kind of harmony arises from comparing two members of the same line with each other, divided in the manner to be seen in the three instances already given; because the beauty of proportion in the members, according to each of these divisions, is founded in nature. But there is a perception of harmony in versification, which arises from the comparison of two lines, and observing the relative proportion of their members; whether they correspond exactly to each other by similar divisions, as in the couplets already quoted; or whether they are diversified by cesures in different places. As,

See the bold youth || strain up the threatening steep,
Rush thro' the thickets || down the valleys sweep.

Where we find the cesure at the end of the second foot of the first line, and in the middle of the third foot of the last.

Hang o'er their coursers heads || with eager speed,
And earth rolls back || beneath the flying steed.

Here the cesure is at the end of the third foot in the former, and of the second in the latter line.——The perception of this species of harmony is far superior to the former; because, to the pleasure of comparing the members of the same line with each other, there is superadded that of comparing the different members of the different lines with each other; and the harmony is enriched by having four members of comparison instead of two. The pleasure is still increased in comparing a greater number of lines, and observing the relative proportion of the couplets to each other in point of similarity and diversity. As thus,

Thy forests, Windsor, || and thy green retreats,
At once the monarch's || and the muse's seats,
Invite my lays. || Be present sylvan maids,
Unlock your springs || and open all your shades.

Here we find that the cesure is in the middle of the verse in each line of the first couplet, and at the end of the second foot in each line of the last; which gives a similarity in each couplet distinctly considered, and a diversity when the one is compared with the other, that has a very pleasing effect. Nor is the pleasure less where we find a diversity in the lines of each couplet, and a similarity in comparing the couplets themselves. As in these,

Not half so swift || the trembling doves can fly,
When the fierce eagle || cleaves the liquid sky;
Not half so swiftly || the fierce eagle moves,
When thro' the clouds || he drives the trembling doves.

There is another mode of dividing lines well suited to the nature of the couplet, by introducing semipauses, which with the cesure divide the line into four portions. By a semipause, we mean a small rest of the voice, during a portion of time equal to half of that taken up by the cesure; as will be perceived in the following fine couplet:

Warms | in the sun || refreshes | in the breeze,
Glows | in the stars || and blossoms | in the trees.

That the harmony, and of course the pleasure, resulting from poetic numbers, is increased as well by the semipause as by the cesure, is obvious to every ear; because lines so constructed furnish a greater number of members for comparison: but it is of more importance to observe, that by means of the semipauses, lines which, separately considered, are not of the finest harmony, may yet produce it when opposed to each other, and compared in the couplet. Of the truth of this observation, the following couplet, especially as it succeeds that immediately quoted, is a striking proof:

Lives | thro' all life || extends | thro' all extent,
Spreads | undivided || operates | unspent.

What we have advanced upon this species of verse, will contribute to solve a poetical problem thrown out by Dryden as a crux to his brethren: it was to account for the peculiar beauty of that celebrated couplet in Sir John Denham's *Cooper's Hill*, where he thus describes the Thames:

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Tho' deep | yet clear || tho' gentle | yet not dull.
Strong | without rage || without o'erflowing | full.

This description has great merit independent of the harmony of the numbers; but the chief beauty of the versification lies in the happy disposition of the pauses and semipauses, so as to make a fine harmony in each line when its portions are compared, and in the couplet when one line is compared with the other.

Having now said all that is necessary upon pauses and semipauses, we have done the utmost justice to our subject which the limits assigned us will permit. *Feet* and *pauses* are the constituent parts of verse; and the proper adjustment of them depends upon the poet's knowledge of *numbers*, *accent*, *quantity*, and *movement*, all of which we have endeavoured briefly to explain. In conformity to the practice of some critics, we might have treated separately of rhime and of blank verse; but as the essentials of all heroic verses are the same, such a division of our subject would have thrown no light upon the art of English versification. It may be just worth while to observe, that the pause at the end of a couplet ought to coincide, if possible, with a slight pause in the sense, and that there is no necessity for this coincidence of pauses at the end of any particular blank verse. We might likewise compare our heroic line with the ancient hexameter, and endeavour to appretiate their respective merits; but there is not a reader capable of attending to such a comparison who will not judge for himself; and it may perhaps be questioned, whether there be two who will form precisely the same judgment. Mr Sheridan, and all the mere English critics, give a high degree of preference to our heroic, on account of the vast variety of feet which it admits; whilst the readers of Greek and Latin poetry prefer the hexameter, on account of its more musical notes and majestic length.

Pogge || Poictou.

POGGE, the CATAPHRACTUS COTTUS, in ichthyology. See COTTUS, n° 2.

POGGIUS BRACCIOLINUS, a man of great parts and learning, who contributed much to the revival of knowledge in Europe, was born at Terranuova, in the territories of Florence, in 1380. His first public employment was that of writer of the apostolic letters, which he held 10 years, and was then made apostolic secretary, in which capacity he officiated 40 years, under seven popes. In 1453, when he was 72 years of age, he accepted the employment of secretary to the republic of Florence, to which place he removed, and died in 1459. He visited several countries, and searched many monasteries, to recover ancient authors, numbers of which he brought to light: his own works consist of moral pieces, orations, letters, and A History of Florence from 1350 to 1455, which is the most considerable of them.

POGO, is a name by which the inhabitants of the Philippine islands distinguish their quail, which, though smaller than ours, is in every other respect very like it.

POICTIERS, an ancient, large, and considerable town of France, capital of Poictou. It was a bishop's see, and contained four abbeys, a mint, an university famous for law, 22 parishes, 9 convents for men, and 12 nunneries. There are here several Roman antiquities, and particularly an amphitheatre, but partly demolished, and hid by the houses. There is also a triumphal arch, which serves as a gate to the great street. It is not peopled in proportion to its extent. Near this place Edward the Black Prince gained a decisive victory over the French, taking King John and his son Philip prisoners, in 1356, whom he afterwards brought over into England. See FRANCE, n° 71, &c.—It is seated on a hill on the river Clain, 52 miles south-west of Tours, and 120 north by east of Bourdeaux. E. Long. 0. 25. N. Lat. 46. 35.

POICTOU, a province of France, bounded on the north by Bretagne, Anjou, and part of Touraine: on the east by Touraine, Berry, and Manche; on the south by Angoumois, Saintonge, and the territory of Aunis; and on the west by the sea of Gascony. It is divided into the Upper and Lower; and is fertile in corn and wine, and feeds a great number of cattle, particularly mules. It was in possession of the kings of England for a considerable time, till it was lost by the unfortunate Henry VI. Poictiers is the capital town.

Poictou, Poinciana.

Colic of Poictou. See MEDICINE, n° 303.

POINCIANA, BARBADOES FLOWER-FENCE: A genus of the monogynia order, belonging to the decandria class of plants; and in the natural method ranking under the 33d order, *Lomentaceæ*. The calyx is pentaphyllous; the petals five, the uppermost larger than the rest; the stamina long, and all fertile; the seed-vessel a legumen. There is only one species, viz. the pulcherrima, a native of both Indies. It rises with a straight stalk 10 or 12 feet high, which is covered with a grey bark, and is sometimes as thick as the small of a man's leg, dividing into several spreading branches at the top, which are armed at each joint with two short, crooked, strong spines, and garnished with decompound winged leaves, each leaf consisting of six or eight pair of simple winged leaves. They are of a light green colour, and when bruised emit a strong odour. The branches are terminated by loose spikes of flowers, which are sometimes formed into a kind of pyramid, and at others disposed more in the form of an umbel. The footstalk of each flower is near three inches long; the flower is composed of five petals, which are roundish at the top, but are contracted to narrow tails at the base. They spread open, and are beautifully variegated with a deep red or orange colour, yellow, and some spots of green; and emit a very agreeable odour. After the flower is past, the germen becomes a broad flat pod three inches long, divided into three or four cells by transverse partitions, each including one flattish irregular seed. The plant is propagated by seeds; but, being tender, is to be constantly kept in the bark-stove. It is very impatient of moisture in winter; and if the least damp seizes its top, it either kills the plant or destroys its head. With proper management it will grow taller here than in the places where it is native; but its stems will not be thicker than a man's finger. In Barbadoes it is planted in hedges to divide the lands, whence it has the

the name of *flower-fence*. In the West Indies, its leaves are made use of as a purge instead of senna; and in Jamaica it is called *sena*.

POINT, a term used in various arts.

POINT, in grammar, a character used to mark the divisions of discourse (See COMMA, COLON, &c.) A point proper is what we otherwise call a *full stop* or *period*. See PUNCTUATION.

POINT, in geometry, according to Euclid, is that which hath neither parts nor magnitude.

POINT, in music, a mark or note anciently used to distinguish the tones or sounds: hence we still call it *simple counter-point*, when a note of the lower part answers exactly to that of an upper; and *figurative counter-point*, when any note is syncopated, and one of the parts makes several notes or inflexions of the voice, while the other holds on one.

We still use a point, to raise the value of a note, and prolong its time by one half, *e. g.* a point added to a semibreve instead of two minims, make it equal to three; and so of the other notes. See the article TIME.

POINT, in astronomy, a term applied to certain points or places marked in the heavens, and distinguished by proper epithets.

The four grand points or divisions of the horizon, viz. the east, west, north, and south, are called the *cardinal points*.

The zenith and nadir are the vertical points; the points wherein the orbits of the planets cut the plane of the ecliptic are called the *nodes*: the points wherein the equator and ecliptic intersect are called the *equinoctial points*; particularly, that whence the sun ascends towards the north pole, is called the *vernal point*; and that by which he descends to the south pole, the *autumnal point*. The points of the ecliptic, where the sun's ascent above the equator, and descent below it, terminate, are called the *solstitial point*; particularly the former of them, the *estival* or *summer-point*; the latter, the *brumal* or *winter-point*.

POINT is also used for a cape or headland jutting out into the sea: thus seamen say, two points of land are in one another, when they are so in a right line against each other, as that the innermost is hindered from being seen by the outermost.

POINT, in perspective, is used for various poles or places, with regard to the perspective plane. See PERSPECTIVE.

POINT is also an iron or steel instrument, used with some variety in several arts. Engravers, etchers, cutters in wood, &c. use points to trace their designs on the copper, wood, stone, &c. See the articles ENGRAVING, &c.

POINT, in the manufactories, is a general term, used for all kinds of laces wrought with the needle; such are the point le Venice, point de France, point de Genoa, &c. which are distinguished by the particular economy and arrangement of their points.—*Point* is sometimes used for lace woven with bobbins; as English point, point de Malines, point d'Havre, &c.

POINT, in poetry, denotes a lively brisk turn or conceit, usually found or expected at the close of an epigram. See POETRY, n° 169.

POINT-Blank, in gunnery, denotes the shot of a gun levelled horizontally, without either mounting or sinking the muzzle of the piece.—In shooting point-blank, the shot or bullet is supposed to go directly forward in a straight line to the mark; and not to move in a curve, as bombs and highly elevated random-shots do.—When a piece stands upon a level plane, and is laid level, the distance between the piece and the point where the shot touches the ground first, is called the *point-blank* range of that piece; but as the same piece ranges more or less, according to a greater or less charge, the point-blank range is taken from that of a piece loaded with such a charge as is used commonly in action. It is therefore necessary that these ranges of all pieces should be known, since the gunner judges from thence what elevation he is to give to his pieces when he is either farther from or nearer to the object to be fired at; and this he can do pretty nearly by sight, after considerable practice.

POINTING, in grammar, the art of dividing a discourse, by points, into periods and members of periods, in order to show the proper pauses to be made in reading, and to facilitate the pronunciation and understanding thereof. See the article PUNCTUATION.

POINTS, in heraldry, are the several different parts of an escutcheon, denoting the local positions of any figure. See HERALDRY, p. 441. col. 2.

POINTS, in electricity, are those acute terminations of bodies which facilitate the passage of the electrical fluid from or to such bodies. See ELECTRICITY.

POINTS, or *Vowel Points*, in the Hebrew language. See PHILOLOGY, Sect. I. n° 31, &c.

POISON, is any substance which proves destructive to the life of animals in a small quantity, either taken by the mouth, mixed with the blood, or applied to the nerves. See MEDICINE, n° 261, 269, 303, 322, 408, &c. &c.

Of poisons there are many different kinds, which are exceedingly various in their operations. The mineral poisons, as arsenic and corrosive mercury, seem to attack the solid parts of the stomach, and to produce death by eroding its substance: the antimonials seem rather to attack the nerves, and to kill by throwing the whole system into convulsions; and in this manner also most of the vegetable poisons seem to operate. All of these, however, seem to be inferior in strength to the poisons of some of the more deadly kinds of serpents, which operate so suddenly that the animal bit by them will be dead before another that had swallowed arsenic would be affected.

Much has been written concerning a poison made use of by the African negroes, by the Americans, and by the East Indians. To this very strange effects have been ascribed. It has been said that by this poison a man might be killed at any certain time; as, for instance, after the interval of a day, a week, a month, a year, or even several years. These wonderful effects, however, do not seem worthy of credit; as the Abbé Fontana has given a particular account of an American poison called *ticunas*, which in all probability is the same with that used in Africa and the East Indies; and from his account it is extremely improbable that any such effects could be produced with certainty.

With this poison the Abbé was furnished by Dr Heberden. It was closed and sealed up in an earthen pot inclosed in a tin-case. Within the tin-case was a note containing the following words: "Indian poison, brought from the banks of the river of the Amazons

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by Don Pedro Maldonado. It is one of the forts mentioned in the Philosophical Transactions, Vol. XLVII. N° 12." In the volume of the Philosophical Transactions here quoted, mention is made of two poisons little different in their activity; the one called the *poison of Lamas*, and the other of *Ticunas*. The poison in the earthen vessel used by the Abbé Fontana was that of the ticunas; he was also furnished with a number of American arrows dipped in poison, but whether that of the lamas or ticunas he could not tell.

Our author begins his account of the nature of this poison with detecting some of the mistakes which had been propagated concerning it.—It had been asserted, that the Ticunas poison proves noxious by the mere effluvia, but much more by the steam which exhales from it in boiling or burning: that, among the Indians, it is prepared only by women condemned to die; and that the mark of its being sufficiently prepared is when the attendant is killed by its steam. All these assertions are by the Abbé refuted in the clearest manner. He exposed a young pigeon to the smell of the poison when the vessel was opened, to the steam of it when boiling, and to the vapour of it when burning to the sides of the vessel, without the animal's being the least injured; on which, concluding that the vapours of this poison were not to be dreaded, he exposed himself to them without any fear.

This poison dissolves very readily even in cold water, and likewise in the vegetable and mineral acids. With oil of vitriol it becomes as black as ink, but not with the rest of the acids. In oil of vitriol it also dissolves more slowly than in any of the rest. It does not effervesce with acids or alkalis; neither does it alter milk, nor tinge it, except with the natural colour of the poison; nor does it tinge the vegetable juices either red or green. When examined by the microscope, there is no appearance of regularity or crystallization; but it for the most part appears made up of very small, irregular, roundish bodies, like vegetable juices. It dries without making any noise, and has an extremely bitter taste when put upon the tongue.

The ticunas poison is harmless when put into the eyes; nor is it fatal when taken by the mouth, unless the quantity is considerable. Six grains of the solid poison, dissolved in water, killed a young pigeon which drank it in less than 20 minutes. Five grains killed a small Guinea-pig in 25 minutes. Eight grains killed a rabbit in an hour and eight minutes, &c. In those experiments it was observed that much less poison was required to kill an animal whose stomach was empty than one that had a full stomach. Three rabbits and two pigeons were killed in less than 35 minutes by taking a dose of three grains each on an empty stomach; but when the experiment was repeated on five animals with full stomachs, only one of them died.

The most fatal operation of this poison is when mixed with the blood. The smallest quantity, injected into the jugular vein, killed the animal as if by a stroke of lightning. When applied to wounds in such a manner that the flowing of the blood could not wash it away, the animal fell into convulsions and a train of fatal nervous symptoms, which put an end to its life in a few minutes. Yet, notwithstanding these seeming affections of the nerves, the poison proved harmless when applied to the naked nerves themselves, or even to the medullary substance of them slit open.

The strength of this poison seems to be diminished, and even destroyed, by mineral acids, but not at all by alkalis or ardent spirits; but if the fresh poison was applied to a wound, the application of mineral acids immediately after could not remove the pernicious effects. So far, indeed, was this from being the case, that the application of nitrous acid to the wounded muscle of a pigeon killed the animal in a short time without any poison at all.—The effects of the arrows were equally fatal with those of the poison itself (A).

The poison of the viper is analogous in its effects to that of ticunas, but inferior in strength; the latter killing more instantaneously when injected into a vein than even the poison of the most venemous rattlesnake.

The Abbé has, however, observed a difference in the action of the two poisons upon blood taken out of the body. He cut off the head of a pigeon, and received its blood into two warm conical glasses, to the amount of about 80 drops into each. Into the blood contained in one porringer, he put four drops of water; and into the other four drops of the poison dissolved in water as usual. The event of this experiment was, that the blood, with which the water only was mixed, coagulated in a short time; but that in which the poison was mixed did not coagulate at all. The poison of the viper also hinders the blood from coagulating, but gives it a much blacker tinge than the poison of the ticunas. The poison of the viper also proves certainly fatal when injected

(A) Mr Paterson, *in his travels in Africa, in the years* 1777-8-9, fell in with an European woman who had been wounded with a poisoned arrow. Great pains had been taken to cure her, but in vain; for at different periods of the year an inflammation came on which was succeeded by a partial mortification. She told him that the wound was easily healed up; but in two months afterwards there was a certainty of its breaking out again, and this had been the case for many years. The Hottentots poison their arrows with a species of euphorbia. See EUPHORBIA.—The amaryllis disticha, a large bulbous plant growing about the Cape of Good Hope, called *mad poison*, is used for the same purpose. The natives take the bulbs when they are putting out their leaves, cut them transversely, extract a thick fluid, and keep it in the sun till it acquires the consistence of gum, when it is fit for use. With arrows poisoned with this gum they kill antelopes and other small animals intended for food. After they are wounded, the animals generally run for several miles, and are frequently not found till next day. When the leaves of this plant are young, the cattle are very fond of them, though they occasion instant death. Mr Paterson mentions another shrubby plant producing a nut, called by the Dutch *woolf gift* or *wolf poison*, the only poison useful to the European inhabitants. The nuts are roasted like coffee, pulverized, and stuffed into some pieces of meat or a dead dog, which are thrown into the fields. By this means the voracious hyenas are generally killed. See RHUS.

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injected into the veins, even in very small quantity; but it produces a kind of grumous coagulation and blackness in the blood when drawn from a vein, though it prevents the proper coagulation of that fluid, and its separation into crassamentum and serum as usual. See VIPER.

In the Philosophical Transactions, N° 335. we have a number of experiments which show the effects of many different poisons upon animals; from whence it appears, that many substances which are not at all accounted poisonous, yet prove as certainly fatal when mixed with the blood as even the poison of rattlesnakes, or the ticunas itself.—An ounce of emetic wine, being injected into the jugular vein of a large dog, produced no effect for a quarter of an hour. At the expiration of that space he became sick, had a continual vomiting, and evacuation of some hard excrements by stool. By these evacuations he seemed to be somewhat relieved; but soon grew uneasy, moved from place to place, and vomited again. After this he laid himself down on the ground pretty quietly; but his rest was disturbed by a return of his vomiting, and his strength greatly decreased. An hour and an half after the operation he appeared half dead, but was greatly revived by having some warm broth poured down his throat with a funnel. This, however, proved only a temporary relief; for in a short time the vomiting returned, he made urine in great quantity, howled miserably, and died in convulsions.—A dram and an half of sal ammoniac dissolved in an ounce and an half of water, and injected into the jugular vein of a dog, killed him with convulsions almost instantly.—The same effect followed from injecting a dram of salt of tartar dissolved in an ounce of warm water; but a dram and an half of common salt injected into the jugular produced little other bad consequence than a temporary thirst.—A dram of purified white vitriol, injected into the crural vein of a dog, killed him immediately.—Fifteen grains of salt of urine dissolved in an ounce of water, and injected into the crural vein of a dog, threw him into such violent convulsions that he seemed to be dying; nevertheless he recovered from a second dose, though not without a great deal of difficulty: but an ounce of urine made by a man fasting produced no bad effect. Diluted aquafortis injected into the jugular and crural vein of a dog killed him immediately by coagulating the blood. Oil of sulphur (containing some quantity of the volatile vitriolic acid) did not kill a dog after repeated trials. On the contrary, as soon as he was let go, he ran into all the corners of the room searching for meat: and having found some bones, he fell a gnawing them with strange avidity, as if the acid, by injection into his veins, had given him a better appetite.—Another dog who had oil of tartar injected into his veins, swelled and died, after suffering great torment. His blood was found florid, and not coagulated.—A dram and a half of spirit of salt diluted with water, and injected into the jugular vein of a dog, killed him immediately. In the right ventricle of the heart the blood was found partly grumous and concreted into harder clots than ordinary, and partly frothy. Warm vinegar was injected without doing any manifest harm.—Two drams of sugar dissolved into an ounce of water were injected into the jugular vein of a dog without any hurt.

These are the results of the experiments where saline substances were injected into the veins. Many acrids proved equally fatal. A decoction of two drams of white hellebore, injected into the jugular vein of a dog, killed him like a stroke of lightning. Another dog was killed in a moment by an injection of an ounce of rectified spirit of wine in which a dram of camphor was dissolved.—Ten drams of highly rectified spirit of wine, injected into the crural vein of a dog, killed him in a very short time: he died quietly, and licking his jaws with his tongue, as if with pleasure. In the vena cava and right ventricle of the heart the blood was coagulated into a great many little clots.—Three drams of rectified spirit of wine injected into the crural vein of a small dog made him apoplectic, and as it were half dead. In a little time he recovered from the apoplexy, and became giddy; and, when he endeavoured to go, reeled and fell down. Though his strength increased by degrees, yet his drunkenness continued. His eyes were red and fiery; and his sight so dull that he scarce seemed to take notice of any thing: and when he was beat, he would scarce move. However, in four hours he began to recover, and would eat bread when offered him; the next day he was out of danger.—Five ounces of strong white-wine injected into the crural vein of a dog made him very drunk for a few hours, but did not produce any other consequences. An ounce of strong decoction of tobacco injected into a vein killed a dog in a very short time in terrible convulsions. Ten drops of oil of sage rubbed with half a dram of sugar, and thus dissolved in water, did no harm by being injected into the blood.

Mercury, though seemingly void of all acrimony, proves also fatal when injected into the blood. Soon after the injection of half an ounce of this mineral into the jugular vein of a dog, he was seized with a dry short cough which came by intervals. About two days after, he was troubled with a great difficulty of breathing, and made a noise like that of a broken-winded horse. There was no tumour about the root of the tongue or the parotid glands, nor any appearance of a salivation. In four days he died; having been for two days before so much troubled with an orthopnœa, that he could sleep only when he leaned his head against something. When opened, about a pint of bloody serum was found in the thorax, and the outside of the lungs in most places was blistered. Some of the blisters were larger and others smaller than a pea, but most of them contained mercurial globules. Several of them were broken; and upon being pressed a little, the mercury ran out with a mixture of a little sanies; but upon stronger pressure, a considerable quantity of sanies issued out. In the right ventricle of the heart some particles of quicksilver were found in the very middle of the coagulated blood lodged there, and the same thing also was observed in the pulmonary artery. Some blood also was found coagulated in a very strange and unusual manner between the columnæ of the right ventricle of the the heart, and in this a greater quantity of quicksilver than anywhere else. In the left ventricle was found a very tenacious blood, coagulated, and sticking to the great valve, including the tendons of it, and a little resembling a polypus. No mercury could be found in this ventricle by the most diligent search; whence it appears, that the mercury had passed no farther than the extremities of the pulmonary artery, where it had stuck, and occasioned fatal obstructions.—In another dog, which had mercury injected into

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into the jugular, it appears to have passed the pulmonary artery, as part of it was found in the cavity of the abdomen, and part also in some other cavities of the body. All the glandules were very turgid and full of liquor, especially in the ventricles of the brain, and all round there was a great quantity of serum.

In like manner, oil of olives proves certainly fatal when injected into the blood. Half an ounce of this, injected into the crural vein of a dog, produced no effect in half a quarter of an hour: but after that, the animal barked, cried, looked dejected, and fell into a deep apoplexy; so that his limbs were deprived of all sense and motion, and were flexible any way at pleasure. His respiration continued very strong, with a snorting and wheezing, and a thick humour sometimes mixed with blood flowing out of his mouth. He lost all external sense: the eyes, though they continued open, were not sensible of any objects that were put to them; and even the cornea could be touched and rubbed, without his being the least sensible of it: his eyelids, however, had a convulsive motion. The hearing was quite lost; and in a short time the feeling became so dull, that his claws and ears could be bored with red-hot pincers without his expressing the least sense of pain. Sometimes he was seized with a convulsive motion of the diaphragm and muscles subservient to respiration; upon which he would bark strongly, as if he had been awake: but this waking was only in appearance; for all the time of this barking he continued as insensible as ever. In three hours he died; and on opening his body, the bronchiæ were filled with a thick froth.—An ounce of oil of olives injected into the jugular of another dog killed him in a moment; but a third lived an hour after it. He was seized with great sleepiness, snorting, and wheezing, but did not bark like the first. In all of them a great quantity of thick froth was found in the lungs.

We come now to speak of those poisons which prove mortal (B) when taken by the mouth. The principal of these are, arsenic, corrosive mercury, glass of antimony, and lead *. What the effects of these substances are when injected into the blood, cannot be related, as no experiments seem to have been made with them in that way, excepting antimony, whose effects have been already mentioned. The effects of opium, when injected into the veins, seem to be similar to its effects when taken by the mouth. Fifty grains of opium, dissolved in an ounce of water, were injected into the crural vein of a cat. Immediately after the operation she seemed much dejected, but did not cry; only made a low, interrupted, and complaining noise. This was succeeded by trembling of the limbs, convulsive motions of the eyes, ears, lips, and almost all parts of the body, with violent convulsions of the breast. Sometimes she would raise up her head, and seem to look about her; but her eyes were very dull, and looked dead. Though she was let loose, and had nothing tied about her neck, yet her mouth was so filled with froth, that she was almost strangled. At last, her convulsive motions continuing, and being seized with stretching of her limbs, she died in a quarter of an hour. Upon opening the body, the blood was found not to be much altered from its natural state.—A dram and an half of opium was dissolved in an ounce and an half of water, and then injected into the crural vein of a lusty strong dog. He struggled violently; made a loud noise, though his jaws were tied; had a great difficulty of breathing, and palpitation of the heart; with convulsive motions of almost all parts of his body. These symptoms were succeeded by a profound and apoplectic sleep. Having untied him, he lay upon the ground without moving, or making any noise, though severely beaten. About half an hour after he began to recover some sense, and would move a little when beaten. The sleepiness still decreased; so that in an hour and a half he would make a noise and walk a little when beat. However, he died in four days, after having voided a quantity of fetid excrements, in colour resembling the diluted opium he had swallowed.

* See *Chemistry*, n° 925, 1256, &c. *Medicine* as above referred to, and *Pharmacy*, *passim*.

The oil of tobacco has generally been reckoned a very violent poison when introduced into the blood; but from the Abbé Fontana's experiments, it appears to be far inferior in strength to the poison of ticunas, or to the bite of a viper. A drop of oil of tobacco was put into a small incision in the right thigh of a pigeon, and in two minutes the animal could not stand on its right foot. The same experiment was repeated on another pigeon and produced exactly the same effect. In another case, the oil was applied to a slight wound in the breast; three minutes after which, the animal could not stand on the left foot. This experiment was also repeated a second time, with the same success. A tooth-pick, steeped in oil of tobacco, and introduced into the muscles of the breast, made the animal fall down in a few seconds as if dead. Applied to two others, they threw up several times all the food they had eaten. Two others treated in the same manner, but with empty stomachs, made many efforts to vomit.—In general, the vomiting was found to be a constant effect of this poison: but the loss of motion in the part to which the poison is applied, was found to be only accidental. None of the animals died by the application

* See *Leake's Practical Treatise on Diseases of the Viscera.*

(B) Of all poisons * those which may be called culinary are perhaps the most destructive, because they are generally the least suspected. All copper ‡ vessels, therefore, and vessels of bell-metal, which contains copper, should be laid aside. Even the common *earthen-ware*, when they contain acids, as in pickling, become very pernicious, as they are glazed with lead, which in the smallest quantity when dissolved is very fatal; and even tin, the least exceptionable of the metals for culinary purposes except iron, is not always quite free of poisonous qualities, it having been found to contain a small portion of arsenic. Mushrooms and the common laurel are also very fatal. The bitter almond contains a poison, and its antidote likewise. The cordial dram *ratafia*, much used in France, is a slow poison, its flavour being procured from the kernels of peach, black cherry stones, &c.—The spirit of *lauro-cerasus* is peculiarly fatal. The adulteration of bread, beer, wine, porter, &c. produces very fatal consequences, and merits exemplary punishment. Next to culinary poisons the abuse of medicines deserves particular attention.

‡ See *Poison of Copper.*

application of oil of tobacco. Dr Leake however asserts the contrary; saying, that this oil, which is used by the Indians in poisoning arrows, when infused into a fresh wound, besides sickness and vomiting, occasions convulsions and death. See *Practical Essay on Diseases of the Viscera*, p. 67.

The pernicious effects of laurel-water are taken notice of under the article MEDICINE, n° 261. The account is confirmed by the experiments of the Abbé Fontana; who tells us, that it not only kills in a short time when taken by the mouth, but that, when given in small doses, the animal writhes so that the head joins the tail, and the vertebræ arch out in such a manner as to strike with horror every one who sees it. In order to ascertain the effects of this water when taken into the blood, our author opened the skin of the lower belly of a pretty large rabbit, and made a wound in it about an inch long; and having slightly wounded the muscles under it in many parts, applied two or three tea-spoonfuls of laurel-water. The animal fell down convulsed in less than three minutes, and died soon after. The experiment was repeated with similar success in other animals; but was always found to act most powerfully, and in the shortest time, when taken by the mouth, or injected by way of clyster. From these experiments, however, he concluded, that laurel-water would kill by being injected into the blood: but in this he was deceived; for two rabbits had each of them a large tea-spoonful injected into the jugular vein, without any inconvenience either at the time of injection or afterwards. It proved innocent also when applied to the bare nerves, and even when introduced into their medullary substance.

We ought now to give some account of the proper antidotes for each kind of poison; but from what has been related concerning the extreme activity of some of them, it is evident that in many cases there can be but very little hope. People are most apt to be bit by serpents in the legs or hands; and as the poison, from the Abbé Fontana's experiments, appears to act only in consequence of being absorbed into the blood, it is plain, that to prevent this absorption is the chief indication of cure. We have recommended several methods for this purpose under the article MEDICINE, n° 408.; but the Abbé Fontana proposes another not mentioned there, namely, ligature. This, if properly applied between the wounded part and the heart, must certainly prevent the bad effects of the poison: but then it tends to produce a disease almost equally fatal; namely, a gangrene of the part; and our author gives instances of animals being thus destroyed after the effects of the poison were prevented; for which reason he prefers amputation. But the good effects of either of these methods, it is evident, must depend greatly on the nature of the part wounded, and the time when the ligature is applied or the amputation performed. If the teeth of the serpent, or the poisoned arrow, happens to strike a large vein, the only possibility of escaping instant death is to compress the trunk of the vein above the wounded place, and to enlarge the wound, that the blood may flow freely and in large quantity, in order to wash away the poison, and discharge the infected parts of the blood itself. If this is neglected, and the person falls into the agonies of death, perhaps strongly stimulating medicines given in large doses, and continued for a length of time, may enable nature to counteract the virulence of the poison. For this purpose volatile alkalis seem most proper, as acting soonest. See MEDICINE, p. 346. col. 2. and p. 347. col. 1.; and perhaps a combination of them with ether might be advantageous, as by the volatility of that medicine the activity of the alkali would probably be increased. In the Philosophical Transactions, we have an account of the recovery of a dog seemingly by means of the volatile alkali, when probably he was in a dying condition. This dog indeed seems to have had a remarkable strength of constitution. The poor creature had first got two ounces of the juice of nightshade, which he bore without any inconvenience. An equal quantity of the juice of hemlock was then given him without effect. He then got a large dose of the root of wolfsbane with the same success. Two drachms of white hellebore root were next given. These caused violent vomitings and purgings, but still he outlived the operation. He was then made to swallow five roots of the colchicum, or meadow-saffron, dug fresh out of the earth. The effect of these was similar to that of the white hellebore, but still he did not die. Lastly, he got two drams of opium; and he even outlived this dose. He was first cast into a deep sleep by it; but soon awaked, and was seized with violent vomitings and purgings, which carried off the effect of the opium. Seeing then that the animal had resisted the most violent poisons, it was resolved to try the effects of the bite of a viper; and he was accordingly bit three or four times on the belly a little below the navel by one enraged. The immediate consequence of this was an incipient gangrene in the parts adjoining to the wound, as appeared by the rising of little black bladders filled with a sanious matter, and a livid colour which propagated itself all around. The motion of the heart became very faint and irregular, and the animal lay without strength or sensation, as if he had been seized with a lethargy or apoplexy. In this condition his wound was cupped and scarified, and Venice treacle (a famous antidote) applied to it. In two hours after this all the symptoms were increased, and he seemed to be nearly dead; upon which half a drachm of volatile salt of hartshorn mixed with a little broth was poured down his throat; and the consequence was, that in a short time he was able to stand on his feet and walk. Another dose entirely dispelled his lethargy, and the heart began to recover its strength. However, he continued very weak; and though he eat no solid meat for three days, yet at the end of that time his strength was evidently increased. The first day he drank water plentifully and greedily, and on the second day he drank some broth. On the third day he began to eat solid meat, and seemed out of danger; only some large and foul ulcers remained on that part of the belly which was bit, and before these were healed he was killed by another dog.

From comparing this with some other observations, indeed, it would seem that volatile alkali is the best antidote against all poisons which suddenly kill by a mixture with the blood, and even of some others. Indeed its effects in curing the bite of snakes seems to be put beyond all doubt, by a paper in the 2d volume of the Asiatic Researches, p. 323. "From the effect of a ligature applied between the bitten part and the heart (says Mr Williams, the author of the paper), it is evident that

that the poison diffuses itself over the body by the returning venous blood; destroying the irritability, and rendering the system paralytic. It is therefore probable, that the volatile caustic alkali, in resisting the disease of the poison, does not act so much as a specific in destroying its quality, as by counteracting the effect on the system, by stimulating the fibres, and preserving that irritability which it tends to destroy."

But whatever be the mode of its operation, the medicine is unquestionably powerful. Mr Williams used either the volatile caustic alkali, or eau-de-luce; the former of which he seems to have preferred. Of it he gave 60 drops as a dose in water, and of the eau-de-luce he gave 40, at the same time applying some of the medicine to the part bitten, and repeating the dose as he found occasion. Of seven cases, some of which were apparently very desperate, only one died, and that appears to have been occasioned by bad treatment after the cure. Many of the patients were perfectly recovered in seven or eight minutes, and none of them required more than two hours: On the whole, Mr Williams says that he "never knew an instance of the volatile caustic alkali failing in its effect, where the patient has been able to swallow it." Dr Mead asserts, that the alkali counteracts the deadly effects of laurel water; we have seen its effects in curing the bite of a viper, and of snakes; and from Dr Wolfe's experiments on hydrophobous patients, it may even claim some merit there. Still, however, there is another method of attempting a cure in such deplorable cases; and that is, by injecting into the veins any thing which will not destroy life, but will destroy the effects of the poison. It is much to be regretted, that in those cruel experiments which we have already related, the intention seems almost always to have been to kill the animal at all events; whereas, it ought to have been to preserve him alive, and to ascertain what medicines could be safely injected into the blood, and what could not, with the effects which followed the injection of different quantities, none of which were sufficient to destroy life. But in the way they were managed, scarce any conclusion can be drawn from them. Indeed it appears that little good is to be expected from this mode; it is mere speculation, and future experiments must show whether it ever shall be used for the cure of poisons, or for any other purposes: its being now totally laid aside, seems to militate strongly against the efficacy of it; besides, the extreme cruelty of the operation will ever be a strong bar to its general introduction. See Injection.

There still remains another method of cure in desperate cases, when there is a certainty that the whole mass of blood is infected; and that is, by the bold attempt of changing the whole diseased fluid for the blood of a sound animal. Experiments of this kind have also been tried; and the method of making them, together with the consequences of such as are recorded in the Philosophical Transactions, we shall notice under the article Transfusion.

Dr Mead, finding that many pretenders to philosophy have called the goodness of the Creator in question, for having created substances whose manifest and obvious qualities are noxious and destructive, remarks, by way of answer, that they have also salutary virtues. But, besides their physical effects, they are likewise food for animals which afford us good nourishment, goats and quails being fattened by hellebore, starlings by hemlock, and hogs innocently eating henbane; besides, some of those vegetables, which were formerly thought poisonous, are now used in medicine, and future discoveries may probably increase the number. The poison of many vegetables is their only defence against the ravages of animals; and by means of them we are often enabled to defend useful plants from the destroying insect; such as by sprinkling them with essential oil of turpentine; and by means of some substances poisonous to them, we are enabled to destroy those insects which infest the human body, and the bodies of domestic animals, &c.—As for poisonous minerals, arsenic for example, Dr Mead observes, that it is not a perfect mineral, but only an active substance, made use of by nature in preparing several metals in the earth, which are of great service to mankind; and, after confirming this by several instances, he concludes by saying, the case will be found much the same in all natural productions of this kind. As for poisonous animals, &c. their noxious qualities may easily be accounted for, by reflecting that it is their only mode of self-defence. See Aranea, p. 195. and Serpent.

Poison of Copper. This metal, though when in an undissolved state it produces no sensible effects, becomes exceedingly active when dissolved; and such is the facility with which the solution is effected, that it becomes a matter of some consequence to prevent the metal from being taken into the human body even in its proper form. It doth not, however, appear that the poison of copper is equally pernicious with those of arsenic or lead; much less with some others treated of in the last article. The reason of this is, that it excites vomiting so speedily as to be expelled, even though taken in considerable quantity, before it has time to corrode the stomach. Roman vitriol, which is a solution of copper in the vitriolic acid, has been used as a medicine in some diseases with great success. Verdigrise also, which is another very active preparation of the metal, has been by some physicians prescribed as an emetic, especially in cases where other poisons had been swallowed, in order to procure the most speedy evacuation of them by vomit. Where copper is not used with this view, it has been employed as a tonic and antispasmodic, with which it has been admitted into the Edinburgh Dispensatory under the title of *Cuprum Ammoniacale*. The effects of the metal, however, when taken in a pretty large quantity, and in a dissolved state, or when the stomach abounds with acid juices sufficient to dissolve it, are very disagreeable and even dangerous; as it occasions violent vomitings, pains in the stomach, faintings, and sometimes convulsions and death. The only cure for these symptoms is to expel the poison by vomiting as soon as possible, and to obtund its acrimony; for which purpose drinking warm milk will probably be found the most efficacious remedy. In order to prevent the entrance of the poison into the body, no copper vessels should be used in preparing food but such as are either well tinned or kept exceedingly clean. The practice of giving a fine blue or green colour to pickles, by preparing them in copper vessels, ought not to be tolerated; for Dr Falconer, in a treatise on this subject, assures us, that these are sometimes so strongly impregnated by this method of preparing

Poison. preparing them, that a small quantity of them will produce a slight nausea.——Mortars of brass or bell-metal ought for the same reason to be avoided, as by this means a considerable quantity of the pernicious metal may be mixed with our food, or with medicines. In other cases, an equal caution ought to be used. The custom of keeping pins in the mouth, of giving copper halfpence to children to play with, &c. ought to be avoided; as thus a quantity of the metal may be insensibly taken into the body, after which its effects must be uncertain.——It is proper to observe, however, that copper is much more easily dissolved when cold than when hot; and therefore the greatest care should be taken never to let any thing designed for food, even common water, remain long in copper vessels when cold; for it is observed, that though the confectioners can safely prepare the most acid syrups in clean copper vessels without their receiving any detriment whilst hot, yet if the same syrups are allowed to remain in the vessels till quite cold, they become impregnated with the pernicious qualities of the metal.

Poison of Lead. See MEDICINE, n° 303.

Poison-Tree. See RHUS.

Poison-Tree of Java, called in the Malayan language *bohun upas*, is a tree which has often been described by naturalists; but its existence has been very generally doubted, and the descriptions given of it containing much of the marvellous, have been often treated as idle fictions. N. P. Foersch, however, in an account of it written in Dutch, asserts that it does exist; and tells us, that he once doubted it as much as any person; but, determined not to trust general opinions, he made the most particular inquiries possible; the result of which was, that he found that it is situated in the island of Java, about 27 leagues from Batavia, 14 from Soura Charta, the emperor's seat, and about 19 from Tinkjoe, the residence of the sultan of Java. It is surrounded on all sides by hills and mountains, and the adjacent country for 12 miles round the tree is totally barren. Our author says he has gone all round the spot at about 18 miles from the centre, and on all sides he found the country equally dreary, which he ascribes to its noxious effluvia. The poison procured from it is a gum, issuing from between the bark and the tree; and it is brought by malefactors who have been condemned to death, but who are allowed by this alternative to have a chance for their life. An old ecclesiastic, our author informs us, dwelt on the outside of the surrounding hills, whose business it was to prepare the criminals for their fate, if death should be the consequence of their expedition. And indeed so fatal is its effluvia, that he acknowledged that scarcely two out of 20 returned from above 700 whom he had dismissed.

Mr Foersch farther tells us, that he had seen several of the criminals who had returned, and who told him, that the tree stands on the borders of a rivulet, is of a middling size, and that five or six young ones of the same kind stand close to it. They could not, however, see any other plant or shrub near it; and the ground was of brownish sand, full of stones and dead bodies, and difficult to pass. The Malayans think this tract was thus rendered noxious and uninhabitable by the judgement of God, at Mahomet's desire, on account of the sins of the inhabitants. No animal whatever is ever seen there; and such as get there by any means never return, but have been brought out dead by such of the criminals as have themselves escaped death.

Our author relates a circumstance which happened in the year 1775, to about 400 families (1600 souls), who refused to pay some duty to the emperor, and who were in consequence declared rebels and banished: they petitioned for leave to settle in the uncultivated parts round Upas: the consequence of which was, that in less than two months their number was reduced to about 300 souls, who begged to be reconciled to the emperor, and were again received under his protection. Many of these survivors Mr Foersch saw, and they had just the appearance of persons tainted with an infectious disorder.

With the juice of this tree arrows, lancets, and other offensive weapons, are poisoned. With lancets thus poisoned, Mr Foersch observes, that he saw 13 of the emperor's concubines executed for infidelity to his bed in February 1776. They were lanced in the middle of their breasts; in five minutes after which they were seized with a *tremor* and *subsultus tendinum*, and in 15 minutes they were dead. Their bodies were full of livid spots, like those of *petechiæ*, their faces swelled, colour blue, and eyes yellow, &c. Soon after he saw seven Malayans executed in the same way, and saw the same effects follow; on which he resolved to try it on other animals, and found the operation similar on three puppies, a cat, and a fowl, none of which survived more than 13 minutes. He also tried its effects internally on a dog seven months old; the animal became delirious, was seized with convulsions, and died in half an hour. From all which our author concludes, that it is the most violent of all vegetable poisons, and that it contributes greatly to the unhealthiness of the island in which it grows. By means of it many cruel and treacherous murders are perpetrated. He adds, that there exists a sort of cajoe-upas on the coast of Macassar, the poison of which, though not near so violent or malignant, operates nearly in the same manner.

To this account our readers will give such a degree of credit as they think is due; it is our business however to add, that it has been controverted in all its parts in a memoir of Lambert Nolst, M. D. fellow of the Batavian Experimental Society at Rotterdam, (see Gentleman's Mag. May 1794, p. 433.) This memoir was procured from John Matthew a Rhyn, who had been 23 years, from 1763 to 1786, resident in the island, and therefore had every opportunity of informing himself on the spot. In this memoir we are told, that Foersch's account of the tree is extremely suspicious, from a variety of circumstances: 1. Though he had letters of introduction, he went to no considerable house, and afterwards privately withdrew among the English. 2. When the emperor was asked respecting Foersch, and the facts he relates, he answered, that he had never heard either of him or of the tree. 3. The distances given to mark the situation of the tree are not accurate. 4. The execution of criminals is different from what he represents. 5. The circumstance of several criminals returning when Foersch was there has a suspicious appearance. 6. There exists no such tradition, as that the tree was placed there by Mahomet. 7. There were no such disturbances in 1775 as Foersch represents, the tract to which

which he alludes having submitted to the Dutch East India Company as early as 1756. 8. The island is not unhealthy, as Foersch asserts; nor are violent or premature deaths frequent. 9. The Javanese are a curious and intelligent people, and of course could not be so ignorant of this tree if it had any existence. 10. The assertions and pretended facts of Foersch have no collateral evidence; and every thing which we gather from the accounts of others, or from the history of the people, invalidates them. For these and other reasons, Dr Nolst concludes, that very little credit is due to the representations of Foersch, and that the island of Java produces no such tree, which, if it really grew there, would be the most remarkable of all trees.

POLA, in ichthyology, is the name of a flat fish, resembling the soal, but somewhat shorter and smaller. It is called *cynoglossus* and *linguatula*. It abounds in the Mediterranean, and is sold both in Rome and in Venice for the table.

POLACRE, a ship with three masts, usually navigated in the Levant and other parts of the Mediterranean. These vessels are generally furnished with square sails upon the main-mast, and *lateen* sails upon the fore-mast and mizen-mast. Some of them, however, carry square sails upon all the three masts, particularly those of Provence in France. Each of their masts is commonly formed of one piece, so that they have neither top-mast nor top-gallant-mast; neither have they any *horses* to their yards, because the men stand upon the top-sail-yard to loose or furl the top-gallant-sail, and on the lower-yard to *reef*, to loose, or furl, the top-sail, whose yard is lowered sufficiently down for that purpose.

POLAEDRASTYLA, in natural history, is the name of a genus of crystals, derived from the Greek πολυς, *many*, εδρα, *sides*, the primitive particle α, *not*, and στυλος, a column; and means a crystal with many planes, and without a column.

The bodies of this genus are crystals of two octangular pyramids, with the bases joined, the whole body consisting of 16 planes. Of this genus there are only two species known: 1. A brown kind with short pyramids, found in great plenty in Virginia on the sides of hills; and, 2. A colourless one, with longer pyramids. This has yet been found only in one place, which is the great mine at Gossalaer, in Saxony, where it usually lies at great depths.

POLAND, a kingdom of Europe, in its largest extent bounded by Pomerania, Brandenburg, Silesia, and Moravia, to the west; and, towards the east, by part of Russia and the Lesser Tartary; on the north, it has the Baltic, Russia, the grand province of Livonia, and Samogitia; and on the south, it is bounded by Bessarabia, Transylvania, Moldavia, and Hungary. Geographers generally divide it into the provinces of Poland Proper, Lithuania, Samogitia, Courland, Prussia, Massovia, Polachia, Polesia, Little Russia, called likewise *Russia Rubra* or *Red Russia*, Podolia, and the Ukrain. Now, however, it is very considerably reduced in extent, as will appear in the course of its history. For a map of Poland, Lithuania, and Prussia, see Plate CCCCX.

With regard to the history of Poland, we are not to gather the earlier part of it from any accounts transmitted to us by the natives. The early histories of all nations indeed are involved in fable; but the Poles never had even a fabulous history of their own nation. The reason of this is, that it was not the custom with that nation to entertain itinerant poets for the amusement of the great; for to the songs of these poets entertained among other nations we are obliged for the early part of their history; but this assistance being deficient in Poland, we must have recourse to what is recorded concerning it by the historians of other nations.

1 Polish sovereigns at first only styled dukes.

The sovereigns of Poland at first had the title of *duces*, dukes or generals, as if their office had been only to lead the armies into the field. The first of these is universally allowed to have been Lechus or Lecht; and to render him more illustrious, he is said to have been a lineal descendant from Japhet the son of Noah. According to some writers, he migrated at the head of a numerous body of the descendants of the ancient Sclavi from some of the neighbouring nations; and, to this day, Poland is called by the Tartars the kingdom of *Lechus*. Busching, however, gives a different account of the origin of the Poles. Sarmatia, he observes, was an extensive country, inhabited by a variety of nations of different names. He supposes the Poles to be the descendants of the ancient Lazi, a people who lived in Colchis near the Pontus Euxinus; whence the Poles are sometimes called *Polazi*. Crossing several rivers, they entered Posnania, and settled on the borders of the Warta, while their neighbours the Zechi settled on the Elbe, in the 550th year of Christ. As to the name of *Poland*, or *Polska*, as it is called by the natives, it comes from the Sclavonic word *Pole*, or *Poln*, which signifies a country adapted to hunting, because the whole country was formerly covered with vast forests, exceedingly proper for that employment.

2 Lechus the first duke.

3 Derivation of the different names of Poland.

4 Viscimer the second duke.

Of the transactions of Lechus during the time that he enjoyed the sovereignty, we have no certain account. His successor was named *Viscimer*, who is generally supposed to have been the nephew of Lechus. He was a warlike and successful prince, subduing many provinces of Denmark, and building the city of Wismar, so called from the name of the sovereign. But the Danish historians take no notice of his wars with their country; nor do they even mention a prince of this name. However, he is said to have reigned for a long time with great glory; but to have left the people in great distress, on account of the disputes which arose about a successor.

5 Form of government changed into aristocracy.

After the death of Viscimer, the nobility were on the point of electing a sovereign, when the people, harassed by the grievous burdens occasioned by the wars of Viscimer, unanimously demanded another form of government, that they might no longer be liable to suffer from ambition and tyranny. At first the nobility pretended to yield to this humour of the people with great reluctance; however, they afterwards determined on such a form of government as threw all the power into their own hands. Twelve palatines, or vaivodes, were chosen; and the Polish dominions divided into as many provinces. These palatines exercised a despotic authority within their several jurisdictions, and aggravated the misery of the people by perpetual wars among themselves; upon which the Poles, worn out with oppression, resolved to return to their old form of government. Many assemblies were held for

Plate CCCCX.


POLAND, LITHUANIA AND PRUSSIA.
Longit. E. from London.
British Statute Miles
SWEDEN
BALTIC SEA
GULF OF RIGA
COURLAND
SAMOGITIA
LITHUANIA
WHITE RUSIA
GREAT DUTCHY OF LITHUANIA
KINGDOM OF PRUSIA
POLISH PRUSIA
BLACK RUSIA
MASOVIA
GREAT POLAND
CUJAVIA
POLESIA
VOLHINIA
LITTLE POLAND
RED RUSIA
POCUTIA
PODOLIA
UPPER PODOLIA
POLISH KIOVIA
PADOVIA
RUSSIA
GERMANY
HUNGARY
TURKY IN EUROPE
II Hours E. from London.
A Bell Prin. Wal. Sculptor fecit.

Poland. for this purpose; but, by reason of the opposition of the vaivodes, they came to nothing. At last, however, they cast their eyes upon Cracus, or Gracus, whose wealth and popularity had raised him to the highest honours among his countrymen. The Poles say that he was a native of Poland, and one of the 12 vaivodes;
6 The dukedom restored. but the Bohemians affirm that he was a native of their country: however, both agree in maintaining, that he was descended from the ancient family of the Gracchi in Rome; who, they say, were banished to this country. He is said to have signalized himself against the Franks, whom he overthrew in some desperate engagements, and afterwards built the city of Cracow with their spoils. He did not enlarge his dominions, but made his subjects happy by many excellent regulations. At last, after a long and glorious reign, he expired, or, according to some, was assassinated by a nobleman who aspired to the crown.

Cracus left three children; Cracus, Lechus, and a daughter named *Vanda*. The first succeeded to the dukedom in virtue of his birthright; but was soon after murdered by his brother Lechus. However, it seems the thoughts of the crime which he had committed so disturbed his conscience, that the secret could not be kept. When it was known that he had been the murderer of his late sovereign, he was deposed with all possible marks of ignominy and contempt, and his sister Vanda declared duchess. She was a most beautiful and accomplished lady; and soon after she had been raised to the sovereignty, one Rithogar, a Teutonic prince, sent an ambassador demanding her in marriage, and threatening war if his proposals were refused. Vanda marched in person against him at the head of a numerous army, and the event proved fatal both to Rithogar and herself. The troops of Rithogar abandoned him without striking a blow, upon which he killed himself in despair; and Vanda, having become enamoured of him, was so much concerned for his death, that she drowned herself in the river Vistula or Wesel. From this unfortunate lady the country of Vandalia takes its name.

7 Again abolished. The family of Cracus having become extinct by the death of Vanda, the Poles were again left at liberty to choose a new sovereign or a new form of government. Through a natural levity, they changed the form of government, and restored the vaivodes notwithstanding all that they had formerly suffered from them. The consequences were the same as before: the vaivodes abused their power; the people were oppressed, and the state was distracted between foreign wars and civil contentions.
8 Restored a second time. At that time the Hungarians and Moravians had invaded Poland with a numerous army, and were opposed only by a handful of men almost ready to surrender at discretion. However, one Premislaus, a private soldier, contrived a stratagem by which the numerous forces of the enemy were overthrown; and for his valour was rewarded with the dukedom. We are ignorant of the other transactions of his reign; but all historians inform us that he died deeply regretted, and without issue; so that the Poles had once more to choose a sovereign.

On the death of Premislaus several candidates appeared for the throne; and the Poles determined to prefer him who could overcome all his competitors in a horse-race. A stone pillar was erected near the capital, on which were laid all the ensigns of the ducal authority; and an herald proclaimed, that he who first arrived at that pillar from a river at some distance, named *Pouderic*, was to enjoy them. A Polish lord named *Lechus* was resolved to secure the victory to himself by a stratagem; for which purpose he caused iron spikes to be driven all over the course, reserving only a path for his own horse. The fraudulent design took effect in part, all the rest of the competitors being dismounted, and some severely hurt by their fall. Lechus, in consequence of this victory, was about to be proclaimed duke; when, unluckily for him, a peasant who had found out the artifice opposed the ceremony; and upon an examination of the fact, Lechus was torn in pieces, and the ducal authority conferred upon the peasant.

The name of the new monarch was also Lechus. He attained the sovereignty in the year 774, and behaved with great wisdom and moderation. Though he possessed the qualities of a great warrior, and extended his dominions on the side of Moravia and Bohemia, yet his chief delight was to make his subjects happy by peace. In the decline of life he was obliged to engage in a war with Charlemagne, and is said by some to have fallen in battle with that powerful monarch; though others assert that he died a natural death, having lived so long that the springs of life were quite worn out.

Lechus III. was succeeded by his son Lechus IV. who inherited all his father's virtues. He suppressed an insurrection in the Polish provinces, by which he acquired great reputation; after which he led his army against the Greek and Italian legions who had overrun Panonia. He gained a complete victory over his enemies. Nor was his valour more conspicuous in the battle than his clemency to the vanquished: for he dismissed all his prisoners without ransom; demanding no other conditions than that they should never again disturb the peace of Poland, or the allies of that kingdom. This duke is said to have been endowed with many virtues, and is charged only with the vice of incontinence. He left 20 natural children, and only one legitimate son, named *Popiel*, to whom he left the sovereignty. Popiel was also a virtuous and pacific prince, who never had recourse to arms but through necessity. He removed the seat of government from Cracow to Gnesna, and was succeeded by his nephew Popiel II. a minor.

The young king behaved with propriety as long as he was under the tuition of others; but as soon as he had got the reins of government into his own hands the face of affairs was altered. Lechus III. who, as hath been already mentioned, had 20 illegitimate children, had promoted them to the government of different provinces; and they had discharged the duties of their offices in such a manner as showed that they were worthy of the confidence reposed in them. However, as soon as Popiel came of age, being seduced by the advice of his wife, an artful and ambitious woman, he removed them from their posts, treated them with the utmost contempt, and at last found means to poison them all at once at an entertainment. A dreadful punishment, however, according to the historians of those times, attended his treachery and cruelty. The bodies of the unhappy governors were left unburied; and from them issued a swarm of rats, who pursued Popiel, his wife, and children, wherever they went, and at last devoured them. The nation now became a prey to civil discord at the same time that it was harassed

Poland.

harassed by a foreign enemy; and, in short, the state seemed to be on the verge of dissolution, when Piastus was proclaimed duke in 830, from whom the natives of ducal or regal dignity were called *Piastes*. See PIASTUS. This excellent monarch died in 861, and was succeeded by his son Ziemovitus, who was of a more warlike disposition than his father, and who first introduced a regular discipline among the Polish troops. He maintained a respectable army, and took great pains to acquire a perfect knowledge in the art of war. The consequence of this was, that he was victorious in all his battles; and retook from the Germans and Hungarians not only all that they had gained, but enlarged his dominions beyond what they had been. After his death nothing remarkable happened in Poland till the time of Mieczslaus I. who attained the ducal authority in 964. He was born blind, and continued so for seven years: after which he recovered his sight without using any medicine; a circumstance so extraordinary, that in those times of ignorance and superstition it was accounted a miracle. In his reign the Christian religion was introduced into Poland. The most probable account of the manner in which Christianity was introduced is, that Mieczslaus having by ambassadors made his addresses to Daborwka daughter to the Duke of Bohemia, the lady rejected his offer unless he would suffer himself to be baptized. To this the duke consented, and was baptized, after having been instructed in the principles of Christianity. He founded the archbishoprics of Gnesna and Cracow; and appointed St Adalbert, sent by the pontiff to propagate Christianity in Poland, primate of the whole kingdom. On the birth of his son Boleslaus he redoubled his zeal; founding several bishoprics and monasteries; ordering likewise that, when any part of the Gospel was read, the hearers should half-draw their swords, in testimony of their readiness to defend the faith. He was, however, too superstitious to attend to the duties of a sovereign; and suffered his dominions to be ravaged by his barbarous neighbour the duke of Russia. Yet, with all his devotion, he could not obtain the title of king from the pope, though he had warmly solicited it; but it was afterwards conferred on his son, who succeeded to all his dominions.

9 Why the sovereigns of Poland are called *Piastes*.

10 Christianity introduced by Mieczslaus I.

11 Boleslaus the first king of Poland.

Boleslaus I. the first king of Poland, surnamed *Chrobry*, succeeded to the sovereignty in 999. He also professed and cherished Christianity, and was a man of great valour and prudence. However, the first transaction of his reign savoured very much of the ridiculous piety of those times. He removed from Prague to Gnesna the remains of a saint which he had purchased at a considerable price. The Emperor Otho III. made a pilgrimage, on account of a vow, to the tomb of this saint. He was hospitably received by Boleslaus, whom, in return, he invested with the regal dignity; an act which was confirmed by the pope. This new dignity added nothing to the power of Boleslaus; though it increased his consequence with his own subjects. He now affected more state than before: his body-guards were considerably augmented; and he was constantly attended by a numerous and splendid retinue whenever he stirred out of his palace. Thus he inspired his people with an idea of his greatness, and consequently of their own importance; which no doubt was necessary for the accomplishment of a design he had formed, namely, an offensive war with Russia: but when he was upon the point of setting out on this expedition, he was prevented by the breaking out of a war with the Bohemians. The elevation of Boleslaus to the regal dignity had excited the envy of the duke of Bohemia, who had solicited the same honour for himself, and had been refused. His jealousy was further excited by the connection between Boleslaus and the emperor, the former having married Rixa the emperor's niece. Without any provocation, therefore, or without giving the least intimation of his design, the duke of Bohemia entered Poland at the head of a numerous army, committing everywhere dreadful ravages. Boleslaus immediately marched against him, and the Bohemians retired with precipitation. Scarcity of provisions, and the inclemency of the season, prevented Boleslaus at that time from pursuing; but as soon as these obstacles were removed, he entered Bohemia at the head of a formidable army, with a full resolution of taking an ample revenge. The Bohemians were altogether unable to resist; neither indeed had they courage to venture a battle, though Boleslaus did all in his power to force them to it. So great indeed was the cowardice of the duke or his army, that they suffered Prague, the capital of the duchy, to be taken after a siege of two years; having never, during all that time, ventured to relieve it by fighting the Polish army. The taking of this city was quickly followed by the reduction of all the places of inferior note: but though Boleslaus was in possession of almost all the fortified places in Bohemia, he could not believe his conquests to be complete until he became master of the duke's person. This unfortunate prince had shut himself up with his son in his only remaining fortress of Wissogrod, where he imagined that he should be able to foil all the attempts of the Polish monarch. In this, however, he found himself disappointed. Boleslaus invested the place, and made his approaches with such rapidity, that the garrison, dreading a general assault, resolved to capitulate, and persisted in their resolution notwithstanding all the intreaties and promises of the duke. The consequence was, that the unhappy prince fell into the hands of his enemies, and had his eyes put out by Boleslaus; after which, his son Jaremir was put into perpetual and close confinement.

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12 He conquers Bohemia

13 And Moravia.

From Bohemia Boleslaus marched towards Moravia; but no sooner did he arrive on the frontier than the whole province submitted without a blow. He then resumed his intention of invading Russia; for which he had now a very fair opportunity, by reason of a civil war which raged with violence among the children of duke Volodomir. The chief competitors were Jarislaus and Suantepolk. The latter, having been defeated by his brother, was obliged to take refuge in Poland, where he used all the arguments in his power with king Boleslaus in order to induce him to revenge his cause. Boleslaus having already an intention of invading that country, needed but little intreaty; and therefore moved towards Russia at the head of a very numerous army: giving out, that he had no other design than to revenge the injustice done to Suantepolk. He was met on the banks of the river Bog by Jarislaus at the head of an army much superior in number to his own; and for some days the Polish army was kept at bay by the Russians. At last Boleslaus, growing impatient, resolved to pass the river at all events; and therefore forming his cavalry in the best manner for breaking the torrent,

14 Gains a great victory over the Russians.

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torrent, he exposed his own person to the utmost of its force. Encouraged by his example, the Poles advanced breast-high in the water to the opposite shore; from whence the enemy gave them all the annoyance in their power. In spite of all opposition, however, the Poles reached the bank, and soon gained a complete victory, Jarislaus being obliged to fly to Kiovia. This city was immediately invested; but Jarislaus retired farther into the country in order to recruit his army, leaving the city to its fate. The garrison made a brave defence, but were at last compelled to surrender at discretion. A vast treasure was found in the place; great part of which was distributed by Boleslaus among the soldiers.

15
Places Suantepolk on the throne of Russia,

Though the king of Poland had now become master of the greatest part of Russia, he knew that the only possible means of keeping the country in subjection was by placing a natural sovereign over the inhabitants. For this reason he reinstated Suantepolk, though his pretensions were still disputed by Jarislaus. The latter had formed a flying camp, and meditated a scheme of surprising and carrying off his rival brother; but having failed in this attempt, he retired to Novogorod, where the attachment of the inhabitants enabled him to make some resistance, till at last he was attacked and defeated by Boleslaus, which seemed to give the finishing stroke to his affairs.

16
Who attempts to cut him off with his whole army, but is defeated.

The king of Poland, however, now met with a more dangerous enemy in the perfidious and ungrateful Suantepolk than he had experienced in Jarislaus. The Russian prince, imagining himself a dependent on Boleslaus, formed a conspiracy against him; by which he projected nothing less than the destruction of him and his whole army. The massacre was already begun when Boleslaus received intelligence. The urgency of the case admitted of no delay: the king therefore mounted his horse; and having with the utmost haste assembled part of his army, fell upon the traitors with such fury, that they were obliged to betake themselves to flight, and Boleslaus got safe into Poland.

17
A dreadful battle between the Russians and Poles.

But in the mean time Jarislaus having assembled fresh forces, pursued the Polish army; and having come up with them just as one half had crossed the river Boristhenes, attacked them with the utmost fury. Boleslaus defended himself with the greatest resolution; but, by reason of his forces being divided, victory was dubious for a long time. At last, when the army had wholly crossed, the Russians were entirely put to the rout, and a terrible carnage ensued. The victory, however, though complete, was not decisive; for which reason Boleslaus thought proper to continue his retreat, without attempting to conquer a country too extensive for him ever to keep in subjection.

18
Saxony conquered by Boleslaus,

Still, however, his martial inclination continued, and he led his army into Saxony. The inhabitants of this country had hitherto resisted all attempts that had been made on their freedom, and still made a violent struggle for liberty; though, in spite of their utmost efforts, they were obliged at last to submit to the yoke. On his withdrawing the troops from Saxony, however, the king thought proper to leave the people to their liberty, contenting himself with a rich booty. The boundaries of his empire he now fixed at the river Elbe; where he erected two iron columns, in order to transmit the memory of his conquest to posterity.

Boleslaus, still unsated with victory, now meditated the conquest of Prussia and Pomerania; the latter of which provinces had, in the former civil wars, been dismembered from Poland.

19
With Prussia and Pomerania.

His arms were attended with equal success against both: indeed the very terror of his name seemed to answer all the purposes of a formidable army. These, however, he seems to have designed to be the last of his warlike enterprises; for he now applied himself wholly to the enacting of wholesome laws for the benefit of his people.

20
Gains another great victory over the Russians, on which the whole country submits.

But in the midst of this tranquillity Jarislaus assembled the most numerous army that had ever been heard of in Russia, with which he appeared on the frontiers of Poland. Boleslaus, though now advanced in years, marched out against his adversaries, and met them on the banks of the Boristhenes, rendered famous by the victory he had lately gained there. The Poles crossed the river by swimming; and attacked the enemy before they had time to draw up in order of battle with such impetuosity, that a total rout soon ensued. The Russians were seized with a panic, and Jarislaus was hurried away, and almost trampled to death by the fugitives. Many thousand prisoners were taken, but Boleslaus released them upon very easy conditions; contenting himself with an inconsiderable tribute, and endeavouring to engage the affections of the people by his kindness. This well-timed clemency produced such an happy effect, that the Russians voluntarily submitted to his jurisdiction, and again became his subjects.

21
Boleslaus dies.

Soon after this he died in the year 1025, after having vastly extended his dominions, and rendered his subjects happy.

Boleslaus was succeeded by his son Mieczslaus II. but he possessed none of the great qualities of his father, being indolent and debauched in his behaviour. In the very beginning of his reign, the Russians, Bohemians, and Moravians, revolted. However, as the spirit and discipline introduced by Boleslaus still remained in the Polish army, Mieczslaus found no great difficulty in reducing them again to obedience: after which, devoting himself entirely to voluptuousness, he was seized with a frenzy, which put an end to his life in the year 1034.

22
Rixa, a tyrannical regent, driven out with her son Casimir.

The bad qualities of this prince proved very detrimental to the interest of his son Casimir; though the latter had received an excellent education, and was possessed of many virtues. Instead of electing him king, they chose Rixa his mother queen-regent. She proved tyrannical, and so partial to her countrymen the Germans, that a rebellion ensued, and she was forced to fly to Germany; where she obtained the protection of the emperor by means of the immense treasures of Boleslaus, which she had caused to be transported thither before her. Her bad behaviour and expulsion proved still more fatal to the affairs of Casimir than even that of his father. He was immediately driven out of the kingdom; and a civil war taking place, a great many pretenders to the crown appeared at once.

23
Poland distressed by foreign and domestic wars.

To the miseries occasioned by this were added those of a foreign war; for the Bohemians and Russians invaded the kingdom in different places, committing the most dreadful ravages. The consequence of these accumulated distresses was, that the nobility came at last to the resolution of recalling Casimir, and electing him sovereign. However, before they took this measure, it was thought proper to send to Rome to complain of the behaviour of the duke of Bohemia. The deputies were at first received favourably:

 but

but the influence of the duke's gold prevailing, no redress was obtained; so that at last it was resolved, without more ado, to send for Casimir.

24 Casimir recalled and elected king.

The only difficulty was where to find the fugitive prince; for he had been gone five years from the kingdom, and nobody knew the place of his retreat. At last, by sending an embassy to his mother, it was found out that he had retired into France, where he applied closely to study at the university of Paris. Afterwards he went to Italy; where, for the sake of subsistence, he took upon him the monastic habit. At that time he had returned to France, and obtained some preferment in the abbey of Clugni. Nothing now obstructed the prince's return but the sacred function with which he was invested. However, a dispensation was obtained from the pope, by which he was released from his ecclesiastical engagements, on condition that he and all the kingdom should become subject to the capitation tax called *Peter-pence*. Some other conditions of less consequence were added; such as, that the Poles should shave their heads and beards, and wear a white linen robe at festivals, like other professors of the Catholic religion. Great preparations were made for the reception of the young prince: and he was met on the frontier by the nobility, clergy, and forces of the nation; by whom he was conducted to Gnesna, and crowned by the primate with more than usual solemnity. He proved a virtuous and pacific prince, as indeed the distracted situation of the kingdom would not admit of the carrying on of wars. However, Casimir proved his courage in subduing the banditti by which the country was over-run; and by marrying the princess Mary, sister to the duke of Russia, all quarrels with that nation were for the present extinguished. Upon the whole, the kingdom flourished during his reign; and became more respectable from the wisdom and stability of the administration than it could have been by many victories. After a happy reign of 16 years, he died beloved and regretted by all his subjects.

25 Poland subjected to the tax called *Peter-pence*.

26 Boleslaus II. a valiant and successful prince.

By the happy administration of Casimir the kingdom recovered sufficient strength to carry on successful wars against its foreign enemies. Boleslaus II. the son of Casimir, an enterprising and valiant prince, succeeded to the throne; and soon made himself so famous, that three unfortunate princes all took refuge at his court at once, having been expelled from their own dominions by their rebellious subjects. These were, Jacomir, son of Briteslaus duke of Bohemia; Bela, brother to the king of Hungary; and Zaslaus duke of Kiovia, eldest son to Jarislaus duke of Russia, and cousin to the king of Poland. Boleslaus determined to redress all their grievances; but while he deliberated upon the most proper means for so doing, the duke of Bohemia, dreading the consequence of Jacomir's escape, assembled an army, and, without any declaration of war, marched through the Hercynian forest, desolated Silesia, and laid waste the frontiers of Poland with fire and sword. Boleslaus marched against him with a force greatly inferior; and, by mere dint of superior capacity, cooped up his adversary in a wood, where he reduced him to the greatest distress. In this extremity the duke sent proposals for accommodation; but they were rejected with disdain by Boleslaus; upon which the former, ordering fires to be kindled in his camp, as if he designed to continue there, removed with the utmost silence in the night-time; and marching through narrow defiles, was advanced several leagues before Boleslaus received advice of his retreat. The king pursued him, but in vain; for which reason he returned, after having ravaged the frontiers of Moravia. The next year he entered Bohemia with a numerous army; but the duke, being unwilling to encounter such a formidable adversary, submitted to such terms as Boleslaus thought proper to impose. In these the king of Poland stipulated for certain conditions in favour of Jacomir, which he took care to see punctually executed; after which he determined to march towards Hungary, to assist the fugitive prince Bela.

27 Entertains three unfortunate princes.

28 Affords effectual succour to Jacomir prince of Bohemia,

29 And to Bela prince of Hungary.

This prince had been for some time solicited by a party of disaffected nobility to return, as his brother, the reigning king, had alienated the hearts of his subjects by his tyrannical behaviour: as soon therefore as Boleslaus had finished the war in Bohemia, he was solicited by Bela to embrace so favourable an opportunity, and put him in possession of the kingdom of Hungary. This the king readily complied with, as being agreeable to his own inclinations; and both princes entered Hungary by different routes, each at the head of a numerous body. The king of that country, however, was not disconcerted by such a formidable invasion; and being largely assisted by the emperor, advanced against his antagonists with a vast army; among whom was a numerous body of Bohemians, who had come to his assistance, though in direct violation of the treaty subsisting between the duke and the king of Poland. At last a decisive battle was fought, in which the Germans behaved with the greatest valour, but were entirely defeated through the treachery of the Hungarians, who in the heat of the battle deserted and went over to Bela. Almost all the foreign auxiliaries were killed on the spot; the king himself was seized, and treated with such insolence by his perfidious subjects, that he died in a short time of a broken heart; so that Bela was placed on the throne without further opposition, except from a revolt of the peasants, which was soon quelled by the Polish army.

30 He projects the conquest of Russia.

Boleslaus, having succeeded so happily in these two enterprises, began to look upon himself as invincible; and, instead of designing only to assist Zaslaus, as he had first intended, now projected no less than the subjection of the whole country. He had indeed a claim to the sovereignty by virtue of his descent from Mary, queen of Poland, sister to Jarislaus; and this he endeavoured to strengthen by marrying a Russian princess himself. Having therefore assembled a very numerous and well-disciplined army, he entered the duchy of Kiovia, where he was opposed by Wisseslaus, who had usurped the sovereignty, with a vast multitude of forces. Boleslaus, however, continued to advance; and the Russian prince being intimidated by the number and good order of his enemies, deserted his own troops, and fled away privately with a slender retinue; upon which his force dispersed themselves for want of a leader. The inhabitants of the city of Kiovia now called to their assistance Suantoslaus and Wszevold two brothers of Wisseslaus; but these princes acting the part of mediators, procured pardon for the inhabitants from Zaslaus their natural sovereign. With the same facility the two princes recovered all the other dominions belonging to Zaslaus; only one city venturing to stand a siege, and that was soon reduced. But in the mean time the king

31 Meets with surprising success.

of Hungary dying, a revolt ensued, and the two sons of Bela were on the point of being deprived of their paternal dominions. This Boleslaus no sooner heard than he marched directly into Hungary; where by the bare terror of his name, he re-established tranquillity, and confirmed the princes in the enjoyment of their kingdom. In the time that this was doing, Zaslaus was again driven from his territories, all the conquests that had been formerly made were lost, and Suantoslaus and Wszevold more powerful than ever. The king's vigour, however, soon disconcerted all their measures. He ravaged all those territories which composed the palatinates of Lusac and Chelm, reduced the strong city of Wolyn, and transported the booty to Poland. The campaign was finished by a battle with Wszevold; which proved so bloody, that though Boleslaus was victorious, his army was weakened in such a manner that he could not pursue his conquests. In the winter he made numerous levies; and returning in the spring to Kiovia, reduced it, after several desperate attacks, by famine. On this occasion, instead of treating the inhabitants with cruelty, he commended their valour, and strictly prohibited his troops from pillaging or insulting them; distributing provisions among them with the utmost liberality.

32 Reduces Kiovia, but enervates himself there.

This clemency procured the highest honour to the king of Poland; but his stay here produced a most terrible disaster. Kiovia was the most dissolute, as well as the richest city, in the north; the king and all his soldiers gave themselves up to the pleasures of the place. Boleslaus himself affected all the imperious state of an eastern monarch, and contracted an inclination for the grossest debaucheries. The consequence had almost proved fatal to Poland. The Hungarian and Russian wars had continued for seven years, during all which time the king had never been at home excepting once for the short space of three months. In the mean time the Polish women, exasperated at hearing that their husbands had neglected them and connected themselves with the women of Kiovia, raised their slaves to the beds of their masters; and in short the whole sex conspired in one general scheme of prostitution, in order to be revenged of the infidelity of their husbands, excepting one single woman, namely, *Margaret*, the wife of Count Nicholas of Demboisin, who preserved her fidelity in spite of all solicitation. Advice of this strange revolution was soon received at Kiovia, where it excited terrible commotions. The soldiers blamed the king for their dishonour; forgetting how much they had to accuse their own conduct in giving their wives such extreme provocation. The effect of these discontents was a general desertion, and Boleslaus saw himself suddenly left almost alone in the heart of Russia; the soldiers having unanimously resolved to return home to take vengeance of their wives and their gallants.

33 Universal defection of the Polish women.

A dreadful kind of war now ensued. The women knew that they were to expect no mercy from their enraged husbands, and therefore persuaded their lovers to take arms in their defence. They themselves fought by the side of their gallants with the utmost fury, and sought out their husbands in the heat of battle, in order to secure themselves from all danger of punishment by their death. They were, however, on the point of being subdued, when Boleslaus arrived with the few remaining Poles, but assisted by a vast army of Russians, with whom he intended to take equal vengeance on the women, their gallants, and his own soldiers who had deserted him. This produced a carnage more dreadful than ever. The soldiers united with their former wives and their gallants against the common enemy, and fought against Boleslaus and his Russians with the fury of lions. At last, however, the fortune of the king prevailed; the rebels were totally subdued, and the few who escaped the sword were tortured to death, or died in prison.

34 A terrible civil war ensues.

To add to the calamities of this unhappy kingdom, the schisms which for some time had prevailed in the church of Rome found their way into Poland also; and the animosity of parties became aggravated in proportion to the frivolousness of their differences. By perverse accident the matter came at last to be a contention for wealth and power between the king and clergy. This soon gave occasion to bloodshed; and the bishop of Cracow was massacred in the cathedral while he was performing the duties of his office. This and some other enormous crimes in a short time brought on the most signal vengeance of the clergy. Gregory VII. the pope at that time, thundered out the most dreadful anathemas against the king, released his subjects from their allegiance, deprived him of the titles of sovereignty, and laid the kingdom under a general interdict, which the archbishop of Gnesna saw punctually enforced. To this terrible sentence Boleslaus in vain opposed his authority, and recalled the spirit which had formerly rendered him so formidable to the neighbouring states. The minds of the people were blinded by superstition, so that they deemed it a less heinous crime to rise in rebellion against their sovereign than to oppose the tyranny of the holy see. Conspiracies were daily formed against the person and government of Boleslaus. The whole kingdom became a scene of confusion, so that the king could no longer continue with safety in his own dominions. He fled therefore with his son Mieczslaus, and took refuge in Hungary; but here also the holy vengeance of the clergy pursued him, nor did they cease persecuting him till he was brought to a miserable end. Authors differ widely with respect to the manner of his death. Some say that he was murdered by the clergy as he was hunting; others, that he killed himself in a fit of despair; and one author tells us, that he wandered about in the woods of Hungary, lived like a savage upon wild beasts, and was at last killed and devoured by dogs. The greatest number, however, tell us, that being driven from place to place by the persecutions of the clergy, he was at last obliged to become a cook in a monastery at Carinthia, in which mean occupation he ended his days.

35 Religious contentions.

36 Boleslaus deposed by the pope, and the whole kingdom put under an interdict.

37 The king's extreme distress and death.

The destruction of Boleslaus was not sufficient to allay the papal resentment. It extended to the whole kingdom of Poland. Mieczslaus, the son of Boleslaus, was not suffered to ascend the throne; and the kingdom continued under the most severe interdict, which could be removed only by the force of gold, and the most abject concessions. Besides the tax called *Peter-pence*, new impositions were added of the most oppressive nature; till at length the pontiff, having satiated his avarice, and impoverished the country, consented that the brother of the deceased monarch should be raised to the sovereignty, but only with the title of duke. This prince, named *Uladislaus*, being of a meek disposition, with

38 The interdict removed at the expence of grievous impositions.

with little ambition, thought it his duty to acquiesce implicitly in the will of the pope; and therefore accepted the terms offered, sending at the same time an embassy to Rome, earnestly intreating the removal of the interdict. The request was granted; but all his endeavours to recover the regal dignity proved fruitless, the pope having, in conjunction with the emperor of Germany, conferred that honour on the duke of Bohemia. This was extremely mortifying to Uladislaus, but it was absorbed in considerations of the utmost consequence to himself and his dominions. Russia took the opportunity of the late civil disturbances to throw off the yoke; and this revolt drew after it the revolt of Prussia, Pomerania, and other provinces. The smaller provinces, however, were soon reduced; but the duke had no sooner returned to Poland, than they again rebelled, and hid their families in impenetrable forests. Uladislaus marched against them with a considerable army; but was entirely defeated, and obliged to return back with disgrace. Next year, however, he had better fortune; and, having led against them a more numerous army than before, they were content to submit and deliver up the ringleaders of the revolt to be punished as the duke thought proper.

39 Uladislaus becomes sovereign, but is allowed only the title of duke.

No sooner were the Pomeranians reduced, than civil dissensions took place. Sbigneus, the son of Uladislaus by a concubine, was placed at the head of an army by the discontented nobility, in order to subvert his father's government, and dispute the title of Boleslaus, the legitimate son of Uladislaus, to the succession. The war was terminated by the defeat and captivity of Sbigneus; who was at first confined, but afterwards released on condition that he should join his father in punishing the palatine of Cracow. But before this could be done, the palatine found means to effect a reconciliation with the duke; with which the young princes being displeased, a war took place between them and their father. The end of all was, that the palatine of Cracow was banished, and the princes submitted; after which, Uladislaus, having chastised the Prussians and Pomeranians who had again revolted, died in the year 1103, the 59th of his age.

40 Boleslaus III. divided his dominions betwixt Sbigneus his illegitimate brother and himself.

Uladislaus was succeeded by his son Boleslaus III. who divided the dominions equally betwixt his brother Sbigneus and himself. The former being dissatisfied with his share, raised cabals against his brother. A civil war was for some time prevented by the good offices of the primate: but at last Sbigneus, having privately stirred up the Bohemians, Saxons, and Moravians, against his brother, made such formidable preparations as threatened the conquest of all Poland. Boleslaus, being unprovided with forces to oppose such a formidable power, had recourse to the Russians and Hungarians; who readily embraced his cause, in expectation of turning it to their own advantage. The event was, that Sbigneus was entirely defeated; and might easily have been obliged to surrender himself at discretion, had not Boleslaus generously left him in quiet possession of the duchy of Mazovia, in order to maintain himself suitably to the dignity of his birth. This kindness the ungrateful Sbigneus repaid by entering into another conspiracy; but the plot being discovered, he was seized, banished, and declared a traitor if ever he set foot again in Poland. Even this severity did not produce the desired effect: Sbigneus persuaded the Pomeranians to arm in his behalf; but he was defeated, taken prisoner, and again banished. Almost all the nobility solicited the king to put such an ungrateful traitor to death; however, that generous prince could not think of polluting his hands with the death of his brother, notwithstanding all he had yet done. Nay, he even took him back to Poland, and appointed him a maintenance suitable to his rank: but he soon had reason to repent his kindness; for his unnatural brother in a short time began to raise fresh disturbances, in consequence of which he soon met with the death which he deserved.

41 A civil war.

42 Generosity of Boleslaus, and ingratitude of Sbigneus,

43 Who is at last put to death.

Boleslaus was scarce freed from the intrigues of his brother, when he found himself in greater danger than ever from the ambition of the emperor Henry IV. The emperor had attacked the king of Hungary, with whom Boleslaus was in close alliance, and from whom he had received assistance when in great distress himself. The king of Poland determined to assist his friend; and therefore made a powerful diversion in Bohemia, where he repeatedly defeated the Imperialists: upon which, the emperor collecting all his forces, ravaged Silesia, and even entered Poland, where he laid siege to the strong town of Lubusz; but was at last obliged to abandon the enterprise, after having sustained much loss. However, Henry was not discouraged, but penetrated still farther into Poland, and was laying waste all before him, when the superior skill of Boleslaus compelled him to retire, after having almost destroyed his army with fatigue and famine, without once coming to action. Enraged at this disappointment, Henry laid siege to Glogaw, in hopes of drawing the Poles to an engagement before he should be obliged to evacuate the country. The fortifications of the place were weak; but the spirit of the inhabitants supplied their deficiencies, and they gave the Imperialists a most unexpected and vigorous reception. At last, however, they were on the point of surrendering to superior force; and actually agreed to give up the place, provided they did not receive any succours during that time. Boleslaus determined, however, not to let such a brave garrison fall a sacrifice to their loyalty; and therefore prevailed on the besieged to break the capitulation rather than surrender when they were on the point of being delivered. All this was transacted with the utmost secrecy; so that the emperor advanced, without thoughts of meeting with any resistance, to take possession of the city; but, being received by a furious discharge of arrows and javelins, he was so incensed, that he resolved to storm the place, and give no quarter. On the approach of the army, the Imperialists were astonished to see not only the breaches filled up, but new walls, secured by a wet ditch, reared behind the old, and erected during the suspension of hostilities by the industry of the besieged. The attack, however, went on; but the inhabitants, animated by despair, defended themselves with incredible valour, and at last obliged the Imperialists to break up the siege with precipitation. Next day Boleslaus arrived, and pursued the emperor with such vigour, that he obliged him to fly with disgrace into his own country. This soon brought on a peace, which was confirmed by a marriage between Boleslaus and the emperor's sister.

44 War with the emperor Henry IV.

45 Who is worsted.

Hitherto the glory of Boleslaus had equalled, or even eclipsed, that of his namesake and predecessor Boleslaus the Great; but about the year 1135 he was brought

46 Boleslaus brought into difficulties by his own credulity and generosity.

Poland.

brought into difficulties and disgrace by his own credulity. He was imposed upon by an artful story patched up by a certain Hungarian; who insinuated himself so far into his affections, that he gave him the government of Wislica, a strong town on the river Nida. But the traitor gave up the place to the Russians, who pillaged and burnt it; carrying the inhabitants at the same time into slavery. Boleslaus was incensed, and entered immediately upon a war with Russia, by which means he only heaped one calamity upon another. He received a deputation from the inhabitants of Halitz, to implore his assistance in favour of a young prince, who had been banished into Poland. Boleslaus marched to their relief with a choice body of troops; but as he was preparing to enter the town, he was attacked by the whole Russian army, and, after a most violent conflict, entirely defeated. By this disgrace the duke was so much afflicted, that he died in a short time, after having reigned 36 years.

47 Poland divided among the children of Boleslaus.

Boleslaus, by his will, left his dominions equally divided among his four sons. Uladislaus, the eldest, had the provinces of Cracow, Sirad, Lencici, Silesia, and Pomerania. Boleslaus, the second son, had for his share the palatinates of Culm and Cujava, with the duchy of Mazovia. The palatinates of Kaleszh and Posnania fell to Mieczslaus the third son; and to Henry, the fourth son, were assigned those of Lublin and Sandomir. Casimir the youngest child, then an infant in the cradle, was entirely forgot, and no provision made for him. There have been but very few instances where dominions were thus divided, that the princes remained satisfied with their respective shares; neither did the sons of Boleslaus long continue at peace with one another. By the will of the late duke, all the brothers were obliged to own the supremacy of Uladislaus, who was declared duke of all Poland: they were restrained from forming alliances, declaring war, or concluding peace, without his approbation: they were obliged to take the field with a certain number of troops, whenever the duke required it; and they were forbid to meddle with the guardianship of the infant prince Casimir, his education being left entirely to the sovereign. The harmony of the princes was first disturbed by the ambition of Christina, the wife of Uladislaus, who formed a scheme to get possession of all Poland, and deprive the younger children of the benefit of their father's will. Having obtained her husband's concurrence, she assembled the states of Poland, and made a long speech, showing the dangers which might arise from a partition of the ducal dominions among so many; and concluded with attempting to show the necessity of revoking the ratification of the late duke's will, in order to ensure the obedience of the princes and the tranquillity of the republic. Many of the nobility expressed their resentment against this speech, and fully refuted every article in it; but they were all afterwards gained over, or intimidated by Uladislaus; so that none appeared to take the part of the young princes except a noble Dane, who lost his life for so doing.

48 A civil war.

49 Uladislaus drives out all the rest,

Uladislaus now having got the nobility on his side, first drove Boleslaus out of his territories; next, he marched against Henry, and dispossessed him also, forcing both to take refuge with Mieczslaus in Posnania, where all the three brothers were besieged. Several of the nobility interposed, and used all their influence to effect a reconciliation, but in vain; for Uladislaus was as inexorable as if he had received an injury, and therefore insisted that the besieged princes should surrender at discretion, and submit to the will of the conqueror. Thus driven to despair, the brothers sallied out, and attacked the duke's army with such impetuosity, that they obtained a complete victory, and took all his baggage and valuable effects. The brothers improved their victory, and laid siege to Cracow. The Russians, who had assisted Uladislaus at first, now entirely abandoned him, and evacuated Poland, which obliged him to shut himself up in Cracow; but, finding the inhabitants little disposed to stand a siege, he retired into Germany in order to solicit assistance from his wife's friends. But here he found himself mistaken, and that these friends were attached to him only in his prosperity; while in the mean time the city of Cracow surrendered, the unfortunate Uladislaus was formally deposed, and his brother Boleslaus raised to the supreme authority.

50 And is deposed.

The new duke began his administration with an act of generosity to his brother Uladislaus, to whom he gave the duchy of Silesia, which thus was separated from Poland, and has never since been re-annexed to it. This had no other effect upon Uladislaus than the putting him in a condition to raise fresh disturbances; for he now found means to persuade the emperor Conrade to invade Poland: but Boleslaus so harassed and fatigued his army by perpetual marches, ambuscades, and skirmishes, that he was obliged in a short time to return to his own country; and for some years Poland enjoyed a profound tranquillity.

During this interval Henry entered on a crusade; and, though he lost almost all his army in that enthusiastic undertaking, he is celebrated by the superstitious writers of that age, as the bulwark of the church, and one of the greatest Christian heroes: however, in all probability, the reason of this extraordinary fame is, that he made large donations to the knights of St John of Jerusalem. Soon after the return of Henry, Poland was invaded by the emperor Frederic Barbarossa, who was persuaded to this by the solicitations of Uladislaus and his wife Christina. The number of the Imperialists was so great, that Boleslaus and his brothers did not think proper to oppose them in the field; they contented themselves with cutting off the convoys, placing ambuscades, harassing them on their march, and keeping them in perpetual alarms by false attacks and skirmishes. With this view the three brothers divided their forces, desolated the country before the enemy, and burnt all the towns and cities which were in no condition to stand a siege. Thus the emperor, advancing into the heart of a desolated country where he could not subsist, was at last reduced to such a situation, that he could neither go forward nor retreat, and was obliged to solicit a conference with Boleslaus. The latter was too prudent to irritate him by an unseasonable haughtiness, and therefore went to the German camp attended only by his brothers and a slight guard. This instance of confidence was so agreeable to the emperor, that a treaty was soon agreed upon, which was confirmed by a marriage between Adelaide, niece to the emperor, and Mieczslaus duke of Posnania.

51 Poland invaded by the emperor Barbarossa,

52 Who is obliged to sue for peace.

Boleslaus having thus happily escaped from so great a danger, took it into his head to attempt the conquest of Prussia, for no other reason but because the inhabitants

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tants were heathens. Having unexpectedly invaded the country with a very numerous army, he succeeded in his enterprise; great numbers of infidels were converted, and many churches set up: but no sooner was Boleslaus gone, than the inhabitants returned to their old religion. Upon this Boleslaus again came against them with a formidable power; but, being betrayed by some Prussians whom he had taken into his service and raised to posts of honour, his army was led into defiles and almost entirely cut off, duke Henry was killed, and Boleslaus and Mieczslaus escaped with great difficulty.

This misfortune was quickly followed by another; for now the children of Uladislaus laid claim to all the Polish dominions which had been possessed by their father, most of which had been bestowed upon young Casimir. They were supported in their pretensions by a great number of discontented Poles, and a considerable body of German auxiliaries. Boleslaus, finding himself unable to withstand his enemies by force, had recourse to negociation, by which means he gained time to recruit his army and repair his losses. An assembly of the states was held, before which the duke so fully refuted the claims of the children of Uladislaus, that it was almost unanimously voted that they had kindled an unjust war; and to take away every pretence for renewing the civil discords of Poland, they were a second time invested with the duchy of Silesia, which for the present put an end to all disputes. After this, Boleslaus applied himself to promote, by all means, the happiness of his subjects, till his death, which happened in the year 1174.

53 A civil war.

On the death of Boleslaus, the states raised his brother Mieczslaus to the ducal throne, on account of the great opinion they had of him. But the moment that Mieczslaus ceased to be a subject, he became a tyrant, and a slave to almost every kind of vice; the consequence of which was, that in a very short time he was deposed, and his brother Casimir elected in his stead.

54 Casimir, an excellent prince,

Casimir was a prince of the greatest justice and benevolence, insomuch that he scrupled to accept of the honour which the states had conferred upon him, lest it should be a trespass against the laws of equity. However, this scruple being soon got over, he set himself about the securing peace and tranquillity in all parts of his dominions. He redressed all grievances, suppressed exorbitant imposts, and assembled a general diet, in which it was proposed to rescue the peasants from the tyranny of the nobility; an affair of such consequence, that the duke could not enter upon it by his own authority, even though supported by the clergy. Yet it proved less difficult than had been imagined, to persuade the nobility to relinquish certain privileges extremely detrimental to natural right. They were influenced by the example of their virtuous sovereign, and immediately granted all that he required; and, to secure this declaration in favour of the peasants, the archbishop of Gnesna thundered out anathemas against those who should endeavour to regain the unjust privileges which they had now renounced; and to give a still greater weight to this decision, the acts of the diet were transmitted to Rome, where they were confirmed by the pope.

But though the nobility in general consented to have their power somewhat retrenched, it proved matter of discontent to some, who for this reason immediately became the partisans of the deposed Mieczslaus. This unfortunate prince was now reduced to such indigence, that he wrote an account of his situation to his brother Casimir; which so much affected him, that in an assembly of the diet he proposed to resign the sovereignty in favour of his brother. To this the states replied in the most peremptory manner: they desired him never more to mention the subject to them, lest they should be under the necessity of deposing him and excluding his brother, who, they were determined, should never more have the dominion of Poland. Casimir, however, was so much concerned at the account of his brother's misfortunes, that he tried every method to relieve him, and even connived at the arts practised by some discontented noblemen to restore him. By a very singular generosity, he facilitated the reduction of Gnesna and Lower Poland, where Mieczslaus might have lived in peace and splendor, had not his heart been so corrupted that it could not be subdued by kindness. The consequence was, that he used all his art to wrest from his brother the whole of his dominions, and actually conquered the provinces of Mazovia and Cujava; but of these he was soon dispossessed, and only some places in Lower Poland were left him. After this he made another attempt, on occasion of a report that Casimir had been poisoned in an expedition into Russia. He surprised the city of Cracow: but the citadel refused to surrender, and his hopes were entirely blasted by the return of Casimir himself; who, with an unparalleled generosity and magnanimity, asked peace of his brother whom he had vanquished and had in a manner at his mercy.—The last action of this amiable prince was the conquest of Russia, which he effected rather by the reputation of his wisdom and generosity than by the force of his arms. Those barbarians voluntarily submitted to a prince so famed for his benevolence, justice, and humanity. Soon after his return, he died at Cracow, lamented as the best prince in every respect who had ever filled the throne of Poland.

55 Conquers Russia.

Casimir left one son, named *Lechus*, an infant; and the states, dreading the consequences of a long minority, hesitated at appointing him sovereign, considering how many competitors he must necessarily have, and how dubious it must be whether he might be fit for the sovereignty after he had obtained it. At last, however, Lechus was nominated, chiefly through the interest he had obtained on account of the reputation of his father's virtues. The consequence of his nomination was precisely what might have been expected. Mieczslaus formed an alliance against him with the dukes of Oppelen, Pomerania, and Breslau; and having raised all the men in Lower Poland fit to bear arms, took the road to Cracow with a very numerous army. A bloody battle was fought on the banks of the river Mozgarva; in which both sides were so much weakened, that they were unable to keep the field, and consequently were forced to retire for some time in order to repair their forces. Mieczslaus was first ready for action, and therefore had the advantage: however, he thought proper to employ artifice rather than open force; and therefore having attempted in vain to corrupt the guardians of Lechus, he entered into a treaty with the duchess-dowager his mother. To her he represented in the strongest manner the miseries which would ensue from her refusal of the conditions he proposed. He stipulated to adopt Lechus and Conrade, her sons, for his own; to

56 Civil war between Lechus and the deposed Mieczslaus.

surrender the province of Cujavia for their present support; and to declare them heirs to all his dominions.

57 Mieczslaus restored.

The principal nobility opposed this accommodation, but it was accepted by the duchess in spite of all their remonstrances; and Mieczslaus was once more put in possession of the capital, after having taken a solemn oath to execute punctually every article of the treaty.

It is not to be supposed that a prince of such a perfidious disposition as Mieczslaus would pay much regard to the obligations of a simple contract. It was a maxim with him, that a sovereign is no longer obliged to keep his oath than while it is neither safe nor beneficial to break it. Having therefore got all the power into his hands, he behaved in the very same manner as if no treaty with the duchess had subsisted. The duchess, perceiving herself duped, formed a strong party, and excited a general insurrection. The rebellion could not be withstood: Mieczslaus was driven out of Cracow, and on the point of being reduced to his former circumstances, when he found means to produce a variance between the duchess and palatine of Cracow; and thus once more turned the scale in his favour. The forces of Mieczslaus now became superior, and he, in consequence, regained possession of Cracow, but did not long enjoy his prosperity, falling a victim to his intemperance; so that Lechus was restored to the sovereignty in the year 1206.

58 Poland ravaged by the Tartars.

The government of Lechus was the most unfortunate of any of the sovereigns of Poland. In his time the Tartars made an irruption, and committed everywhere the most cruel ravages. At last they came to an engagement with the Poles, assisted by the Russians; and after an obstinate and dreadful conflict, obtained a complete victory. This incursion, however, terminated as precipitately as it commenced; for without any apparent reason they retired, just as the whole kingdom was ready to submit; but the devastations they had committed produced a famine, which was soon followed by a plague that depopulated one of the most populous countries of the north. In this unhappy situation of affairs, death ended the misfortunes of Lechus, who was murdered by his own subjects as he was bathing. A civil war took place after his death; and the history for some time is so confused, that it is difficult to say with certainty who was his successor. During this unfortunate state of the country, the Tartars made a second irruption, laid all desolate before them, and were advancing to the capital, when they were attacked and defeated with great slaughter by the palatine of Cracow with only a handful of men. The power of the enemy, however, was not broken by this victory; for, next year, the Tartars returned, and committed such barbarities as can scarce be imagined. Whole provinces were defeated, and every one of the inhabitants massacred. They were returning, laden with spoil, when the palatine fell upon them a second time, but not with the same success as before: for, after an obstinate engagement, he was defeated, and thus all Poland was laid open to the ravages of the barbarians; the nobility fled into Hungary, and the peasants sought an asylum among rocks and impenetrable forests. Cracow, being left entirely defenceless, was soon taken, pillaged, and burnt; after which the barbarians, penetrating into Silesia and Moravia, desolated these countries, destroying Breslau and other cities. Nor did Hungary escape the fury of their barbarity: the king gave battle to the Tartars, but was defeated with vast slaughter, and had the mortification to see his capital laid in ashes, and above 100,000 of his subjects perish by fire and sword. The arms of the Tartars were invincible; nothing could withstand the prodigious number of forces which they brought into the field, and the fury with which they fought. They fixed their head-quarters on the frontiers of Hungary; and spread their devastations on every side with a celerity and success that threatened the destruction of the whole empire, as well as of the neighbouring kingdoms.

In this dreadful situation was Poland when Boleslaus, surnamed the *Chaste*, was raised to the sovereignty; but this, so far from putting an end to the troubles, only superadded a civil war to the rest of the calamities. Boleslaus was opposed by his uncle Conrade the brother of Lechus, who was provoked at becoming the subject of his own nephew. Having assembled a powerful army, he gained possession of Cracow; assumed the title of *Duke of Poland;* and might possibly have kept possession of the sovereignty, had not his avarice and pride equally offended the nobility and peasants. In consequence of their discontents, they unanimously invited Boleslaus, who had fled into Hungary, to come and head the insurrection which now took place in every quarter. On his arrival, he was joyfully received into the capital: but Conrade still headed a powerful party; and it is reported that on this occasion the knights of the Teutonic order were first called into Poland, to dispute the pretensions of Boleslaus. All the endeavours of Conrade, however, proved unsuccessful: he was defeated in two pitched battles, and forced to live in a private situation; though he never ceased to harass his nephew, and make fresh attempts to recover the crown. However, of the reign of Boleslaus we have little account, except that he made a vow of perpetual continency, and imposed the same on his wife; that he founded near 40 monasteries; and that he died after a long reign in 1279, after having adopted Lechus duke of Cujavia, and procured a confirmation of his choice by the free election of the people.

59 Knights of the Teutonic order first called into Poland.

60 Poland over-run by the Russians, Tartars, and Lithuanians.

The reign of this last prince was one continued scene of foreign and domestic trouble. On his first accession he was attacked by the united forces of Russia and Lithuania assisted by the Tartars; whom, however, he had the good fortune to defeat in a pitched battle. By this victory the enemy were obliged to quit the kingdom; but Lechus was so much weakened, that civil dissensions took place immediately after. These increased to such a degree, that Lechus was obliged to fly to Hungary, the common resource of distressed Polish princes. The inhabitants of Cracow alone remained firm in their duty; and these brave citizens stood all the fatigue and danger of a tedious siege, till they were at last relieved by Lechus at the head of an Hungarian army, who defeated the rebels, and restored to his kingdom a legitimate government. He had scarce reascended the throne when the united forces of the Russians, Tartars, and Lithuanians, made a second irruption into Poland, and desolated the country with the most savage barbarity. Their forces were now rendered more terrible than ever by their having along with them a vast number of large dogs trained to the art of war. Lechus, however, with an army much inferior, obtained a complete victory;

victory; the Poles being animated by despair, as perceiving, that, if they were conquered, they must also be devoured. Soon after this, Lechus died with the reputation of a warlike, wise, but unfortunate prince. As he died without issue, his crown was contested, a civil war again ensued; and the affairs of the state continued in a very declining way till the year 1296, when Premislaus, the duke at that time, resumed the title of *king*. However, they did not revive in any considerable degree till the year 1305, when Uladislaus Locticus, who had seized the throne in 1300, and afterwards been driven out, was again restored to it. The first transaction of his reign was a war with the Teutonic knights, who had usurped the greater part of Pomerania during the late disturbances. They had been settled in the territory of Culm by Conrade duke of Mazovia; but soon extended their dominion over the neighbouring provinces, and had even got possession of the city of Dantzic, where they massacred a number of Pomeranian gentlemen in cold blood; which so much terrified the neighbouring towns, that they submitted without a stroke. The knights were commanded by the Pope himself to renounce their conquests; but they set at nought all his thunders, and even suffered themselves to be excommunicated rather than part with them. As soon as this happened, the king marched into the territories of the marquis of Brandenburg, because he had pretended to sell a right to the Teutonic knights to those countries, when he had none to them himself. Uladislaus next entered the territory of Culm, where he laid every thing waste with fire and sword; and, being opposed by the joint forces of the marquis, the knights, and the duke of Mazovia, he obtained a complete victory after a desperate and bloody engagement. Without pursuing the blow, he returned to Poland, recruited his army, and being reinforced by a body of auxiliaries from Hungary and Lithuania, he dispersed the enemy's forces, and ravaged a second time all the dominions of the Teutonic order. Had he improved this advantage, he might easily have exterminated the whole order, or at least reduced them so low, that they could never have occasioned any more disturbances in the state; but he suffered himself to be soothed and cajoled by the promises which they made without any design of keeping them, and concluded a treaty under the mediation of the kings of Hungary and Bohemia. In a few months he was convinced of the perfidy of the knights; for they not only refused to evacuate Pomerania as had been stipulated in the treaty, but endeavoured to extend their usurpations, for which purpose they had assembled a very considerable army. Uladislaus, enraged at their treachery, took the field a third time, and gave them battle with such success, that 4000 knights were left dead on the spot, and 30,000 auxiliaries killed or taken prisoners. Yet, though the king had it once more in his power to destroy the whole Teutonic order, he satisfied himself with obtaining the territories which had occasioned the war; after which he spent the remainder of his life in peace and tranquillity.

61 War with the Teutonic knights.

62 Russia Nigra conquered by Casimir the Great.

Uladislaus was succeeded by his son Casimir III. surnamed the *Great*. He subdued the province called *Russia Nigra* in a single campaign. Next he turned his arms against Mazovia; and with the utmost rapidity over-ran the duchy, and annexed it as a province to the crown: after which he applied himself to domestic affairs, and was the first who introduced a written code of laws into Poland. He was the most impartial judge, the most rigid observer of justice, and the most submissive to the laws, of any potentate mentioned in the history of Europe. The only vice with which he is charged is that of incontinency; but even this the clergy declared to be a venial sin, and amply compensated by his other virtues, particularly the great liberality which he showed to the clerical order.

63 Unhappy reign of Louis.

Casimir was succeeded in 1370 by his nephew Louis king of Hungary; but, as the Poles looked upon him to be a foreign prince, they were not happy under his administration. Indeed a coldness between this monarch and his people took place even before he ascended the throne; for in the *pacta conventa*, to which the Polish monarchs were obliged to swear, a great number of unusual articles were inserted. This probably was the reason why he left Poland almost as soon as his coronation was over, carrying with him the crown, sceptre, globe, and sword of state, to prevent the Poles from electing another prince during his absence. He left the government in the hands of his mother Elizabeth; and she would have been agreeable to the people, had her capacity for government been equal to the task. At that time, however, the state of Poland was too much distracted to be governed by a woman. The country was over-run with bold robbers and gangs of villains, who committed the most horrid disorders; the kingdom was likewise invaded by the Lithuanians; the whole province of Russia Nigra revolted; and the kingdom was universally filled with dissension. The Poles could not bear to see their towns filled with Hungarian garrisons; and therefore sent a message to the king, telling him that they thought he had been sufficiently honoured in being elected king of Poland himself, without suffering the kingdom to be governed by a woman and his Hungarian subjects. On this Louis immediately raised a numerous army, with a design fully to conquer the spirit of his subjects. His first operations were directed against the Russians; whom he defeated, and again reduced to subjection. Then he turned his arms against the Lithuanians, drove them out of the kingdom, and re-established public tranquillity. However, instead of being satisfied with this, and removing the Hungarian garrisons, he introduced many more, and raised Hungarians to all the chief posts of government. His credit and authority even went so far as to get a successor nominated who was disagreeable to the whole nation, namely *Sigismund* marquis of Brandenburg. After the death of Louis, however, this election was set aside; and Hedwiga, daughter of Casimir the Great, was proclaimed queen.

64 Hedwiga marries the duke of Lithuania, thereby uniting that duchy, together with Samogitia and Russia Nigra, to Poland.

This princess married Jagello duke of Lithuania, who was now converted to Christianity, and baptized by the name of *Uladislaus*. In consequence of this marriage, the duchy of Lithuania, as well as the vast provinces of Samogitia and Russia Nigra, became annexed to the crown of Poland. Such a formidable accession of power excited the jealousy of the Teutonic knights, who were sensible that Uladislaus was now bound to undertake the reduction of Pomerania, and revenge all the injuries which Poland had sustained from them for a great number of years. From his first accession therefore they considered this monarch as their greatest enemy, and endeavoured to prevent his designs against them by effect-

Poland. ing a revolution in Lithuania in favour of his brother Andrew. The prospect of success was the greater here, as most of the nobility were discontented with the late alliance, and Uladislaus had proposed to effect a revolution in religion, which was highly disagreeable. On a sudden, therefore, two armies marched towards the frontiers of the duchy, which they as suddenly penetrated, laying waste the whole country, and seizing upon some important fortresses before the king of Poland had any notice of the matter. As soon as he received advice of these ravages, Uladislaus raised some forces with the utmost celerity, which he committed to the care of his brother Skirgello, who defeated the Teutonic knights, and soon obliged them to abandon all their conquests. In the mean time Uladislaus marched in person into the Higher Poland, which was subjected to a variety of petty tyrants, who oppressed the people, and governed with intolerable despotism. The palatine of Posnia in particular had distinguished himself by his rebellious practices; but he was completely defeated by Uladislaus, and the whole country reduced to obedience.

65 Troubles in Lithuania.

Having secured the tranquillity of Poland, Uladislaus visited Lithuania, attended by a great number of the clergy, in order to convert his subjects. This he effected without great difficulty; but left the care of the duchy to his brother Skirgello, a man of a cruel, haughty, and debauched turn, and who immediately began to abuse his power. With him the king sent his cousin Vitowda, a prince of a generous, brave, and amiable disposition, to be a check upon his conduct; but the barbarity of Skirgello soon obliged this prince to take refuge among the Teutonic knights, who were now become the asylum of the oppressed and discontented. For some time, however, he did not assist the knights in their designs against his country; but having applied for protection to the king, and finding him remiss in affording the necessary assistance, he at last joined in the schemes formed by the knights for the destruction of Poland. Entering Lithuania at the head of a numerous army, he took the capital, burnt part of it, and destroyed 14,000 persons in the flames, besides a great number who were massacred in attempting to make their escape. The upper part of the city, however, was vigorously defended, so that the besiegers were at last obliged to abandon all thoughts of making themselves masters of it, and to content themselves with desolating the adjacent country. The next year Vitowda renewed his attempts upon this city, but with the same ill success; though he got possession of some places of less note. As soon, however, as an opportunity offered, he came to an accommodation with the king, who bestowed on him the government of Lithuania. During the first years of his government, he bestowed the most diligent attention upon domestic affairs, endeavouring to repair the calamities which the late wars had occasioned; but his impetuous valour prompted him at last to engage in a war with Tamerlane the Great, after his victory over Bajazet the Turkish emperor. For some time before, Vitowda had been at war with the neighbouring Tartars, and had been constantly victorious, transporting whole hordes of that barbarous people into Poland and Lithuania, where to this day they form a colony distinct in manners and dress from the other inhabitants. Uladislaus, however, dissuaded him from attacking the whole strength of the nation under such a celebrated commander as Tamerlane: but Vitowda was obstinate; he encountered an army of 400,000 Tartars under Ediga, Tamerlane's lieutenant, with only a tenth part of their number. The battle continued for a whole day; but at last Vitowda was surrounded by the numbers of his enemy, and in the utmost danger of being cut in pieces. However, he broke his way through with prodigious slaughter on both sides; and came off at last without a total defeat, having killed a number of the enemy equal to the whole of his own army.

66 Terrible battle with the Tartars.

67 Wars with the Teutonic knights.

During the absence of Vitowda, the Teutonic knights had penetrated into Lithuania, committing everywhere the most dreadful ravages. On his return he attacked and defeated them, making an irruption into Livonia, to punish the inhabitants of that country for the assistance they had given to the Teutonic order. This was succeeded by a long series of wars between Poland and Prussia, in which it became necessary for Uladislaus himself to take the field. The knights had now one way or other got possession of Samogitia, Mazovia, Culm, Silesia, and Pomerania; so that Uladislaus resolved to punish them before they became too powerful. With this view he assembled an army composed of several different nations, with which he penetrated into Prussia, took several towns, and was advancing to Marienburg the capital of Pomerania, when he was met by the army of the Prussian knights, who determined to hazard a battle. When the engagement began, the Poles were deserted by all their auxiliaries, and obliged to stand the brunt of the battle by themselves. But the courage and conduct of their king so animated them, that after a most desperate battle they obtained a complete victory; near 40,000 of the enemy being killed in the field, and 30,000 taken prisoners. This terrible overthrow, however, was less fatal to the affairs of the Prussian knights than might have been expected; as Uladislaus did not improve his victory, and a peace was concluded upon easier terms than his adversaries had any reason to expect.—Some infraction of the treaty occasioned a renewal of hostilities; and Uladislaus was so much elated with victory that he would hearken to no terms, by which means the enemy were driven to the desperate resolution of burying themselves in the ruins of their capital. The siege was accordingly commenced, and both sides behaved with the greatest vigour; but at last, through the good conduct and valour of the grand master of the knights named *Plawen*, the Polish monarch found himself obliged to grant them an advantageous peace, at a time when it was universally expected that the whole order would have been exterminated.

Uladislaus V. died in 1435, and was succeeded by his son Uladislaus VI. at that time only nine years of age. He had scarce ascended the throne, when the kingdom was invaded by the Tartars, who defeated Buccarius the general of the Polish forces; and committing everywhere dreadful ravages, returned to their own country loaded with booty. A few years after, the nation was involved in a war with Amurath the emperor of the Turks, who threatened to break into Hungary; and it was thought by the diet to be good policy to assist the Hungarians at this juncture, because it was impossible to know where the storm might fall after Hungary was conquered. But before all things were prepared for the young king to take the field, a strong body of auxiliaries were dispatched under the celebrated John Hunniades vaivode of Transylvania, to oppose the Turks, and likewise to support the election of Uladislaus to the crown of Hungary. This detachment surprised the Turkish army near the river Morava, and defeated Amurath with the loss of 30,000 men; after which Hunniades retook all the places which had been conquered by Amurath, the proud sultan was forced to sue for peace, and Uladislaus was raised without opposition to the crown of Hungary. A treaty was concluded, by which the Turks promised to relinquish their designs upon Hungary, to acknowledge the king's right to that crown, and to give up all their conquests in Rascia and Servia. This treaty was sealed by mutual oaths: but Uladislaus broke it at the persuasion of the pope's legate; who insisted, that now was the time for humbling the power of the infidels; and produced a special commission from the pope, absolving him from the oath he had taken at the late treaty. The consequence of this perfidy was, that Uladislaus was entirely defeated and killed at Varna, and the greatest part of his army cut in pieces.

68 Uladislaus defeated and killed by the Turks.

Uladislaus VI. was succeeded by Casimir IV. in whose reign the Teutonic knights were subdued, and obliged to yield up the territories of Culm, Michlow, and the whole duchy of Pomerania, together with the towns of Elbing, Marienburg, Talkmith, Schut, and Christburgh, to the crown of Poland. On the other hand, the king restored to them all the other conquests he had made in Prussia, granted a seat in the Polish senate to the grand-master, and endowed him with other privileges, on condition that, six months after his accession, he should do homage for Prussia, and take an oath of fidelity to the king and republic.

69 Teutonic knights subdued.

This success raised the spirits of the Polish nation, which had drooped ever since the battle of Varna. The diet did not, however, think proper to renew the war against the Turks, but took under their protection the hospodar of Moldavia; as thinking that this province would make a convenient barrier to the Polish dominions on one side. The request of the prince who asked this protection was therefore readily granted, an oath of fidelity exacted from him and the inhabitants, and a tribute required; regular payment of which was made for a great number of years afterwards.

70 Crowns of Bohemia and Hungary united to Poland.

About this time also the crown of Bohemia becoming vacant, the people were extremely desirous of being governed by one of the princes of Poland; upon which the barons were induced to bestow the crown upon Uladislaus, eldest son of Casimir, in opposition to the intrigues of the king of Hungary. Not satisfied with this acquisition, Uladislaus took advantage of the dissensions in Hungary, in order to unite that crown to his own: and this he also effected; by which means his power was greatly augmented, though not the felicity of his people. So many foreign expeditions had exhausted the treasury, and oppressed the peasants with taxes; the gentry were greatly diminished by a number of bloody engagements; agriculture was neglected, and the country almost depopulated. Before a proper remedy could be applied for these evils, Casimir died in 1492; much more admired, than beloved or regretted, by his subjects. It is related by the historians of this period, that in the reign of Casimir IV. the deputies of the provinces first appeared at the diet, and assumed to themselves the legislative power; all laws before this time having been framed by the king in conjunction with the senate. It is observed also, that before Casimir's time, the Latin language was understood only by the clergy of Poland; in proof of which, it is alleged, that at an interview between this prince and the king of Sweden at Dantzick, his Polish majesty was forced to make use of the assistance of a monk to interpret between him and the Swedish monarch. Casimir, ashamed of the ignorance shown by himself and court, published an edict, enjoining the diligent study of the Latin, which in our days is spoken as vernacular by every Polish gentleman, though very unclassically.

During the succeeding reigns of John, Albert, and Alexander, the Polish affairs fell into decline; the kingdom being harassed by continual wars with the Turks and Tartars. However, they were retrieved by Sigismund I. who ascended the throne in 1507. This monarch, having reformed some internal abuses, next set about rendering the kingdom as formidable as it had formerly been. He first quelled a rebellion which broke out in Lithuania; after which, he drove the Walachians and Moldavians out of Russia Nigra, and defeated the Russians in a pitched battle, with the loss of 30,000 men. In this engagement he was obliged to cause his cavalry to swim across the Boristhenes in order to begin the attack, while a bridge was preparing for the infantry. These orders were executed with astonishing celerity, notwithstanding the rapidity of the stream, the steepness of the banks, and the enemy's opposition. The onset was led by the Lithuanians, who were directed to retreat gradually, with a view of drawing the enemy within reach of the cannon. This the Russians mistook for a real flight; and as they were pursuing with eagerness, Sigismund opened his line to the right and left, pouring in grape-shot from the artillery with dreadful success. The Russian general, and several noblemen of the first distinction, were taken prisoners, while the whole loss of the royal army did not amount to 300 men.

71 Exploits of Sigismund I.

After this complete victory, the king turned his arms against the Teutonic knights, who had elected the marquis of Brandenburgh their grand-master; and this prince not only refused to acknowledge the sovereignty of the crown of Poland, but even invaded the Polish territories. Sigismund marched against him, and gained possession of several important places in Brandenburgh; but as he was pursuing his conquests, the marquis was reinforced by 14,000 Germans, led by the duke of Schonenburg, who ventured to lay siege to Dantzic, after having ravaged all the neighbouring country. The Dantzickers, however, defended themselves with so much spirit, that the besiegers were soon obliged to relinquish their enterprise. In their retreat they were attacked by a strong detachment of Polish cavalry, who made prodigious havock among them, and compelled the wretched remains to take shelter in Pomerania, where they were inhumanly butchered by the peasants. Soon after this the marquis was obliged to submit to the clemency of the conqueror; from whom, however, he obtained better conditions than could have been expected, or indeed than he would

Poland.

would have got, had he not abandoned the interest of the Teutonic order, and resigned the dignity of grand-master. In order to secure him in his interest, therefore, Sigismund granted him half the province of Prussia as a secular duke, and dependent on the crown of Poland; by which means he entirely deprived that order of the best part of their dominions, and put it quite out of their power to disturb the tranquillity of Poland any more.

The power of Sigismund had now excited the jealousy of the House of Austria; for which reason they took every method in their power to stir up enemies against him. By their means, the Russians, Moldavians, and Tartars, were all excited to fall upon the Polish territories at once. The vaivode of Walachia, with 50,000 men, made an irruption into the small province of Pokatior, but was entirely defeated by count Taro at the head of no more than 6000. This victory is wholly ascribed to the good conduct of the commander, who possessed himself of some eminences on the flanks of the enemy. On these he erected batteries; which played with such fury as soon put their ranks in disorder: upon which the Poles attacked them sword in hand, and entirely dispersed them with the loss of 10,000 killed or taken. The count having then augmented his army with a strong body of Lithuanians, attacked the Muscovites and Tartars, drove them entirely out of the duchy, pursued them into Russia, reduced several towns, and at last said siege to the strong fortress of Straradub; in which the regent, together with some of the best troops of Russia, were inclosed. The garrison made a gallant defence; and the fortifications were composed of beams joined together, and supported by a bulwark of earth, upon which the cannon-shot made no impression: but the count contrived a method of setting the wood on fire; by which means the regent and nobility were obliged to surrender at discretion, and Taro carried off upwards of 60,000 prisoners, with an immense booty.

In the reign of Sigismund, we may look upon the kingdom of Poland to have been at its greatest pitch of glory. This monarch possessed, in his own person, the republic of Poland, the great duchies of Lithuania, Smolensko, and Saveria, besides vast territories lying beyond the Euxine and Baltic; while his nephew Lewis possessed the kingdoms of Bohemia, Hungary, and Silesia. But this glory received a sudden check in 1548, by the defeat and death of Louis, who perished in a battle fought with Solyman the Great, emperor of the Turks. The daughter of this prince married Ferdinand of Austria; whereby the dominions of Hungary, Bohemia, and Silesia, became inseparably connected with the hereditary dominions of the Austrian family. This misfortune is thought to have hastened the death of Sigismund; though, being then in his 84th year, he could not have lived long by the ordinary course of nature. He did not, however, survive the news many months, but died of a lingering disorder, leaving behind him the character of the completest general, the ablest politician, the best prince, and the strongest man, in the north; of which last, indeed, some instances are related by historians that are almost incredible.

Sigismund Augustus, who succeeded his father Sigismund I. proved also a very great and happy prince. At that time the most violent and bloody wars were carrying on in Germany, and indeed through other parts of Europe, on account of religion; but Sigismund wisely avoided interfering in these disputes. He would not admit into his dominions any of those divines who were taxed with holding heterodox opinions, nor even allow his people the liberty of corresponding with them; yet he never persecuted, or employed any other means for the preservation of the state than those of a well-conducted and regular policy. Instead of disputing with his subjects about speculative opinions, Sigismund applied himself diligently to the reforming of abuses, enforcing the laws, enriching the treasury, promoting industry, and redeeming the crown-lands where the titles of the possessors appeared illegal. Out of the revenue recovered in this manner he obtained a formidable standing army, without laying any additional tax upon the subjects; and though he preferred peace to war, he was always able to punish those that offered indignities to his crown or person. His knowledge in the art of war was soon tried in a contest with the Russians, who had made an irruption into Livonia, encouraged by the disputes which had subsisted between the Teutonic knights and the archbishop of Riga, cousin to Sigismund. The province was at that time divided between the knights and the prelate; and the Russians, under pretence of assisting the former, had seized great part of the dominions of the latter. The archbishop had recourse to his kinsman the king of Poland; who, after fruitless efforts to accommodate matters, marched towards the frontiers of Livonia with an army of 100,000 men. The knights were by no means able to resist such a formidable power; and therefore, deserting their late allies, put themselves under the protection of the king of Poland. The czar, John Basilides, though deserted by the knights, did not lose his courage; nay, he even insolently refused to return any answer to the proposals of peace made by Sigismund. His army consisted of 300,000 men, with whom he imagined himself able to reduce all Livonia, in spite of the utmost efforts of the king of Poland: however, having met with some checks on that quarter, he directly invaded Poland with his whole army. At first he carried every thing before him; but the Poles soon made a vigorous opposition. Yet the Russians, though everywhere defeated, still continued their incursions, which Sigismund at last revenged by invading Russia in his turn. These mutual desolations and ravages at last made both parties desirous of peace, and a truce for three years was agreed on; during the continuance of which the king of Poland died, and with him was extinguished the house of Jagellon, which had governed Poland for near 200 years.

72 Sigismund Augustus, a wise and valiant prince.

73 War with Russia.

74 Extinction of the house of Jagellon.

On the death of Sigismund, Poland became a prey to intestine divisions; and a vast number of intrigues were set on foot at the courts of Vienna, France, Saxony, Sweden, and Brandenburgh; each endeavouring to establish a prince of their own nation on the throne of Poland. The consequence of all this was, that the kingdom became one universal scene of corruption, faction, and confusion; the members of the diet consulted only their own interest, and were ready on every occasion to sell themselves to the best bidder. The Protestants had by this time got a considerable footing in the kingdom, and thus religious disputes were in-

75 Distracted state of Poland.

Poland. termingled with political ones. One good effect, however, flowed from this confusion: for a law was passed, by which it was enacted, that no difference in religious opinions should make any contention among the subjects of the kingdom; and that all the Poles, without discrimination, should be capable of holding public offices and trusts under the government; and it was also resolved, that the future kings should swear expressly to cultivate the internal tranquillity of the realm, and cherish without distinction their subjects of all persuasions.

While the candidates for the throne were severally attempting to support their own interest in the best manner they could, John Crasoski, a Polish gentleman of great merit, but diminutive stature, had just returned from France, whither he had travelled for improvement. His humour, wit, and diverting size, had rendered him universally agreeable at the court of France, and in a particular manner engaged the esteem of Catharine de Medicis, which the little Pole had the address to make use of for his own advantage. He owed many obligations to the duke of Anjou; whom, out of gratitude, he represented in such favourable terms, that the Poles began to entertain thoughts of making him their king. These sentiments were confirmed and encouraged by Crasoski, who returned into France by order of several leading men in Poland, and acquainted the king and queen Catharine, that nothing was wanting besides the formality of an embassy to procure the crown for the duke of Anjou, almost without opposition. Charles IX. king of France, at that time also promoted the scheme, being jealous of the duke of Anjou's popularity, and willing to have him removed to as great a distance as possible. Accordingly the parties came to an agreement; and it was stipulated that

76 Duke of Anjou chosen king of Poland.

the duke of Anjou should maintain the laws, liberties, and customs of the kingdom of Poland, and of the grand duchy of Lithuania; that he should transport all his effects and annual revenues in France into Poland; that the French monarch should pay the late king Sigismund's debts; that he should maintain 100 young Polish gentlemen at his court; and 50 in other places; that he should send a fleet to the Baltic, to assist Poland against the Russians; and lastly, that Henry should marry the princess Anne, sister to the late king Sigismund; but this article Henry would not ratify till his return to Poland.

Every thing being thus settled, the young king quitted France, attended by a splendid retinue, and was accompanied by the queen-mother as far as Lorrain. He was received by his subjects on the frontiers of Poland, and conducted to Cracow, where he was soon after crowned. The affections of the Poles were soon engaged by the youth and accomplishments of Henry; but scarce was he seated on the throne, when, by the death of Charles IX. he became heir to the crown of France. Of this he was informed by repeated messages from queen Catharine; he repented his having accepted the crown of Poland, and resolved to leave it

77 Runs away from his kingdom,

for that of France. But being sensible that the Poles would oppose his departure, he kept his intentions secret, and watched an opportunity of stealing out of the palace in disguise in the night-time. The Poles, as might well have been expected, were irritated at being thus abandoned, from the mere motive of interest, by a prince whom they had loved and honoured so much. Parties were dispatched after him by different roads; and Zamoski, a nobleman who headed one of these parties, overtook him some leagues distant from Cracow. All the prayers and tears of that nobleman, however, could not prevail on Henry to return; he rode post to Vienna, and then passed into France by the way of Italy.

In the mean time, the Poles were so much exasperated against Henry and his whole nation, that all the French in Cracow would have been massacred if the magistrates had not placed guards in the streets. Henry, however, had foreseen the consequences of his flight, and therefore endeavoured to apologise for his behaviour. One Danzai undertook his cause in full senate; and with great eloquence explained the king's motives for his abrupt departure. Henry also wrote to the chief nobility and clergy with his own hand. But nothing could satisfy the Poles; who now acquainted their king, that if he did not immediately return, they would be obliged to divest him of the royal dignity, and to choose another sovereign. Henry began to excuse himself on account of the wars in which he was engaged, and promised to send men of unexceptionable integrity to govern Poland till he should return: but no excuses could be accepted; and, on the 15th of July 1575, he was solemnly divested of the regal dignity in full diet, and the throne declared vacant.

78 And is deposed.

After the deposition of Henry, commotions and factions again took place. However, the contending parties were now reduced to two; one who supported the interest of Maximilian emperor of Germany; the other, who were for electing the princess Anne, and marrying her to Stephen Batori prince of Transylvania. The latter prevailed through the courage of one gentleman, who, in imitation of the power assumed by the Roman tribunes, stood up in the full senate, and opposed the proclamation of Maximilian, declaring that his election was violent and illegal. In this situation of affairs, it was obvious that strength and celerity must determine which election was legitimate: both parties wrote to the princes whose cause they had espoused, intreating them to come with all possible expedition to take possession of the throne. Batori proved the more alert; for while Maximilian was disputing about certain conditions which the Poles required for the security of their privileges, he entered Poland, married the princess, and was crowned on the first of May 1576.

79 Stephen Batori chosen king.

No opposition was made to the authority of Batori except by the inhabitants of Dantzic. These adhered to the interest of Maximilian even after he was dead, and had the presumption to demand from the king an oath acknowledging their absolute freedom and independence. Batori referred them to the senate, declaring that he had no right to give up the privileges of the republic; but admonished the citizens to avoid all occasion of a civil war, which must necessarily terminate in their disadvantage. But the obstinate citizens, construing the king's lenity into fear, shut the gates against the ambassador, seized upon the fortress of Grebin, and published a manifesto resembling a libel upon the king and the republic. The king, incensed at these proceedings, marched against Grebin, retook the castle, and ravaged certain territories belonging

80 Dantzic revolts.

 longing to the Dantzickers; who retaliated by burning to the ground a monastery named *Oliva*, to prevent the Poles from taking possession of so important a situation.

Notwithstanding these outrages, Batori renewed his overtures for an accommodation: but the Dantzickers were deaf to these salutary proposals; so that he was obliged to declare them rebels, and send against them a body of troops under one Zborowski. As the number of the Polish army, however, was not considerable, the Dantzickers marched out to give him battle. They were assisted by a corps of Germans, and a resolution was formed of attacking the Poles in their camp by surprise; but the project was disconcerted by a sudden storm, accompanied with dreadful thunder and lightning, which spread a panic through the army, as if it had been a judgment from heaven, and obliged the commander, John de Collen, to retire into the city. In a short time, however, they recovered their spirits, and came to an action with the Poles; but were defeated with the loss of 8000 men killed on the spot, a great many taken prisoners, and the loss of several pieces of cannon. But this check, instead of abating the courage of the Dantzickers, only animated them the more, and they resolved to hold out to the last extremity. In the

81 Poland invaded by the Russians.

mean time, the czar of Muscovy, thinking the present opportunity favourable for extending his dominions, laid siege to Revel; but, not being able to make himself master of that place, he was obliged to content himself with ravaging Livonia, which he did in a dreadful manner. This did not, however, hinder Batori from laying siege to Dantzic in person, and pursuing the operations with the utmost vigour. Collen made many vigorous sallies, in several of which he defeated the Poles; but happening at last to be killed, nobody was found capable of supplying his place, and the citizens were at last obliged to surrender at discretion;

82 Dantzic submits.

though not till they had obtained a promise from the elector of Saxony and landgrave of Hesse of interposing as mediators in their behalf. The only terms which the king demanded of them were, that they should ask his pardon, dismiss their troops, and rebuild the monastery of Oliva which they had destroyed; while his majesty, on the other hand, confirmed all their privileges, and granted them full liberty of adhering to the confession of Augsburg, for which they had for some time been strenuous advocates.

83 Cruelty of the Russians.

The war with Dantzic was no sooner ended, than the king directed his whole strength against the czar of Muscovy, who had made himself master of several important cities in Livonia. The czar behaved every where with the greatest cruelty, slaughtering all without distinction who were able to bear arms, and abandoning the women and children to the shocking brutality of the Tartars who served in his army. Such was the horror inspired by the perfidy and cruelty of the czar's conduct, that the inhabitants of Wender chose rather to bury themselves in the ruins of their town than to submit to such an inhuman enemy. For a considerable time the Russians were allowed to proceed in this manner, till the whole province of Livonia, excepting Riga and Revel, had suffered the barbarities of this insulting conqueror; but at last, in 1578, a body of forces was dispatched into the province, the towns of Wender and Dunnenburg were surprised, and an army sent by the czar to surprise the former was defeated.

At this time the Muscovites were not the only enemies who opposed the king of Poland, and oppressed Livonia. That unhappy province was also invaded by the Swedes, who professed themselves to be enemies equally to both parties, and who were scarce inferior in cruelty to the Russians themselves. The king, however, was not daunted by the number of his adversaries; but having made great preparations, and called to his assistance Christopher prince of Transylvania, with all the standing forces of that country, he took the field in person against the Muscovites, and laid siege to Polocz, a town of great importance situated on the

84 Siege of Polocz.

river Dwina. The Russians no sooner heard of the approach of the Polish army, than they resolved to put all the citizens to death, thinking by this means to strike terror into the enemy. When Batori came near the town, the most shocking spectacle presented itself; the river appeared dyed with blood, and a vast number of human bodies fastened to planks, and terribly mangled, were carried down its stream. This barbarity, instead of intimidating the Poles, irritated them to such a degree, that nothing could resist them. Finding that their cannon made little impression upon the walls of the city, which were constructed of wood, they advanced to the assault with burning torches in their hands; and would soon have reduced the fortifications to ashes, had not a violent storm of rain prevented them. The design, however, was put in execution as soon as the rain slackened; and the barbarous Russians were obliged to surrender at discretion. It reflects the highest honour on Batori, that, notwithstanding the dreadful instances of cruelty which he had before his eyes, he would not suffer his soldiers to retaliate. Indeed the cruelties committed by the Russians on this occasion,

85 Monstrous barbarities committed by the Russians in that city.

seem almost to have authorised any revenge that could possibly have been taken. A number of Germans were found in the city, some expiring under the most dreadful tortures, and others dead of pains which nature could no longer support. Several of the officers had been dipped in cauldrons of boiling oil, with a cord drawn under the skin of the umbilical region, which fastened their hands behind; in which situation their eyes had been torn out from their sockets, or burnt with red-hot irons, and their faces otherwise terribly mangled. The disfigured carcases, indeed, plainly showed the barbarous treatment they had met with; and the dreadful tale was confirmed by the testimony of the few who survived. The Polish soldiers were exasperated almost to madness; so that scarce all the authority of Batori could restrain them from cutting in pieces the wretches who had been the authors of such a dreadful tragedy.

86 Russia ravaged by Batori.

After the reduction of Polocz, Batori continued the war with great success. Two detachments from the army penetrated the enemy's country by different roads, wasted all before them to the gates of Smolensko, and returned with the spoils of 2000 villages which they had pillaged and destroyed. In the mean time the Swedes and Poles thought proper to come to an accommodation: and though John king of Sweden was at that time prevented from bearing his share of the war, yet Batori reduced such a number of cities, and committed such

67 The Czar sues for peace.

such devastations in the Russian territories, that the czar was obliged to sue for peace; which he obtained on condition of relinquishing Livonia, after having thrown away the lives of more than 400,000 of his subjects in attempting to conquer it.

Batori, being thus freed from a most destructive and cruel war, applied himself to the internal government of his kingdom. He regulated the Polish cavalry in such a manner as made them become formidable to the Turks and other neighbouring nations: and this is the military establishment to which the Poles have given the name of *quartienne;* because a fourth part of the revenue is employed in supporting them. Batori sent this body of cavalry towards the frontiers of Tartary, to check the incursions of those barbarians; by which means the Ukraine, a vast tract of desert country, was filled with flourishing towns and villages, and became a strong barrier against the Turks, Tartars, and Russians.

88 Batori civilizes the Cossacks.

The last memorable action of Batori was his attaching the Cossacks to Poland, civilizing and instructing them in the arts of war and peace. His first endeavour was to gain their affections by his liberality; for which purpose, he presented them with the city of Techtemeravia, situated on the Boristhenes, which they formed into a magazine, and made the residence of their chieftains. He gave them officers of all degrees, established discipline among them, altered their arms, and formed them into a regular militia, which afterwards performed eminent services to the state. All kinds of manufactures at that time known in Poland were likewise established among the Cossacks; the women were employed in spinning and weaving woollen cloths, while the men were taught agriculture, and other arts proper for their sex.

While Batori was employed in this manner, the Swedes broke the convention into which they had entered with Poland, and were on the point of getting possession of Riga. To this, indeed, Batori himself had given occasion, by attempting to impose the Romish religion upon the inhabitants, after having promised them entire liberty of conscience. This so irritated them, that they revolted, and were on the point of admitting a Swedish garrison into the city, when the king was informed of what was going forward. Upon this he resolved to take a most exemplary vengeance on the inhabitants of Riga; but before he could execute his intention, he died in the year 1586, the 54th of his age, and 10th of his reign.

89 His death.

The death of Batori involved Poland in fresh troubles. Four candidates appeared for the crown, viz. the princes Ernest and Maximilian of the house of Austria; Sigismund prince of Sweden, and Theodore czar of Muscovy. Each of these had a separate party; but Sigismund and Maximilian managed matters so well, that in 1587 both of them were elected. The consequence of this was a civil war; in which Maximilian was defeated and taken prisoner: and thus Sigismund III. surnamed *De Vasa*, became master of the throne of Poland without opposition. He waged a successful war with the Tartars, and was otherwise prosperous; but though he succeeded to the crown of Sweden, he found it impossible for him to retain both kingdoms, and he was formally deposed from the Swedish throne. In 1610 he conquered Russia, and placed his son on the throne; but the Polish conquests of that country have always been but for a short time. Accordingly the young prince was soon after deposed; and the Russians not only regained their liberty, but began to make encroachments on Poland itself. A very unfortunate war also took place with Sweden, which was now governed by the great Gustavus Adolphus; the particulars of which, with the other exploits of that renowned warrior, are related under the article SWEDEN. At last Sigismund, worn out with cares and misfortunes, died in 1629.

90 War with Gustavus Adolphus.

After Sigismund's death the affairs of Poland seemed to revive a little under Uladislaus VII.; for he obliged the Russians to sue for peace, and Sweden to restore some of her conquests: but having attempted to abridge the liberty of the Cossacks, they revolted, and gave the Poles several terrible defeats. Nor was the war terminated in the lifetime of Uladislaus, who died in 1648. His successor, John Casimir, concluded a peace with these dangerous enemies: but the war was soon after renewed; and while the kingdom was distracted between these enemies and the discontents of its own inhabitants, the Russians took the opportunity of invading and pillaging Lithuania. In a little after the whole kingdom was subdued by Charles Gustavus, successor to Christina queen of Sweden.

91 Poland subdued by Charles Gustavus.

Happily for Poland, however, a rupture took place between the courts of Sweden and Copenhagen; by which means the Poles were enabled to drive out the Swedes in 1657. This was succeeded by civil wars and contests with Russia, which so much vexed the king, that he resigned the crown in 1668.

For two years after the resignation of Casimir the kingdom was filled with confusion; but on the 17th of September 1670, one Michael Coribut Wiesnowiski, collaterally descended from the house of Jagello, but in a very mean situation at that time, was chosen king. His reign continued but for three years; during which time John Sobieski, a celebrated Polish general, gave the Turks a dreadful overthrow, though their army consisted of more then 300,000 men; and had this blow been pursued, the Cossacks would have been entirely subdued, and very advantageous terms might have been obtained from the sultan. Of that vast multitude of Turks no more than 15,000 made their escape, the rest being all either killed or taken: however, the Polish soldiers, being bound by the laws of their country only to stay a certain time in the field, they refused to pursue this signal victory, and suffered the king to make peace on any terms he could procure.

Wiesnowiski died before the news of this transaction reached Cracow; and after his death a new scene of confusion ensued, till at last the fortune of John Sobieski prevailed, and he was elected king of Poland in 1674. He was a most magnanimous and heroic prince; who, by his valour and good conduct, retrieved the affairs of Poland, and entirely checked the progress of the Turks westward. These barbarians were everywhere defeated, as is particularly related under the article TURKY; but notwithstanding his great qualities, Poland was now so thoroughly corrupted, and pervaded by a spirit of disaffection, that the latter part of this monarch's reign was involved in troubles, through the ambition and contention of some powerful noblemen.

92 John Sobieski retrieves the Polish affairs.

Sobieski died in 1696; and with him fell the glory of Poland. Most violent contests took place about the succession; the recital of which would far exceed our limits.

limits. At last Frederic Augustus, elector of Saxony, prevailed; but yet, as some of the most essential ceremonies were wanting in his coronation, because the primate, who was in an opposite interest, would not perform them, he found it extremely difficult to keep his subjects in proper obedience. To add to his misfortunes, having engaged in a league with Denmark

93 Poland conquered by Charles XII.

and Russia against Sweden, he was attacked with irresistible fury by Charles XII. Though Augustus had not been betrayed, as indeed he almost always was, he was by no means a match for the ferocious Swede. The particulars of this war, however, as they make great part of the exploits of that northern hero, more properly fall to be related under the article SWEDEN. Here, therefore, we shall only observe, that Augustus was reduced to the humiliating necessity of renouncing the crown of Poland on oath, and even of congratulating his rival Stanislaus upon his accession to the throne: but when the power of Charles was broken by his defeat at Pultowa, the fortune of Augustus again prevailed; Stanislaus was driven out; and the former being absolved from his oath by the pope, resumed the throne of Poland.

94 Degeneracy of the Poles.

Since that time the Polish nation hath never made any figure. Surrounded by great and ambitious powers, it hath sunk under the degeneracy of its inhabitants; so that it now scarce exists as a nation. This catastrophe took place in the following manner: On the 5th of October 1763, died Augustus III. elector of Saxony, and king of Poland. He was succeeded by

95 Elevation of Poniatowski, by the name of Stanislaus Augustus, to the throne.

Count Poniatowski, a Polish grandee, who was proclaimed September 7th 1764, by the name of *Stanislaus Augustus*, and crowned on the 25th of November the same year.—During the interregnum which took place between the death of Augustus III. and the election of Stanislaus, a decree had been made by the convocation-diet of Poland, with regard to the *dissidents*, as they were called, or dissenters from the Popish religion. By this decree they were prohibited from the free exercise of their religion, much more than they had formerly been, and totally excluded from all posts and places under the government. On this several of the European powers interposed, at the application of the dissidents, for their good offices. The courts of Russia, Prussia, Great Britain, and Denmark, made remonstrances to the diet; but, notwithstanding these remonstrances, the decree was confirmed by the coronation-diet held after the king's election.

96 Interference of foreign powers in behalf of the dissidents.

October 6. 1766, an ordinary diet was assembled. Here declarations from the courts above mentioned were presented to his Polish majesty, requiring the re-establishment of the dissidents in their civil rights and privileges, and the peaceable enjoyment of their modes of worship secured to them by the laws of the kingdom which had been observed for two centuries. These privileges, it was alleged, had been confirmed by the treaty of Oliva, concluded by all the northern powers, which could not be altered but by the consent of all the contracting parties. The Popish party contended strongly for a confirmation of some decrees made against the dissidents in 1717, 1723, and 1736. The deputies from the foreign powers replied, that those decrees had passed in the midst of intestine troubles, and were contradicted by the formal protestations and express declarations of foreign powers. At last, after violent contests, the matter was referred to the bishops and senators for their opinion. Upon a report from them, the diet came to a resolution, That they would fully maintain the dissidents in all the rights and prerogatives to which they were intitled by the laws of their country, particularly by the constitutions of the year 1717, &c. and by treaties; and that as to their complaints with regard to the exercise of their religion, the college of archbishops and bishops, under the direction of the prince primate, would endeavour to remove those difficulties in a manner conformable to justice and neighbourly love.—By this time, however, the court of Russia seemed determined to make her remonstrances more effectual, and a small body of Russian troops marched to within two miles of the capital of Poland.

These resolutions of the diet were by no means agreeable to the dissidents. They dated the beginning of their sufferings from the year 1717. The referring their grievances to the archbishops and bishops was looked upon as a measure the most unreasonable that could be imagined, as that body of men had always been their opposers, and in fact the authors of all the evils which had befallen them.—Shortly after matters were considered in this view, an additional body of Russians, to the number of about 15,000, entered Poland.

97 Consequences of this.

The dissidents, being now pretty sure of the protection of foreign powers, entered, on the 20th of March 1767, into two confederacies, at Thorn and Sluck. One of them was signed by the dissidents of Great and Little Poland, and the other by those of the Great Duchy of Lithuania. The purport of these confederacies was, an engagement to exert themselves in the defence of their ancient privileges, and the free exercise of their religion; professing, at the same time, however, the utmost loyalty to the king, and resolving to send a deputation to him to implore his protection. They even invited those of the Catholic communion, and all true patriots, to unite with them in maintaining the fundamental laws of the kingdom, the peace of religion, and the right of each one jointly with themselves. They claimed, by virtue of public treaties, the protection of the powers who were guarantees of their rights and liberties; namely, the empress of Russia, and the kings of Sweden, Great Britain, Denmark, and Prussia. Lastly, they protested, that they had no intention of acting to the detriment of the Roman Catholic religion, which they duly respected; and only asked the liberty of their own, and the re-establishment of their ancient rights. The three cities of Thorn, Elbing, and Dantzic, acceded to the confederacy of Thorn on the 10th of April; as did the duke and nobles of Courland to that of Sluck on the 15th of May.

The empress of Russia and king of Prussia, in the mean time, continued to issue forth new declarations in favour of the dissidents; and the Russian troops in Poland were gradually augmented to 30,000 men. Great numbers of other confederacies were also formed in different parts of the kingdom. These at first took little part in the affairs of the dissidents: they complained only of the administration of public affairs, into which they alleged that innovations had been introduced, and were therefore for some time called *confederations of malcontents*. All these confederacies published manifestoes, in

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in which they recommended to the inhabitants to quarter and treat the Russian troops as the defenders of the Polish liberties.

98 General confederacy.

The different confederacies of malcontents formed in the 24 districts of Lithuania united at Wilna on the 22d of June; and that general confederacy re-established prince Radzivil, who had married the king's sister, in his liberty, estates, and honour, of which he had been deprived in 1764 by the states of that duchy. On the 23d of June prince Radzivil was chosen grand marshal of the general confederacy of all Poland, which then began to be called the *national confederacy*, and was said to be composed of 72,000 noblemen and gentlemen.

The general confederacy took such measures as appeared most proper for strengthening their party. They sent to the several waywodes of the kingdom, requiring their compliance with the following articles: 1. That all the gentlemen who had not signed the confederacy should do it immediately; 2. That all the courts of justice should subsist as formerly, but not judge any of the confederates; 3. That the marshals of the crown should not pass any sentence without the participation of at least four of the confederates; and, 4. That the marshals of the crown and the treasurers should be immediately restored to the possession of their respective rights. The Catholic party in the mean time were not idle. The bishop of Cracow sent a very pathetic and zealous letter to the dietines assembled at Warsaw on the 15th of August, in which he exhorted them to arm their nuncios with courage, by giving them orthodox and patriotic instructions, that they might not grant the dissidents new advantages beyond those which were secured to them by the constitutions of the country, and treaties with foreign powers, &c. The pope also sent briefs to the king, the great chancellor, the noblesse, bishops of the kingdom, and to the prince primate, with such arguments and exhortations as were thought most proper to ward off the impending danger. Councils in the mean time were frequently held at the bishop of Cracow's palace, where all the prelates at Warsaw assembled.

On the 26th of September 1767 the confederacy of dissidents was united with the general confederacy of malcontents in the palace of prince Radzivil, who on that occasion expressed great friendship for the dissidents. In a few days after, the Russian troops in the capital were reinforced, and a considerable body of them was posted at about five miles distance.

99 Tumults in the diet.

On the 5th of October an extraordinary diet was held: but the affair of the dissidents met with such opposition, that it was thought necessary to adjourn the meeting till the 12th; during which interval, every expedient was used to gain over those who opposed prince Radzivil's plan. This was, to appoint a commission, furnished with full power to enter into conference with prince Repnin, the Russian ambassador, concerning the affairs of the dissidents. Notwithstanding all the pains taken, however, the meeting of the 12th proved exceedingly tumultuous. The bishops of Cracow and Kiow, with some other prelates, and several magnats, declared, that they would never consent to the establishment of such a commission; and at the same time spoke with more vehemence than ever against the pretensions of the dissidents. Some of the deputies answered with great warmth; which occasioned such animosities, that the meeting was again adjourned till the 16th.

100 Violent proceedings of the Russians.

On the 13th the bishops of Cracow and Kiow, the palatine of Cracow, and the staroste of Dolmski, were carried off by Russian detachments. The crime alleged against them, in a declaration published next day by prince Repnin, was, that they had been wanting in respect to the dignity of the empress of Russia, by attacking the purity of her intentions towards the republic; though she was resolved to continue her protection and assistance to the general confederacy united for preserving the liberties of Poland, and correcting all the abuses which had been introduced into the government, &c.

It was probably owing to this violent proceeding of the Russians, that prince Radzivil's plan was at last adopted, and several new regulations were made in favour of the dissidents. These innovations, however, soon produced a civil war, which at last ended in the ruin of the kingdom. In the beginning of the year 1768, a new confederacy was formed in Podolia, a province bordering on Turky, which was afterwards called the *confederacy of Bar*. The intention of it was, to abolish, by force of arms, the new constitutions, particularly those in favour of the dissidents. The members of the new confederacy likewise expressed great resentment against the carrying away the bishops of Cracow, &c. and still detaining them in custody.

101 Confederacy of Bar.

Podolia was reckoned the fittest place for the purpose of the confederates, as they imagined the Russians could not attack them there without giving umbrage to the Ottoman court. Similar confederacies, however, were quickly entered into throughout the kingdom: the clergy excited all ranks of men to exert themselves in defence of their religion; and so much were their exhortations regarded, that even the king's troops could not be trusted to act against these confederates. The empress of Russia threatened the new confederates as disturbers of the public tranquillity, and declared that her troops would act against them if they persisted. It was, however, some time before the Russian troops were considerably reinforced; nor did they at first seem inclined to act with the vigour which they might have exerted. A good many skirmishes soon happened between these two contending parties, in which the confederates were generally defeated. In one of these the latter being worsted, and hardly pressed, a number of them passed the Niester, and took refuge in Moldavia. This province had formerly belonged to Poland, but was now subject to the Grand Signior: the Russians, however, pursued their enemies into Moldavia; but in order to prevent any offence being taken by the Porte, prince Repnin wrote to the Russian resident at Constantinople, to intimate there, that the conduct of the Russian colonel who commanded the party was quite contrary to the orders of his court, and that therefore he would be turned out of his post.

Great cruelty in the mean time was exercised against the dissidents where there were no Russian troops to protect them. Towards the end of October 1769, prince Martin Lubomirski, one of the southern confederates, who had been driven out of Poland, and had taken shelter with some of his adherents among the mountains of Hungary, got a manifesto posted up on several of the churches of Cracow, in which he invited the

Poland. the nation to a general revolt, and assuring them of the assistance of the Ottoman Porte, with whom he pretended to have concluded a treaty. This was the beginning of hostilities between the Turks and Russians, which were not terminated but by a vast effusion of blood on both sides.

The unhappy kingdom of Poland was the first scene of this war, and in a short time was reduced to the most deplorable situation. In the end of the year 1768, the peasants of the Greek religion in the Polish Ukraine, and province of Kiow, took up arms, and committed the greatest ravages, having, as they pretended, been threatened with death by the confederates unless they would turn Roman Catholics. Against these insurgents the Russians employed their arms, and made great numbers of them prisoners. The rest took refuge among the Haidamacks; by whom they were soon joined, and in the beginning of 1769 entered the Ukraine in conjunction with them, committing everywhere the most horrid massacres. Here, however, they were at last defeated by the Polish troops, at the same time that several of the confederacies in Poland were severely chastised. Soon after, the Chan of the Crim Tartars, having been repulsed with loss in an attempt on New Servia, entered the Polish territories, where he left frightful marks of his inhumanity upon some innocent and defenceless persons. This latter piece of conduct, with the cruelties exercised by the confederates, induced the Polish cossacks of Braclau and Kiovia, amounting to near 30,000 effective men, to join the Russians, in order to defend their country against these destroyers. Matters continued much in the same way during the rest of the year 1769; and in 1770, skirmishes frequently happened between the Russians and confederates, in which the latter were almost always worsted; but they took care to revenge themselves by the most barbarous cruelties on the diffidents, wherever they could find them. In 1770, a considerable number of the confederates of Bar, who had joined the Turks, and been excessively ill used by them, came to an accommodation with the Russians, who took them under their protection on very moderate terms.—Agriculture in the mean time had been so much neglected, that the crop of 1770 was very deficient. This encouraged a number of desperadoes to associate under the denomination of *confederates*, who were guilty of still greater excesses than those who had been under some kind of regulation. Thus a great part of the country was at last reduced to a mere desert, the inhabitants being either exterminated, or carried off to stock the remote Russian plantations, from whence they never could return.

102 War between this confederacy and the Russians.

103 New confederacies. In the year 1771, the confederacies, which seemed to have been extinguished, sprung up afresh, and increased to a prodigious degree. This was occasioned by their having been secretly encouraged and supplied with money by France. A great number of French officers engaged as volunteers in their service; who, having introduced discipline among their troops, they acted with much greater vigour than formerly, and sometimes proved too hard for their enemies. These gleams of success proved at last their total ruin. The Russians were reinforced, and properly supported. The Austrian and Prussian troops entered the country, and advanced on different other sides; and the confederates found themselves in a short time entirely surrounded by their enemies, who seemed to have nothing less in view than an absolute conquest of the country, and sharing it among themselves.

Before matters came to this crisis, however, the confederates formed a design of assassinating the king, on account of his supposed attachment to the dissidents. Of this singular occurrence we have the following account in the travels of Mr Coxe, communicated to the author by Mr Wraxall.—"A Polish nobleman, named *Pulaski*, a general in the army of the confederates, was the person who planned the atrocious enterprise; and the conspirators who carried it into execution were about 40 in number, and were headed by three chiefs, named *Lukawski*, *Strawenski*, and *Kosinski*. These three chiefs had been engaged and hired to that purpose by Pulaski, who in the town of Czetschokow in Great Poland obliged them to swear in the most solemn manner, by placing their hands between his, either to deliver the king alive into his hands, or, in case that was impossible, to put him to death. The three chiefs chose 37 persons to accompany them. On the second of November, about a month after they had quitted Czetschokow, they obtained admission into Warsaw, unsuspected or undiscovered, by the following stratagem. They disguised themselves as peasants who came to sell hay, and artfully concealed their saddles, arms, and clothes, under the loads of hay which they brought in waggons, the more effectually to escape detection.

104 Attempt to assassinate the king,

"On Sunday night, the third of September 1771, a few of these conspirators remained in the skirts of the town; and the others repaired to the place of rendezvous, the street of the Capuchins, where his majesty was expected to pass by about his usual hour of returning to the palace. The king had been to visit his uncle prince Czartoriski, grand chancellor of Lithuania, and was on his return from thence to the palace between nine and ten o'clock. He was in a coach, accompanied by at least 15 or 16 attendants, beside an aid-de-camp in the carriage: scarce was he at the distance of 200 paces from prince Czartoriski's palace, when he was attacked by the conspirators, who commanded the coachman to stop on pain of instant death. They fired several shot into the carriage, one of which passed through the body of a heyduc, who endeavoured to defend his master from the violence of the assassins. Almost all the other persons who preceded and accompanied his majesty were dispersed; the aid-de-camp abandoned him, and attempted to conceal himself by flight. Meanwhile the king had opened the door of his carriage with the design of effecting his escape under shelter of the night, which was extremely dark. He had even alighted, when the assassins seized him by the hair, exclaiming in Polish, with horrible execrations, 'We have thee now; thy hour is come.' One of them discharged a pistol at him so very near, that he felt the heat of the flash; while another cut him across the head with his sabre, which penetrated to the bone. They then laid hold of his majesty by the collar, and, mounting on horseback, dragged him along the ground between their horses at full gallop for near 500 paces through the streets of Warsaw.

105 Who is taken prisoner,

106 And wounded,

"Soon finding, however, that he was incapable of following them on foot, and that he had already almost lost

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loſt his reſpiration from the violence with which they had dragged him, they ſet him on horſeback; and then redoubled their ſpeed for fear of being overtaken. When they came to the ditch which ſurrounds Warſaw, they obliged him to leap his horſe over. In the attempt the horſe fell twice, and at the ſecond fall broke its leg. They then mounted his majeſty upon another, all covered as he was with dirt.

107 And rifled. "The conſpirators had no ſooner croſſed the ditch, than they began to rifle the king, tearing off the order of the Black Eagle of Pruſſia which he wore round his neck, and the diamond croſs hanging to it. He requeſted them to leave his handkerchief, which they conſented to: his tablets eſcaped their rapacity. A great number of the aſſaſſins retired after having thus plundered him, probably with intent to notify to their reſpective leaders the ſucceſs of their enterpriſe; and the king's arrival as a priſoner. Only ſeven remained with him, of whom Koſinſki was the chief. The night was exceedingly dark; they were abſolutely ignorant of the way; and, as the horſes could not keep their legs, they obliged his majeſty to follow them on foot, with only one ſhoe, the other being loſt in the dirt.

"They continued to wander through the open meadows, without following any certain path, and without getting to any diſtance from Warſaw. They again mounted the king on horſeback, two of them holding him on each ſide by the hand, and a third leading his horſe by the bridle. In this manner they were proceeding, when his majeſty, finding they had taken the road which led to a village called *Burakow*, warned them not to enter it, becauſe there were ſome Ruſſians ſtationed in that place who might probably attempt to reſcue him (A). Finding himſelf, however, incapable of accompanying the aſſaſſins in the painful poſture in which they held him kept down on the ſaddle, he requeſted them, ſince they were determined to oblige him to proceed, at leaſt to give him another horſe and a boot. This requeſt they complied with; and continuing their progreſs through almoſt impaſſable lands, without any road, and ignorant of their way, they at length found themſelves in the wood of Bielany, only a league diſtant from Warſaw. From the time they had paſſed the ditch they repeatedly demanded of Koſinſki their chief, if it was not yet time to put the king to death; and theſe demands were reiterated in proportion to the obſtacles and difficulties they encountered, till they were ſuddenly alarmed by a Ruſſian patrole or detachment. Inſtantly holding council, four of them diſappeared, leaving him with the other three, who compelled him to walk on. Scarce a quarter of an hour after, a ſecond Ruſſian guard challenged them anew. Two of the aſſaſſins then fled, and the king remained alone with Koſinſki the chief, both on foot. His majeſty, exhauſted with all the fatigue which he had undergone, implored his conductor to ſtop, and ſuffer him to take a moment's repoſe. Koſinſki refuſed it, menacing him with his naked ſabre; and at the ſame time informed him, that beyond the wood they ſhould find a carriage. They continued their walk, till they came to the door of the convent of Bielany. Koſinſki appeared loſt in thought, and ſo much agitated by his reflections, that the king perceiving his diſorder, and obſerving that he wandered without knowing the road, ſaid to him, 'I ſee you are at loſs which way to proceed. Let me enter the convent of Bielany, and do you provide for your own ſafety.' 'No (replied Koſinſki), I have ſworn.'

108 His preſence of mind remarkable.

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"They proceeded till they came to Mariemont, a ſmall palace belonging to the houſe of Saxony, not above half a league from Warſaw: here Koſinſki betrayed ſome ſatisfaction at finding where he was, and the king ſtill demanding an inſtant's repoſe, he conſented at length. They ſat down together on the ground, and the king employed theſe moments in endeavouring to ſoften his conductor, and induce him to favour or permit his eſcape. His majeſty repreſented the atrocity of the crime he had committed in attempting to murder his ſovereign, and the invalidity of an oath taken to perpetrate ſo heinous an action: Koſinſki lent attention to this diſcourſe, and began to betray ſome marks of remorſe. But (ſaid he), if I ſhould conſent and reconduct you to Warſaw, what will be the conſequence? I ſhall be taken and executed! I give you my word (anſwered his majeſty), that you ſhall ſuffer no harm; but if you doubt my promiſe, eſcape while there is yet time. I can find my way to ſome place of ſecurity; and I will certainly direct your purſuers to take the contrary road to that which you have choſen. Koſinſki could not any longer contain himſelf, but, throwing himſelf at the king's feet, implored forgiveneſs for the crime he had committed; and ſwore to protect him againſt every enemy, relying totally on his generoſity for pardon and preſervation. His majeſty reiterated to him his aſſurances of ſafety. Judging, however, that it was prudent to gain ſome aſylum without delay, and recollecting that there was a mill at ſome conſiderable diſtance, he immediately made towards it. Koſinſki knocked, but in vain; no anſwer was given: he then broke a pane of glaſs in the window, and intreated for ſhelter to a nobleman who had been plundered by robbers. The miller refuſed, ſuppoſing them to be banditti, and continued for more than half an hour to perſiſt in his denial. At length the king approached, and ſpeaking through the broken pane, endeavoured to perſuade him to admit them under his roof, adding, 'If we were robbers, as you ſuppoſe, it would be very eaſy for us to break the whole window, inſtead of one pane of glaſs.' This argument prevailed. They at length opened the door, and admitted his majeſty. He immediately wrote a note to General Coccei, colonel of the foot-guards, informing him of his danger and miraculous eſcape.

109 He gains over his conductor, effects his eſcape, and

"When the meſſenger arrived with the note, the aſtoniſhment and joy was incredible. Coccei inſtantly rode to the mill, followed by a detachment of the guards. He

(A) "This intimation, which the king gave to his aſſaſſins, may at firſt ſight appear extraordinary and unaccountable, but was really dictated by the greateſt addreſs and judgment. He apprehended with reaſon, that, on the ſight of a Ruſſian guard, they would inſtantly put him to death with their ſabres, and fly; whereas by informing them of the danger they incurred, he in ſome meaſure gained their confidence: in effect, this behaviour of the king ſeemed to ſoften them a little, and made them believe he did not mean to eſcape from them."

He met Koſinſki at the door with his ſabre drawn, who admitted him as ſoon as he knew him. The king had ſunk into a ſleep, cauſed by his fatigue; and was ſtretched on the ground, covered with the miller's cloak. Coccei immediately threw himſelf at his majeſty's feet, calling him his ſovereign, and kiſſing his hand. It is not eaſy to paint or deſcribe the aſtoniſhment of the miller and his family, who inſtantly imitated Coccei's example, by throwing themſelves on their knees (B). The king returned to Warſaw in General Coccei's carriage, and reached the palace about five in the morning. His wound was found not to be dangerous; and he ſoon recovered the bruiſes and injuries which he had ſuffered during this memorable night. So extraordinary an eſcape is ſcarce to be paralleled in hiſtory, and affords ample matter of wonder and ſurpriſe.

"It is natural to inquire what is become of Koſinſki, the man who ſaved his majeſty's life, and the other conſpirators. He was born in the palatinate of Cracow, and of mean extraction; having aſſumed the name of *Koſinſki* (C), which is that of a noble family, to give himſelf credit. He had been created an officer in the troops of the confederates under Pulaſki. It would ſeem as if Koſinſki began to entertain the idea of preſerving the king's life from the time when Lukawſki and Strawenſki abandoned him; yet he had great ſtruggles with himſelf before he could reſolve on this conduct, after the ſolemn engagements into which he had entered. Even after he had conducted the king back to Warſaw, he expreſſed more than once his doubts of the propriety of what he had done, and ſome remorſe for having deceived his employers. He was detained under a very ſtrict confinement, and obliged to give evidence againſt his two companions Lukawſki and Strawenſki, who were beheaded, his majeſty having obtained for them from the diet a mitigation of the horrible puniſhment which the laws of Poland inflict upon regicides. About a week after the execution of theſe conſpirators, Koſinſki was ſent out of Poland, after the king had ſettled upon him an annual penſion which he enjoyed at Semigallia in the papal territories."

110 Is received at Warſaw with demonſtrations of joy.

Upon the king's return to Warſaw he was received with the utmoſt demonſtrations of joy. Every one exclaimed with rapture, "The king is alive!" and all ſtruggled to get near him, to kiſs his hand, or even to touch his clothes. But neither the virtues nor the popularity of the ſovereign could allay the factious ſpirit of the Poles, nor prevent the diſmemberment of his kingdom.

111 Partition of Poland projected by the king of Pruſſia.

"The partition of Poland was firſt projected by the king of Pruſſia. Poliſh or Weſtern Pruſſia had long been an object of his ambition: excluſive of its fertility, commerce, and population, its local ſituation rendered it highly valuable to that monarch; it lay between his German dominions and Eaſtern Pruſſia, and while poſſeſſed by the Poles, cut off at their will all communication between them." The period was now arrived when the ſituation of Poland ſeemed to promiſe the eaſy acquiſition of this valuable province. "Frederic purſued it, however, with all the caution of an able politician. On the commencement of the troubles, he ſhowed no eagerneſs to interfere in the affairs of this country; and although he had concurred with the empreſs of Ruſſia in raiſing Staniſlaus Auguſtus to the throne of Poland, yet he declined taking any active part in his favour againſt the confederates. Afterwards, when the whole kingdom became convulſed throughout with civil commotions (1769), and deſolated likewiſe by the plague, he, under pretence of forming lines to prevent the ſpreading of the infection, advanced his troops into Poliſh Pruſſia, and occupied that whole diſtrict.

112 Who gains over the emperor and the empreſs to his meaſures.

"Though now completely maſter of the country, and by no means apprehenſive of any formidable reſiſtance from the diſunited and diſtracted Poles, yet, as he was well aware that the ſecurity of his new acquiſition depended upon the acquieſcence of Ruſſia and Auſtria, he planned the partition of Poland. He communicated the project to the emperor, either upon their interview at Nieſs in Sileſia in 1769, or in that of the following year at Neuſtadt in Auſtria; from whom the overture met with a ready concurrence. To induce the empreſs of Ruſſia to acquieſce in the ſame project, he diſpatched his brother Henry to Peterſburg, who ſuggeſted to the empreſs that the houſe of Auſtria was forming an alliance with the Porte, with which ſhe was then at war; that if ſuch alliance took place, it would create a moſt formidable combination againſt her; that, nevertheleſs, the friendſhip of that houſe was to be purchaſed by acceding to the partition; that upon this condition the emperor was willing to renounce his connection with the Grand Signior, and would ſuffer the Ruſſians to proſecute the war without interruption. Catharine, anxious to puſh her conqueſts againſt the Turks, and dreading the interpoſition of the emperor in that quarter; perceiving likewiſe, from the intimate union between the courts of Vienna and Berlin, that it would not be in her power, at the preſent juncture, to prevent the intended partition—cloſed with the propoſal, and ſelected no inconſiderable portion of the Poliſh territories for herſelf. The treaty was ſigned at Peterſburg in the beginning of February 1772, by the Ruſſian, Auſtrian, and Pruſſian plenipotentiaries. It would be tedious to enter into a detail of the pleas urged by the three powers in favour of their ſeveral demands; it would be no leſs unintereſting to lay before the reader the anſwers and remonſtrances of the king and ſenate, as well as the appeals to the other ſtates which had guaranteed the poſſeſſions of Poland. The courts of London, Paris, Stockholm, and Copenhagen, remonſtrated againſt the uſurpations; but remonſtrances without aſſiſtance could be of no effect. Poland ſubmitted to the diſmemberment not without the moſt violent ſtruggles, and now for the firſt time felt and lamented the fatal effects of faction and diſcord. 113 Poland diſmembered.

A diet being demanded by the partitioning powers, in order to ratify the ceſſion of the provinces, it met on the 19th of April 1773; and ſuch was the ſpirit of the members, that, notwithſtanding the deplorable ſituation of

(B) "I have been (ſays Mr Wraxall) at this mill, rendered memorable by ſo ſingular an event. It is a wretched Poliſh hovel, at a diſtance from any houſe. The king has rewarded the miller to the extent of his wiſhes in building him a mill upon the Viſtula, and allowing him a ſmall penſion."

(C) His real name was John Kutſma.

of their country, the threats and bribes of the three powers, the partition-treaty was not carried through without much difficulty. For some time the majority of the nuncios appeared determined to oppose the dismemberment, and the king firmly persisted in the same resolution. The ambassadors of the three courts enforced their requisitions by the most alarming menaces, and threatened the king with deposition and imprisonment. They also gave out by their emissaries, that in case the diet continued refractory, Warsaw should be pillaged. This report was industriously circulated, and made a sensible impression upon the inhabitants. By menaces of this sort, by corrupting the marshal of the diet, who was accompanied with a Russian guard; in a word, by bribes, promises, and threats, the members of the diet were at length prevailed on to ratify the dismemberment.

114 Provinces seized by the three partitioning powers.

Of the dismembered countries, the Russian province is the largest, the Austrian the most populous, and the Prussian the most commercial. The population of the whole amounts to near 5,000,000 souls; the first containing 1,500,000, the second 2,500,000, and the third 860,000. Western Prussia was the greatest loss to Poland, as by the dismemberment of that province the navigation of the Vistula entirely depends upon the king of Prussia: by the loss consequently of this district a fatal blow was given to the trade of Poland; for his Prussian majesty has laid such heavy duties upon the merchandize passing to Dantzic, as greatly to diminish the commerce of that town, and to transfer a considerable portion of it to Memel and Konigsburgh.

The partitioning powers, however, did less injury to the republic by dismembering its fairest provinces, than by perpetuating the principles of anarchy and confusion, and establishing on a permanent footing that exorbitant liberty which is the parent of faction, and has proved the decline of the republic. Under pretence of amending the constitution, they have confirmed all its defects, and have taken effectual precautions to render this unhappy country incapable of emerging from its present deplorable state, as has been lately seen in the failure of the most patriotic attempt that was perhaps ever made by a king to reform the constitution of his kingdom.

115 The kings of Poland originally hereditary,

The kings of Poland were anciently hereditary and absolute; but afterwards became elective and limited, as we find them at this day. In the reign of Louis, towards the end of the 14th century, several limitations were laid on the royal prerogative. In that of Casimir IV. who ascended the throne in 1446, representatives from the several palatinates were first called to the diet; the legislative power till then having been lodged in the states, and the executive in the king and senate.

116 Afterwards elective.

On the decease of Sigismund Augustus, it was enacted by law, "That the choice of a king for the future should perpetually remain free and open to all the nobles of the kingdom;" which law has accordingly been hitherto observed.

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"As soon as the throne is vacant, all the courts of justice, and other ordinary springs of the machine of government, remain in a state of inaction, and all the authority is transferred to the primate, who, in quality of interrex, has in some respects more power than the king himself; and yet the republic takes no umbrage at it, because he has not time to make himself formidable. He notifies the vacancy of the throne to foreign princes, which is in effect proclaiming that a crown is to be disposed of; he issues the *universalia*, or circular letters for the election; gives orders to the starosts (a sort of military officers who have great authority, and whose proper business it is to levy the revenue) to keep a strict guard upon the fortified places, and to the grand-generals to do the same upon the frontiers, towards which the army marches.

117 Place and manner of the election.

"The place of election is the field of Wola, at the gates of Warsaw. All the nobles of the kingdom have a right of voting. The poles encamp on the left side of the Vistula, and the Lithuanians on the right, each under the banners of their respective palatinates, which makes a sort of civil army; consisting of between a hundred and fifty and two hundred thousand men, assembled to exercise the highest act of freedom. Those who are not able to provide a horse and a sabre stand behind on foot, armed with scythes, and do not seem at all less proud than the rest, as they have the same right of voting.

"The field of election is surrounded by a ditch with three gates, in order to avoid confusion, one to the east for Great Poland, another to the south for Little Poland, and a third to the west for Lithuania. In the middle of the field, which is called *Koluu*, is erected a great building of wood, named the szopa or hall for the senate, at whose debates the deputies are present, and carry the result of them to the several palatinates. The part which the marshal acts upon this occasion is very important; for, being the mouth of the nobility, he has it in his power to do great service to the candidates; he is also to draw up the instrument of election, and the king elect must take it only from his hand.

"It is prohibited, upon pain of being declared a public enemy, to appear at the election with regular troops, in order to avoid all violence. But the nobles, who are always armed with pistols and sabres, commit violence against one another, at the time that they cry out 'liberty!'

"All who aspire openly to the crown are expressly excluded from the field of election, that their presence may not constrain the voters. The king must be elected *nemine contradicente*, by all the suffrages without exception. The law is founded upon this principle, that when a great family adopts a father, all the children have a right to be pleased. The idea is plausible in speculation; but if it was rigorously kept to, Poland could have no such thing as a lawful king. They therefore give up a real unanimity, and content themselves with the appearance of it; or rather, if the law, which prescribes it, cannot be fulfilled by means of money, they call in the assistance of the sabre.

"Before they come to this extremity, no election can possibly be carried on with more order, decency, and appearance of freedom. The primate in few words recapitulates to the nobles on horseback the respective merit of the candidates; he exhorts them to choose the most worthy, invokes heaven, gives his blessing to the assembly, and remains alone with the marshal of the diet, while the senators disperse themselves into the several palatinates, to promote an unanimity of sentiments. If they succeed, the primate goes himself to collect the votes, naming once more all the candidates. 'Szoda (answer the nobles), that is the man we choose;' and

Poland.

and instantly the air resounds with his name, with cries of *vivat*, and the noise of pistols. If all the palatines agree in their nominations, the primate gets on horseback; and then the profoundest silence succeeding to the greatest noise, he asks three times if all are satisfied? and after a general approbation, three times proclaims the king; and the grand-marshal of the crown repeats the proclamation three times at the three gates of the camp. How glorious a king this, if endued with royal qualities! and how incontestable his title in the suffrages of a whole people! But this sketch of a free and peaceable election is by no means a representation of what usually happens. The corruption of the great, the fury of the people, intrigues and factions, the gold and the arms of foreign powers, frequently fill the scene with violence and blood."

118 The *pacta conventa.*

Before the king is proclaimed, the *pacta conventa* is read aloud to him, which on his knees at the altar he swears to observe. As this contract, which is drawn up, methodized, and approved, by the senate and nobility, may be deemed the great charter of Poland, we shall enumerate the principal articles of which it consists. These are, that the king shall not attempt to encroach on the liberty of the people, by rendering the crown hereditary in his family; but that he shall preserve all the customs, laws, and ordonnances, respecting the freedom of election: that he shall ratify all treaties subsisting with foreign powers which are approved by the diet: that it shall be his chief study to cultivate peace, preserve the public tranquillity, and promote the interest of the realm: that he shall not coin money except in the name of the republic, nor appropriate to himself the advantages arising from coinage: that in declaring war, concluding peace, making levies, hiring auxiliaries, or admitting foreign troops upon any pretext within the Polish dominions, the consent of the diet and senate shall be necessary: that all offices and preferments shall be given to the natives of Poland and Lithuania; and that no pretence shall excuse or palliate the crime of introducing foreigners into the king's council or the departments of the republic: that the officers of his majesty's guards shall be Poles or Lithuanians; and that the colonel shall absolutely be a native of Poland, and of the order of nobility: that all the officers shall be subordinate to the authority of the mareschal: that no individual shall be vested with more employments than the law allows: that the king shall not marry without the approbation of the senate; and that the household of the queen shall be determined and regulated by the republic: that the sovereign shall never apply his private signet to acts and papers of a public nature: that the king shall dispose of the offices both of the court and of the republic; and regulate with the senate the number of forces necessary for the defence of the kingdom: that he shall administer justice by the advice of the senate and his council: that the expences of his civil list shall be the same with those of his predecessors: that he shall fill up all vacancies in the space of six weeks: that this shall be his first business in the diet, obliging the chancellor to publish his appointments in due form: that the king shall not diminish the treasure kept at Cracow; but, on the contrary, endeavour to augment that and the number of the crown-jewels: that he shall borrow no money without the consent of the diet: that he shall not equip a naval force without the consent and full approbation of the republic: that he shall profess the Roman Catholic faith, promote, maintain, and defend it, through all the Polish dominions: and finally, that all their several liberties, rights, and privileges, shall be preserved to the Polanders and Lithuanians in general, and to all the districts and provinces contained within each of these great divisions, without change, alteration, or the smallest violation, except by the consent of the republic. To these articles a variety of others are added, according to circumstances and the humour of the diet; but what we have recited form the standing conditions, which are scarce ever altered or omitted.

119 The diet of Poland, and

The diet of Poland is composed of the king, the senate, bishops, and the deputies of the nobility or gentry of every palatinate, called, in the collective capacity, *comitia togata*; that is, when the states assemble in the city without arms and horses; or *comitia paludata*, when they meet in the fields armed, as during an interregnum, at the diet of election. It is a prerogative of the crown to assemble the diet at any particular place, except on occasion of a coronation, which the custom of the country requires should be celebrated at the capital. For a number of years, indeed, the diet regularly assembled at Warsaw; but, on complaint made by the Lithuanians, it was agreed, that every third diet should be held at Grodno. "When it is proposed to hold a general diet, the king, or, in case of an interregnum, the primate, issues writs to the palatines of the several provinces, specifying the time and place of the meeting. A sketch likewise is sent of the business to be deliberated on by the assembly; the senate is consulted in this particular, and six weeks are allowed the members to prepare themselves for the intended session. It is remarkable, that the diet never sits more than six weeks in the most critical conjunctures and pressing emergencies: they have been known to break up in the middle of an important debate, and to leave the business to a future meeting. This custom hath been justly esteemed one of the greatest defects of the Polish constitution, which probably owes its origin to convenience, but is now superstitiously observed from whim and caprice. On receipt of the king's writ, the palatine communicates the meeting of the diet to all the castellans, starostas, and other inferior officers and gentry within his jurisdiction, requiring them to assemble on a certain day to elect deputies, and take into consideration the

120 Dietines.

business specified in the royal summons. These meetings are called *petty diets*, *dietines*, or *lantage*, in the language of the country; every gentleman possessing three acres of land having a vote, and matters being determined by a majority; whereas in the general diet decrees are only valid when the whole body is unanimous. Every palatinate has three representatives, though the business devolves on one called a *nuncio*, who is elected for his ability and experience; and the other two are added only to give weight to this leading member, and do honour by their magnificent appearance to the palatinate they represent. As these deputies, since the reign of Casimir III. have seats in the diet, it naturally divides the general assembly into two bodies, the upper and lower; the one being composed of the senate, the superior clergy, and the great officers; the other of the representatives of the palatinates, who prepare all business for the superior body.

"The

"The first business of the assembly is to choose a mareschal; upon which occasion the debates and tumults run so high, that the whole time for the session of the diet is often consumed in altercation and wrangling about the election of a speaker, who has now nothing farther to do than return quietly to his own home. After his election, he kisses the king's hand; and the chancellor, as the royal representative, reports the matters to be deliberated by the diet. Then the mareschal acquaints the king with the instructions of the deputies from their constituents, the grievances which they would have redressed, and the abuses they require to be remedied. He likewise requests of his majesty to fill up the vacant offices and benefices, according to law; and he is answered by a set speech from the chancellor, who reports the king's inclination to satisfy his people, as soon as he hath consulted his faithful senate There is something very peculiarly absurd in some of the customs observed by the Polish diet: one in particular merits attention. Not only an unanimity of voices is necessary to pass any bill, and constitute a decree of the diet, but every bill must likewise be assented to unanimously, or none can take effect. Thus, if out of twenty bills one should happen to be opposed by a single voice, called *liberum veto*, all the rest are thrown out, and the diet meets, deliberates, and debates, for six weeks to no purpose.

121 Absurd customs observed in the diet.

122 The *liberum veto*.

"To add to the other inconveniences attending the constitution of the diet of Poland, a spirit of venality in the deputies, and a general corruption, hath seized all ranks and degrees in that assembly. Here, as in some other countries, the cry of liberty is kept up for the sake of private interest. Deputies come with a full resolution of profiting by their patriotism, and not lowering their voice without a gratification. Determined to oppose the most salutary measures of the court, they either withdraw from the assembly, protest against all that shall be transacted in their absence, or else excite such a clamour as renders it necessary for the court to silence them by some lucrative pension, donation, or employment. Thus not only the business of the assembly is obstructed by its own members, but frequently by largesses from neighbouring powers, and sometimes by the liberality of an open enemy, who has the art of distributing his money with discretion.

123 The senate of Poland.

"Perhaps the most respectable department of the Polish government is the senate, composed of the bishops, palatines, castellans, and ten officers of state, who derive a right from their dignities of sitting in that assembly; in all amounting to 144 members, who are styled *senators of the kingdom* or *counsellors of the state*, and have the title of *excellency*, a dignity supported by no pension or emoluments necessarily annexed. The senate presides over the laws, is the guardian of liberty, the judge of right, and the protector of justice and equity. All the members, except the bishops, who are senators *ex officio*, are nominated by the king, and they take an oath to the republic before they are permitted to enter upon their functions. Their honours continue for life: at the general diet they sit on the right and left of the sovereign, according to their dignity, without regard to seniority. They are the mediators between the monarch and the subject, and, in conjunction with the king, ratify all the laws passed by the nobility. As a senator is bound by oath to maintain the liberties of the republic, it is thought no disrespect to majesty that they remind the prince of his duty. They are his counsellors, and this freedom of speech is an inseparable prerogative of their office."

Such was the constitution of Poland before it was new-modelled by the partitioning powers. That it was a very bad constitution needs no proof; but those foreign reformers did not improve it. For two centuries at least, the Poles have with great propriety denominated their government a republic, because the king is so exceedingly limited in his prerogative, that he resembles more the chief of a commonwealth than the sovereign of a powerful monarchy. That prerogative, already too confined to afford protection to the peasants, groaning under the aristocratic tyranny of the nobles, was, after the partition treaty, still further restrained by the establishment of the *permanent council*, which was vested with the whole executive authority, leaving to the sovereign nothing but the name. The permanent council consists of 36 persons, elected by the diet out of the different orders of nobility; and though the king, when present, presides in it, he cannot exert a single act of power but with the consent of the majority of persons, who may well be called his *colleagues*.

124 The permanent council.

That the virtuous and accomplished Stanislaus should labour to extricate himself and the great body of the people from such unparalleled oppression, and that the more respectable part of the nation should wish to give to themselves and their posterity a better form of government, was surely very natural and very meritorious. The influence of the partitioning powers was indeed exerted to make the king contented with his situation. His revenues, which before did not exceed L. 100,000, were now increased to three times that sum. The republic likewise agreed to pay his debts, amounting to upwards of L. 400,000. It bestowed on him also, in hereditary possession, four starosties, or governments of castles, with the districts belonging to them; and reimbursed him of the money he had laid out for the state. It was also agreed, that the revenues of the republic should be enhanced to 33 millions of florins (near two millions Sterling), and the army should consist of 30,000 men. Soon after the conclusion of the peace with Turky, the empress of Russia also made the king a present of 250,000 rubles, as a compensation for that part of his dominions which fell into her hands.

These bribes, however, were not sufficient to blind the eyes of Stanislaus, or to cool the ardour of his patriotism. He laboured for posterity, and with such apparent success, that on the 3d of May 1791, a new constitution of the government of Poland was established by the king, together with the confederate states assembled in double number to represent the Polish nation. That this was a perfect constitution, we are far from thinking; but it was probably as perfect as the inveterate prejudices of the nobles would admit of. It deviated as little as possible from the old forms, and was drawn up in 11 articles, respecting the government of the republic; to which were added 21 sections, regulating the dietines or primary assemblies of Poland.

125 A new constitution established in 1791.

Of this constitution, the first article established the Roman Catholic faith, with all its privileges and immunities, as the dominant national religion; granting to all other people, of whatever persuasion, peace in matters of faith, and the protection of government. The second

126 Substance of the first five articles of it.

Poland. second article guaranteed to the nobility or the equestrian order, all the privileges which it enjoyed under the kings of the house of Jagellan. The third and fourth articles granted to the free royal towns internal jurisdictions of their own; and exempted the peasants from slavery, declaring every man free as soon as he sets his foot on the territory of the republic. The fifth article, after declaring, that in civil society all power should be derived from the will of the people, enacted that the government of the Polish nation should be composed of three distinct powers, the *legislative*, in the states assembled; the *executive*, in the king and the council of inspection; and the *judicial* power, in the jurisdictions existing, or to be established. The sixth and seventh articles, as being of more importance, we shall give in the words of the constitution itself.

127 The diet to consist of two houses, viz. the house of nuncios,

VI. *The Diet*, or *the legislative power*, shall be divided into two houses, viz. the house of nuncios, or deputies, and the house of senate, where the king is to preside. The former being the representative and central point of supreme national authority, shall possess the preeminence in the legislature; therefore all bills are to be decided first in this house.

1. *All General Laws*, viz. constitutional, civil, criminal, and perpetual taxes; concerning which matters, the king is to issue his propositions by the circular letters sent before the dietines to every palatinate and to every district for deliberation, which coming before the house with the opinion expressed in the instructions given to their representatives, shall be taken the first for decision.

2. *Particular Laws*, viz. temporal taxes; regulations of the mint; contracting public debts; creating nobles, and other casual recompenses; reparation of public expences, both ordinary and extraordinary; concerning war; peace; ratification of treaties, both political and commercial; all diplomatic acts and conventions relative to the laws of nations; examining and acquitting different executive departments, and similar subjects arising from the accidental exigencies and circumstances of the state; in which the propositions, coming directly from the throne into the house of nuncios, are to have preference in discussion before the private bills.

128 And the house of senate.

In regard to the house of senate, it is to consist of bishops, palatines, castellans, and ministers, under the presidency of the king, who shall have but one vote, and the casting voice in case of parity, which he may give either personally, or by a message to the house. Its power and duty shall be,

1. Every general law that passes formally through the house of nuncios, is to be sent immediately to this, which is either accepted, or suspended till farther national deliberation, by a majority of votes, as prescribed by law. If accepted, it becomes a law in all its force; if suspended, it shall be resumed at the next diet; and if it is then agreed to again by the house of nuncios, the senate must submit to it.

3. Every particular law or statute of the diet in matters above specified, as soon as it has been determined by the house of nuncios, and sent up to the senate, the votes of both houses shall be jointly computed, and the majority, as described by law, shall be considered as a decree and the will of the nation. Those senators and ministers who, from their share in executive power, are accountable to the republic, cannot have an active voice in the diet, but may be present, in order to give necessary explanations to the states.

These ordinary legislative diets shall have their uninterrupted existence, and be always ready to meet; renewable every two years. The length of sessions shall be determined by the law concerning diets. If convened out of ordinary session upon some urgent occasion, they shall only deliberate on the subject which occasioned such a call, or on circumstances which may arise out of it.

No law or statute enacted by such ordinary diet can be altered or annulled by the same. The complement of the diet shall be composed of the number of persons in both houses to be determined hereafter.

The law concerning the dietines or primary elections, as established by the present diet, shall be regarded as a most essential foundation of civil liberty. 129 The *liberum veto* abolished.

The majority of votes shall decide every thing, and everywhere; therefore we abolish, and utterly annihilate, *liberum veto*, all sorts of confederacies and confederate diets, as contrary to the spirit of the present constitution, as undermining the government, and as being ruinous to society.

Willing to prevent, on one hand, violent and frequent changes in the national constitution, yet, considering on the other, the necessity of perfecting it, after experiencing its effects on public prosperity, we determine the period of every 25 years for an extraordinary constitutional diet, to be held purposely for the revision and such alterations of the constitution as may be found requisite: which diet shall be circumscribed by a separate law hereafter. 130 Extraordinary diet for revising the constitution.

VII. The most perfect government cannot exist or last without an effectual executive power. The happiness of the nation depends on just laws, but the good effects of laws flow only from their execution. Experience has taught us, that the neglecting this essential part of government has overwhelmed Poland with disasters.

Having, therefore, secured to the free Polish nation the right of enacting laws for themselves, the supreme inspection over the executive power, and the choice of their magistrates, we entrust to the king and his council the highest power of executing the laws. This council shall be called *straz*, or the council of inspection. 131 Powers of the king and council of inspection.

The duty of such executive power shall be to watch over the laws, and to see them strictly executed according to their import, even by the means of public force, should it be necessary. All departments and magistracies are bound to obey its directions. To this power we leave the right of controling such as are refractory, or of punishing such as are negligent in the execution of their respective offices.

This executive power cannot assume the right of making laws, or of their interpretation. It is expressly forbidden to contract public debts; to alter the repartition of the national income, as fixed by the diet; to declare war; to conclude definitively any treaty, or any diplomatic act; it is only allowed to carry on negociations with foreign courts, and facilitate temporary occurrences, always with reference to the diet.

132 Crown elective in regard to families;

The crown of Poland we declare to be elective in regard to families, and it is settled so for ever.

Having experienced the fatal effects of interregna, periodically

Poland. periodically subverting government, and being desirous of preventing for ever all foreign influence, as well as of insuring to every citizen a perfect tranquillity, we have, from prudent motives, resolved to adopt hereditary succession to our throne: therefore we enact and declare, that, after the expiration of our life, according to the gracious will of the Almighty, the present elector of Saxony shall reign over Poland, and in his person shall the dynasty of future kings of Poland begin. We reserve to the nation, however, the right of electing to the throne any other house or family, after the extinction of the first.

133 But hereditary in each family till its extinction.

134 Coronation oath.

Every king, on his accession to the throne, shall take a solemn oath to God and the nation, to support the present constitution, to fulfil the *pacta conventa*, which will be settled with the present elector of Saxony, as appointed to the crown, and which shall bind him in the same manner as former ones.

135 King's person sacred:

The king's person is sacred and inviolable; as no act can proceed immediately from him, he cannot be in any manner responsible to the nation; he is not an absolute monarch, but the father and the head of the people; his revenues, as fixed by the *pacta conventa*, shall be sacredly preserved. All public acts, the acts of magistracies, and the coin of the kingdom, shall bear his name.

136 His particular powers.

The king, who ought to possess every power of doing good, shall have the right of pardoning those that are condemned to death, except the crimes be against the state. In time of war, he shall have the supreme command of the national forces: he may appoint the commanders of the army, however, by the will of the states. It shall be his province to patentee officers in the army, and other dignitaries, consonant to the regulations hereafter to be expressed, to appoint bishops, senators, and ministers, as members of the executive power.

137 Members of the council of inspection.

The king's council of inspection is to consist, 1. Of the primate, as the head of the clergy, and the president of the commission of education, or the first bishop in ordine. 2. Of five ministers, viz. the minister of police, minister of justice, minister of war, minister of finances, and minister for the foreign affairs. 3. Of two secretaries to keep the protocols, one for the council, another for the foreign department; both, however, without decisive vote. The hereditary prince coming of age, and having taken the oath to preserve the constitution, may assist at all sessions of the council, but shall have no vote therein. The marshal of the diet, being chosen for two years, has also a right to sit in this council, without taking any share in its resolves; for the end only to call together the diet, always existing, in the following case: should he deem, from the emergencies hereunder specified, the convocation of the diet absolutely necessary, and the king refusing to do it, the marshal is bound to issue his circular letters to all nuncios and senators, adducing real motives for such meeting.

138 Powers of the marshal.

The cases demanding such convocation of the diet are the following: 1. In a pressing necessity concerning the law of nations, and particularly in case of a neighbouring war. 2. In case of an internal commotion, menacing with the revolution of the country, or of a collision between magistratures. 3. In an evident danger of general famine. 4. In the orphan state of the country, by demise of the king, or in case of the king's dangerous illness. All the resolutions of the council of inspection are to be examined by the rules above mentioned. The king's opinion, after that of every member in the council has been heard, shall decisively prevail. Every resolution of this council shall be issued under the king's signature, countersigned by one of the ministers sitting therein; and thus signed, shall be obeyed by all executive departments, except in cases expressly exempted by the present constitution.

Should all the members refuse their countersign to any resolution, the king is obliged to forego his opinion; but if he should persist in it, the marshal of the diet may demand the convocation of the diet; and if the king will not, the marshal himself shall send his circular letters as above. Ministers composing this council cannot be employed at the same time in any other commission or department.

If it should happen that two thirds of secret votes in both houses demand the changing of any person, either in the council, or any executive department, the king is bound to nominate another. Willing that the council of inspection should be responsible to the nation for their actions, we decree, that when these ministers are denounced and accused before the diet (by the special committee appointed for examining their proceedings) of any transgression of positive law, they are answerable with their persons and fortunes. Such impeachments being determined by a simple majority of votes, collected jointly from both houses, shall be tried immediately by the comitial tribunal, where the accused are to receive their final judgment and punishment, if found guilty; or to be honourably acquitted on sufficient proof of innocence.

139 Commissions of education, police, &c.

In order to form a necessary organization of the executive power, we establish hereby separate commissions, connected with the above council, and subjected to obey its ordinations. These commissions are, 1. of education; 2. of police; 3. of war; 4. of treasury. It is through the medium of these four departments that all the particular orderly commissions (D), as established by the present diet, in every palatinate and district, shall depend on, and receive all orders from, the council of inspection, in their respective duties and occurrences.

140 Administration of justice.

The eighth article regulates the administration of justice, beginning with a very sensible declaration, that the judicial power is incompatible with the legislative, and that it cannot be administered by the king. It therefore constitutes primary courts of justice for each palatinate or district, composed of judges chosen at the dietine; and appoints higher tribunals, erected one in each of the three provinces into which the kingdom is divided, with which appeals may be lodged from the primary

(D) Orderly commissions are newly instituted; each palatinate and district chooses a certain number of commissaries; their office lasts two years; their principal duty is to maintain police and good order in their district; to put into execution decrees and regulations of supreme departments; to collect taxes; to keep cash; to make such payments as assigned by the commission of finances; to protect citizens from the military oppression; to furnish recruits, besides many other duties of internal management.

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mary courts. It appoints likewise for the trial of persons accused of crimes against the state, one supreme general tribunal for all classes, called a *comitial tribunal* or court, composed of persons chosen at the opening of every diet. The ninth article provides a regency during the king's minority, in case of his settled alienation of reason, or upon the emergency of his being made a prisoner of war. This regency was to be composed of the council of inspection, with the queen at their head, or, in her absence, the primate of the kingdom. The tenth article enjoins, that the education of the king's sons shall be entrusted to the king with the council, and a tutor appointed by the states; and the eleventh regulates the army in such a manner, as to prevent it from being employed to overturn the constitution.

141 Regency on certain occasions.

The regulation of the dietines contains nothing that can be interesting to a British reader, except what relates to the election and duties of nuncios or representatives to the general diet. And here it is enacted, that persons having a right to vote are all nobles of the equestrian order; *i. e.* 1. All hereditary proprietors of landed property, or possessed of estates by adjudication for a debt, paying territorial tax to government: sons also of such proprietors during the life of their parents, before the ex-division of patrimony. 2. Brothers inheriting estates before they have shared their succession. 3. All mortgages who pay 100 florins (50 shillings) of territorial tax per year from their possessions. 4. All life-holders of lands paying territorial tax to the same amount. 5. All nobles in the army possessed of such qualifying estates have a vote in their respective districts in time of peace, and properly furloughed by their commanders. 6. Legal possession is understood to be qualifying when it has been formerly acquired and actually enjoyed for twelve calendar months previously.

142 The election and duties of nuncios.

Persons who have no right to vote are, 1. Those of the equestrian order that are not actually possessed of a property, as described in the foregoing article. 2. Such as hold royal, ecclesiastical, or noble lands, even with right of inheritance, but on condition of some duty or payment to their principals, consequently dependent thereon. 3. Gentry possessing estates on feudal tenure, called *ordynachie*, as being bound to certain personal service thereby. 4. All renters of estates that have no other qualifying property. 5. Those that have not accomplished 18 years of age. 6. *Crimine notati*, and those that are under a decree passed in default, even in the first instance, for having disobeyed any judicial court.

143 Persons eligible and not eligible.

Every person of the equestrian order that pays territorial tax to government for his freehold, let it be ever so small, is eligible to all elective offices in his respective district.

Gentlemen actually serving in the army, even possessed of landed hereditary estate, must have served six complete years before they are eligible to the office of a nuncio only. But this condition is dispensed with in favour of those that have filled before some public function.

Whoever is not personally present at the dietine; whoever has not completed 23 years of age; whoever has not been in any public function, nor passed the biennial office of a commissary in the orderly commission; those that are not exempted by law from obligations of *scarta bellatum*, which subjects all newly-nobilitated persons to certain civil restrictions until the next generation; and, lastly, all those against whom may be objected a decree *in contumaciam* in a civil cause; are not eligible.

During the business of election, the president who opened the meeting, with the rest of the committee, except those who are assessors, shall prepare instructions for procedure; and in regard to the propositions sent by the king and the council of inspection, these instructions shall be worded thus: "Our nuncios shall vote *affirmative* to the article *N*;" or, "Our nuncios shall vote *negative* to the article *N*," in case it is found contrary to the opinion of the dietine: and should any amendment or addition be deemed necessary and agreed on, it may be inserted in the instructions at the end of the relative proposition.

144 Instructions to the nuncios.

At the meeting of the dietines, after the diet has sat, the nuncios are bound to appear before their constituents, and to bring their report of the whole proceedings of that assembly; first, respecting the acts of legislature; next, with respect to the particular projects of their palatinate or district recommended to them by the instructions.

145 Who are accountable to their constituents.

It is at these dietines that nuncios, after they have rendered to their constituents a clear account of their proceedings and of the diet, may be either confirmed or changed, and new ones elected in their stead till the general election for the following ordinary diet.

New nuncios are chosen, 1. In the room of the deceased. 2. In the room of those that are become senators or ministers of state. 3. In case of resignation. 4. In the room of such as are disqualified by the diet. 5. When any of the assembly desires a new election, to substitute another nuncio in the room of one expressly pointed out; which request must be made in writing, signed by 12 members besides, and be delivered to the marshal of the dietine. In this last case, the marshal is to read the name of the nuncio objected to, and to make the following proposition: "Shall the nuncio *N* be confirmed in his function? or, Shall there be a new election made in his stead?" The opinion of the meeting being taken by a division, the majority shall decide the question, and be declared by the marshal. If the majority approves the conduct of the nuncio, the marshal and the assessors shall certify this confirmation on the diploma; and in case of disapprobation, the marshal shall declare the vacancy, and begin the form of a new election.

Such are the outlines of the Polish constitution established by the king and the confederates in 1791. It will not bear a comparison with that under which Britons have the happiness to live; but it is surely infinitely superior to that motley form of government which, for a century past, has rendered Poland a perpetual scene of war, tumult, tyranny, and rebellion. Many of the corrupt nobles, however, perceiving that it would curb their ambition, deprive them of the base means which they had long enjoyed of gratifying their avarice by setting the crown to sale, and render it impossible for them to continue with impunity their tyrannical oppression of the peasants, protested against it, and withdrew from the confederates. This was nothing more than what might have been expected, or than what the king and his friends undoubtedly did expect. But the malcontents were not satisfied with a simple protest; they preferred their complaints to the empress of Russia,

146 This constitution, though superior to the former, protested against by some corrupt nobles,

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fia, who, ready on all occasions, and on the slightest pretence, to invade Poland, poured her armies into the republic, and surrounding the king and the diet with ferocious soldiers, compelled them, by the most furious and indecent menaces, to undo their glorious labour of love, and to restore the constitution as settled after the partition treaty.

147 And opposed by the Russians.

Of the progress of the Russians in this work of darkness, our readers will be pleased with the following manly and indignant narrative, taken from a periodical work * of acknowledged merit.

* *New Annual Register*, 1792.

"It was on the 21st of April 1792, that the diet received the first notification from the king, of the inimical and unjust intentions of Russia. He informed them that, without the shadow of pretence, this avowed enemy of the rights of mankind had determined to invade the territory of the republic with an army of 60,000 men. This formidable banditti, commanded by generals Soltikow, Michelson, and Kosakowski, was afterwards to be supported by a corps of 20,000, and by the troops then acting in Moldavia, amounting to 70,000. The king, however, professed that he was not discouraged, and declared his readiness to put himself at the head of the national troops, and to terminate his existence in a glorious contest for the liberties of his country. Then, and not before, the diet decreed the organisation of the army, and its augmentation to 100,000. The king and the council of inspection were invested with unlimited authority in every thing that regarded the defence of the kingdom. Magazines were ordered to be constructed when it was too late, and quarters to be provided for the army.

148 The nation rises to maintain its independence.

"The diet and the nation rose as one man to maintain their independence. All private animosities were obliterated, all private interests were sacrificed; the greatest encouragements were held forth to volunteers to enroll themselves under the national standard, and it was unanimously decreed by the diet, that all private losses should be compensated out of the public treasury.

"On the 18th of May, the Russian ambassador delivered a declaration, which was worthy of such a cause. It was a tissue of falsehood and hypocrisy. It asserted, that this wanton invasion, which was evidently against the sense of almost every individual Polander, was meant entirely for the *good* of the republic. It censured the precipitancy with which the new constitution was adopted, and ascribed the ready consent of the diet to the influence of the Warsaw mob. It represented the constitution as a violation of the principles on which the Polish republic was founded—complained of the licentiousness with which the *sacred name of the empress* was treated in some speeches of the members; and concluded by professing, that on these accounts, and in behalf of the emigrant Poles, her imperial majesty had ordered her troops to enter the territories of the republic.

"At the moment this declaration was delivered to the diet, the Russian troops, accompanied by Counts Potocki, Rzewuski, Branicki, and a few Polish apostates, appeared upon the frontiers, and entered the territories of the republic in several columns, before the close of the month. The spirit manifested by the nobility was truly honourable. Some of them delivered in their plate to the mint. Prince Radzvil engaged voluntarily to furnish 10,000 stand of arms, and another a train of artillery. The courage of the new and hastily embodied soldiers corresponded with the patriotism of their nobles. Prince Poniatowski, nephew to the king, was appointed commander in chief; and though his force was greatly inferior to the enemy, it must be confessed that he made a noble stand. On the 24th of May, the enemy's Cossacks were repulsed, and pursued by the patroles of the republic to the very entrenchments. On the 26th, about one o'clock, the piquets of the republic discovered a large body of Don Cossacks approaching the outposts; and a squadron of cavalry, commanded by Lieutenant Kwasniewski, supported by Lieutenant Golejowski with two squadrons more, in all about 300, marched out to meet them. They attacked the Cossacks with success, but pursued them with more valour than prudence to the side of a wood, where they found themselves drawn into an ambuscade, and surrounded by 2000 horse, two battalions of chasseurs, and six pieces of cannon. The intrepid Poles bravely fought their way through the Russian line, and killed upwards of 200 of the enemy. The Poles in this engagement lost 100 men and two officers; one of whom, Lieutenant Kwasniewski, was wounded and made prisoner. The remainder of the detachment reached their quarters in safety.

149 Spirit of the nobility.

150 Conduct of the court of Berlin.

"Perhaps the history of man can scarcely furnish an instance of perfidy, meanness, and duplicity, equal to that which was manifested by Prussia on this occasion. By the treaty of defensive alliance, solemnly contracted between the republic of Poland and the king of Prussia, and ratified on the 23d of April 1790, it is expressly stipulated, 'That the contracting parties shall do all in their power to guarantee and preserve to each other reciprocally the whole of the territories which they respectively possess: That, in case of menace or invasion from any foreign power, they shall assist each other with *their whole force*, if necessary:'—and by the sixth article, it is further stipulated, 'that if any foreign power whatever shall presume to interfere in the internal affairs of Poland, his Prussian majesty shall consider this as a case falling within the meaning of the alliance, and shall assist the republic according to the tenor of the fourth article," that is, with his *whole force*. What then is the pretext for abandoning this treaty? It is, that the *empress of Russia has shown a decided opposition to the order of things established in Poland on the third of May* 1791, *and is provoked by Poland presuming to put herself into a posture to defend it.*—It is known, however, by the most authentic documents, that nothing was effected on the third of May 1791, to which Prussia had not previously assented, and which she did not afterwards sanction; and that Prussia, according to the assertion of her own king, did not intimate a single doubt respecting the revolution till one month (and according to the Prussian minister till six months) after it had taken place; in short, to use the monarch's own words as fully explanatory of his double politics, "not till the *general tranquillity of Europe* permitted him to explain himself."——Instead, therefore, of assisting Poland, Prussia insultingly recommended to Poland to retrace her steps; in which case, she said that she would be ready to *attempt an accommodation* in her favour. This attempt was never made, and probably never intended; for the empress pursued her measures.

The duchy of Lithuania was the great scene of action in the beginning of the war; but the Russians had made little

little progress before the middle of the month of June. On the 10th of that month, General Judycki, who commanded a detachment of the Polish troops, between Mire and Swierzna, was attacked by the Russians; but, after a combat of some hours, he obliged them to retire with the loss of 500 men dead on the field.—The general was desirous of profiting by this advantage, by pursuing the enemy, but was prevented by a most violent fall of rain. On the succeeding day, the Russians rallied again to the attack; and it then too fatally appeared, that the Poles were too young and undisciplined to contend with an inferior force against experienced troops and able generals. By a masterly manoeuvre, the Russians contrived to surround their antagonists, at a moment when the Polish general supposed that he had obliged the enemy to retreat; and though the field was contested with the utmost valour by the troops of the republic, they were at length compelled to give way, and to retire towards Nieswiesz.

151 War with Russia.

On the 14th another engagement took place near Lubar, on the banks of the river Sluez, between a detachment of the Russian grand army and a party of Polish cavalry, dispatched by Prince Joseph Poniatowski, to intercept the enemy. The patriotic bravery of the Poles was victorious in this contest; but upon reconnoitering the force of the enemy, the prince found himself incapable of making a successful stand against such superior numbers. He therefore gave orders to strike the camp at Lubar, and commenced a precipitate retreat. During their march, the Polish rear was harassed by a body of 4000 Russians, till arriving at Boruskowee, the wooden bridge unfortunately gave way, under the weight of the cavalry. The enemy, in the mean time, brought their artillery to play upon the rear of the fugitives, who lost upwards of 250 men. The Polish army next directed its course toward Zielime, where meeting, on the 17th, with a reinforcement from Zaslow, it halted to give battle to the enemy. The Russians were upwards of 17,000 strong, with 24 pieces of cannon, and the force of the republic much inferior. After a furious contest from seven in the morning till five in the afternoon, the Russians were at length obliged to retreat, and leave the field of battle in possession of the patriots. The Russians were computed to have lost 4000 men in this engagement, and the Poles about 1100.

Notwithstanding these exertions, the Poles were obliged gradually to retire before their numerous and disciplined enemies. Nieswez, Wilna, Minsk, and several other places of less consequence, fell into their hands one after another. On a truce being proposed to the Russian general Kochowski, the proposal was haughtily rejected; while the desertion of vice-brigadier Rudnicki and some others, who preferred dishonour to personal danger, proclaimed a tottering cause. The progress of the armies of Catharine was marked with devastation and cruelty, while, such was the aversion of the people both to the cause and the manner of conducting it, that, as they approached, the country all around became a wilderness, and scarcely a human being was to be seen.

In the mean time, a series of little defeats, to which the inexperience of the commanders, and the intemperate valour of new raised troops, appear to have greatly contributed, served at once to distress and to dispirit these defenders of their country. Prince Poniatowski continued to retreat, and on the 17th of July, his rear being attacked by a very superior force, it suffered a considerable loss, though the skill and courage of General Kosciusko enabled him to make a most respectable defence. On the 18th, a general engagement took place between the two armies. The Russian line extended opposite Dubienka, along the river Bog, as far as Opalin. The principal column, consisting of 14,000 men, was chiefly directed against the division of General Kosciusko, which consisted of 5000 men only. After a most vigorous resistance, in which the Russians lost upwards of 4000 men, and the troops of the republic only some hundreds, the latter was compelled to give way before the superior numbers of the enemy, and to retire further into the country.

152 The king proposes submission.

This unequal contest was at last prematurely terminated. The king, whose benevolent intentions were, perhaps, overpowered by his mental imbecillity, and whose age and infirmities, probably, rendered him unequal to the difficulties and dangers which must attend a protracted war, instead of putting himself, according to his first resolve, at the head of his army, determined, at once, to surrender at discretion. On the 23d of July, he summoned a council of all the deputies at that moment in Warsaw. He laid before them the last dispatches from the empress, which insisted upon total and unreserved submission. He pointed out the danger of a dismemberment of the republic, should they delay to throw themselves upon the clemency of the empress, and to intreat her protection. He mentioned the fatal union of Austria and Prussia with Russia; and the disgraceful supineness manifested by every other court in Europe.

Four citizens, the intrepid and patriotic Malachowski, the princes Sapieha, Radzvil, and Soltan, vehemently protested against these dastardly proceedings; and the following evening a company of gentlemen from the different provinces assembled for the same purpose. The assembly waited immediately on these four distinguished patriots, and returned them their acknowledgements for the spirit and firmness with which they had resisted the usurpations of despotism. The submission of the king to the designs of Russia was no sooner made known, than Poland was bereft of all her best and most respectable citizens. Malachowski as marshal of the diet, and Prince Sapieha grand marshal of Lithuania, entered strong protests on the journals of the diet against these hostile proceedings, and declared solemnly that the diet legally assembled in 1788 was not dissolved.

153 Confederation at Warsaw overawed by Russia, restores the former constitution.

On the second of August a confederation was formed at Warsaw, of which the grand apostate, Potocki, was chosen Marshall. The acts of this confederation were evidently the despotic dictates of Russia, and were calculated only to restore the ancient abuses, and to place the country under the aggravated oppression of a foreign yoke.

It is remarkable, that at the very moment when Poland was surrendering its liberties to its despotic invaders, the generous sympathy of Great Britain was evinced by a liberal subscription, supported by all the most respectable characters in the nation, of every party and of every sect, for the purpose of assisting the king and the republic to maintain their independence. Though the

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the benevolent design was frustrated, the fact remains on record as a noble testimony of the spirit of Britons in the cause of freedom, of the indignation which fills every British heart at the commission of injustice, and of the liberality with which they are disposed to assist those who suffer from the oppression of tyrants.

154
The empress seizes upon part of the Polish territory.

Not satisfied with restoring the old wretched constitution, the empress of Russia seized upon part of the territory which, at the last partition, she and her coadjutors had left to the republic; and her ambassador entering into the diet with a crowd of armed ruffians, compelled the king and that assembly to grant the form of legality to her usurpations. The nation, however, did not submit. General Kosciusko kept together a few retainers, whom he was soon enabled to augment to the number of an army; and seizing on the person of the king, he has ever since waged against Russia a war, of which, it must be confessed, the object is doubtful. His enemies accuse him of cherishing in the republic the principles of the French Jacobins; and some late occurrences give a countenance to the accusation. Yet it is known he protested at first that his aim reached no farther than to restore the constitution of 1791; and if public report may be credited, an insurrection has lately taken place in Great Poland, or South Prussia, in favour of that constitution. If other Poles have been driven to democracy, they have only, with the common weakness of human nature, run from one extreme to another; and in flying from the tyranny of their invaders, have fallen into the horrors of anarchy. That Kosciusko will succeed against the powerful empire of Russia, there is not the smallest probability; and if there were, the court of Berlin, to complete its character, has withdrawn from the most honourable alliance in which it was ever engaged, and seems to have employed the subsidy which it received from Great Britain for the maintenance of that alliance, to co-operate with the empress in annihilating the kingdom and republic of Poland. What will be the ultimate fate of that unhappy country, and its amiable sovereign, it is impossible to say; but appearances at present indicate a division of the whole territory among the three hostile powers who formerly robbed it of some of its most valuable provinces; and when that division is made, the virtuous Stanislaus may be removed to a better world by the dagger, by the bowl, by the gripe of a giant, or by a red-hot spit!

155
Deplorable state of the country.

156
Air, climate, &c. of Poland.

The air of this kingdom is cold in the north, but temperate in the other parts both in summer and winter, and the weather in both more settled than in many other countries. The face of the country is for the most part level, and the hills are but few. The Crapack or Carpathian mountains separate it from Hungary on the south. The soil is very fruitful both in corn and pasturage, hemp and flax. Such is the luxuriance of the pastures in Podolia, that it is said one can hardly see the cattle that are grazing in the meadows. Vast quantities of corn are yearly sent down the Vistula to Dantzic, from all parts of Poland, and bought up chiefly by the Dutch. The eastern part of the country is full of woods, forests, lakes, marshes, and rivers; of the last of which, the most considerable in Poland are, the Vistula, Nieper, Niester, Duna, Bog, Warta, and Memel. The metals found in this country are iron and lead, with some tin, gold, and silver; but there are no mines of the two last wrought at present. The other products of Poland are most sorts of precious stones, ochre of all kinds, fine rock-crystal; Muscovy glass, talc, alum, saltpetre, amber, pitcoal, quicksilver, spar, sal-gem, lapis calaminaris, and vitriol. In Lesser Poland are salt-mines, which are the chief riches of the country, and bring most money into the exchequer. In the woods, which consist mostly of oak, beech, pine, and fir-trees, besides the more common wild beasts, are elks, wild asses, wild oxen or uri, lynxes, wild horses, wild sheep with one horn, bisons, hyænas, wild goats, and buffaloes. In the meadows and fenny ground is gathered a kind of manna; and the kermesberries produced in this country are used both in dying and medicine.

157
Different classes of inhabitants.

The inhabitants consist of nobles, citizens, and peasants. The first possess great privileges, which they enjoy partly by the indulgence of their kings, and partly by ancient custom and prescription. Some of them have the title of *prince*, *count*, or *baron*; but no superiority or pre-eminence on that account over the rest, which is only to be obtained by some public post or dignity. They have the power of life and death over their vassals; pay no taxes; are subject to none but the king; have a right to all mines and salt-works on their estates; to all offices and employments, civil, military, and ecclesiastic; cannot be cited or tried out of the kingdom; may choose whom they will for their king, and lay him under what restraints they please by the Pacta Conventa; and none but they and the burghers of some particular towns can purchase lands. In short, they are almost entirely independent, enjoying many other privileges and prerogatives besides those we have specified; but if they engage in trade, they forfeit their nobility.

158
Language.

The Polish tongue is a dialect of the Sclavonic: (see PHILOLOGY, n° 222.). It is neither copious nor harmonious. Many of the words, as they are written, have not a single vowel in them; but the High Dutch and Latin are understood and spoken pretty commonly, though incorrectly. The language in Lithuania differs much from that of the other provinces. True learning, and the study of the arts and sciences, have been little attended to in Poland, till of late they began to be regarded with a more favourable eye, and to be not only patronized, but cultivated by several of the nobles and others, both laymen and ecclesiastics.

159
Archbishoprics, &c.

There are two archbishops in the kingdom, viz. those of Gnesna and Leopol, and about a dozen bishops. The archbishop of Gnesna is always a cardinal, and primate of the kingdom. The prevailing religion is Popery, but there are great numbers of Lutherans, Calvinists, and Greeks, who are called *Dissidents*, and by the laws of the kingdom were intitled to toleration; but were much oppressed till very lately. The Jews are indulged with great privileges, and are very numerous in Poland; and in Lithuania, it is said there are a multitude of Mahometan Tartars. We may judge of the numbers of Jews in this country by the product of their annual poll-tax, which amounts to near 57,000 rixdollars.

160
Manufactures.

There are few or no manufactures in the kingdom, if we except some linen and woollen clothes and hardwares; and the whole trade is confined to the city of Dantzic, and other towns on the Vistula or Baltic.

161
Revenue.

Before the present troubles the king's revenue was all

all clear to himself; for he paid no troops, not even his own guards; but all the forces, as well as the officers of state, were paid by the republic. The public revenues arose chiefly from the crown-lands, the salt-mines in the palatinate of Cracow, from the rents of Marienburg, Dirshau, and Regenhus, from the government of Cracow, and district of Niepolomiez, and from ancient tolls and customs, particularly those of Elbing and Dantzic. From what sources those revenues now arise, it is difficult to say; but Prussia has got possession of the most lucrative customs.

162 Order of knighthood.

The order of the White Eagle was instituted by Augustus II. in the year 1705. Its ensign is a cross of gold enamelled with red, and appendant to a blue ribbon. The motto, *Pro fide, rege, et lege.*

163 Forces.

The standing forces of Poland are divided into the crown-army, and that of Lithuania, consisting of horse and foot, and amounting to between 20,000 and 30,000 men. These troops are mostly cantoned on the crown-lands, and in Poland are paid by a capitation or poll-tax; but in Lithuania other taxes are levied for this purpose. Most of the foot are Germans. On any sudden and imminent danger, the whole body of the nobility, with their vassals, are obliged to appear in the field on horseback; and the cities and towns furnish a certain number of foot-soldiers, with carriages, and military stores: but for want of proper arms, provisions, subordination, and discipline, and by being at liberty after a few weeks to return home, this body has proved but of little advantage to the republic. Dantzic is the only place in the Polish dominions that deserves the name of a fortress, and it is now in the possession of Prussia. Foreign auxiliaries are not to be brought into the kingdom, nor the national troops to march out of it, without the consent of the states.

Such was the military establishment of Poland before the partition treaty. What it has been since, and is at present, we cannot positively say.

164 Character of the people.

The Poles are personable men, and have good complexions. They are esteemed a brave, honest people, without dissimulation, and exceedingly hospitable. They clothe themselves in furs in winter, and over all they throw a short cloak. No people keep grander equipages than the gentry. They look upon themselves as so many sovereign princes; and have their guards, bands of music, and keep open houses: but the lower sort of people are poor abject wretches, in the lowest state of slavery. The exercises of the gentry are hunting, riding, dancing, vaulting, &c. They reside mostly upon their estates in the country; and maintain themselves and families by agriculture, breeding of bees, and grazing.

POLAR, in general, something relating to the poles of the world, or poles of the artificial globes.

Polar Regions, those parts of the world which lie near the north and south poles. See the article Pole.

POLARITY, the quality of a thing considered as having poles, or a tendency to turn itself into one certain posture; but chiefly used in speaking of the magnet.

POLE (Reginald), cardinal, and archbishop of Canterbury, a younger son of Sir Rich. Pole, Lord Montague, was born at Stoverton castle, in Staffordshire, in the year 1500. At seven years of age he was sent to a Carthusian monastery at Shene, near Richmond in Surry; and thence, when he was about 12 years old, removed to Magdalen college in Oxford, where, by the instructions of the celebrated Lineacre and Latimer, he made considerable progress in learning. In 1515 he took the degree of bachelor of arts, and was admitted to deacon's orders some time after: in 1517, he was made prebendary of Salisbury, and in 1519 dean of Wimborne and dean of Exeter. We are not surprised at this young nobleman's early preferments, when we consider him as the kinsman of Henry VIII. and that he was bred to the church by the king's special command.

Being now about the age of 19, he was sent, according to the fashion of the times, to finish his studies at Padua in Italy, where he resided some time in great splendor, having a handsome pension from the king. He returned to England in 1525, where he was most graciously received at court, and universally admired for his talents and address; but preferring study and sequestration to the pleasures of a court, he retired to the Carthusian convent at Shene, where he had continued about two years, when the pious king began to divulge his scruples of conscience concerning his marriage with Catharine of Spain. Pole foresaw that this affair would necessarily involve him in difficulties; he therefore determined to quit the kingdom, and accordingly obtained leave to visit Paris. Having thus avoided the storm for the present, he returned once more to his convent at Shene; but his tranquillity was again interrupted by the king's resolution to shake off the pope's supremacy, of which Pole's approbation was thought indispensably necessary. How he managed in this affair, is not very clear. However, he obtained leave to revisit Italy, and his pension was continued for some time.

The king, having now divorced Queen Catharine, married Anne Boleyn, and being resolved to throw off the papal yoke, ordered Dr Richard Sampson to write a book in justification of his proceedings, which he sent to Pole for his opinion. To this Pole, secure in the pope's protection, wrote a scurrilous answer, entitled *Pro Unitate Ecclesiastica*, and sent it to the king; who was so offended with the contents, that he withdrew his pension, stripped him of all his preferments, and procured an act of attainder to be passed against him. In the mean time, Pole was created a cardinal, and sent nuncio to different parts of Europe. King Henry made several attempts to have him secured and brought to England, but without effect. At length the pope fixed him as legate at Viterbo, where he continued till the year 1543, when he was appointed legate at the council of Trent, and was afterwards employed by the pope as his chief counsellor.

Pope Paul III. dying in 1549, Pole was twice elected his successor, and, we are told, twice refused the papal dignity: first, because the election was made in too great haste; and the second time, because it was done in the night. This delicacy in a cardinal is truly wonderful: but the intrigues of the French party seem to have been the real cause of his miscarriage; they started many objections to Pole, and by that means gained time to procure a majority against him. Cardinal Maria de Monte obtained the triple crown; and Pole, having kissed his slipper, retired to the convent of Magazune near Verona, where he continued till the death of Edward VI. in the year 1553. On the accession of queen Mary, Pole was sent legate to England, where he was received by her majesty with great veneration, and conducted

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ducted to the archbishop's palace at Lambeth; poor Cranmer being at that time prisoner in the Tower. He immediately appeared in the House of Lords, where he made a long speech; which being reported to the commons by their speaker, both these obsequious houses concurred in an humble supplication to be reconciled to the see of Rome. They presented it on their knees to her majesty, who interceded with the cardinal, and he graciously condescended to give them absolution. This business being over, the legate made his public entry into London, and immediately set about the extirpation of heresy. The day after the execution of Cranmer, which he is said, though we believe falsely, to have advised, he was consecrated archbishop of Canterbury. In the same year, 1556, he was elected chancellor of the university of Oxford, and soon after of Cambridge; both which he visited, by his commissioners. He died of a double quartan ague in the year 1558, about 16 hours after the death of the queen; and was buried in the cathedral of Canterbury.

As to his character, the Romish writers ascribe to him every virtue under heaven: even Bishop Burnet is extremely lavish in his praise, and attributes the cruelties of Mary's reign to the advice of Gardiner. In this Mr Hume agrees with the bishop, and represents Pole as the advocate of toleration. By every impartial account, he seems to have been a man of mild manners, and of real worth, though undoubtedly a zealous member of the church of Rome.—He wrote, *Pro unitate ecclesiastica, De ejusdem potestate*, A treatise on Justification, and various other tracts.

Mr Philips published a very well written, though a very partial account, of Pole's life, to which Glocester Ridley replied. This last work, which is entitled a *Review of Mr Philips's Life of Reginald Pole*, was published in 1766. It is a complete confutation of the former, and is a very learned and temperate vindication of the doctrines of the Reformation.

Pole, in astronomy, that point in the heavens round which the whole sphere seems to turn. It is also used for a point directly perpendicular to the centre of any circle's plane, and distant from it by the length of a radius.

Pole, in geography, one of the points on which the terraqueous globe turns; each of them being 90 degrees distant from the equator, and, in consequence of their situation, the inclination of the earth's axis, and its parallelism during the annual motion of our globe round the sun, having only one day and one night throughout the year.

1 The poles enjoy much light;

It is remarkable, that though the *north* in Hebrew, Greek, Latin, and French, derives its name from gloom, obscurity, and darkness, the poles enjoy more light than any other part of the world. The ancients believed the north to be covered with thick darkness; Strabo tells us, that Homer, by the word σοφος, which properly signifies *obscurity* or *darkness*, meant the *north*; and thus Tibullus, speaking of the north, says,

Illic et densa tellus absconditur umbra.
Paneg. ad Missel.

The Arabians call the northern ocean the *dark sea*; the Latins gave the name of *Aquilo* to the north wind, because *aquilus* signifies *black*; and the French call it *la bise*, from *bis* "black." According to the ancients, the Cimmerians lived in darkness, because they were placed near the north. But all this is mere prejudice; for there are no places in the world that enjoy light longer than the arctic and antarctic poles; and this is accounted for by considering the nature of twilight. In the torrid zone, and under the line, night immediately follows the setting of the sun, without any sensible twilight; whereas the twilight begins and continues increasing in proportion as places are distant from the equator or approach the pole. To this long twilight we must add the *aurora borealis*, which appears in the northern regions, Greenland, &c. in clear nights, at the beginning of the new moon, casting a light equal to that of full moon. See Gassendi *in the life of Peyresc*, book iii. and La Perere in his *Account of Greenland*. There is also long moonlight at the poles during winter. See Astronomy, n° 373. But though there is really more light in the polar regions than elsewhere, yet owing to the obliquity with which the rays of the sun fall upon them, and the great length of winter night, the cold is so intense, that those parts of the globe which lie near the poles have never been fully explored, though the attempt has been repeatedly made by the most celebrated navigators. Indeed their attempts have chiefly been confined to the northern regions; for with regard to the south pole, there is not the same incitement to attempt it. The great object for which navigators have ventured themselves in these frozen seas, was to find out a more quick and more ready passage to the East Indies*; and this hath been attempted three several ways: one by coasting along the northern parts of Europe and Asia, called the *north-east passage*; another, by sailing round the northern part of the American continent, called the *north-west passage*; and the third, by sailing directly over the pole itself.

2 And why.

* See Cook, p. 395. col. 2.

We have already given a short account of several unsuccessful attempts which have been made from England to discover the first two of these. See *North-West Passage*, and *North-East Passage*. But before we proceed to the third, we shall make a few further observations on them, and mention the attempts of some other nations.

3 Attempts to find out the north-east passage.

During the last century, various navigators, Dutchmen particularly, attempted to find out the *north-east passage*, with great fortitude and perseverance. They always found it impossible, however, to surmount the obstacles which nature had thrown in the way. Subsequent attempts are thought by many to have demonstrated the impossibility of ever sailing eastward along the northern coast of Asia; and this impossibility is accounted for by the increase of cold in proportion to the extent of land. See America, n° 3—5. This is indeed the case in temperate climates; but much more so in those frozen regions where the influence of the sun, even in summer, is but small. Hence, as the continent of Asia extends a vast way from west to east, and has besides the continent of Europe joined to it on the west, it follows, that about the middle part of that tract of land the cold should be greater than anywhere else. Experience has determined this to be fact; and it now appears, that about the middle part of the northern coast of Asia the ice never thaws; neither have even the hardy Russians and Siberians themselves been able to overcome the difficulties they met with in that part of their voyage. In order to make this the more plain and

4 Why it is impossible to sail along the north-east coast of Asia.

Pole. and the following accounts more intelligible, we shall observe, that from the north-western extremity of Europe, called the *North Cape*, to the north-eastern extremity of Asia, called the *Promontory of the Tschutski**, is a space including about 160 degrees of longitude, *viz.* from 40 to 200 east from Ferro: the port of Archangel lies in about 57 degrees east longitude, Nova Zembla between 70 and 95; which last is also the situation of the mouth of the great river Oby. Still farther eastward are the mouths of the rivers Jenisey in 100°; Piasida in 105°; Chatanga in 124°; Lena, which has many mouths, between 134° and 142°; Indigirka in 162°; and the Kovyma in 175°. The coldest place in all this tract, therefore, ought to be that between the mouths of the Jenisey and the Chatanga; and indeed here the unsurmountable difficulty has always been, as will appear from the following accounts of the voyages made by the Russians with a view to discover the north-east passage.

* See Cook's *Discoveries*, n° 109. and 118.

5 Voyage of Morzovieff, &c.

In 1734, lieutenant Morzovieff sailed from Archangel towards the river Oby, but could scarce advance 20 degrees of longitude during that season. The next summer he passed through the straits of Weygatz into the sea of Kara; but did not double the promontory which separates the sea of Kara from the bay or mouth of Oby. In 1738, the lieutenants Malgyin and Shurakoff doubled that promontory with great difficulty, and entered the bay of Oby. Several unsuccessful attempts were made to pass from the bay of Oby to the Jenisey; which was at last effected, in 1738, by two vessels commanded by lieutenants Offzin and Koskeleff. The same year the pilot Feodor Menin sailed eastwards from the Jenisey to the mouth of the Piasida: but here he was stopped by the ice; and finding it impossible to force a passage, he returned to the Jenisey.

6 Of Prontshistcheff.

In July 1735, lieutenant Prontshistcheff sailed down the river Lena, in order to pass by sea to the mouth of the Jenisey. The western mouths of the Lena were so choaked up with ice, that he was obliged to pass thro' the most easterly one; and was prevented by contrary winds from getting out till the 13th of August. Having steered north-west along the islands which lie scattered before the mouths of the Lena, he found himself in lat. 70. 4.; yet even here he saw pieces of ice from 24 to 60 feet in height, and in no place was there a free channel left of greater breadth than 100 or 200 yards. His vessel being much damaged, he entered the mouth of the Olenek, a small river near the western mouth of the Lena; and here he continued till the ensuing season, when he got out in the beginning of August. But before he could reach the mouth of the Chatanga, he was so entirely surrounded and hemmed in with ice, that it was with the utmost difficulty he could get loose. Observing then a large field of ice stretching into the sea, he was obliged to sail up the Chatanga. Getting free once more, he proceeded northward, doubled the cape called *Taimura*, and reached the bay of that name, lying in about 115° east from Ferro; from thence he attempted to proceed westward along the coast. Near the shore were several small islands, between which and the shore the ice was immoveably fixed. He then directed his course towards the sea, in order to pass round the chain of islands. At first he found the sea more free to the north of these islands, but observed much ice lying between them. At last he arrived at what he took to be the last of the islands, lying in lat. 77. 25. Between this island and the shore, as well as on the other side of the island which lay most to the north, the ice was firm and immoveable. He attempted, however, to steer still more to the north; and having advanced about six miles, he was prevented by a thick fog from proceeding: this fog being dispersed, he saw nothing everywhere but ice, which at last drove him eastward, and with much danger and difficulty he got to the mouth of the Olenek on the 29th of August.

7 Of Chariton Laptieff.

Another attempt to pass by sea from the Lena to the Jenisey was made in 1739 by Chariton Laptieff, but with no better success than that just mentioned. This voyager relates, that between the rivers Piasida and Taimura, a promontory stretches into the sea, which he could not double, the sea being entirely frozen up before he could pass round.

8 Mr Coxe's observations.

Besides the Russians, it is certain that some English and Dutch vessels have passed the island of Nova Zembla into the sea of Kara: "But (says Mr Coxe in his Account of the Russian voyages) no vessel of any nation has ever passed round that cape which extends to the north of the Piasida, and is laid down in the Russian charts in about 78° lat. We have already seen that no Russian vessel has ever got from the Piasida to the Chatanga, or from the Chatanga to the Piasida; and yet some authors have positively asserted that this promontory has been sailed round. In order therefore to elude the Russian accounts, which clearly assert the contrary, it is pretended that Gmelin and Muller have purposely concealed some parts of the Russian journals, and have imposed on the world by a misrepresentation of facts. But without entering into any dispute upon this head, I can venture to affirm, that no sufficient proof has been as yet advanced in support of this assertion; and therefore, until some positive information shall be produced, we cannot deny plain facts, or give the preference to hearsay evidence over circumstantial and well attested accounts."

9 Of the navigation from the Lena to Kamschatka.

The other part of this north-east passage, *viz.* from the Lena, to Kamschatka, though sufficiently difficult and dangerous, is yet practicable; as having been once performed, if we may believe the accounts of the Russians. According to some authors indeed, says Mr Coxe, this navigation has been open a century and an half; and several vessels at different times have passed round the north-eastern extremity of Asia. But if we consult the Russian accounts, we shall find that frequent expeditions have been unquestionably made from the Lena to the Kovyma, but that the voyage from the Kovyma round Tschutskoi Noss into the Eastern Ocean has been performed but once. According to Mr Muller, this formidable cape was doubled in the year 1648. The material incidents of this remarkable voyage are as follow.

10 Voyage of Deshneff, Ankudinoff, &c.

"In 1648 seven kotches, or vessels, sailed from the mouth of the river Kovyma, in order to penetrate into the Eastern Ocean. Of these, four were never more heard of: the remaining three were commanded by Simon Deshneff, Gerasim Ankudinoff, and Fedot Alexeeff. Deshneff and Ankudinoff quarrelled before their departure concerning the division of profits and honours to be acquired by their voyage; which, however, was not so easily accomplished as they had imagined. Yet

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Deſhneff in his memorials makes no mention of obſtructions from the ice, nor probably did he meet with any; for he takes notice that the ſea is not every year ſo free from ice as it was at that time. The veſſels ſailed from the Kovyma on the 20th of June, and in September they reached the promontory of the Tſchutſki, where Ankudinoff's veſſel was wrecked, and the crew diſtributed among the other two. Soon after this the two veſſels loſt ſight of each other, and never joined again. Deſhneff was driven about by tempeſtuous winds till October, when he was ſhipwrecked conſiderably to the ſouth of the Anadyr. Having at laſt reached that river, he formed a ſcheme of returning by the ſame way that he had come; but never made the attempt. As for Alexeeff, after being alſo ſhipwrecked, he had died of the ſcurvy, together with Ankudinoff; part of the crew were killed by the ſavages, and a few eſcaped to Kamſchatka, where they ſettled."

* See Cook's *Diſcoveries*, nº 95—100.

From Captain* Cook's voyage towards the north-eaſtern parts of Aſia, it appears, that it is poſſible to double the promontory of Tſchutſki without any great difficulty: and it now appears, that the continents of Aſia and America are ſeparated from one another but by a narrow ſtrait, which is free from ice; but, to the northwards, that experienced navigator was everywhere ſtopped by ice in the month of Auguſt, ſo that he could neither trace the American continent farther than to the latitude of 70°, nor reach the mouth of the river Kovyma on the Aſiatic continent; though it is probable that this might have been done at another time when the ſituation of the ice was altered either by winds or currents.

11 Inſurmountable obſtacles in the north-eaſt paſſage.

On the whole, therefore, it appears that the inſurmountable obſtacle in the north-eaſt paſſage lies between the rivers Piaſida and Chatanga; and unleſs there be in that ſpace a connection between the Aſiatic and American continents, there is not in any other part. Ice, however, is as effectual an obſtruction as land: and though the voyage were to be made by accident for once, it never could be eſteemed a paſſage calculated for the purpoſes of trade, or any other beneficial purpoſe whatever.

12 Of the north weſt paſſage.

With regard to the north-weſt paſſage, the ſame difficulties occur as in the other. Captain Cook's voyage has now aſſured us, that if there is any ſtrait which divides the continent of America into two, it muſt lie in a higher latitude than 70°, and conſequently be perpetually frozen up. If a north-weſt paſſage can be found then, it muſt be by ſailing round the whole American continent, inſtead of ſeeking a paſſage through it, which ſome have ſuppoſed to exiſt in the bottom of Baffin's Bay. But the extent of the American continent to the northward is yet unknown; and there is a poſſibility of its being joined to that part of Aſia between the Piaſida and Chatanga, which has never yet been circumnavigated* It remains therefore to conſider, whether there is any poſſibility of attaining the wiſhed for paſſage by ſailing directly north, between the eaſtern and weſtern continents.

* See Cook's *Diſcoveries*, nº 11.

13 Barrington's arguments in favour of a poſſibility of reaching the pole.

Of the practicability of this method, the Honourable Daines Barrington is very confident, as appears by ſeveral tracts which he publiſhed in the years 1775 and 1776, in conſequence of the unſucceſsful attempts made by Captain Phipps, now Lord Mulgrave. See NORTH-*Eaſt Paſſage*, p. 108. col. 1. top of the page.—In theſe tracts he inſtances a great number of navigators who have reached very high northern latitudes; nay, ſome who have been at the pole itſelf, or gone beyond it.—Theſe inſtances are, 1. One Captain Thomas Robertſon aſſured our author, that he had been in latitude 82½, that the ſea was open, and he was certain that he could have reached the latitude of 83°.—2. From the teſtimony of Captain Cheyne, who gave anſwers to certain queries drawn up by Mr Dalrymple concerning the polar ſeas, it appears that he had been in the latitude of 82°.—3. One Mr Watt informed our author, that when he was 17 years of age, at that time making his firſt voyage with Captain M'Callam, a bold and ſkilful navigator, who commanded a Scotch whale-fiſhing ſhip, as during the time that the whales are ſuppoſed to copulate no fiſhing can be carried on, the captain reſolved to employ that interval in attempting to reach the north pole. He accordingly proceeded without the leaſt obſtruction to 83½, when the ſea was not only open to the northward, but they had ſeen no ice for the laſt three degrees; but while he ſtill advanced, the mate complained that the compaſs was not ſteady, and the captain was obliged with reluctance to give over his attempt.—4. Dr Campbell, the continuator of Harris's voyages, informed Mr Barrington, that Dr Dallie, a native of Holland, being in his youth aboard a Dutch ſhip of war which at that time was uſually ſent to ſuperintend the Greenland fiſhery, the captain determined, like the Scotchman above-mentioned, to make an attempt to reach the pole during the interval between the firſt and ſecond fiſheries. He penetrated, according to the beſt of Dr Campbell's recollection, as far as 88°; when the weather was warm, the ſea free from ice, and rolling like the bay of Biſcay. Dallie now preſſed the captain to proceed: but he anſwered, that he had already gone too far, and ſhould be blamed in Holland for neglecting his ſtation; upon which account he would ſuffer no journal to be kept, but returned as ſoon as poſſible to Spitſbergen.—5. In the year 1662-3, Mr Oldenburg, then ſecretary of the Royal Society, was ordered to regiſter a paper, entitled "Several inquiries concerning Greenland, anſwered by Mr Gray, who had viſited theſe parts." The 19th of theſe queries is the following: How near hath any one been known to approach the pole?—The anſwer is, "I once met upon the coaſt of Greenland a Hollander that ſwore he had been half a degree from the pole, ſhowing me his journal, which was alſo atteſted by his mate; where they had ſeen no ice or land, but all water."—6. In Captain Wood's account of a voyage in queſt of the north-eaſt paſſage, we have the following account of a Dutch ſhip which reached the latitude of 89. "Captain Goulden, who had made above 30 voyages to Greenland, did relate to his majeſty, that being at Greenland ſome 20 years before, he was in company with two Hollanders to the eaſtward of Edge's iſland; and that the whales not appearing on the ſhore, the Hollanders were determined to go farther northward; and in a fortnight's time returned, and gave it out that they had ſailed into the latitude 89°, and that they did not meet with any ice, but a free and open ſea, and that there run a very hollow *grown* ſea like that of the Bay of Biſcay. Mr Goulden being not ſatisfied with the bare relation, they produced him four journals out of the two ſhips, which teſtified the ſame, and that they all agreed within four minutes."

Pole. minutes."—7. In the Philosophical Transactions for 1675 we have the following passage: "For it is well known to all that sail northward, that most of the northern coasts are frozen up for many leagues, though in the open sea it is not so, *no nor under the pole itself*, unless by accident." In which passage the having reached the pole is alluded to as a known fact, and as such stated to the Royal Society.—8. Mr Miller, in his Gardener's Dictionary, mentions the voyage of one Captain Johnson, who reached 88 degrees of latitude. Mr Barrington was at pains to find a full account of this voyage; but met only with the following passage in Buffon's Natural History, which he takes to be a confirmation of it. "I have been assured by persons of credit, that an English captain, whose name was Monson, instead of seeking a passage to China between the northern countries, had directed his course to the pole, and had approached it within two degrees, where there was an open sea, without any ice." Here he thinks that Mr Buffon has mistaken Johnson for Monson.—9. A map of the northern hemisphere, published at Berlin (under the direction of the Academy of Sciences and Belles Letters), places a ship at the pole, as having arrived there according to the Dutch accounts.—10. Moxon, hydrographer to Charles II. gives an account of a Dutch ship having been two degrees beyond the pole, which was much relied on by Wood. This vessel found the weather as warm there as at Amsterdam.

Besides these, there are a great number of other testimonies of ships which have reached the lat. of 81, 82, 83, 84 (A), &c.; from all which our author concludes, that if the voyage is attempted at a proper time of the year, there would not be any great difficulty of reaching the pole. Those vast pieces of ice which commonly obstruct the navigators, he thinks, proceed from the mouths of the great Asiatic rivers which run northward into the frozen ocean, and are driven eastward and westward by the currents. But though we should suppose them to come directly from the pole, still our author thinks that this affords an undeniable proof that the pole itself is free from ice; because, when the pieces leave it, and come to the southward, it is impossible that they can at the same time accumulate at the pole.

Pole. 14 Why we cannot suppose the sea all round the pole to be frozen.

The extreme cold of the winter air on the continents of Asia and America has afforded room for suspicion, that at the pole itself, and for several degrees to the southward of it, the sea must be frozen to a vast depth in one solid cake of ice; but this Mr Barrington refutes from several considerations. In the first place, he says, that on such a supposition, by the continual intensity of the cold, and the accumulation of snow and frozen vapour, this cake of ice must have been increasing in thickness since the creation, or at least since the deluge; so that now it must be equal in height to the highest mountains in the world, and be visible at a great distance. Besides, the pieces broken off from the sides of such an immense mountain must be much thicker than any ice that is met with in the northern ocean; none of which is above two yards in height above the surface of the water, those immense pieces called *ice-mountains* being always formed on land.

Again, the system of nature is so formed, that all parts of the earth are exposed for the same length of time, or nearly so, throughout the year to the rays of the sun. But, by reason of the spheroidal figure of the terraqueous globe, the poles and polar regions enjoy the sun somewhat longer than others; and hence the Dutch who wintered in Nova Zembla in 1672 saw the sun a fortnight sooner than they ought to have done by astronomical calculations. By reason of this flatness about the poles, too, the sun not only shines for a greater space of time on these inhospitable regions, but with less obliquity in the summer-time, and hence the effect of his rays must be the greater. Now Mr Barrington considers it as an absurd supposition, that this glorious luminary should shine for six months on a cake of barren ice where there is neither animal nor vegetable. He says that the polar seas are assigned by nature as the habitation of the whales, the largest animals in the creation; but if the greatest part of the polar seas are for ever covered with an impenetrable cake of ice, these huge animals will be confined within very narrow bounds; for they cannot subsist without frequently coming to the top of the water to breathe.

15 Quantity of ice formed is not always in proportion to the degree of cold.

Lastly, the quantity of water frozen by different degrees of cold is by no means directly in proportion to the

(A) See *M. Bauche's Observations on the North or Ice Sea*, where he gives an account of various attempts made to reach the pole, from which he is convinced that the sea is there open, and that the thing is practicable. M. de Pages, in his *Travels*, Vol. III. informs us, that he wished to take a voyage to the north seas, for the purpose of bringing under one view the various obstacles from the ice, which have impeded the researches of navigators in those seas; and for this purpose he was prepared to continue his voyage to as high a latitude as possible, and that he might be able to say whether any land actually exists north from the coast of Greenland. He sailed without any encouragement from his court (France) on the 16th of April 1776 from the Texel, in a Dutch vessel bound to Spitsbergen. On the 16th of May she was a little way north of 81°, the highest latitude she reached.

"Being now (says the author) less than 180 leagues from the pole, the idea of so small a distance served effectually to awaken my curiosity. Had I been able to inspire my fellow-voyagers with sentiments similar to my own, the winds and currents which at this moment carried us fast towards the pole, a region hitherto deemed inaccessible to the eye of mortals, would have been saluted with acclamations of joy. This quarter, however, is not the most eligible for such an enterprize: here the sea lying in the vicinity of those banks of ice, so frequent a little farther to the west, is much too confined. Nevertheless, when I consider the very changeable nature of the shoals under whatever form, even in their most crowded and compact state; their constant changes and concussions which break and detach them from one another, and the various expedients that may be employed for freeing the ship from confinement, as well as for obviating impending danger—I am far from viewing a voyage to the pole as a chimerical idea."

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the intensity of the cold, but likewise to the duration of it. Thus, large bodies of water are never frozen in any temperature of short duration, though shallow bodies often are. Our author observes, that as much of a given mass of water was frozen in five hours of a temperature 12° below the freezing point, as was frozen in one hour of the temperature 50° below it; and that long duration of the temperature between 20 and 32 is, with regard to the congelation of water, equivalent to intensity of cold such as is marked 0 and below 0 in Fahrenheit, but of short duration. See COLD and CONGELATION.

16 Mr Forster's arguments against the possibility of reaching the pole.

On the other hand, Mr Forster, in his Observations, takes the contrary side of the question with no little vehemence. "I know (says he) that M. de Buffon, Lomonosof, and Crantz, were of opinion, that the ice found in the ocean is formed near the lands only from the fresh water and ice carried down into the sea by the many rivers in Siberia, Hudson's Bay, &c.; and therefore, when we fell in with such quantities of ice in December 1772, I expected we should soon meet with the land from whence these ice masses had been detached. But being disappointed in the discovery of this land, though we penetrated beyond the 67° twice, and once beyond 71°, south latitude, and having besides some other doubts concerning the existence of the pretended southern continent, I thought it necessary to inquire what reasons chiefly induced the above authors to form the opinion that the ice floating in the ocean must be formed near land, or that an austral land is absolutely requisite for that purpose; and having looked for their arguments, I find they amount chiefly to this: 'That the ice floating in the ocean is all fresh: that salt water does not freeze at all; or if it does, it contains briny particles. They infer from thence, that the ice in the ocean cannot be formed in the sea far from any land: there must therefore exist austral lands; because, in order to form an idea of the original of the great ice-masses agreeably to what is observed in the northern hemisphere, they find that the first point for fixing the high ice-islands is the land; and, secondly, that the great quantity of flat ice is brought down the rivers.' I have impartially and carefully considered and examined these arguments, and compared every circumstance with what we saw in the high southern latitude, and with other known facts; and will here insert the result of all my inquiries on this subject.

"First, they observe the ice floating in the ocean to yield, by melting, fresh water: which I believe to be true. However, hitherto it has by no means been generally allowed to be fresh: for Crantz says expressly, that 'the flat pieces (forming what they call the *ice-fields)* are salt, because they were congealed from sea-water.' The ice taken up by us for watering the ship was of all kinds, and nevertheless we found it constantly fresh: Which proves, either that the principle of analogy cannot be applied indiscriminately in both hemispheres; and that one thing may be true in the northern hemisphere which is quite otherwise in the southern, from reasons not yet known or discovered by us; or we must think that Crantz and others are mistaken, who suppose the ice floating in the ocean to be salt.

"The next remark is, That salt water does not freeze at all; or if it does, it contains briny particles. M. de Buffon tells us, 'that the sea between Nova Zembla and Spitzbergen, under the 79° north latitude, does not freeze, as it is there considerably broad: and that it is not to be apprehended to find the sea frozen not even under the pole itself; for indeed there is no example of having ever found a sea wholly frozen over, and at a considerable distance from the shores; that the only instance of a sea entirely frozen is that of the Black Sea, which is narrow and not very salt, and receives a great many rivers coming from northern regions, and bringing down ice: that this sea therefore sometimes freezes to such a degree, that its whole surface is congealed to a considerable thickness; and, if the historians are to be credited, was frozen, in the reign of the emperor Constantine Copronymus, 30 ells thick, not including 20 ells of snow which was lying on the ice. This fact, continues M. de Buffon, seems to be exaggerated: but it is true, however, that it freezes almost every winter; whilst the high seas which are 1000 leagues nearer towards the pole do not freeze; which can have no other cause than the difference in saltness, and the little quantity of ice carried out by rivers, if compared to the enormous quantity of ice which the rivers convey into the Black Sea.' M. de Buffon is not mistaken when he mentions that the Black Sea frequently freezes. Strabo informs us, that the people near the Bosphorus Cimmerius pass this sea in carts from Panticapæum to Phanagorea; and that Neoptolemus, a general of Mithridates Eupator, won a battle with his cavalry on the ice on the very spot where he gained a naval victory in the summer. Marcellinus Comes relates, that under the consulship of Vincentius and Fravita, in the year 401 after Christ, the whole surface of the Pontus was covered with ice, and that the ice in spring was carried through the Propontis, during 30 days, like mountains. Zonaras mentions the sea between Constantinople and Scutari frozen to such a degree in the reign of Constantine Copronymus, that even loaded carts passed over it. The prince Demetrius Cantemir observes, that in the year 1620-1 there happened so intense a frost, that the people walked over the ice from Constantinople to Iskodar. All these instances confirm M. de Buffon's assertion. But as this great natural historian says that the Black Sea is the only instance of a sea being entirely frozen (B), I must beg leave to dissent from him; for it is equally well attested that the Baltic is sometimes entirely frozen, according to Caspar Schutz's account. In the year 1426, the winter was so severe, that people travelled over the ice across the Baltic from Dantzic to Lubeck; and the sea was likewise passable from Denmark to Mecklenburgh: and in the year 1459 the whole Baltic was entirely frozen, so that persons travelled, both on foot and on horseback, over

(B) In the year 860 the Mediterranean was covered with ice, so that people travelled in carts and horses across the Ionian Sea to Venice; *(Hermannus Contractus ap. Pistor. Script.* t. ii. p. 236.) And in 1234 the Mediterranean was again thus frozen, that the Venetian merchants travelled over the ice with their merchandise to what place they chose; *Matth. Paris*, p. 78.

Pole. over ice from Denmark to the Venedick Hanſ-towns, called *Lubeck*, *Wiſmar*, *Roſtock*, and *Stralſund*, which had never happened before; people likewiſe travelled acroſs the Baltic over ice from Reval in Eſtland to Denmark and to Sweden, and back again, without the leaſt danger (c). But, according to Sæmund Frode, even the great German Ocean between Denmark and Norway was frozen in the year 1048, ſo that the wolves frequently ran over the ice from one country to the other. The great northern ocean is likewiſe moſt certainly ſometimes frozen to a great diſtance from any land: for Muller relates, that in the year 1715 a Coſſack called *Markoff*, with ſome other perſons, was ſent by the Ruſſian government to explore the north ſea; but finding it next to impoſſible to make any progreſs during ſummer on account of the vaſt quantities of ice commonly filling this ocean, he at laſt determined to try the experiment during winter. He therefore took ſeveral ſledges drawn according to the cuſtom of the country by dogs, which commonly go about 80 or 100 verſts per day, 105 of which make a degree; and on March the 15th, old ſtyle, with this caravan of nine perſons, he left the ſhores of Siberia at the mouth of the river Yana, under the 71° of north latitude, and proceeded for ſeven days together northward, ſo that he had reached at leaſt the 77° or 78° north latitude, when he was ſtopped by the ice, which there began to appear in the ſhape of prodigious mountains. He climbed up to the top of ſome of theſe ice-mountains: but ſeeing from thence no land, nor any thing except ice as far as the eye could reach, and having beſides no more food for his dogs left, he thought it very neceſſary to return; which he with great difficulty performed, on April the 3d, as ſeveral of the dogs, which had periſhed for want, were employed to ſupport thoſe that remained alive. Theſe facts, I believe, will convince the unprejudiced reader, that there are other ſeas beſides the Black Sea which really do freeze in winter, and that the ice carried down the rivers could not at leaſt freeze the German Ocean between Norway and Denmark, becauſe the rivers there are ſo ſmall, and bear a very inconſiderable proportion to the immenſe ocean, which, according to experiments made by Mr Wilke, is very ſalt, though near the land, in the Swediſh harbour of Landſcrona.

"Now, if ſix or ſeven degrees of latitude, containing from 360 to 420 ſea-miles, are not to be reckoned a great diſtance from the land, I do not know in what manner to argue, becauſe no diſtance whatſoever will be reckoned far from any land. Nay, if the Coſſack Markoff, being mounted on one of the higheſt ice-mountains, may be allowed to ſee at leaſt to the diſtance of 20 leagues, the extent alluded to above muſt then be increaſed to 480 Engliſh ſea-miles; which certainly is very conſiderable, and makes it more than probable that the ocean is frozen in winter, in high northern latitudes, even as far as the pole. Beſides, it invalidates the argument which theſe gentlemen wiſh to infer from thence, *that the ocean does not freeze in high latitudes, eſpecially where there is a conſiderably broad ſea*; for we have ſhown inſtances to the contrary. Pole.

"But M. de Buffon ſpeaks of ice carried down the rivers into the northern ocean, and forming there theſe immenſe quantities of ice. 'And in caſe, ſays he, we would ſuppoſe, againſt all probability, that at the pole it could be ſo cold as to congeal the ſurface of the ſea, it would remain equally incomprehenſible how theſe enormous floating ice-maſſes could be formed, if they had not land for a point to fix on, and from whence they are ſevered by the heat of the ſun. The two ſhips which the India Company ſent in 1739 upon the diſcovery of the auſtral lands, found ice in 47° or 48° ſouth latitude, but at no great diſtance from land; which they diſcovered, without being able to approach it. This ice, therefore, muſt have come from the interior parts of the lands near the ſouth pole; and we muſt conjecture, that it follows the courſe of ſeveral large rivers, waſhing theſe unknown lands, in the ſame manner as the rivers Oby, the Yeniſea, and the other great rivers which fall into the northern ſea, carry the ice-maſſes, which ſtop up the ſtraits of Waigats for the greater part of the year, and render the Tartarian ſea inacceſſible upon this courſe.' Before we can allow the analogy between the rivers Oby, Yeniſea, and the reſt which fall into the northern ocean, and thoſe coming from the interior parts of the auſtral lands, let us compare the ſituation of both countries, ſuppoſing the auſtral lands really to exiſt. The Oby, Yeniſea, and the reſt of the Siberian rivers, falling down into the northern

(c) In 1296 the Baltic was frozen from Gothland to Sweden. (*Incerti auctoris Annales Denor. in Weſtphalii monument. Cimbr.* t. i. p. 1392.

In 1306 the Baltic was, during fourteen weeks, covered with ice between all the Daniſh and Swediſh iſlands. (*Ludwig. reliquiæ, MSS.* t. ix. p. 170.)

In 1323 there was a road for foot-paſſengers and horſemen over the ice on the Baltic during ſix weeks. (*id. ibid.*)

In 1349, people walking over the ice from Stralſund to Denmark. (*Incerti auct. cit. ap. Ludwig.* t. ix. p. 181.)

In 1408 the whole ſea between Gothland and Oeland, and likewiſe between Roſtock and Gezoer, was frozen. (*id. ibid.*)

In 1423 the ice bore riding from Pruſſia to Lubec. (*Crantzii Vandal.* l. x. c. 40.) The whole ſea was covered with ice from Mecklenburg to Denmark. (*Incert. auct. ap. Ludwig.* t. ix. p. 125.)

In 1461 (ſays *Nicol. Marſchallus in Annal. Herul. ap. Weſtphal.* t. i. p. 261.) Tanta erat hyems, ut concreto gelu oceano plauſtris millia paſſuum ſupra CCC merces ad ultimam Thylen (*Iceland*) et Orcades veherentur e *Germania* tota pene bruma.

In 1545 the ſea between Roſtock and Denmark, and likewiſe between Fionia and Sealand, was thus frozen, that the people travelled over the ice on foot, with ſledges to which horſes and oxen were put. (*Anonym. ap. Ludwig.* t. ix. p. 176.)

In 1294 the Cattegat or ſea between Norway and Denmark was frozen; that from Oſlo in Norway, they could travel on it to Jutland. (*Strelow Chron. Juthiland*, p. 148.)

northern ocean, have their sources in 48° and 50° north latitude, where the climate is mild and capable of producing corn of all kinds. All the rivers of this great continent increasing, these great rivers have likewise their sources in mild and temperate climates, and the main direction of their course is from south to north; and the coast of the northern ocean, not reckoning its sinuosities, runs in general west and east. The small rivers which are formed in high latitudes have, properly speaking, no sources, no springs, but carry off only the waters generated by the melting of snow in spring, and by the fall of rain in the short summer, and are for the greatest part dry in autumn. And the reason of this phenomenon is obvious, after considering the constitution of the earth in those high northern climates. At Yakutsk, in about 62° north latitude, the soil is eternally frozen, even in the height of summer, at the depth of three feet from the surface. In the years 1685 and 1686, an attempt was made to dig a well; and a man, by great and indefatigable labour, continued during two summer-seasons, and succeeded so far in this laborious task, that he at last reached the depth of 91 feet; but the whole earth at this depth was frozen, and he met with no water; which forced him to desist from so fruitless an attempt. And it is easy to infer from hence how impossible it is that springs should be formed in the womb of an eternally frozen soil.

17 Of the freezing of salt-water.

"The argument, therefore, is now reduced to this, *That salt water does not freeze at all; or, if it does, the ice contains briny particles.* But we have already produced numberless instances, that the sea does freeze; nay, Crantz allows, *that the flat pieces of ice are salt, because they were congealed from sea-water.* We beg leave to add a few decisive facts relative to the freezing of the sea. Barentz observes in the year 1596, September the 16th, the sea froze two fingers thick, and next night the ice was as thick again. This happened in the midst of September; what effect then must the intense frost of a night in January not produce? When Captain James wintered in Charleton's Isle, the sea froze in the middle of December 1631. It remains, therefore, only to examine, whether the ice formed in the sea must necessarily contain briny particles. And here I find myself in a very disagreeable dilemma; for during the intense frost of the winter in 1776, two sets of experiments were made on the freezing of sea-water, and published, contradicting one another almost in every material point. The one by Mr Edward Nairne F. R. S. an ingenious and accurate observer; the other by Dr Higgins, who reads lectures on chemistry and natural philosophy, and consequently must be supposed to be well acquainted with the subject. I will therefore still venture to consider the question as undecided by these experiments, and content myself with making a few observations on them: but previously I beg leave to make this general remark, that those who are well acquainted with mechanics, chemistry, natural philosophy, and the various arts which require a nice observation of minute circumstances, need not be informed, that an experiment or machine succeeds often very well when made upon a smaller scale, but will not answer if undertaken at large; and, *vice versa*, machines and experiments executed upon a small scale will not produce the effect which they certainly have when made in a more enlarged manner. A few years ago an experiment made on the dyeing of scarlet, did not succeed when undertaken on a small scale, whereas it produced the desired effect when tried at a dyer's house with the large apparatus; and it evidently confirms the above assertion, which I think I have a right to apply to the freezing of salt-water. It is therefore probable, that the ice formed in the ocean at large, in a higher latitude, and in a more intense degree of cold, whereof we have no idea here, may become solid, and free from any briny particles, though a few experiments made by Dr Higgins, in his house, on the freezing of salt-water, produced only a loose spongy ice filled with briny particles.

18 Result of Mr Nairn's experiments on this subject.

"The ice formed of sea-water by Mr Nairne was very hard, 3½ inches long, and 2 inches in diameter: it follows from thence, that the washing the outside of this ice in fresh water, could not affect the inside of a hard piece of ice. This ice when melted yielded fresh water, which was specifically lighter than water which was a mixture of rain and snow-water, and next in lightness to distilled water. Had the ice thus obtained not been fresh, the residuum of the sea-water, after this ice had been taken out, could not have been specifically heavier than sea-water, which, however, was the case in Mr Nairne's experiment. It seems, therefore, in my opinion, evident from hence, that salt-water does freeze, and has no other briny particles than what adhere to its outside. All this perfectly agrees with the curious fact related by Mr Adanson (D), who had brought to France two bottles of sea-water, taken up in different parts of the ocean, in order to examine it, and to compare its saltness, when more at leisure; but both the bottles containing the salt-water were burst by being frozen, and the water produced from melting the ice proved perfectly fresh. This fact is so fairly stated, and so very natural, that I cannot conceive it is necessary to suppose, without the least foundation for it, *that the bottles were changed, or that Mr Adanson does not mention the circumstance by which the sea-water was thus altered upon its being dissolved*: for as he expressly observes the bottles to have been burst, it is obvious that the concentrated briny parts ran out, and were entirely drained from the ice, which was formed of the fresh water only.

"The ice formed by Dr Higgins from sea-water, *consisted of thin laminæ, adhering to each other weakly.* Dr Higgins took out the frozen ice from the vessels wherein he exposed the sea-water, and continued to do so till the remaining concentrated sea-water began to form crystals of sea-salt. Both these experiments, therefore, by no means prove what the Doctor intended to infer from thence; for it was wrong to take out such ice, which only *consisted of thin laminæ, adhering to each other weakly.* Had he waited with patience, he would have obtained a hard ice as well as Mr Nairne, which, by a more perfect congelation, would have excluded the

(D) Second Supplement to the Probability of reaching the North Pole, p. 119.

the briny particles intercepted between the *thin laminæ, adhering to each other weakly*; and would have connected the laminæ, by others formed by fresh water. The Doctor found afterwards, it is true, thicker and somewhat more solid ice: but the sea-water had already been so much concentrated by repeated congelations, that it is no wonder the ice formed in it became at last brackish: it should seem, then, that no conclusive arguments can be drawn from these experiments.

"There are two other objections against the formation of the ice in the great ocean. The *first* is taken from the immense bulk and size of the ice masses formed in the ocean, which is *the deepest mass of water we know of*. But it has been experimentally proved, that in the midst of summer, in the latitudes of 55°, 55° 26′, and 64° south, at 100 fathoms depth, the thermometer stood at 34°, 34°½ and 32°; and that in all instances, the difference between the temperature at top and 100 fathoms depth never exceeded four degrees of Fahrenheit's thermometer, or that the temperature of the air did not differ five degrees from that of the ocean at 100 fathom deep. If we now add to this, that beyond the 71° south the temperature of the air and ocean must be still colder, and that the rigours of an antarctic winter are certainly more than sufficient to cool the ocean to 28°½, which is requisite for congealing the aqueous particles in it; if we moreover consider, that these severe frosts are continued during six or eight months of the year, we may easily conceive that there is time enough to congeal large and extensive masses of ice. But it is likewise certain, that there is more than one way by which those immense ice masses are formed. We suppose very justly, that the ocean does freeze, having produced so many instances of it; we allow likewise, that the ice thus formed in a calm, perhaps does not exceed three or four yards in thickness; a storm probably often breaks such an ice-field, which Crantz allows to be 200 leagues one way and 80 the other; the pressure of the broken fragments against one another frequently sets one upon the other piece, and they freeze in that manner together; several such double pieces, thrown by another pressure upon one another, form at last large masses of miles extent, and of 20, 40, 60, and more fathoms thickness, or of a great bulk or height. Martens, in his description of Spitzbergen, remarks, that the pieces of ice cause so great a noise by their shock, that the navigators in those regions can only with difficulty hear the words of those that speak; and as the ice-pieces are thrown one upon another, ice-mountains are formed by it. And I observed very frequently, in the years 1772 and 1773, when we were among the ice, masses which had the most evident marks of such a formation, being composed of strata of some feet in thickness. This is in some measure confirmed by the state in which the Cossack Markoff found the ice at the distance of 420 miles north from the Siberian coasts. The high masses were not found formed, as is suspected in the *Second supplement to the probability of reaching the north pole*, p. 143-145, near the land, under the high cliffs, but far out at sea; and when these ice mountains were climbed by Markoff, nothing but ice, and no vestiges of land, appeared as far as the eye could reach. The high climates near the poles are likewise subject to heavy falls of snow, of several yards in thickness, which grow more and more compact, and by thaws and rain are formed into solid ice, which increase the stupendous size of the floating ice mountains.

"The *second* objection against the freezing of the ocean into such ice as is found floating in it, is taken from the *opacity* of ice formed in salt water; because the largest masses are commonly transparent like crystals with a fine blue tint, caused by the reflection of the sea. This argument is very specious, and might be deemed unanswerable by those who are not used to cold winters and their effects. But whosoever has spent several winters in countries which are subject to intense frosts, will find nothing extraordinary or difficult in this argument: for it is a well-known fact in cold countries, that the ice which covers their lakes and rivers is often opaque, especially when the frost sets in, accompanied by a fall of snow; for, in those instances, the ice looks, before it hardens, like a dough or paste, and when congealed it is opaque and white; however, in spring, a rain and the thaw, followed by frosty nights, change the opacity and colour of the ice, and make it quite transparent and colourless like a crystal: but, in case the thaw continues, and it ceases entirely to freeze, the same transparent ice becomes soft and porous, and turns again entirely opaque. This I believe may be applicable to the ice seen by us in the ocean. The field-ice was commonly opaque; some of the large masses, probably drenched by rain, and frozen again, were transparent and pellucid; but the small fragments of loose ice, formed by the decay of the large masses, and soaked by long-continued rains, we found to be porous, soft, and opaque.

"It is likewise urged as an argument against the formation of ice in the ocean, that it always requires land, in order to have a point upon which it may be fixed. First, I observe, that in Mr Nairne's experiments, the ice was generated on the surface, and was seen shooting crystals downwards: which evidently evinces, in my opinion, that ice is there formed or generated where the intensest cold is; as the air sooner cools the surface than the depth of the ocean, the ice shoots naturally downwards, and cools the ocean more and more, by which it is prepared for further congelation. I suppose, however, that this happens always during calms, which are not uncommon in high latitudes, as we experienced in the late expedition. Nor does land seem absolutely necessary in order to fix the ice; for this may be done with as much ease and propriety to the large ice mountains which remain undissolved floating in the ocean in high latitudes; or it may, perhaps, not be improper to suppose, that the whole polar region, from 80° and upwards, in the southern hemisphere, remains a solid ice for several years together, to which yearly a new circle of ice is added, and of which, however, part is broken off by the winds and the return of the mild season. Wherever the ice floats in large masses, and sometimes in compact bodies formed of an infinite number of small pieces, there it is by no means difficult to freeze the whole into one piece; for amongst the ice the wind has not a power of raising high and great waves. This circumstance was not entirely unknown to the ancients; and it is probable they acquired this information from the natives of

Pole.

of ancient Gaul, and from the Britons and other northern nations, who sometimes undertook long voyages. The northern ocean was called by the ancients the *frozen*, the *dead*, the *lazy*, and *immoveable sea*: sometimes they gave it the name *mare cronium*, the concrete sea, and *morimarusa*, the dead sea. And, what is very remarkable, in all the northern cold countries the frost sometimes is so intense, that all the waters become suddenly coagulated into a kind of paste or dough, and thus at once congeal."

19 Observations on Mr Forster's reasoning.

On this reasoning of Mr Forster's, however, we must observe, that it cannot possibly invalidate any fact which Mr Barrington has advanced. The best concerted and most plausible theory in the world must yield to experience; for this is in fact what must judge all theories. Now, from what we have already related, it is demonstrated, that in the space between the mouths of the rivers Piasida and Chatanga more ice must be formed, and more intense colds generated, than in any other part of the world; consequently, for a considerable space both on the east and west side of that, the sea must be more full of ice than anywhere else. Now, between these two rivers there is the promontory of Taimura, which runs out to the latitude of 78°, or near it, and which of necessity must obstruct the dispersion of the ice; and that it actually does so is in some degree probable, because in one of the Russian voyages above-mentioned the eastern mouth of the Lena was quite free, when the western ones were entirely choaked up with ice. Now the mouth of the Yana lies several degrees to the eastward of the Lena: consequently, when the ice comes eastward from the Cape of Taimura, it must necessarily fill all that sea to the latitude of 78° and upwards; but the Cossack Markoff, if he proceeded directly north, could not be farther than the promontory of Taimura, and consequently still enveloped among the ice. Besides, we are certain, that the sea in 78° is not at all frozen into a solid cake in some places, since Lord Mulgrave, in 1773, reached 81°. Mr Forster's argument, therefore, either proves nothing, or it proves too much. If it proves, that about the middle of the eastern continent the cold is so intense that a sufficient quantity of ice is formed to obstruct the navigation for several hundred miles round, this proves nothing; because we knew before that this must be the case: But if it proves, that the sea must be unnavigable by reason of ice all round the globe at 78° N. L. this is too much; because we certainly know, that in 1773 Lord Mulgrave reached the latitude of 81°. However, though it should be allowed that the sea is quite clear all the way to the pole, it must be a very great uncertainty whether any ship could by that way reach the East Indies; because we know that it must sail down between the continents of Asia and America, through that strait whose mouth must often be blocked up with ice driving eastward along the continent of Asia.

The south pole is still more inaccessible than the north pole; for the ice is found in much lower southern than northern latitudes. Upon this subject M. Pages speaks thus: "Having in former voyages (says he) visited many parts of the terraqueous globe in different latitudes, I had opportunities of acquiring a considerable knowledge of climate in the torrid as well as in the temperate divisions of the earth. In a subsequent voyage I made it my business to be equally well informed respecting the reputed inhospitable genius of the South Seas; and upon my return from that expedition I entertained not the smallest doubt that there exists a peculiar and perpetual rigour in the southern hemisphere.' (See his *Travels round the World*, v. iii. translated from the French, and printed at London, 1792, for Murray.) This superior degree of cold has by many been supposed to proceed from a greater quantity of land about the south than the north pole *; and the notion of a vast continent in these regions prevailed almost universally, insomuch that many have sought for it, but hitherto in vain. See the articles *Cook's Discoveries*, n° 38—49. and n° 68. and 69. *South-Sea*, and *Terra Australis*.

Pole ‖ Polemo.

* See America, n° 1—5, and Cook's Discoveries, n° 38, &c.

Magnetic Pole. See Magnet, Magnetism, § 4. p. 432. and p. 441. and Variation.

North Pole. See Pole.

Pole-Axe, a sort of hatchet nearly resembling a battle-axe, having an handle about 15 inches in length, and being furnished with a sharp point or claw, bending downwards from the back of its head; the blade whereof is formed like that of any other hatchet. It is principally employed in sea-fights to cut away and destroy the rigging of any adversary who endeavours to board.

Pole-axes are also said to have been successfully used on some occasions in boarding an enemy, whose sides were above those of the boarder. This is executed by detaching several gangs to enter at different parts of the ship's length, at which time the pole-axes are forcibly driven into her side, one above another, so as to form a sort of scaling-ladders.

Pole Cat. See Mustela.

Pole Star. See Astronomy, n° 3. 17. and 39.

POLEIN, in English antiquity, is a sort of shoe, sharp or picked at the point. This fashion took its rise in the time of king William Rufus; and the picks were so long, that they were tied up to the knees with silver or golden chains. They were forbidden by stat. an. 4 Edw. IV. cap. 7. *Tunc fluxus crinium, tunc luxus vestium, tunc usus calceorum cum arcuatis aculeis inventus est*. Malmesb. in Will. ii.

POLEMARCHUS was a magistrate at Athens, who had under his care all the strangers and sojourners in the city, over whom he had the same authority that the archon had over the citizens. It was his duty to offer a solemn sacrifice to Enyalus (said to be the same with Mars, though others will have it that he was only one of his attendants), and another to Diana, surnamed Αγροτερα, in honour of the famous patriot Harmodius. It was also his business to take care that the children of those that had lost their lives in the service of their country should be provided for out of the public treasury.

Potter's Grecian Antiquities.

POLEMICAL, in matters of literature, an appellation given to books of controversy, especially those in divinity.

POLEMO, who succeeded Xenocrates in the direction of the academy, was an Athenian of distinguished birth, and in the earlier part of his life a man of loose morals. The manner in which he was reclaimed from the pursuit of infamous pleasures, and brought under the discipline of philosophy, affords a memorable example of the power of eloquence employed in the cause of virtue. His history is thus related by Dr Enfield: "As he was, one morning about the rising of the sun, returning home from the revels of the night,

night, clad in a loose robe, crowned with garlands, strongly perfumed, and intoxicated with wine, he passed by the school of Xenocrates, and saw him surrounded with his disciples. Unable to resist so fortunate an opportunity of indulging his sportive humour, he rushed without ceremony into the school, and took his place among the philosophers. The whole assembly was astonished at this rude and indecent intrusion, and all but Xenocrates discovered signs of resentment. Xenocrates, however, preserved the perfect command of his countenance; and with great presence of mind turned his discourse from the subject on which he was treating to the topics of temperance and modesty, which he recommended with such strength of argument, and energy of language, that Polemo was constrained to yield to the force of conviction. Instead of turning the philosopher and his doctrine to ridicule, as he at first intended, he became sensible of the folly of his former conduct; was heartily ashamed of the contemptible figure which he had made in so respectable an assembly; took his garland from his head; concealed his naked arm under his cloak; assumed a sedate and thoughtful aspect; and, in short, resolved from that hour to relinquish his licentious pleasures, and devote himself to the pursuit of wisdom. Thus was this young man, by the powerful energy of truth and eloquence, in an instant converted from an infamous libertine to a respectable philosopher. In such a sudden change of character it is difficult to avoid passing from one extreme to another. Polemo, after his reformation, in order to brace up his mind to the tone of rigid virtue, constantly practised the severest austerity and most hardy fortitude. From the thirtieth year of his age to his death he drank nothing but water. When he suffered violent pain, he showed no external sign of anguish. In order to preserve his mind undisturbed by passion, he habituated himself to speak in an uniform tone of voice, without elevation or depression. The austerity of his manners was, however, tempered with urbanity and generosity. He was fond of solitude, and passed much of his time in a garden near his school. He died, at an advanced age, of a consumption. Of his tenets little is said by the ancients, because he strictly adhered to the doctrine of Plato."

POLEMONIUM, Greek Valerian, or *Jacob's Ladder*: A genus of the monogynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 29th order, *Campanaceæ*. The corolla is quinquepartite; the stamina inserted into scales, which close the bottom of the corolla; the stigma is trifid: the capsule bilocular superior. There are two species, of which the most remarkable is the cœruleum, with an empalement longer than the flower. It grows naturally in some places of England: however, its beauty has obtained it a place in the gardens. There are three varieties; one with a white, another with a blue, and another with a variegated flower; also a kind with variegated leaves. They are easily propagated by seeds; but that kind with variegated leaves is preserved by parting its roots, because the plants raised from seeds would be apt to degenerate and become plain.

POLEMOSCOPE, in optics, the same with Opera-glass. See Dioptrics, p. 37. col. 1. par. 3.

POLENBURG (Cornelius), an excellent painter of little landscapes and figures, was born at Utrecht in 1586, and educated under Blomaert, whom he soon quitted to travel into Italy; and studied for a long time in Rome and Florence, where he formed a style entirely new, which, though preferable to the Flemish, is unlike any Italian, except in his having adorned his landscapes with ruins. There is a varnished smoothness and finishing in his pictures, that render them always pleasing, though simple and too nearly resembling one another. The Roman cardinals were charmed with the neatness of his works, as was also the great duke; but could not retain him. He returned to Utrecht, and pleased Rubens, who had several of his performances. King Charles I. invited him to London, where he generally painted the figures in Steenwyck's perspectives: but the king could not prevail on him to fix here; for after staying only four years, and being handsomely rewarded by his majesty for several pieces which he performed for him, he returned to Utrecht, and died there at the age of 74. His works are very scarce and valuable.

POLERON, one of the Banda or nutmeg islands in the East Indies. This was one of those spice islands which put themselves under the protection of the English, and voluntarily acknowledged James I. king of England for their sovereign; for which reason the natives of this and the rest of the islands were murdered or driven thence by the Dutch, together with the English.

POLESIA, a province of Poland, bounded by Polachio and Proper Lithuania on the north, and by Volhinia on the south. It is one of the palatinates of Lithuania, and is commonly called *Brescia*, and its capital is of this name. It is full of forests and lakes.

POLESINO-de-Rovigo, a province of Italy, in the republic of Venice, lying to the north of the river Po; and bounded on that side by the Paduan, on the south by the Ferrarese, on the east by Degado, and on the west by the Veronese. It is 45 miles in length, and 17 in breadth, and is a fertile country. Rovigo is the capital.

POLETÆ were ten magistrates of Athens, who, with three that had the management of money allowed for public shows, were empowered to let out the tribute-money and other public revenues, and to sell confiscated estates; all which bargains were ratified by their president, or in his name. They were by their office also bound to convict such as had not paid the tribute called Μετοικιον, and sell them in the market by auction. The market where these wretches were sold was called πωλητηριον του μετοικιου.

POLIANTHES, the Tuberose: A genus of the monogynia order, belonging to the hexandria class of plants; and in the natural method ranking under the 10th order, *Coronariæ*. The corolla is funnel-shaped, incurvated, and equal; the filaments are inserted into the throat of the corolla; in the bottom of which the germen is situated. There is but one species, consisting of some varieties; all of which being exotics of tender quality, require aid of artificial heat, under shelter of frames and glasses, &c. to bring them to flower in perfection in this country. The polianthes, or tuberose, hath an oblong, bulb-like, tuberous, white root; crowned with a few long very narrow leaves; amidst them an upright, straight, firm stem, three or four feet high, terminated by a long spike of large white flowers arranged alternately. The varieties are the common tuberose,

berose, with single flowers,—double-flowered,—dwarf-stalked,—variegated-leaved. They all flower here in June, July, and August: the flowers are funnel or bell shaped; garnish the upper part of the stem in a long spike, consisting of from 10 to 20 or more separate in alternate arrangements, the lower flowers opening first, which are succeeded by those above, in regular order, making in the whole a most beautiful appearance, highly enriched with a most fragrant odour. The common single-flowered tuberose is the sort the most commonly cultivated, as it generally blows the most freely, and possesses the finest fragrance. The double-flowered kind also highly merits culture, as when it blows fair it makes a singularly fine appearance. The dwarf and the variegated kinds are inferior to the other two, but may be cultivated for variety.

All the varieties being exotics from warm countries, although they are made to flower in great perfection in our gardens by assistance of hot-beds, they will not prosper in the open ground, and do not increase freely in England; so that a supply of the roots is imported hither annually from Genoa, and other parts of Italy, by most of the eminent nursery and seedsmen, and the Italian warehouse-keepers; generally arriving in February or March, time enough for the ensuing summer's bloom; and are sold commonly at the rate of twelve or fifteen shillings per hundred, being careful always to procure as large roots as possible, for on this depends the success of having a complete blow. They, requiring artificial heat to blow them in this country, are planted in pots, and plunged in a hot-bed, under a deep frame furnished with glass lights; or placed in a hot-house, where they may be blowed to great perfection with little trouble. The principal season for planting them is March and April: observing, however, that in order to continue a long succession of the bloom, it is proper to make two or three different plantings, at about a month interval; one in March, another in April, and a third the beginning of May, whereby the blow may be continued from June until September; observing, as above-mentioned, they may be flowered either by aid of a common dung or bark hot-bed, or in a hot-house.

With respect to the propagation of these plants, it is principally by offsets of the roots. The blowing roots that are brought annually from abroad for sale are often furnished with offsets, which ought to be separated previous to planting. Those also that are planted here in our gardens frequently furnish offsets fit for separation in autumn when the leaves decay: they must then be preserved in sand all winter in a dry sheltered place; and in the beginning of March, plant them either in a bed of light dry earth in the full ground; or, to forward them as much as possible, allow them a moderate hot-bed; and in either method indulge them with a shelter in cold weather, either of a frame and lights, or arched with hoops and occasionally matted; but let them enjoy the full air in all mild weather, giving also plenty of water in dry weather during the season of their growth in spring and summer. Thus let them grow till their leaves again decay in autumn: then take them up, clean them from earth, and lay them in sand till spring; at which time such roots as are large enough to blow may be planted and managed as already directed, and the smaller roots planted again in a nursery-bed, to have another year's growth; afterwards plant them for flowering. The Egyptians put the flowers of tuberose into sweet oil; and by this means give it a most excellent flavour, scarce inferior to oil of jasmine.

POLICANDRO, a small island in the Archipelago, seated between Milo and Morgo. It has no harbour, but has a town about three miles from the shore near a huge rock. It is a ragged stony island, but yields as much corn as is sufficient for the inhabitants, who consist of about 120 Greek families, all Christians. The only commodity is cotton; of which they make napkins, a dozen of which are sold for a crown. E. Long. 35. 25. N. Lat. 36. 36.

POLICASTRO, an episcopal town of Italy, in the kingdom of Naples, and in the Hither Principato; but now almost in ruins, for which reason the bishop resides in another town. E. Long. 15. 46. N. Lat. 40. 26.

POLICY, or POLITY, in matters of government. See POLITY.

Policy of Insurance, or *Assurance*, of ships, is a contract or convention, whereby a person takes upon himself the risks of a sea-voyage; obliging himself to make good the losses and damages that may befal the vessel, its equipage, tackle, victualling, lading, &c. either from tempests, shipwrecks, pirates, fire, war, reprisals, in part or in whole; in consideration of a certain sum of seven, eight, or ten *per cent.* more or less according to the risk run; which sum is paid down to the assurer by the assuree upon his signing the policy. See INSURANCE.

POLIDORO DA CARAVAGGIO, an eminent painter, born at Caravaggio in the Milanese in 1492. He went young to Rome, where he worked as a labourer in preparing stucco for the painters; and was so animated by seeing them at work in the Vatican, that he solicited some of them to teach him the rules of designing. He attached himself particularly to Maturino, a young Florentine; and a similarity in talents and taste producing a disinterested affection, they associated like brothers, laboured together, and lived on one common purse, until the death of Maturino. He understood and practised the chiaro-scuro in a degree superior to any in the Roman school; and finished an incredible number of pictures both in fresco and in oil, few of the public buildings at Rome being without some of his paintings. Being obliged to fly from Rome when it was stormed and pillaged, he retired to Messina, where he obtained a large sum of money with great reputation, by painting the triumphal arches for the reception of Charles V. after his victory at Tunis: and when he was preparing to return to Rome, he was murdered, for the sake of his riches, by his Sicilian valet with other assassins, in the year 1543.

POLIFOLIA. See ANDROMEDA.

POLIGNAC (Melchier de), an excellent French genius and a cardinal, was born of an ancient and noble family at Puy, the capital of Velay, in 1662. He was sent by Louis XIV. ambassador extraordinary to Poland, where, on the death of Sobieski, he formed a project of procuring the election of the prince of Conti. But failing, he returned home under some disgrace; but when restored to favour, he was sent to Rome as auditor of the Rota. He was plenipotentiary during the congress at Utrecht, at which time Clement I. created him a cardinal; and upon the accession of Louis XV. he was appointed to reside at Rome as minister of

Polisher || Politeness.

France. He remained there till the year 1732, and died in the year 1741. He left behind him a MS. poem entitled *Anti-Lucretius, seu De Deo et Natura*; the plan of which he is said to have formed in Holland in a conversation with Mr Bayle. This celebrated poem was first published in the year 1749, and has since been several times printed in other countries besides France. He had been received into the French Academy in 1704, into the Academy of Sciences in 1715, into that of the Belles Lettres in 1717: and he would have been an ornament to any society, having all the accomplishments of a man of parts and learning.

POLISHER, or BURNISHER, among mechanics, an instrument for polishing and burnishing things proper to take a polish. The gilders use an iron-polisher to prepare their metals before gilding, and the bloodstone to give them the bright polish after gilding.

The polishers, among cutlers, are a kind of wooden wheels made of walnut-tree, about an inch thick, and of a diameter at pleasure, which are turned round by a great wheel; upon these they smooth and polish their work with emery and putty.

The polishers for glass consist of two pieces of wood; the one flat, covered with old hat; the other long and half-round, fastened on the former, whose edge it exceeds on both sides by some inches, which serves the workmen to take hold of, and to work backwards and forwards by.

The polishers used by spectacle-makers are pieces of wood a foot long, seven or eight inches broad, and an inch and a half thick, covered with old beaver hat, whereon they polish the shell and horn frames their spectacle-glasses are to be set in.

POLISHING, in general, the operation of giving a gloss or lustre to certain substances, as metals, glass, marble, &c.

The operation of polishing optic-glasses, after being properly ground, is one of the most difficult points of the whole process. See TELESCOPE.

POLITENESS means elegance of manners or good breeding: Lord Chesterfield calls it the art of pleasing. It has also been called an artificial good nature; and indeed good nature is the foundation of true politeness; without which art will make but a very indifferent figure, and will generally defeat its own ends. "Where compliance and assent, caution and candour, says an elegant essayist *, arise from a natural tenderness of disposition and softness of nature, as they sometimes do, they are almost amiable and certainly excusable; but as the effects of artifice, they must be despised. The persons who possess them are, indeed, often themselves dupes of their own deceit, when they imagine others are deluded by it. For excessive art always betrays itself; and many, who do not openly take notice of the deceiver, from motives of delicacy and tenderness for his character, secretly deride and warmly resent his ineffectual subtilty."

* Dr Knox.

"True politeness (says another author †) is that continual attention which humanity inspires us with, both to please others, and to avoid giving them offence. The surly plain dealer exclaims loudly against this virtue, and prefers his own shocking bluntness and Gothic freedom. The courtier and fawning flatterer, on the contrary, substitute in its place insipid compliments, cringings, and a jargon of unmeaning sentences. The one blames politeness, because he takes it for a vice; and the other is the occasion of this, because that which he practises is really so."

† Beauties of History.

Both these characters act from motives equally absurd, though not equally criminal. The conduct of the artful flatterer is guided by self-love, while that of the plain-dealer is the effect of ignorance; for nothing is more certain, than that the desire of pleasing is founded on the mutual wants and the mutual wishes of mankind; on the pleasure which we wish to derive from society, and the character which we wish to acquire. Men having discovered that it was necessary and agreeable to unite for their common interests, they have made laws to repress the wicked, they have settled the duties of social life, and connected the idea of respectability with the practice of those duties; and after having prescribed the regulations necessary to their common safety, they have endeavoured to render their commerce with one another agreeable, by establishing the rules of politeness and good breeding. Indeed, as an elegant author already quoted remarks, the philosopher who, in the austerity of his virtue, should condemn the art of pleasing as unworthy cultivation, would deserve little attention from mankind, and might be dismissed to his solitary tub, like his brother Diogenes. It is the dictate of humanity, that we should endeavour to render ourselves agreeable to those in whose company we are destined to travel in the journey of life. It is our interest, it is the source of perpetual satisfaction; it is one of our most important duties as men, and particularly required in the professor of Christianity."

It is needless to particularize the motives which have induced men to practise the agreeable virtues; for, from whatever source the desire of pleasing proceeds, it has always increased in proportion to the general civilization of mankind. In a rude state of society, pleasure is limited in its sources and in its operation. When the wants of mankind, and the means of attaining them, are few, personal application is necessary to gratify them, and it is generally sufficient; by which means an individual becomes more independent than can possibly be the case in civilized life, and of course less disposed to give or receive assistance. Confined to the solitary wish of furnishing means for his own happiness, he is little intent on the pleasures of conversation and society. His desire of communication is equal to the extent of his knowledge. But as soon as the natural wants of life are filled up, we find unoccupied time, and we labour hard to make it pass in an agreeable manner. It is then we perceive the advantage of possessing a rational nature, and the delights of mutual intercourse. When we consider society in that state of perfection which enables a great part of the members of it to pursue at leisure the pleasures of conversation, we should expect, both from the ease of acquitting ourselves to the satisfaction of our associates, and from the advantages arising from this conduct, that the art of pleasing might be reduced to a few plain and simple rules, and that these might be derived from a slight attention to general manners.

The art of pleasing, in our intercourse with mankind, is indeed so simple, that it requires nothing more than the constant desire to please in all our words and actions; and the practice of it can neither wound a man's self-love, nor be prejudicial to his interest in any possible situation.

Politeness.

But though this be certain, it is doubtless less attended to than in reason it ought to be. Each particular man is so zealous to promote his own ends or his own pleasure, as to forget that his neighbour has claims equal to his own; that every man that enters into company gives up for the time a great many of his peculiar rights; and that he then forms part of an association, met together not for the particular gratification of any one, but for the purpose of general satisfaction. See BREEDING, CONVERSATION, and GOOD MANNERS.

The qualities essential in the art of pleasing, are *virtue*, *knowledge*, and *manners*. All the virtues which form a good and respectable character in a moral sense are essential to the art of pleasing. This must be an established principle, because it depends on the wants and mutual relations of society. In all affairs of common business, we delight in transacting with men in whom we can place confidence, and in whom we find integrity; but truth is so naturally pleasing, and the common affairs of life are so interwoven with social intercourse, that we derive abundantly more satisfaction from an honest character than from specious manners. "Should you be suspected (says Chesterfield) of injustice, malignity, perfidy, lying, &c. all the parts and knowledge of the world will never procure you esteem, friendship, and respect."

The first of virtues in our commerce with the world, and the chief in giving pleasure to those with whom we associate, is inviolable sincerity of heart. We can never be too punctual in the most scrupulous tenderness to our moral character in this respect, nor too nicely affected in preserving our integrity.

The peculiar modes, even of the fashionable world, which are founded in dissimulation, and which on this account have induced several to recommend the practice, would not prevent a man of the highest integrity from being acceptable in the very best company. Acknowledged sincerity gives the same ornament to character that modesty does to manners. It would abundantly atone for the want of ridiculous ceremony, or false and unmeaning professions; and it would in no respect diminish the lustre of a noble air, or the perfection of an elegant address.

If integrity be the foundation of that character which is most generally acceptable, or which, in other words, possesses the power of pleasing in the highest degree, humanity and modesty are its highest ornaments.

The whole art of pleasing, as far as the virtues are concerned, may be derived from the one or other of these sources. Humanity comprehends the display of every thing amiable to others; modesty removes or suppresses every thing offensive in ourselves.

This modesty, however, is not inconsistent with firmness and dignity of character: it arises rather from the knowledge of our imperfection compared with a certain standard, than from conscious ignorance of what we ought to know. We must therefore distinguish between this modesty and what the French call *mauvaise honte*. The one is the unaffected and unassuming principle which leads us to give preference to the merit of others, the other is the aukward struggling of nature over her own infirmities. The first gives an additional lustre to every good quality; while some people, from feeling the pain and inconveniency of the *mauvaise honte*, have rushed into the other extreme, and turned impudent, as cowards sometimes grow desperate from excess of danger. The medium between these two extremes marks out the well-bred man; he feels himself firm and easy in all companies, is modest without being bashful, and steady without being impudent.

A man possessing the amiable virtues is still farther prepared to please, by having in his own mind a perpetual fund of satisfaction and entertainment. He is put to no trouble in concealing thoughts which it would be disgraceful to avow, and he is not anxious to display virtues which his daily conversation and his constant looks render visible.

The next ingredient in the art of pleasing, is to possess a correct and enlightened understanding, and a fund of rational knowledge. With virtue and modesty we must be able to entertain and instruct those with whom we associate.

The faculty of communicating ideas is peculiar to man, and the pleasure which he derives from the interchange alone is one of the most important of his blessings. Mankind are formed with numberless wants, and with a mutual power of assisting each other. It is a beautiful and happy part of the same perfect plan, that they are likewise formed to delight in each other's company, and in the mutual interchange of their thoughts. The different species of communication, in a highly polished age, are as numerous as the different ranks, employments, and occupations of men; and indeed the knowledge which men wish to communicate, takes its tinge from their peculiar profession or occupation.

Thus commercial men delight to talk of their trade, and of the nature of public business; men of pleasure, who wish merely to vary or quicken their amusements, are in conversation light, trifling, and insincere; and the literati delight to dwell on new books, learned men, and important discoveries in science or in arts. But as the different classes of men will frequently meet together, all parties must so contrive matters, as to combine the useful and agreeable together, so as to give the greatest delight at the time, and the greatest pleasure on reflection. An attention to these principles would make the man of pleasure and the man of learning meet together on equal terms, and derive mutual advantage from their different qualifications. With due attention to such ideas, we proceed to mention the kinds of knowledge which are most fitted for conversation. Those who wish to please should particularly endeavour to be informed in those points which most generally occur. An accurate or extensive knowledge on learned subjects is by no means sufficient: we must also have an accurate and extensive knowledge of the common occurrences of life.

It is the knowledge of mankind, of governments, of history, of public characters, and of the springs which put the great and the little actions of the world in motion, which give real pleasure and rational instruction. The knowledge which we communicate must in some shape be interesting to those to whom we communicate it; of that nature, that the desire of receiving it may overbalance every kind of disgust, excited too often on the score of envy and self-love, against those who happen to possess superior endowments, and at the same time of that importance, as to elevate the thoughts somewhat above the actions and the faults of the narrow circle formed in our own immediate neigh-

bourhood.

bourhood. On this account it is recommended by an author who fully knew mankind, as a maxim of great importance in the art of pleasing, to be acquainted with the private character of those men who, from their station or their actions, are making a figure in the world. We naturally wish to see such men in their retired and undisguised moments; and he who can gratify us is highly acceptable. History of all kinds, fitly introduced, and occasionally embellished with pleasing anecdotes, is a chief part of our entertainment in the intercourse of life. This is receiving instruction, without exciting much envy; it depends on memory, and memory is one of those talents the possession of which we least grudge to our neighbour. Our knowledge of history, at the same time, must not appear in long and tedious details; but in apt and well chosen allusions, calculated to illustrate the particular subject of conversation. But the knowledge most necessary is that of the human heart. This is acquired by constant observation on the manners and maxims of the world, connected with that which passes in our own minds. This leads us from the common details of conduct, from slander and defamation, to the sources and principles of action, and enables us to enter into what may be called the philosophy of conversation We may see both the practicability of this kind of discourse, and the nature of it, in the following lines of Horace:

Sermo oritur, non de villis domibusve alienis;
Nec male necne Lepos saltet: sed quod magis ad nos
Pertinet, & nescire malum est, agitamus: utrumne
Divitiis homines, an sint virtute beati?
Quidve ad amicitias, usus rectumne, trahat nos?
Et quæ sit natura boni, summumque quid ejus? &c.

By this means constant materials are supplied for free, easy, and spirited communication. The restraints which are imposed on mankind, either from what their own character may suffer, or from the apprehension of giving offence to others, are entirely taken off, and they have a sufficient quantity of current coin for all the common purposes of life.

In addition to virtue and knowledge, which are the chief ingredients in the art of pleasing, we have to consider graceful and easy manners. Lord Chesterfield indeed considers these as the most essential and important part; as if the diamond received its whole value from the polish. But though he is unquestionably mistaken, there is yet a certain sweetness of manners which is particularly engaging in our commerce with the world. It is that which constitutes the character which the French, under the appellation of *l'aimable*, so much talk of, and so justly value. This is not so easily described as felt. It is the compound result of different things; as complaisance, a flexibility, but not a servility of manners, an air of softness in the countenance, gesture, and expression, equally whether you concur or differ with the person you converse with. This is particularly to be studied when we are obliged to refuse a favour asked of us, or to say what in itself cannot be very agreeable to the person to whom we say it. It is then the necessary gilding of a disagreeable pill. But this, which may be called the *suaviter in modo*, would degenerate and sink into a mean and timid complaisance and passiveness, if not supported by firmness and dignity of character. Hence the Latin sentence, *suaviter in modo, fortiter in re*, becomes a useful and important maxim in life.

Genuine easy manners result from a constant attention to the relations of persons, things, time, and places. Were we to converse with one greatly our superior, we are to be as easy and unembarrassed as with our equals; but yet every look, word, and action, should imply, without any kind of servile flattery, the greatest respect. In mixed companies, with our equals, greater ease and liberty are allowed; but they too have their proper limits. There is a social respect necessary. Our words, gestures, and attitudes, have a greater degree of latitude, though not an unbounded one. That easiness of carriage and behaviour which is exceedingly engaging, widely differs from negligence and inattention, and by no means implies that one may do whatever he pleases; it only means, that one is not to be stiff, formal, and embarrassed, disconcerted and ashamed; but it requires great attention to, and a scrupulous observation of, what the French call *les bienseances*; a word which implies "decorum, good-breeding, and propriety." Whatever we ought to do, is to be done with ease and unconcern; whatever is improper, must not be done at all. In mixed companies, also, different ages and sexes are to be differently addressed. Although we are to be equally easy with all, old age particularly requires to be treated with a degree of deference and regard. It is a good general rule, to accustom ourselves to have a kind feeling to every thing connected with man; and when this is the case, we shall seldom err in the application. Another important point in the *bienseances* is, not to run our own present humour and disposition indiscriminately against every body, but to observe and adopt theirs. And if we cannot command one present humour and disposition, it is necessary to single out those to converse with who happen to be in the humour the nearest to our own. Peremptoriness and decision, especially in young people, is contrary to the *bienseances*: they should seldom seem to dissent, and always use some softening mitigating expression.

There is a *bienseance* also with regard to people of the lowest degree; a gentleman observes it with his footman, and even indeed with the beggar in the street. He considers them as objects of compassion, not of insult; he speaks to neither in a harsh tone, but corrects the one coolly, and refuses the other with humanity.

The following observations perhaps contain the sum of the art of pleasing:

1. A fixed and habitual resolution of endeavouring to please, is a circumstance which will seldom fail of effect, and its effect will every day become more visible as this habit increases in strength.

2. This resolution must be regulated by a very considerable degree of good sense.

3. It is a maxim of almost general application, that what pleases us in another will also please others in us.

4. A constant and habitual attention to the different dispositions of mankind, to their ruling passions, and to their peculiar or occasional humours, is absolutely necessary.

5. A man who would please, must possess a firm, equal, and steady temper. And,

6. An easy and graceful manner, as distant from bashfulness on the one hand as from impudence on the other.

other. "He who thinks himself sure of pleasing (says Lord Chesterfield), and he who despairs of it, are equally sure to fail." And he is undoubtedly in the right. The one, by his assuming vanity, is inattentive to the means of pleasing; and the other, from fear, is rendered incapable of employing them.

A variety of excellent rules for acquiring politeness, with strictures on particular kinds of impoliteness, may be found in the *Spectator*, *Rambler*, *Idler*, *Lounger*, *Mirror*, and other periodical works of that kind; in *Knox's Essays*, and among *Swift's Works*; see *Good Manners*. *Chesterfield's Art of Pleasing*, and his *Letters*, are also worthy of perusal, provided the reader be on his guard against the insincerity and other vices which those books are calculated to infuse, and provided he always bears in mind what we have endeavoured to show in this article, that true politeness does not consist in specious manners and a dissimulating address, but that it must always be founded on real worth and intrinsic virtue.

POLITIAN (Angelo), was born at Monte Pulciano in Tuscany in 1454. He learned the Greek tongue, of which he became a complete master, under Andronicus of Thessalonica. He is said to have written verses both in Greek and Latin when he was not more than 12 years of age. He studied also the Platonic philosophy under Marsilius Ficinus, and that of Aristotle under Argyropylus. He was one of the most learned and polite writers of his time. The first work which gained him a reputation was a poem on the tournament of Julian de Medicis. The account he wrote some time after of the conspiracy of the Pazzi's was very much esteemed. He wrote many other pieces which have merited approbation; and had he lived longer, he would have enriched the republic of letters with many excellent works; but he died at the age of 40 years. His morals answered the homeliness of his face rather than the beauty of his genius; for Paul Jovius informs us, that "he was a man of aukward and perverse manners, of a countenance by no means open and liberal, a nose remarkably large, and squinting eyes. He was crafty, satirical, and full of inward malice: for his constant way was, to sneer and ridicule the productions of other men, and never to allow any criticism, however just, upon his own."

He was, nevertheless, as all acknowledge, a man of most consummate erudition; and not only so, but a very polite and elegant writer. Erasmus, in his *Ciceronianus*, calls him a rare miracle of nature, on account of his excelling in every kind of writing: his words are remarkable: "*Fateor Angelum prorsus angelica fuisse mente, rarum naturæ miraculum, ad quodcunque scripti genus applicaret animum.*" Some of his poems were so much admired, that several learned men have made it their business to comment on them. It has been often reported that he spoke of the Bible with great contempt; and that, having read it but once, he complained he had never spent his time so ill. But this is not probable, for it must be remembered that he was a priest and canon of Florence; and we learn from one of his Epistles that he preached a whole Lent. It does not indeed follow hence, that he did not think contemptuously of the Bible, because many of his church, especially among the better sort, have not been very good believers, and he might be one of them: but it is not likely he would speak out so freely. "I could (as Bayle says) much more easily believe the judgment he is said to have made on the Psalms of David and the Odes of Pindar: he did not deny that there are many good and fine things in the Psalms; but he pretended that the same things appear in Pindar with more brightness and sweetness." The two Scaligers have spoken highly of Politian: the elder has preferred a consolatory elegy of his to that which Ovid sent to Livia upon the death of Drusus, and says, he had rather have been the author of it: the younger calls him an excellent poet, but thinks the style of his epistles too elated and declamatory.

His works have been printed at various times, and in various places: his epistles have probably been most read, because these are things which the generality of people are best pleased with.

POLITICAL, from πολις "a city," signifies any thing that relates to policy or civil government.

Political Arithmetic, is the art of reasoning by figures upon matters relating to government, such as the revenues, number of people, extent and value of land, taxes, trade, &c. in any nation.

These calculations are generally made with a view to ascertain the comparative strength, prosperity, &c. of any two or more nations. With this view, Sir William Petty, in his *Political Arithmetic*, p. 74, &c. computes the land of Holland and Zealand to be about 1,000,000 acres, and that of France to be 8,000,000; and yet the former is one-third part as rich and strong as the latter. The shipping of Europe he computes to be about 2,000,000, of which Britain has 500,000; Holland 900,000; France 100,000; Hamburgh, Denmark, Sweden, and Dantzic 250,000; and Spain, Portugal, Italy, &c. the rest. The exports of France he computes at L. 5,000,000, of which one-fourth came to Britain; of Holland L. 18,000,000, of which L. 300,000 came to Britain. The money raised yearly by the king of France was about L. 6,500,000 Sterling; that of all the Dutch provinces L. 3,000,000, of which 2,100,000 was raised in Holland and Zealand. The number of people in England he computed to be six millions, and their expences, at L. 7 *per annum* a head, L. 42,000,000; the rent of land L. 8,000,000; and the interests, &c. of personal estates as much, the rents of houses L. 4,000,000, and the profits of labour L. 26,000,000. The people of Ireland he reckoned 1,200,000. The corn spent in England, at 5*s.* a bushel for wheat, and 2*s.* 6*d.* for barley, amounts to L. 10,000,000 a-year. The navy of England then required 36,000 men to man it, and other trade and shipping 48,000. In France, to manage the whole shipping trade, there were then required only 1500 men. The whole people of France were 13,500,000; and those of England, Scotland, and Ireland, about 9,500,000. In the three kingdoms are about 20,000 churchmen, and in France more than 270,000. In the dominions of England were above 40,000 seamen, and in France not more than 10,000. In England, Scotland, and Ireland, and all their dependencies, there was then about 60,000 ton of shipping, worth about 4,500,000 in money. The sea-line round England, Scotland, and Ireland, and the adjacent isles, is about 3800 miles. In the whole world he reckoned about 350,000,000 of people; and those with whom the English and Dutch have any commerce, not more than eighty millions; and the value of commodities

Political Arithmetic.

commodities annually traded for in the whole not above L. 45,000,000. That the manufactures exported from England amounted to about L. 5,000,000 *per annum*; lead, tin, and coals, to L. 500,000 *per annum*. The value of the French commodities then brought into England did not exceed L. 1,200,000 *per annum*; and the whole cash of England in current money was then about L. 6,000,000 Sterling.

With these calculations Dr Davenant was dissatisfied; and therefore, from the observations of Mr Greg. King, he advanced others of his own. He reckons the land of England 39 millions of acres; the number of people 5 millions and a half, increasing 9000 a year, making allowance for wars, plagues, and other accidents. He reckons the inhabitants of London 530,000; of other cities and market-towns in England 870,000; and those of villages, &c. 4,100,000. The yearly rent of land he reckons L. 10,000,000; of houses, &c. 2,000,000; the produce of all kinds of grain in a tolerable year L. 9,075,000; the annual rent of corn lands L. 2,200,000, and their net produce L. 9,000,000; the rent of pasture, meadows, woods, forests, commons, heaths, &c. L. 7,000,000; the annual produce by cattle in butter, cheese, and milk, about L. 2,500,000; the value of the wool yearly shorn about L. 2,000,000; of horses yearly bred about L. 250,000; of the flesh yearly spent as food about L. 3,350,000; of the tallow and hides about L. 600,000; of the hay yearly consumed by horses about L. 1,300,000; of the hay consumed by other cattle L. 1,000,000; of the timber yearly felled for building L. 500,000; and of the wood yearly spent in firing, &c. about L. 500,000. The proportion of the land of England to its inhabitants is now about 7½ acres per head; the value of the wheat, rye, and barley, necessary for the sustenance of England, amounts to at least L. 6,000,000 Sterling *per annum*; of the woollen manufacture about L. 8,000,000 *per annum*, and exports of all kinds of the woollen manufacture amount to above L. 2,000,000 *per annum*; the annual income of England, on which the whole people subsist, and out of which all taxes are paid, is reckoned to be about L. 43,000,000, that of France L. 81,000,000, and of Holland L. 18,250,000. See Davenant's *Essay on Trade*, in vol. vi. of his works. For calculations respecting mortality, see Major Grant's *Observations on the Bills of Mortality*, and our article *Bills of Mortality*.

In Vol. XLIX. of the Philosophical Transactions we have an estimate of the number of people in England by Dr Brakenridge, from considering the number of houses and quantity of bread consumed. On the former principle he computes the number of people to be 6,257,418 of all ages, counting in England and Wales 911,310 houses, and allowing six persons to a house. From a survey of the window-lights after the year 1750, the number of houses charged in England and Wales were 690,000, besides 200,000 cottages that pay nothing; the whole number therefore was 890,000, and the number of people, allowing six to a house, 5,340,000. On the latter principle, he estimates the number of quarters of wheat consumed at home to be 2,026,100; and allowing a quarter for three persons in a year, or seven ounces a day for each person, he concludes the number of people to be 6,078,300. Of this number, according to Dr Halley's rule, he supposes about 1,500,000 men able to carry arms. The country he supposes capable of supporting one-half more inhabitants, or 9,000,000; for, according to Mr Templeman's survey, England contains 49,450 square miles, that is, 31,648,000 acres, of which 25,300,000 acres are proper to be cultivated; and allowing three acres, well manured, for the maintenance of one person, there will be maintenance in England for 8,430,000 people; to which add the produce of fishing, and it will enable the country to support 9,000,000. In Ireland, Mr Templeman reckons 17,536,000 acres, of which Dr Brakenridge thinks 12,000,000 are capable of cultivation; and allowing four acres to each person, and the number of inhabitants to be only 1,000,000, Ireland could maintain 2,000,000 more people than it has now. In Scotland, containing 1,500,000 people, and 17,728,000 acres of land, of which there are 11,000,000 good acres, allowing five for each person, he supposes there may be provision for 2,200,000 people, or for 700,000 more than there are at present. Hence he infers, that were both the British isles properly cultivated, there is a provision for 6,000,000 inhabitants beyond the present number. Extending his survey to the whole globe, he supposes the whole surface to be to the quantity of land as 8 to 3, *i. e.* as 199,819,550 to 74,182,331 square miles; out of which, deducting one-third for waste-ground, there will be 49,454,887 square miles, or 31,651,127,680 good acres. And stating the whole number of inhabitants on the globe to be 400,000,000, there will be 79 good acres to each person. See Dr Halley's *Calculations* on the same subject, and *Dr Price's* (for a list of whose works see his life at the word PRICE), and King *on the National Debt*.

Polity.

POLITICS, the first part of economy or ethics, consisting in the well governing and regulating the affairs of a state for the maintenance of the public safety, order, tranquillity, and morals.

Lord Bacon divides politics into three parts, viz. the *preservation* of the state, its *happiness* and *flourishing*, and its *enlargement*. Of the first two, he informs us, various authors have treated, but the last has never been handled; and he has given a specimen of an essay to supply the want.

POLITY, or POLICY, denotes the peculiar form and constitution of the government of any state or nation; or the laws, orders, and regulations, relating thereto *.——Polity differs only from politics, as the theory from the practice of any art.

* See *Government*.

Of the nature of our social duties, both private and political, we have already spoken at some length (see *Moral Philosophy*, Part II. chap. iii. and particularly sect. vii.); and we shall have occasion to take a view of the origin and nature of the several political establishments of Europe, &c. hereafter. (See *Civil Society*.) We shall only further remark in this place upon the necessity of always joining politics and morality together. This view of the subject is indeed antiquated and neglected; but the connection has always been externally respected even by those who have separated them the most widely. Politics and morality, far from standing in opposition to each other, have the most intimate connection, and exhibit the relation which the *part* bears to the *whole*; that is to say, that politics are only a part or a branch of morality. No truth can be more evident than this;

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for as morality is the guide of human life, the principle of order, and the universal source of real improvement and genuine happiness to all mankind, every thing relative to the direction of individuals, or the government of nations, must be comprehended within its sphere, and be subservient to its laws. All the schemes and projects of pretended political wisdom, that deviate from or violate the rules of this master-science, turn out in the issue often to the detriment of their contrivers, always to that of the nation; and it is a palpable and absurd error to think of advancing the happiness of one country at the expence of the general good of mankind. The experience of ages, and the history of the world, confirm these assertions; from which, and from daily observation, we obtain a convincing proof of the wisdom of the good old maxim, both in its application to individuals and to nations, that "honesty is the best policy." See Baron Dahlberg's *Considerations on the Connection between Morality and Politics*, read by himself to the Academy of Sciences at Erfurt.

POLL, a word used in ancient writings for the head: hence to poll, is either to vote, or to enter down the names of those persons who give their votes at an election.

Poll-Evil. See FARRIERY, § xxxii.

Poll-Money, or *Capitation*, a tax imposed by authority of parliament on the person or head; either on all indifferently, or according to some known mark or distinction, as quality, calling, &c.

Thus, by the statute 18 Car. II. every subject in the kingdom was assessed by the head, or poll, according to his degree; every duke L. 100, marquis L. 80, baronet L. 30, knight L. 20, esquire L. 10, &c. and every single private person 12d.

This was no new tax, as appears by former acts of parliament.

POLLACHIUS, or POLLACK. See GADUS.

POLLARD, or CROCARD, the name of a sort of base money current in Ireland in the time of Edward I. See *Simon's History of Irish Coins*, p. 15.

POLLEN, the fecundating or fertilizing dust contained within the antheræ or tops of the stamina, and dispersed upon the female organ when ripe for the purposes of impregnation. See BOTANY.

This dust, corresponding to the seminal fluid in animals, is commonly of a yellow colour; and is very conspicuous in the summits of some flowers, as the tulip and lily. Its particles are very minute, and of extreme hardness. Examined by the microscope, they are generally found to assume some determinate form, which often predominates, not only through all the species of a particular genus, but also through the genera of a natural family or order. The powder in question being triturated, and otherwise prepared in the stomach of bees, by whom great quantities are collected in the hairy brushes with which their legs are covered, is supposed by some authors to produce the substance known by the name of *wax*; a species of vegetable oil, rendered concrete by the presence of an acid, which must be removed before the substance can be rendered fluid.

POLLENTIA, a town or colony of Roman citizens in the Balearis Major. It is now said to be Alcudia, situated on the north-east side of the island Majorca. There was another *Pollentia* of the Picenum, likewise a colony. It is thought to be either the same with or near to the Urbs Salvia, but is now extinct. There was a third of Liguria, situated at the confluence of the Stura and Tanarus. Suetonius calls it a municipium, and the people *Pollentina Plebs*. It was famous for its abundance of black fleeces; but was afterwards, under Arcadius and Honorius, stained with a defeat rather of the Romans under Stilico than of the Goths under Alaricus, though palliated by Claudian the poet; after which Rome was taken and set on fire. It is now called *Solenzo*, a small town of Piedmont, not far from Asti.

POLLEX, in anatomy, denotes either the thumb or great toe, according as *manus* or *pedis* is added to it.

POLLICHIA, in botany: A genus of the monogynia order, belonging to the monandria class of plants; and in the natural method ranking with those that are doubtful. Of this there is only one species, *viz.* the *campestris*, or whorl-leaved pollichia, a native of the Cape of Good Hope, and flowers in September.

POLLICIPES, the TOE-SHELL, in natural history, is the name of a genus of shells, the characters of which are these: they are multivalve flat shells, of a triangular figure, each being composed of several laminæ, which end in a sharp point. They stand upon pedicles, and are furnished with a great number of hairs. We have only one known species of this genus, which is always found in large clusters.

POLLICIS PRESSIO, and POLLICIS VERSIO, were used at the combats of gladiators as signals of life or death to the vanquished combatant; or to the victor to spare or take the life of his antagonist. The *pollicis pressio*, by which the people granted life to the prostrate gladiator, was no more than a clenching of the fingers of both hands together, and so holding the two thumbs upright close together. The *pollicis versio*, which authorised the victor to kill the other as a coward, was the bending back of the thumbs. Such is Dacier's opinion; but others say the *pollicis pressio* was when the people held up one hand with the thumb bent, and the *pollicis versio* when they showed the hand with the thumb raised. Authors, however, are not perfectly agreed, though the phrases *pollicem premere*, and *pollicem vertere*, frequently occur in the Latin classics as indications of the people's will that a gladiator should live or die.

POLLIO (Caius Asinius), a celebrated Latin poet and orator, was of consular dignity, and composed some tragedies which were esteemed, but are now lost. He was the first who opened at Rome a library for the use of the public. He was the friend of Mark Antony; which prevented his complying with the solicitations of Augustus, who pressed him to embrace his party. At length Augustus having wrote some verses against Pollio, he was urged to answer them: on which he said, "I shall take care of writing against a man who has the power of proscribing us." He is praised by Virgil and Horace, whose patron he was.

There was another *Pollio*, a friend of Augustus, who used to feed his fishes with human flesh. This cruelty was discovered when one of his servants broke a glass in the presence of Augustus, who had been invited to a feast. The master ordered the servant to be seized, but he threw himself at the feet of the emperor, and begged him to interfere, and not to suffer him to be devoured by fishes. Upon this the causes of his apprehension were examined; and Augustus, astonished at the barbarity of his favourite, caused the servant to be dismissed, all the fish ponds to be filled up, and the crystal glasses of Pollio to be broken to pieces.

POLLUTION, in general, signifies defilement, or the rendering a person or place unclean or unholy. For the Jewish pollutions, see the article IMPURITY.

The Romanists hold a church to be polluted by the effusion of blood or of seed therein: and that it must be consecrated anew. And the Indians are so superstitious on this head, that they break all the vessels which those of another religion have drank out of, or even only touched; and drain all the water out of a pond in which a stranger has bathed.

POLLUTION, in medicine, a disease which consists in an involuntary emission of the seed in time of sleep. This, in different persons, is very different in degree; some being affected with it only once in a week, a fortnight, three weeks, or a month, and others being subject to it almost every night. The persons most subject to it, are young men of a sanguineous temperament, who feed high and lead a sedentary life. When this happens to a person but once in a fortnight or a month, it is of no great consequence; but when it happens almost every night, it greatly injures the health; the patient looks pale and sickly; in some the eyes become weak and inflamed, are sometimes affected with violent defluctions, and are usually at last encircled with a livid appearance of the skin. This distemper is to be cured rather by a change of life than by medicines. When it has taken its rise from a high diet and a sedentary life, a coarser food and the use of exercise will generally cure it. Persons subject to this disease should never take any stimulating purges, and must avoid as much as possible all violent passions of the mind: and though exercise is recommended in moderation, yet if this be too violent, it will rather increase the disorder than contribute to its cure.

*Self-*POLLUTION. See ONANISM.

POLLUX (Julius), a Greek writer of antiquity, flourished in the reign of the emperor Commodus, and was born at Naucrates, a town in Egypt. He was educated under the sophists, and made great progress in grammatical and critical learning. He taught rhetoric at Athens, and became so famous that he was made preceptor of the emperor Commodus. He drew up for his use, and inscribed to him, while his father Marcus Antoninus was living, an *Onomasticon* or Greek Vocabulary, divided into ten books. It is extant, and contains a vast variety of synonymous words and phrases, agreeably to the copiousness of the Greek tongue, ranged under the general classes of things. It was intended to facilitate the knowledge of the Greek language to the young prince; and it is still very useful to all who have a mind to be perfect in it. The first edition of it was printed at Venice by Aldus in 1502, and a Latin version was afterwards made and published with it: but there was no correct and handsome edition of it till that of Amsterdam, 1706, in folio, by Lederlinus and Hemsterhusius. Lederlinus went through the first seven books, correcting the text and version, and subjoining his own, with the notes of Salmasius, If. Vossius, Valesius, and of Kuhnius, whose scholar he had been, and whom he succeeded in the professorship of the oriental languages in the university of Strasburg. Hemsterhusius continued the same method through the three last books: this learned man has since distinguished himself by an excellent edition of Lucian, and other monuments of solid and profound literature.

Pollux wrote many other things, none of which remain. He lived to the age of 58. Philostratus and Lucian have treated him with much contempt and ridicule. *Philostrat. de vit. Sophist.* lib. ii. and *Lucian in Rhetorum preceptore.*

POLLUX. See CASTOR and POLLUX.

POLLUX, in astronomy, a fixed star of the second magnitude in the constellation Gemini, or the Twins. See CASTOR.

Pollux and Castor, a fiery meteor. See *CASTOR and Pollux*.

POLOCSKI, a palatinate in the duchy of Lithuania, bounded on the north by the palatinate of Weytepski, on the south by the Dwina, on the north by Muscovy, and on the west by Livonia. It is a desert country full of wood, and had formerly its own dukes.

POLOCSKI, a town of Lithuania, and capital of a palatinate of the same name, with two castles to defend it. It was taken by the Muscovites in 1563, and retaken the same year. It is seated on the river Dwina, 50 miles south-west of Weytepski, and 80 east of Braslaw. E. Long. 29. 0. N. Lat. 56. 4.

POLTROON, or POLTRON, a coward or dastard, wanting courage to perform any thing great or noble. The word is borrowed from the French, who according to Salmasius, derive it *a pollice truncato;* because anciently those who would avoid going to the wars cut off their thumb. But Menage, with more probability, derives it from the Italian *poltrone*, and that from *poltro* a "bed;" because timorous, pusillanimous people take pleasure in lying a-bed. Others choose to derive the word from the Italian *poltro* a "colt;" because of that creature's readiness to run away.

POLVERINE, the calcined ashes of a plant; of a similar nature with our pot-ashes or pearl-ashes. It is brought from the Levant and Syria; and in the glass-trade it is always to be preferred to any other ashes. The barilla, or pot-ashes of Spain, yield more pure salt than the polverine of the Levant, but the glass made with it has always some blue tinge: that made with the polverine is perfectly white, which ought always to be used for the finest crystal.

POLYADELPHIA (from πολυς *many*, and αδελφια *brotherhood)*, many brotherhoods. The name of the 18th class of Linnæus's sexual system, consisting of plants with hermaphrodite flowers, in which several stamina or male organs are united by their filaments into three or more distinct bundles.

POLYÆNUS, the name of many famous men recorded in ancient writers. Among them was Julius Polyænus, of whom we have some Greek epigrams extant in the first book of the *Anthologia*. The Polyænus whom it most concerns us to know about, is the author of the eight books of the Stratagems of illustrious Commanders in War. He was probably a Macedonian, and perhaps a soldier in the early part of his life; but of this there is no certainty. He was undoubtedly a rhetorician and a pleader of causes; and appears, from the dedication of his work to the emperors Antoninus and Verus, to have lived towards the latter part of the second century. The *Stratagemata* were published in in Greek by Isaac Casaubon, with notes, in 1589, 12mo; but no good edition of them appeared till that of Leyden, 1690, in 8vo. The title-page runs thus: *Polyæni Stratagematum libri octo, Justo Vulteio interprete, Pancratius Maasvicius recensuit, Isaaci Casauboni nec non suas notas adjecit.*

We have in this work the various stratagems of above 300 captains and generals of armies, chiefly Greeks and barbarians: for the Romans seldom used such finesses; and Polyænus has shown further, that he was not well versed in Roman affairs. A great number of these stratagems appear to us to be ridiculous or impracticable; and neither the generals, nor even common soldiers of our days, would be found simple enough to be caught by them. Few of this order are capable of reading *Polyænus's Stratagems;* and if they were, they would reap little benefit from it. The book is useful to such as study the Greek language and antiquity; for many things will be found in it, illustrating the customs and opinions of ancient times. The sixth and seventh books are imperfect.

Polyænus composed other works besides the *Stratagemata.* Stobœus has produced some passages out of a book *De Republica Macedonum;* and Suidas mentions a piece concerning the Thebans and three books of Tacitus. If death had not prevented, he would have written *Memorabilia of the Emperors Antoninus and Verus:* for he makes a promise of this in the preface to his sixth book of *Stratagems.* Casaubon, in the dedication of Polyænus to Mornæus, calls him *an elegant, acute, and learned writer.*

POLYANDRIA (from πολυς *many,* and ανηρ a *man* or *husband),* many husbands. The name of the 13th class in Linnæus's sexual method, consisting of plants with hermaphrodite flowers, which are furnished with several stamina, that are inserted into the common receptacle of the flower.

POLYANTHEA, a collection of common-places in alphabetical order, for the use of orators, preachers, &c. The word is formed from the Greek πολυς *much,* and ανθος *flower;* and has much the same meaning with *anthology* or *florilege.* The first author of the polyanthea was Dominic Nanni de Mirabellio, whose labour has been improved on by Barth. Amantius, and Franc. Torsius; and since these, by Jos. Langius, under the title of *Polyanthea nova,* 1613.

POLYANTHUS, in botany. See Primula.

POLYBIUS, a famous Greek historian, was born at Megalopolis, a city of Arcadia, 205 years before Christ; and was the son of Lycortas, chief of the republic of the Achæans. He was trained to arms under the celebrated Philopœmen, and is described by Plutarch carrying the urn of that great but unfortunate general in his funeral procession. He arose to considerable honours in his own country, but was compelled to visit Rome with other principal Achæans, who were detained there as pledges for the submission of their state. From hence he became intimate with the second Scipio Africanus, and was present with him at the demolition of Carthage. He saw Corinth also plundered by Mummius, and thence passing through the cities of Achaia, reconciled them to Rome. He extended his travels into Egypt, France, and Spain, that he might avoid such geographical errors as he has censured in others.

It was in Rome that he composed his excellent history, for the sake of which his travels were undertaken. This history was divided into 40 books; but there only remains the five first, with extracts of some parts of the others. It has had several editions in Greek and Latin; and there is an English translation by Mr Hampton. He died at the age of 82.

POLYCARP, one of the most ancient fathers of the Christian church, was born towards the end of the reign of Nero, probably at Smyrna; where he was educated at the expence of Calista, a noble matron distinguished by her piety and charity. He was unquestionably a disciple of St John the Evangelist, and conversed familiarly with other of the apostles. When of a proper age, Bucolus ordained him a deacon and catechist of his church; and upon his death he succeeded him in the bishopric, to which he is said to have been consecrated by St John, who also directed his Apocalypse, among others, to him, under the title of *the angel of the church of Smyrna.* At length the controversy about the observation of Easter beginning to grow high between the eastern and western churches, he went to Rome to discourse with those who were of the opposite party. The see was then possessed by Anicetus, with whom he had many conferences, that were carried on in the most peaceable and amicable manner; and though neither of them could bring the other to embrace his opinion, they both retained their own sentiments without violating that charity which is the great law of their religion.

Whilst at Rome he particularly opposed the heresies of Marcian and Valentinus. His conduct on this occasion is related by Irenæus; who informs us, that when Polycarp passed Marcian in the street without speaking, Marcian said, "Polycarp, own us!" To which he replied with indignation, "I own thee to be the first-born of Satan." Irenæus adds, that when any heretical doctrines were spoken in his presence, he would stop his ears and say, "Good God! to what times hast thou reserved me, that I should hear such things!" and immediately left the place. He was wont to tell, that St John, going into a bath at Ephesus, and finding Cerinthus the heretic in it, immediately started back without bathing, crying out, "Let us run away, lest the bath should fall upon us while Cerinthus the enemy of truth is in it." Polycarp governed the church of Smyrna with apostolic purity, till he suffered martyrdom in the 7th year of Marcus Aurelius; the manner of which is thus related.

The persecution waxing hot at Smyrna, and many having sealed their faith with their blood, the general cry was, "Away with the impious; let Polycarp be sought for." Upon which he privately withdrew into a neighbouring village, where he continued for some time praying night and day for the peace of the church. He was thus employed, when one night he fell into a trance, and dreamed that his pillow took fire, and was burnt to ashes; which, when he awoke, he told his friends was a presage that he should be burnt alive for the cause of Christ. Three days afterwards, in order to escape the incessant search for him, he retired into another village: his enemies, however, were at hand, who seized upon two youths (one of whom they forced by stripes to a confession), by whom they were conducted to his lodging. He might have saved himself by getting into another house; but he submitted, saying, "The will of the Lord be done." He therefore came down from his bed-chamber, and saluting his persecutors with a serene and cheerful countenance, he ordered a table to be set with provisions, invited them to partake of them, and only requested for himself one hour for prayer; after which he was set upon an ass, and conducted towards Smyrna. On the road he met Herod an irenarch or justice of the province, and his father, who were the principal instigators of the persecution. Herod took him up into his chariot, and strenuously endeavoured to undermine his constancy; but having failed in the attempt, he thrust him out of the chariot with so much violence and indignation, that he bruised his thigh with the fall. When at the place of execution, there came, as is said, a voice from heaven, saying, "Polycarp, be strong, and quit thyself like a man." Before the tribunal he was urged to swear by the genius of Cæsar. "Repent (says the proconsul), and say with us, take away the impious." Whereupon the martyr looking round at the crowd with a severe and angry countenance, beckoned with his hand, and looking up to heaven, said with a sigh, in a very different tone from what they meant, "Take away the impious." At last, confessing himself to be a Christian, the crier thrice proclaimed his confession, and the people shouted, "This is the great doctor of Asia, and the father of the Christians; this is the destroyer of our gods, that teaches men not to do sacrifice, or worship the deities." When the fire was prepared, Polycarp requested not to be nailed, as usual, but only tied to the stake; and after a short prayer, which he pronounced with a clear and audible voice, the executioner blew up the fire, which increasing to a mighty flame, "Behold a wonder seen (says my author) by us who were purposely reserved, that we might declare it to others; the flames disposing themselves into the resemblance of an arch, like the sails of a ship swelled with the wind, gently encircled the body of the martyr, who stood all the while in the midst, not like roasted flesh, but like the gold or silver purified in the furnace, his body sending forth a delightful fragrancy, which, like frankincense or some other costly spices, presented itself to our senses. The infidels, exasperated by the miracle, commanded a spearman to run him through with a sword: which he had no sooner done, but such a vast quantity of blood flowed from the wound as extinguished the fire; when a dove was seen to fly from the wound, which some suppose to have been his soul, clothed in a visible shape at the time of its departure (A)." The Christians endeavoured to carry off his body entire, but were not allowed by the irenarch, who commanded it to be burnt to ashes. The bones, however, were gathered up, and decently interred by the Christians.

Thus died St Polycarp, the 7th of the kalends of May, A. C. 167. The amphitheatre on which he suffered was mostly remaining not many years ago; and his tomb, which is in a little chapel in the side of a mountain, on the south-east of the city, was solemnly visited by the Greeks on his festival day; and for the maintenance and repairing of it, travellers were wont to throw a few aspers into an earthen pot that stands there for the purpose. He wrote some homilies and epistles, which are now lost, except that to the Philippians, which is a truly pious and Christian piece, containing short and useful precepts and rules of life, which St Jerome informs us was even in his time read in the public assemblies of the Asiatic churches. It is singularly useful in proving the authenticity of the books of the New Testament; for he has several passages and expressions from Matthew, Luke, the Acts, St Paul's Epistles to the Philippians, Ephesians, Galatians, Corinthians, Romans, Thessalonians, Colossians, 1st Timothy, 1st Epistle of St John, and 1st of Peter; and makes particular mention of St Paul's Epistle to the Ephesians. Indeed his whole Epistle consists of phrases and sentiments taken from the New Testament (B).

POLYCARPON, in botany: A genus of the trigynia order, belonging to the triandria class of plants; and in the natural method ranking under the 22d order, *Caryophyllei*. The calyx is pentaphyllous; there are five very small ovate petals; the capsule is unilocular and trivalved.

POLYCHREST, in pharmacy, signifies a medicine that serves for many uses, or that cures many diseases.

Sal Polychrest, a compound salt made of equal parts of saltpetre and sulphur, deflagrated in a red-hot crucible.

POLYCNEMUM, in botany: A genus of the monogynia order, belonging to the triandria class of plants; and in the natural method ranking under the 12th order, *Holoraceæ*. The calyx is triphyllous; and there are five calciform petals, with one seed almost naked.

POLYCRATES, was a tyrant of Samos, famous for the good fortune which always attended him. He became very powerful; and got possession not only of the neighbouring islands, but also of some cities on the coast of Asia. He had a fleet of 100 ships of war, and was so universally esteemed, that Amasis the king of Egypt made a treaty of alliance with him. The Egyptian king was, however, afraid of his continued prosperity, and advised him to chequer his enjoyments, by relinquishing some of his most favourite objects. Polycrates, in compliance, threw into the sea a beautiful seal, the most valuable of his jewels. The loss of so precious a seal afflicted him for some time; but soon after he received as a present a large fish, in whose belly it was found. Amasis no sooner heard this, than he gave up all alliance with the tyrant of Samos, and observed, that sooner or later his good fortune would vanish. Some time after Polycrates visited Magnesia on the Mæander, where he had been invited by Orontes the governor. Here he was shamefully put to death, merely because the governor wished to terminate his prosperity. The daugh-

(A) The miraculous part of this account is ridiculed by Dr Middleton in his Free Enquiry and Defence of it; but something is offered in its favour by Mr Jortin, who observes, "the circumstances are sufficient only to create a pause and a doubt." *Remarks on Eccl. Hist.* vol. i.

(B) Jortin, vol. i. p. 68. who to the particulars made out by Cotelerius, has added one from Galat. iv. 26. and another from Hebr. iv. 12, 13.

daughter of Polycrates had dissuaded her father from going to the house of Orontes, on account of the bad dreams which she had, but in vain.

POLYCROTA, in the naval architecture of the ancients, is a word used to express such of their galleys as had three, four, five, or more tiers of rowers, seated at different heights; they were distinguished by this term from the *monocrota*, or those which had only single rows of oars. The number of rows of rowers in the polycrote galleys has given occasion to some to suppose those vessels of such a height from the water as is scarce credible. Commentators are not at all agreed upon the construction of these vessels.

POLYDAMAS, was a famous athlete, who imitated Hercules in whatever he did. He killed a lion with his fist, and it is reported he could stop a chariot with his hand in its most rapid course. He was one day with some of his friends in a cave, when on a sudden a large piece of rock came tumbling down, and while all fled away he attempted to receive the falling fragment in his arms. His prodigious strength, however, was insufficient, and he was instantly crushed to pieces under the rock.

POLYDECTES, a son of Magnes, was king of the island of Seriphos. He received with great kindness Danae and her son Perseus, who had been exposed on the sea by Acrisius. He took great care of the education of Perseus; but becoming enamoured of Danae, he removed her from his kingdom, apprehensive of his resentment. He afterwards paid his addresses to Danae; and being rejected, he prepared to offer her violence. Danae fled to the altar of Minerva for protection; and Dictys, the brother of Polydectes, who had himself saved her from the sea-waters, opposed her ravisher, and armed himself in her defence. At this critical moment Perseus arrived; and with Medusa's head he turned into stones Polydectes, with the associates of his guilt. The crown of Seriphos was given to Dictys, who had shown himself so active in the cause of innocence.

POLYDORE VIRGIL. See VIRGIL.

POLYDORUS, a son of Priam by Hecuba, or, according to others, by Laothoe, the daughter of Altes, king of Pedasus. Being young and inexperienced when Troy was besieged by the Greeks, his father removed him to the court of Polymnestor, king of Thrace, to whose care he entrusted the greatest part of his treasures, till his country should be freed from foreign invasion. On the death of Priam, Polymnestor made himself master of the riches which were in his possession; and to ensure them the better, he murdered the young prince, and threw his body into the sea, where it was found by Hecuba. According to Virgil, his body was buried near the shore by his assassin; and there grew on his grave a myrtle, whose boughs dropped blood, when Æneas going to Italy, attempted to tear them from the tree.

POLYGALA, MILKWORT: A genus of the octandria order, belonging to the diadelphia class of plants; and in the natural method ranking under the 33d order, *Lomentaceæ*. The calyx is pentaphyllous, with two of its leaflets wing-shaped and coloured; the legumen is obcordate and bilocular. There are 24 species; of which the most remarkable are,

1. The vulgaris, or common milkwort, is a native of the British heaths and dry pastures. The stalks are about five or six inches long, several arising from the same root: the leaves are firm, smooth, entire, and grow alternate upon the stalks, which are terminated with spikes of flowers, most commonly blue, but often red or white: the calyx consists of five leaves, three of which are small and green, two below, and one above the corolla; the other two intermediate ones are large, oval, flat-coloured, veined, and resemble petals, which at length turn greenish, and remain a defence to the seed-vessel; the corolla consists of three petals folded together, and forming a tube: the carina is terminated by a kind of heart-shaped, concave appendage, fringed at the extremity. The root of this plant has a bitter taste, and has been found to possess the virtues of the American rattlesnake-root. It purges without danger, and is also emetic and diuretic; sometimes operating all the three ways at once. A spoonful of the decoction made by boiling an ounce of the herb in a pint of water till one half has exhaled, has been found serviceable in pleurisies and fevers, by promoting a diaphoresis and expectoration; and three spoonfuls of the same, taken once an hour, has proved beneficial in the dropsy and anasarca. It has also been found serviceable in consumptive complaints.

2. The senega, or seneka, rattlesnake-wort, grows naturally in most parts of North America. This hath a perennial root composed of several fleshy fibres, from which arise three or four branching stalks which grow erect, garnished with spear-shaped leaves placed alternately. The flowers are produced in loose spikes at the end of the branches: they are small, white, and shaped like those of the common sort. It flowers here in July, but the plants do not produce seeds. The root of this species operates more powerfully than the last; but besides the virtues of a purgative, emetic, and diuretic, it has been recommended as an antidote against the poison of a rattlesnake; but this opinion is now exploded. It still, however, maintains its character in several disorders. Its efficacy, particularly in pleurisies, is most fully established in Virginia: formerly near 50 out of 100 died of that distemper, but by the happy use of this root hardly three out of the same number have been lost.

As the seeds of the rattlesnake-wort seldom succeed even in the countries where the plant is a native, the best method of propagating it is to procure the roots from America, and plant them in a bed of light earth in a sheltered situation, where they will thrive without any other culture than keeping them free from weeds. But though the plant will stand out ordinary winters, it will be proper to cover it during that season with old tanner's bark, or other mulch, to keep out the frost.

POLYGAMIA (πολυς *many*, and γαμος *marriage*). This term, expressing an intercommunication of sexes, is applied, by Linnæus, both to plants and flowers. A polygamous plant is that which bears both hermaphrodite flowers and male or female, or both.

POLYGAMY, a plurality of wives or husbands, in the possession of one man or woman at the same time.

Polygamy is so universally esteemed unlawful, and even unnatural, through Europe, and in all Christian countries, that we have generally reasoned upon this conviction. Both religion and reason appear at first sight at least to condemn it; and with this view of the subject

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subject mankind in general rest satisfied: but some bolder geniuses have taken the opposite side of the question; have cast off the prejudices of education, and attempted to show that polygamy is not unlawful, but that it is just and necessary, and would be a public benefit. Such writers, to use the words of an intelligent critic *, "recur to the common subterfuge, of which every *setter up of strange gods*, and every CONSCIENTIOUS troubler of the public peace, have artfully availed themselves to silence the clamour of expostulation. 'TRUTH! TRUTH!' is their general cry: and with this hopeful pretence, prudence and humility, and every amiable and useful virtue, are left behind; while CONSCIENCE *(conscience!)* blindly rushes forward to oppose order, insult authority, and overturn the customs of ages."

* *Monthly Review*, vol. 63. p. 274.

But notwithstanding these fair pretences, it will, we doubt not, be easy to show that truth is not upon their side; prudence and delicacy are certainly at open war with them: for Dr Percival, Phil. Trans. vol. lxvi. part i. p. 163. has very justly observed, that the practice is brutal, destructive to friendship and moral sentiment, inconsistent with one great end of marriage, the education of children, and subversive of the natural rights of more than half of the species. Besides, it is injurious to population, and therefore can never be countenanced or allowed in a well-regulated state; for though the number of females in the world may considerably exceed the number of males, yet there are more men capable of propagating their species than women capable of bearing children; and it is a well-known fact, that Armenia, in which a plurality of wives is not allowed, abounds more with inhabitants than any other province of the Turkish empire.

Indeed it appears, that in some countries where it is allowed, the inhabitants do not take advantage of it. "The Europeans (says M. Niebuhr †) are mistaken in thinking the state of marriage so different among the Mussulmans from what it is with Christian nations. I could not discern any such difference in Arabia. The women of that country seem to be as free and as happy as those of Europe can possibly be. Polygamy is permitted, indeed, among Mahometans, and the delicacy of our ladies is shocked at this idea; but the Arabians rarely avail ‡ themselves of the privilege of marrying four lawful wives, and entertaining at the same time any number of female slaves. None but rich voluptuaries marry so many wives, and their conduct is blamed by all sober men. Men of sense, indeed, think this privilege rather troublesome than convenient. A husband is by law obliged to treat his wives suitably to their condition, and to dispense his favours among them with perfect equality: but these are duties not a little disagreeable to most Mussulmans; and such modes of luxury are too expensive to the Arabians, who are seldom in easy circumstances. I must, however, except one case; for it sometimes happens that a man marries a number of wives in the way of commercial speculation. I know a Mullah, in a town near the Euphrates, who had married four wives, and was supported by the profits of their labour."

† *Heron's Translation of Niebuhr's Travels.*

‡ See *Hindoos*, n° 9.

See a curious kind of polygamy under the article NAYRES. The ancient Britons, too, had a kind of polygamy among them, 12 women being common to 12 men.

Selden has proved, in his *Uxor Hebraica*, that plurality of wives was allowed of, not only among the Hebrews, but also among all other nations, and in all ages. It is true, the ancient Romans were more severe in their morals, and never practised it, though it was not forbid among them: and Mark Antony is mentioned as the first who took the liberty of having two wives.

From that time it became pretty frequent in the empire till the reigns of Theodosius, Honorius, and Arcadius, who first prohibited it by express law in 393. After this the emperor Valentinian, by an edict, permitted all the subjects of the empire, if they pleased, to marry several wives; nor does it appear, from the ecclesiastical history of those times, that the bishops made any opposition to this introduction of polygamy. In effect, there are some even among the Christian casuists who do not look on polygamy as in itself criminal. Jurieu observes, that the prohibition of polygamy is a positive law; but from which a man may be exempted by sovereign necessity. Baillet adds, that the example of the patriarchs is a very powerful argument in favour of polygamy: of these arguments we shall speak hereafter.

It has been much disputed among the doctors of the civil law whether polygamy be adultery. In the Roman law it is called *stuprum*, and punished as such, that is, in some cases, capitally. But a smaller punishment is more consistent with the Jewish law, wherein the prohibition of adultery is perpetual, but that of polygamy temporary only.

In Germany, Holland, and Spain, this offence is differently punished. By a constitution of Charles V. it was a capital crime. By the laws of ancient and modern Sweden it is punished with death. In Scotland it is punished as perjury.

In England it is enacted by statute 1 Jac. I. cap. 11. that if any person, being married, do afterwards marry again, the former husband or wife being alive, it is felony, but within the benefit of clergy. The first wife in this case shall not be admitted as an evidence against her husband, because she is the true wife; but the second may, for she is indeed no wife at all; and so *vice versa* of a second husband. This act makes an exception to five cases, in which such second marriage, tho' in the three first it is void, is, however, no felony. 1. Where either party hath been continually abroad for seven years, whether the party in England had notice of the other's being living or not. 2. Where either of the parties hath been absent from the other seven years within this kingdom, and the remaining party hath had no notice of the other's being alive within that time. 3. Where there is a divorce or separation *a mensa et thoro* by sentence in the ecclesiastical court. 4. Where the first marriage is declared absolutely void by any such sentence, and the parties loosed *a vinculo*. Or, 5. Where either of the parties was under the age of consent at the time of the first marriage; for in such case the first marriage was voidable by the disagreement of either party, which this second marriage very clearly amounts to. But if at the age of consent the parties had agreed to the marriage, which completes the contract, and is indeed the real marriage, and afterwards one of them should marry again, judge Blackstone apprehends that such second marriage would be within the reason and penalties of the act.

Bernardus Ochinus, general of the order of Capuchins, and afterwards a Protestant, published, about the middle

Polygamy. middle of the 16th century, Dialogues in favour of Polygamy, which were anſwered by Theodore Beza. And about the concluſion of the laſt century we had at London an artful treatiſe publiſhed in behalf of a plurality of wives, under the title of *Polygamia Triumphatrix:* the author whereof aſſumes the name of *Theophilus Aletheus;* but his true name was *Lyſerus.* He was a native of Saxony. It has been anſwered by ſeveral.

A new argument in favour of polygamy has been adduced by Mr Bruce, on this principle, that in ſome parts of the world the proportion of female children is much greater than that of males. "From a diligent inquiry (ſays he) into the ſouth and ſcripture-part of Meſopotamia, Armenia, and Syria, from Mouſul or Nineveh to Aleppo and Antioch, I find the proportion to be fully two women to one man. There is indeed a fraction over, but it is not a conſiderable one. From Latikea, Laodicea *ad mare,* down the coaſt of Syria to Sidon, the number is nearly three, or two and three-fourths, to one man. Through the Holy Land, the country called *Horan,* in the Iſthmus of Suez, and the parts of the Delta unfrequented by ſtrangers, it is ſomething leſs than three. But from Suez to the Straits of Babelmandel, which contains the three Arabias, the proportion is fully four women to one man; which I have reaſon to believe holds as far as the line, and 30° beyond it. The Imam of Sama was not an old man when I was in Arabia Felix in 1769; but he had 88 children then alive, of whom 14 only were ſons. The prieſt of the Nile had 70 and odd children; of whom, as I remember, above 50 were daughters.

"It may be objected, that Dr Arbuthnot, in quoting the bills of mortality for 20 years, gave the moſt unexceptionable grounds for his opinion; and that my ſingle aſſertion of what happens in a foreign country, without further foundation, cannot be admitted as equivalent teſtimony: and I am ready to admit this objection, as there are no bills of mortality in any of theſe countries. I ſhall therefore ſay in what manner I attained the knowledge which I have juſt mentioned. Whenever I went into a town, village, or inhabited place, dwelt long in a mountain, or travelled journeys with any ſet of people, I always made it my buſineſs to inquire how many children they had, or their fathers, their next neighbours or acquaintance. I then aſked my landlord at Sidon, ſuppoſe him a weaver, how many children he has had? He tells me how many ſons and how many daughters. The next I aſk is a tailor, a ſmith, &c. in ſhort every man who is not a ſtranger, from whom I can get the proper information. I ſay, therefore, that a medium of both ſexes, ariſing from three or four hundred families, indiſcriminately taken, ſhall be the proportion in which one differs from the other; and this, I am confident, will give the reſult to be three women in 50° of the 90° under every meridian of the globe."

Our author corroborates this argument by ſuppoſing that Mahomet perceived this diſproportion, and that upon it he founded his inſtitution allowing one man to have four wives. "With this view he enacted, or rather revived, the law which gave liberty to every individual to marry four wives, each of whom was to be equal in rank and honour, without any preference but what the predilection of the huſband gave her."

Having thus eſtabliſhed, as he ſuppoſes, the neceſſity of polygamy in the Eaſt, Mr Bruce proceeds to conſider whether there is not ſome other reaſons why it ſhould not be practiſed in Britain farther than the mere equality in numbers of the ſexes to one another. This reaſon he finds in the difference between the conſtitutions of the Europeans and eaſtern nations. "Women in England (ſays he) are capable of child-bearing at 14; let the other term be 48, when they bear no more; 34 years therefore an Engliſh woman bears children. At the age of 14 or 15 they are objects of our love; they are endeared by bearing us children after that time; and none, I hope, will pretend, that at 48 and 50 an Engliſhwoman is not an agreeable companion. The Arab, on the other hand, if ſhe begins to bear children at 11, ſeldom or never has a child after 20. The time, then, of her child-bearing is nine years; and four women, taken altogether, have then the term of 36. So that the Engliſh woman that bears children for 34 years has only two years leſs than the term enjoyed by the four wives whom Mahomet has allowed; and if it be granted that an Engliſh wife may bear at 50, the terms are equal. But there are other grievous differences. An Arabian girl, at 11 years old, by her youth and beauty, is the object of man's deſire: being an infant, however, in underſtanding, ſhe is not a rational companion for him. A man marries there, ſay at 20; and before he is 30, his wife, improved as a companion, ceaſes to be an object of his deſires and a mother of children: ſo that all the beſt and moſt vigorous of his days are ſpent with a woman he cannot love; and with her he would be deſtined to live 40, or 45 years, without comfort to himſelf by increaſe of family, or utility to the public. The reaſons, then, againſt polygamy, which ſubſiſt in England, do not by any means ſubſiſt in Arabia; and that being the caſe, it would be unworthy of the wiſdom of God, and an unevenneſs in his ways, which we ſhall never ſee, to ſubject two nations under ſuch different circumſtances abſolutely to the ſame obſervances."

To all this argumentation, however, it may be replied, that whatever we may now ſuppoſe to be the conſtitution of nature in the warmer parts of the globe, it certainly was different at the beginning. We cannot indeed aſcertain the exact poſition of the Garden of Eden; but it is with reaſon ſuppoſed not to have been far from the ancient ſeat of Babylon. In that country, therefore, where Mr Bruce contends that *four* women are neceſſary to the comfort of one man, it pleaſed God to grant only *one* to the firſt man; and that, too, when there was more occaſion for population than ever there has been ſince, becauſe the whole earth was to be peopled from a ſingle pair. Matters were not altered at the flood; for Noah had but one wife. And this is the very argument uſed by our Saviour himſelf when ſpeaking of divorce without any ſufficient cauſe, and then marrying another woman, which is a ſpecies of polygamy.—Again, with reſpect to the alleged multiplicity of females in the eaſtern part of the world, it is by no means probable that the calculations of Mr Bruce or any other perſon can be admitted in this caſe. Hiſtory mentions no ſuch thing in any nation; and conſidering the vaſt deſtruction among the male part of the human ſpecies more than of the females by war and other accidents, we may ſafely ſay, that if *four* women children were born for every ſingle male, there would

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in such countries be five or six grown up women for every man; a proportion which we may venture to affirm does not, nor ever did, exist anywhere in the world. That it was not so in former times we can only judge from the particular examples recorded in history, and these are but few. We read in the Greek history, indeed, of the *fifty* daughters of Danaus; but these were matched by as many *sons* of another man. Job had only one wife, yet had *seven* sons and but *three* daughters. Jacob had two wives, who bore *twelve* sons, and only one daughter. Abraham had only one child by his first wife, and that was a son. By his second wife Keturah he had six sons; and considering his advanced age at the time he married her, it is by no means probable that he could have 24 daughters; nay, if, as Mr Bruce tells us, the women in the eastern countries bear children only for nine years, it was impossible she could have so many. Gideon, who had many wives, had no fewer than seventy sons by these wives, and even his concubine had a son; so that if all these women had produced according to Mr Bruce's proportion, of nearly three females to one male, he must have had almost 284 children; a better family than any of Mr Bruce's eastern acquaintances can probably boast of.

With regard to this subject, however, it must be observed, that the procreation of male or female children depends in some degree on the health and vigour of the parents. It is by no means improbable, therefore, that the eastern voluptuaries, whose constitutions are debilitated by their excesses, may have many more female than male children born to them. The women themselves, by premature enjoyment, will also be inclined to produce females instead of males; but neither of these circumstances can prove this to be an original law of nature. Something like this may be gathered from sacred history. Gideon above-mentioned, who was a hardy and active warrior, had many sons. The same was the case with David, who led an active and laborious life; while Solomon, who was a voluptuary, had only one son, notwithstanding his multitude of wives.

The most barefaced defence of polygamy that has appeared in modern times is by the Rev. Mr Madan, who published a treatise, artfully vindicating, and strongly recommending it, under the title of *Thelyphthora; or, A treatise on Female Ruin, in its Causes, Effects, Consequences, Prevention, and Remedy*, &c. Marriage, according to this writer, simply and wholly consists in the act of personal union, or *actus coitus*. Adultery, he says, is never used in the sacred writings but to denote the defilement of a betrothed or married woman, and to this sense he restricts the use of the term; so that a married man, in his opinion, is no adulterer, if his commerce with the sex be confined to single women, who are under no obligations by espousals or marriage to other men: but, on the other hand, the woman who should dare to have even but once an intrigue with any other man besides her husband, (let him have as many wives as Solomon), would, *ipso facto*, be an adulteress, and ought, together with her gallant, to be punished with immediate death. This, he boldly says, is the law of God: and on this foundation he limits the privilege of polygamy to the man; in support of which he refers to the polygamous connections of the patriarchs and saints of the Old Testament, and infers the lawfulness of their practice from the blessings which attended it, and the laws which were instituted to regulate and superintend it. He contends for the lawfulness of Christians having, like the ancient Jews, more wives than one; and labours much to reconcile the genius of the evangelical dispensation to an arrangement of this sort. With this view he asserts, that there is not one text in the New Testament that even hints at the criminality of a polygamous connection; and he would infer from St Paul's direction, that bishops and deacons should have but one wife, that it was lawful for laymen to have more. Christ, he says, was not the giver of a new law; but the business of marriage, polygamy, &c. had been settled before his appearance in the world, by an authority which could not be revoked. Besides, this writer not only thinks polygamy lawful in a religious, but advantageous in a civil, light, and highly politic in a domestic view.

In defence of his notion of marriage, which, he says, consists in the union of man and woman as one body, the effects of which in the sight of God no outward forms or ceremonies of man's invention can add to or detract from, he grounds his principal argument on the Hebrew words made use of in Gen. ii. 24. to express the primitive institution of marriage, viz. רבק באשתו, rendered by the LXX. προσκολληθησεται προς την γυναικα αυτȣ, which translation is adopted by the evangelist (Mat, xix. 5.) with the omission only of the superfluous preposition (προς) after the verb. Our translation, "shall cleave to his wife," doth not, he says, convey the idea of the Hebrew, which is literally, as Montanus renders the words, "shall be joined or cemented *in* his woman, and they shall become (*i. e.* by this union) one flesh." But on this criticism it is well remarked, that both the Hebrew and Greek terms mean simply and literally attachment or adherence; and are evidently made use of in the sacred writings to express the whole scope of conjugal fidelity and duty, though he would restrain them to the grosser part of it.

With respect to the Mosaic law, for which Mr Madan is a warm advocate, it was certainly a local and temporary institution, adapted to the ends for which it was appointed, and admirably calculated, in its relation to marriage, to maintain and perpetuate the separation of the Jewish people from the Gentiles. In attempting to depreciate the outward forms of marriage, this writer would make his readers believe, that because none are explicitly described, therefore none existed; and consequently that they are the superfluous ordinances of human policy. But it is evident, from comparing Ruth iv. 10, 13. with Tobit vii. 13. 14. and from the case of Dinah, related Gen. xxxiv. that some forms were deemed essential to an honourable alliance by the patriarchs and saints under the Old Testament, exclusive of the carnal knowledge of each other's persons. It is also evident in the case of the woman of Samaria, whose connection with a man not her husband is mentioned in John iv. that something besides cohabitation is necessary to constitute marriage in the sight of God.

Having stated his notion of marriage, he urges, in defence of polygamy, that, notwithstanding the seventh commandment, it was allowed by God himself, who

Polygamy. who made laws for the regulation of it, wrought miracles in support of it by making the barren woman fruitful, and declared the issue legitimate to all intents and purposes. God's allowance of polygamy is argued from Exod. xxi. 10. and particularly from Deut. xxi, 15. which, he says, amounts to a demonstration. This passage, however, at the utmost, only presupposes that the practice might have existence among so hard-hearted and fickle a people as the Jews; and therefore wisely provides against some of its more unjust and pernicious consequences, such as tended to affect the rights and privileges of heirship. Laws enacted to regulate it cannot be fairly urged in proof of its lawfulness on the author's own hypothesis; because laws were also made to regulate divorce, which Mr Madan condemns as absolutely unlawful, except in cases of adultery. Besides, it is more probable that the "hated wife" had been dismissed by a bill of divorcement, than that she was retained by her husband: and moreover, it is not certain but that the two wives, so far from living with the same husband at the same time, might be dead; for the words may be rendered thus, "if there *should have been* to a man two wives, &c." The words expressing the original institution of marriage, Gen. ii. 24. compared with Mat. xix. 4, 5, 8. afford insuperable objections against Mr Madan's doctrine of polygamy.

If we appeal on this subject, from the authority of Scripture to the writings of the earliest fathers in the Christian church, there is not to be found the faintest trace of any thing resembling a testimony to the lawfulness of polygamy; on the contrary, many passages occur, in which the practice of it is strongly and explicitly condemned.

Monthly Review, vol. 63. p. 338. See also vol. 69.

We shall close this article with the words of an excellent anonymous writer already quoted, and to whose critique on Mr Madan's work we are indebted for the above remarks: "In a word, when we reflect that the primitive institution of marriage limited it to one man and one woman; that this institution was adhered to by Noah and his sons, amidst the degeneracy of the age in which they lived, and in spite of the examples of polygamy which the accursed race of Cain had introduced; when we consider how very few (comparatively speaking) the examples of this practice were among the faithful; how much it brought its own punishment with it; and how dubious and equivocal those passages are in which it appears to have the sanction of divine approbation; when to these reflections we add another, respecting the limited views and temporary nature of the more ancient dispensations and institutions of religion—how often the imperfections and even vices of the patriarchs and people of God, in old time, are recorded, without any express notification of their criminality—how much is said to be commanded, which our reverence for the holiness of God and his law will only suffer us to suppose, were, for wise ends, permitted—how frequently the messengers of God adapted themselves to the genius of the people to whom they were sent, and the circumstances of the times in which they lived:—above all, when we consider the purity, equity, and benevolence of the Christian law; the explicit declarations of our Lord, and his apostle St Paul, respecting the institution of marriage, its design and limitation;—when we reflect, too, on the testimony of the most ancient fathers, who could not possibly be ignorant of the general and common practice of the apostolic church; and, finally, when to these considerations we add those which are founded on justice to the female sex, and all the regulations of domestic economy and national policy—we must wholly condemn the revival of polygamy; and thus bear our honest testimony against the leading design of this dangerous and ill-advised publication."

We would advise our readers to read the whole criticisms on Madan's book in the Monthly Review, together with their account of the several answers to it. The reverend author of the Thelyphthora has there met with a most able antagonist, who traces him through all his deceitful windings, and exposes the futility and falsehood of his arguments with singular ability. See *Monthly Review*, vol. lxiii. p. 273, &c.; see also *Paley's Moral Philosophy*, 4to. p. 262.

POLYGARS, are natives of Hindostan. They inhabit almost impenetrable woods, and are under the absolute direction of their own chieftains. In time of peace they are professionally robbers, but in times of war are the guardians of the country. The general name of these people is *Polygar*. Their original institution, for they live in distinct clans, is not very well understood. It probably took its rise from the municipal regulations relative to the destruction of tygers and other ferocious beasts. Certain tracts of woodland were indisputably allotted as rewards to those who should slay a certain number of those animals; and those lands approximating, probably laid the foundation of the several confederacies of Polygars.

"The Pollams, or woods, from which is derived the word *Polygar*, lying in profusion through all the southern parts of Hindostan, the ravages committed in the open countries by these adventurous clans, are both frequent and destructive. Cattle and grain are the constant booty of the Polygars. They not unfrequently even despoil travellers of their property, and sometimes murder, if they meet with opposition: yet these very Polygars are the hands into which the aged and infirm, the wives, children, and treasure, of both Hindoos and others are entrusted, when the circumjacent country unfortunately happens to be the seat of war. The protection they afford is paid for; but the price is inconsiderable, when the helpless situation of those who fly to them for shelter is considered, and especially when their own very peculiar character is properly attended to. The native governments of Hindostan are under the necessity of tolerating this honourable banditti. Many of them are so formidable as to be able to bring 15,000 and 20,000 men into the field.

"The Hindoo code of laws, in speaking of robberies, hath this remarkable clause, 'The mode of shares amongst robbers shall be this:—If any thief or thieves, by the command of the magistrate, and with his assistance, have committed depredations upon, and brought away any booty from, another province, the magistrate shall receive a share of one sixth part of the whole. If they received no command or assistance from the magistrate, they shall give the magistrate in that case one tenth part for his share, and of the remainder their chief shall receive four shares; and whosoever among them is perfect master of his occupation, shall receive three shares: also, whichever of them is remarkably strong and stout, shall receive two shares, and the rest shall receive each one share.' Here, then, we see not only a sanction, but even an inducement, to fraudulent practices.—Another singular inconsistency among a people who, in many periods of their history, have been proverbial for innocency of manners, and for uncommon honesty in their conduct towards travellers and strangers.

"At the first sight, it would appear that the toleration of the Polygars, owing to their great numbers, and to the security of their fortresses, which are in general impenetrable but to Polygars; that the government licence, in this manner given to them, to live on the spoils of the industrious—might have originally occasioned the formal division, and encouragement to perseverance, which we have just quoted: but the cause I should rather suppose to lie in the nature of certain governments, than to have arisen from any accidental circumstance afterwards; and I am the more inclined to this opinion, from the situation of the northern parts of Hindostan, which are, and always have been, uninfested by these freebooters.

"The dominion of the East was, in former days, most probably divided and subdivided into all the various branches of the feodal system. The vestiges of it remain to this hour: rajahs and zemindars are nothing more than chieftains of a certain degree of consequence in the empire. If, then, experience has shown, in other parts of the world, that clans have always been observed to commit the most pernicious acts of depredation and hostility on each other, and that the paramount lord has seldom been able effectually to crush so general and so complicated a scene of mischief—may we not reasonably venture to suppose, that the Hindoo legislature passed this ordinance for the suppression of such provincial warfare, and for the wholesome purpose of drawing the people, by unalarming degrees, more immediately under the controul of the one sovereign authority? The conclusion, I own, appears to me satisfactory. Moreover, Polygars cannot but be of modern growth; for the law relative to thefts is antecedent to the mention of Polygars in history." Sullivan's *Philosophical Rhapsodies*.

POLYGLOTT, among divines and critics, chiefly denotes a Bible printed in several languages. See Bible and Printing.

POLYGLOTTUS, in ornithology. See Turdus.

POLYGNOTUS, a famous painter of Thasos, flourished about 422 years before the Christian era, and was the son and scholar of Aglaophon. He adorned one of the public porticoes of Athens with his paintings, in which he had represented the most striking events of the Trojan war. The Athenians were so pleased with him, that they offered to reward his labours with whatever he pleased to accept; but he declined the offer; and the Amphictyonic council, which was composed of the representatives of the principal cities of Greece, ordered that Polygnotus should be maintained at the public expence wherever he went.

Of the talents of Polygnotus much honourable mention is made by many of the best authors of antiquity, as Aristotle and Plutarch, Dionysius Halicarnassensis, &c. Pausanias speaks of his pictures of the events of the Trojan war, and, in his Tenth Book, introduces a very long description of other pictures by the same artist, painted also from Homer in the temple at Delphos. The passage, however, gives but a confused and imperfect idea of the painter's performance. How much the art is indebted to this ancient master, what grace and softness he gave to the human countenance, what embellishments he added to the female figure and dress, are much more happily described by Pliny. "Primus mulieres lucida veste pinxit, capita earum mitris versicoloribus operuit, plurimumque picturæ primus contulit: siquidem instituit os adaperire, dentes ostendere, vultum ab antiquo rigore variare."—The same author likewise bears honourable testimony to the liberal spirit of this great artist, who refused any reward for his ingenious labours in the portico.— "Porticum gratuito, cum partem ejus Mycon mercede pingeret." Plin. *lib.* 35. *cap.* 8.

POLYGON, in geometry, a figure with many sides, or whose perimeter consists of more than four sides at least; such are the pentagon, hexagon, heptagon, &c.

POLYGONUM, Knot-grass: A genus of the trigynia order, belonging to the octandria class of plants; and in the natural method ranking under the 12th order, *Holoraceæ*. There is no calyx; the corolla is quinquepartite, and calycine, or serving instead of a calyx; there is one angulated seed. There are 27 species; but the most remarkable are, 1. The bistorta, bistort, or greater snakeweed, hath a thick oblique intorted root, blackish without, and red within; a simple, round, slender stem, near two feet high; oval leaves, having decurrent foot-stalks, and the stalk terminated by thick short spikes of whitish-red flowers. 2. The viviparum, or smaller bistort, hath a thickish root, a simple slender stem half a foot high, spear-shaped leaves, and the stalks and branches terminated by long spikes of whitish-red flowers. Both these perennials flower in May and June, succeeded by ripe seeds in August. They grow wild in England, &c. the first in moist, the other in mountainous, situations. 3. Oriental polygonum, commonly called *persicaria*, hath fibrous roots; an upright, robust, strong, jointed stem, rising eight or ten feet high, dividing at top into several branches; very large oval-lanceolate alternate leaves, on broad footstalks half surrounding the stem; and all the branches terminated by long, slender, hanging spikes of reddish-purple heptandrous and digynious flowers, from July till October. 4. Fagopyrum, buckwheat, or brank, rises with an upright, smooth, branchy stem, from about a foot and a half to a yard high, heart-shaped sagittated leaves, and the branches terminated by clusters of whitish flowers, succeeded by large angular seeds; excellent for feeding pigeons and most sorts of poultry.

All these plants are hardy, and succeed in almost any soil and situation; the two first are perennial in root; and the third and fourth are annual, wholly decay at the end of summer, or early in winter. The first two sorts are retained in some curious gardens for variety; but their chief merit is for medical purposes; they are powerful astringents, and are used both internally and externally; esteemed very efficacious in hæmorrhagies and other fluxes; and good to heal sore mouths. The third sort, Oriental polygonum, or persicaria, is a most elegant annual for the embellishment of pleasure-ground; assuming a majestic tree-like growth by its erect luxuriant stem, and branchy head; which being garnished with noble large foliage, and numerous pendulous spikes of flowers, in constant succession three or four months, exhibits a very ornamental appearance from June or July until October, and is so easy of culture, that from its scattered seeds in autumn, young plants rise spontaneously in abundance the ensuing spring, and shoot up so rapidly as to attain six or eight feet in height by July, when they generally begin flowering, and continue till attacked by the frost, when they totally perish; so that a fresh supply must be raised from seed annually. The fourth sort (buck-wheat) is a sort of corn, and is frequently cultivated both by way of fodder, cutting its stalks while young and green to feed cattle, and for its grain to feed pigeons, poultry, hogs, &c. It flourishes in any soil and situation, but generally thrives best in a light dry earth; and the driest seasons seldom retard its growth. The first and second sorts are easily propagated in plenty, by parting the roots in autumn. The third sort, Oriental polygonum, being annual, is always propagated from seed annually, either in the full ground, or by means of hot-beds.

Uses. The root of a kind of bistort, according to Gmelin, is used in Siberia for ordinary food. This species is by Haller called *bistorta foliis ad oram nervosis*, and by some other botanists *bistorta montana minor*. The natives call it *mouka*; and so indolent are they, that, to save themselves the trouble of digging it out of the earth, they go in spring and pillage the holes of the mountain rats, which they find filled with these roots. In our country, bistort is used as a medicine. All the parts of bistort have a rough austere taste, particularly the root, which is one of the strongest of the vegetable astringents. It is employed in all kinds of immoderate hæmorrhagies and other fluxes, both internally and externally, where astringency is the only indication. It is certainly a very powerful styptic, and is to be looked on simply as such; the sudorific, antipestilential, and other like virtues ascribed to it, it has no other claim to than in consequence of its astringency, and of the antiseptic power which it has in common with other vegetable styptics. The largest dose of the root in powder is a single dram.

POLYGRAPHY, Polygraphia, or *Polygraphice*, the art of writing in various unusual manners or ciphers; as also of deciphering the same. The word is formed from the Greek, πολυ, *multum*, and γραφη, *scriptura*, "writing."

The ancients seem to have been very little acquainted with this art; nor is there any mark of their having gone beyond the Lacedæmonian scytala. Trithemius, Porta, Vigenere, and father Niceron, have written on the subject of polygraphy or ciphers. See Cipher.

POLYHYMNIA, in the pagan mythology, one of the nine muses, thus named from the Greek words πολυς "much," and μνια "memory." She presided over history, or rather rhetoric; and is represented with a crown of pearls and a white robe; her right hand in action as if haranguing, and holding in her left a caduceus or sceptre to show her power.

POLYHEDRON, in geometry, denotes a body or solid comprehended under many sides or planes.

Polyhedron, in optics, is a multiplying glass or lens, consisting of several plane surfaces disposed into a convex form. See Optics, n° 256.

POLYMATHY, denotes the knowledge of many arts and sciences. The word is derived from the Greek, Πολυ, *multum*, and μανθανω, *disco*.

POLYMNESTOR, was a king of the Thracian Chersonesus. He married Ilione, Priam's eldest daughter; and for the sake of the treasure with which he was entrusted by Priam during the siege of Troy, he murdered Polydorus, (see Polydorus). The fleet in which the victorious Greeks returned, together with their Trojan captives, among whom was Hecuba, stopped on the coasts of Thrace, where one of the female captives discovered on the shore the body of Polydorus, whom Polymnestor had thrown into the sea. The dreadful intelligence was immediately communicated to Hecuba his mother, who recollecting the frightful dreams she had the preceding night, did not doubt but Polymnestor was the cruel assassin. Resolved to revenge her son's death, she immediately called out Polymnestor, as if to impart to him something of importance. He was drawn into the snare; and no sooner was he introduced into the apartment of the Trojan princess, than the female captives rushing upon him, put out his eyes with their pins, while Hecuba murdered his two children, who had accompanied him. Euripides informs us, that the Greeks condemned Polymnestor to be banished into a distant island for his perfidy. Hyginus, however, relates the whole differently, and tells us, that when Polydorus was sent to Thrace, Ilione his sister took him instead of her son Deiphilus, who was of the same age, being fearful of her husband's cruelty. The monarch, unacquainted with the imposition, looked upon Polydorus as his own son, and treated Deiphilus as her brother. After the destruction of Troy, the conquerors wished the house and family of Priam to be extirpated, and therefore offered Electra the daughter of Agamemnon to Polymnestor, if he would destroy Ilione and Polydorus. He accepted the offer, and immediately dispatched his own son Deiphilus, whom he took for Polydorus. Polydorus, who passed as the son of Polymnestor, consulted the oracle after the murder of Deiphilus, and being informed that his father was dead, his mother a captive in the hands of the Greeks, and his country in ruins, he communicated the answer to Ilione, whom he had always regarded as his mother. She told him the measures she had pursued to save his life, upon which he avenged the perfidy of Polymnestor by putting out his eyes.

POLYMNIA, in botany: A genus of the polygamia necessaria order, belonging to the syngenesia class of plants; and in the natural method ranking under the 49th order, *Compositæ*. The receptacle is paleaceous; there is no pappus; the exterior calyx is tetraphyllous, or pentaphyllous; the interior decaphyllous, and composed of concave leafets.

POLYNICES, the son of Œdipus by his mother Jocasta. See Jocasta, Œdipus, and Eteocles.

POLYPE. See Polypus.

POLYPETALOUS, among botanists, an epithet applied to such flowers as consist of several petals or flower-leaves.

POLYPHEMUS (fab. hist.), a celebrated Cyclops, and king of all the Cyclops in Sicily, was the son of Neptune and Thoosa the daughter of Phorcys. He is said to have been a monster of great strength, very tall, and

Polypodium. Polypremum, Polypus.

and with one eye in the middle of the forehead. He eat human flesh, and kept his flocks on the coasts of Sicily, when Ulysses, at his return from the Trojan war, was driven there. Ulysses, together with 12 of his companions, visited the coast, and with them was seized by the Cyclops, who confined them in his cave, and daily devoured two of them. Ulysses would have shared the fate of the rest, had he not intoxicated the Cyclops, and put out his eye with a firebrand when he was asleep. Polyphemus was awakened by the sudden pain, and stopped the entrance of his cave; but Ulysses escaped, by creeping between the legs of the rams of the Cyclops, as they were led out to feed on the mountains. Polyphemus became enamoured of Galatæa; but his addresses were disregarded, and the nymph shunned his presence. The Cyclops was still more earnest; and when he saw Galatæa surrender herself to the pleasures of Acis, he crushed his rival with a piece of a broken rock.

POLYPODIUM, in botany; a genus of the order of filices, belonging to the cryptogamia class of plants. The fructifications are in roundish points, scattered over the inferior disc of the frons or leaf.—There are 65 species, of which the most remarkable is the filix mas, or common male fern. This grows in great plenty throughout Britain in woods and stony uncultivated soils. The greatest part of the root lies horizontally, and has a great number of appendages placed close to each other in a vertical direction, while a number of small fibres strike downwards. The leaves are a cubit high, and grow in circular tufts. They are at first alternately pinnate, the pinnæ increasing in size from the base towards the middle, and afterwards gradually decreasing upwards to the summit of the leaf. These pinnæ are again pinnatifid, or subdivided almost to the nerve into obtuse parallel lobes, crenated on the edges. The stalks are covered with brown filmy scales. The fructifications are kidney-shaped, and covered with a permanent scaly shield or involucrum. The capsules are of a pale brown, surrounded with a saffron-coloured elastic ring.

This fern has nearly the same qualities, and is used for most of the same intentions, as the pteris aquilina. They are both burnt together for the sake of their ashes, which are purchased by the soap and glass-makers. In the island of Jura are exported annually 150l. worth of these ashes.

Gunner relates, in his *Flor. Noveg.* that the young curled leaves, at their first appearance out of the ground, are by some boiled and eaten like asparagus; and that the poorer Norwegians cut off those succulent laminæ, like the nails of the finger at the crown of the root, which are the bases of the future stalks, and brew them into beer, adding thereto a third portion of malt, and in times of great scarcity mix the same in their bread. The same author adds, that this fern cut green, and dried in the open air, affords not only an excellent litter for cattle, but, if infused in hot water, becomes no contemptible fodder to goats, sheep, and other cattle, which will readily eat and sometimes grow fat upon it: a circumstance well worth the attention of the inhabitants of the Highlands and Hebrides, as great numbers of their cattle, in hard winters, frequently perish for want of food.

But the anthelmintic quality of the root of the male fern is that for which it is chiefly to be valued, and of which an account is given under the article MEDICINE, p. 343. col. 2.

The polypodium oreopteris is only remarkable because it has been confounded by most of the English botanists with the species which we have now described, and the polypodium thelypteris. It has a large scaly root, wrapped and tied together with small strong fibres, not to be separated without difficulty.—The fructifications are on the margins both when young and old, and never run into one another: the lobes are oval and plain. It is four times as large as the thelypteris, and grows in dry woods, moors, or hills, and very seldom near water; all which characters are widely different from those of the species with which it has been confounded. It is to be found both in England and Scotland, in the latter place very plentifully. See *Linnæan Transactions*, vol. 1. p. 181.

POLYPREMUM, in botany: A genus of the monogynia order, belonging to the tetrandria class of plants; and in the natural method ranking under the 22d order, *Caryophillei*. The calyx is tetraphyllous; the corolla quadrifid and rotaceous, with its lobes obcordate; the capsule compressed, emarginated, and bilocular.

POLYPUS, a species of fresh-water insects, belonging to the genus of hydra, of the order of zoophytes, and class of vermes. (See ANIMALCULE, n° 24, &c.) The name of *hydra* was given them by Linnæus on account of the property they have of reproducing themselves when cut in pieces, every part soon becoming a perfect animal. Dr Hill called them *biota*, on account of the strong principle of life with which every part of them is endowed.

These animals were first discovered by Leeuwenhoek, who gave some account of them in the Philosophical Transactions for 1703; but their wonderful properties were not thoroughly known till the year 1740, when Mr Trembley began to investigate them. Previous to his discoveries, indeed, Leibnitz and Boerhaave, by reasonings *à priori*, had concluded that animals might be found which would propagate by slips like plants; and their conjectures were soon verified by the observations of the gentleman above-mentioned. At first, however, Mr Trembley was uncertain whether he should reckon these creatures animals or plants; and while thus uncertain, he wrote a letter on the subject to Mr Bonnet in January 1741; but in March the same year he had satisfied himself that they were real animals. The surprise of Mr Trembley, and of others, on discovering the true nature of these animals, was very great. When Mr Reaumur saw for the first time two polypes formed from one which he had divided into two parts, he could hardly believe his own eyes; and even after having repeated the operation an hundred times, he said that the sight was by no means familiar to him. On the 18th of July 1741, M. Buffon wrote to Martin Folkes, Esq; president of the Royal Society, acquainting him with "the discovery of a small insect called a *polypus*, which is found about the common duck-weed; and which, being cut in two, puts forth from the upper part a tail, and from the lower end a head, so as to become two animals instead of one. If it be cut into three parts, the middlemost also puts out from one end a head, and from the other a tail, so as to become three distinct animals, all living like the first, and performing the various offices of their species."

species."—In September the same year, a letter was communicated from C. Bentink, Esq; at the Hague, describing the insects discovered by Mr Trembley, adding, that he himself had seen them; and in November that year, a letter was read before the Society from Gronovius at Leyden, giving an account of a water-insect, which, says he, if cut into five or six pieces, in a few hours there will be as many animals exactly similar to their parent. These accounts, however, were all deemed so extraordinary, that they were not credited, until professors Albinus and Muschenbroeck provided themselves with them, and found every thing related concerning them to be exactly true. In March 1742, Mr Folkes gave an account of them to the Royal Society, from some observations made on several polypes which Mr Trembley had sent from Holland. They were soon after found in England, and the observations made upon them were published by several persons; so that no doubt remained concerning the reality of what had been related concerning them.

The general character of the polype is, that it fixes itself by its base; is gelatinous, linear, naked, contractile; and can change its place. The mouth, which is placed at one end, is surrounded by hair-like feelers. The young ones grow out from its sides; but in autumn it produces eggs from its sides. There are six varieties.

1. The *viridis*, or green polype, has commonly ten short arms.

2. The *fusca* has frequently eight arms several times longer than the body.

3. The *grisea* is of a yellowish colour, small towards the bottom, and has long arms, generally about seven in number.

4. The *pallens* has generally about six arms of a moderate length.

5. The *hydatula* has a vesicular body, and four obsolete arms. It is found in the abdomen of sheep, swine, &c.

6. The *stentorea* has been called the *tunnel-shaped*, and has a mouth surrounded with a row of hairs.

7. The *socialis* is bearded, thick, and wrinkled.

The three first species are those on which the greatest number of experiments have been made; and their shapes are so various, that it is by no means easy to describe them. They are generally found in ditches. Whoever has carefully examined these when the sun is very powerful, will find many little transparent lumps of the appearance of a jelly, and size of a pea, and flatted upon one side. The same kind of substances are likewise to be met with on the under side of the leaves of plants which grow in such places. These are the polypes in a quiescent state, and apparently inanimate. They are generally fixed by one end to some solid substance, with a large opening, which is the mouth, at the other; having several arms fixed round it, projecting as rays from the centre. They are slender, pellucid, and formed of a tender substance like the horns of a snail, and capable of contracting themselves into a very small compass, or of extending to a considerable length. The arms are capable of the same contraction and expansion as the body; and with these they lay hold of minute worms and other insects, bringing them to the mouth and swallowing them; the indigestible parts are again thrown out by the mouth.

The green polype was that first discovered by Mr Trembley; and the first appearances of spontaneous motion were perceived in its arms, which it can contract, extend, and twist about in various directions. On the first appearance of danger they contract to such a degree that they appear little bigger than a grain of sand, of a fine green colour, the arms disappearing entirely. Soon after he found the grisea, and afterwards the fusca.

The bodies of the viridis and grisea diminish almost insensibly from the anterior to the posterior extremity; but the fusca is for the most part of an equal size for two-thirds of its length from the anterior to the posterior extremity, from which it becomes abruptly smaller, and then continues of a regular size to the end. These three kinds have at least six, and at most 12 or 13 arms, though sometimes the grisea is met with having 18 arms. They can contract themselves till their bodies do not exceed one-tenth of an inch in length, and they can stop at any intermediate degree of contraction or extension. They are of various sizes, from half an inch to an inch and an half long; their arms are seldom longer than their bodies, though some have them an inch, and some even eight inches, long. The thickness of their bodies decreases as they extend themselves, and *vice versa*; and they may be made to contract themselves either by agitating the water in which they are contained, or by touching the animals themselves. When taken out of the water, they all contract so much that they appear only like a little lump of jelly. The arms have the same power of contraction or expansion that the body has; and they can contract or expand one arm, or any number of arms, independent of the rest; and they can likewise bend their bodies or arms in all possible directions. They can also dilate or contract their bodies in various places, and sometimes appear thick set with folds, which, when carelessly viewed, appear like rings. Their progressive motion is performed by that power which they have of contracting and dilating their bodies. When about to move, they bend down their head and arms, lay hold by means of them on some other substance to which they design to fasten themselves; then they loosen their tail, and draw it towards the head; then either fix it in that place, or stretching forward their head as before, repeat the same operation. They ascend or descend at pleasure in this manner upon aquatic plants, or upon the sides of the vessel in which they are kept; they sometimes hang by the tail from the surface of the water, or sometimes by one of the arms; and they can walk with ease upon the surface of the water. On examining the tail with a microscope, a small part of it will be found to be dry above the surface of the water, and as it were in a little concave space, of which the tail forms the bottom; so that it seems to be suspended on the surface of the water on the same principle that a small pin or needle is made to swim. When a polype, therefore, means to pass from the sides of the glass to the surface of the water, it has only to put that part out of the water by which it is to be supported, and to give it time to dry, which it always does upon these occasions; and they attach themselves so firmly by the tail to aquatic plants, stones, &c. that they cannot be easily disengaged: they often further strengthen these attachments by means

means of one or two of their arms, which serve as a kind of anchors for fixing them to the adjacent substances.

The stomach of the polype is a kind of bag or gut into which the mouth opens, and goes from the head to the tail. This, in a strong light, is visible to the naked eye, especially if the animal be placed between the eye and a candle; for these animals are quite transparent whatever their colour may be. The stomach, however, appears to more advantage through a powerful magnifier. Mr Trembley, by cutting one of these animals transversely into three parts, satisfied himself that they were perforated throughout. Each piece immediately contracted itself, and the perforation was very visible through a microscope. The skin which incloses the stomach is that of the polype itself; so that the whole animal, properly speaking, consists only of one skin, in the form of a tube, and open at both ends. No vessels of any kind are to be distinguished.

The mouth is situated at the anterior end in the middle between the shooting forth of the arms, and assumes different appearances according to circumstances; being sometimes lengthened out in the form of a nipple, at others appearing truncated; sometimes the aperture is quite closed, at others there is a hollow; though at all times a small aperture may be discovered by a powerful magnifier.

The skin of a polype, when examined with a microscope, appears like shagreen, or as if covered with little grains, more or less separated from each other, according to the degree of contraction of the body. If the lips of a polype be cut transversely, and placed so that the cut part of the skin may lie directly before the microscope, the skin throughout its whole thickness will be found to consist of an infinite number of grains, and the interior part is found to be more shagreened than the exterior one; but they are not strongly united to each other, and may be separated without much trouble. They even separate of themselves, though in no great numbers, in the most healthy animals of this kind; for where they are observed to separate in large quantities, it is a symptom of a very dangerous disorder. In the progress of this disorder, the surface of the polype becomes gradually more and more rough and unequal, and no longer well defined or terminated as before. The grains fall off on all sides; the body and arms contract and dilate, and assume a white shining colour; and at last the whole dissolves into an heap of grains, which is more particularly observed in the green polype. By a careful examination we find, that the skin of the polype is entirely composed of grains, cemented by means of a kind of gummy substance; but it is to the grains entirely that the polype owes its colour. The structure of the arms is analogous to that of the body; and they appear shagreened when examined by the microscope, whether they be in a state of contraction or extension; but if very much contracted, they appear more shagreened than the body, though almost quite smooth when in their utmost state of extension. In the green polype the appearance of the arm is continually varying; and these variatiations are more sensible towards the extremity of the arm than at its origin, but more scattered in the parts further on. The extremity is often terminated by a knob, the hairs of which cannot be observed without a very powerful magnifier. They have a remarkable inclination of turning towards the light; so that if that part of the glass on which they are be turned from the light, they will quickly remove to the other.

That species named the *fusca* has the longest arms, and makes use of the most curious manœuvres to seize its prey. They are best viewed in a glass seven or eight inches deep, when their arms commonly hang down to the bottom. When this, or any other kind, is hungry, it spreads its arms in a kind of circle to a considerable extent, inclosing in this, as in a net, every insect which has the misfortune to come within the circumference. (See Animalcule, n° 27.) While the animal is contracted by seizing its prey, the arms are observed to swell like the muscles of the human body when in action. Though no appearance of eyes can be observed in the polype, they certainly have some knowledge of the approach of their prey, and show the greatest attention to it as soon as it comes near them. It seizes a worm the moment it is touched by one of the arms; and in conveying it to the mouth, it frequently twists the arm into a spiral like a cork-screw; by which means the insect is brought to the mouth in a much shorter time than otherwise it would be; and so soon are the insects on which the polypes feed killed by them, that M. Fontana thinks they must contain the most powerful kind of poison; for the lips scarce touch the animal when it expires, though there cannot be any wound perceived on it when dead. The worm, when swallowed, appears sometimes single, sometimes double, according to circumstances. When full, the polype contracts itself, hangs down as in a kind of stupor, but extends again in proportion as the food is digested and the excrementitious part is discharged. The bodies of the insects, when swallowed, are first macerated in the stomach, then reduced into fragments, and driven backward and forward from one end of the stomach to the other, and even into the arms, however fine they may be; whence it appears that the arms, as well as the other parts of this remarkable creature, are a kind of hollow guts or stomachs. In order to observe this motion, it is best to feed the polypes with such food as will give a lively colour; such, for instance, as those worms which are furnished with a red juice. Some bits of a small black snail being given to a polype, the substance of the skin was soon dissolved into a pulp consisting of small black fragments; and on examining the polype with a microscope, it was found that the particles were driven about in the stomach, and that they passed into the arms, from thence back into the stomach, then to the tail; from whence they passed again into the arms, and so on. The grains of which the body of the polype consist take their colour from the food with which it is nourished, and become red or black as the food happens to afford the one colour or the other. They are likewise more or less tinged with these colours in proportion to the strength of the nutritive juices; and it is observable that they lose their colour if fed with aliments of a colour different from themselves. They feed on most insects found in fresh water; and will also be supported with worms, the larvæ of gnats, &c. and even with snails, large aquatic insects, and fish or flesh, if cut into small bits. Sometimes two polypes lay hold of the same worm, and each begins

begins to ſwallow its own end till their mouths meet and the worm breaks. But ſhould this happen not to be the caſe, the one polype will ſometimes devour the other along with its portion. It appears, however, that the ſtomach of one polype is not fitted for diſſolving the ſubſtance of another; for the one which is ſwallowed always gets clear again after being impriſoned for an hour or two.

The manner in which the polypes generate is moſt perceptible in the griſea and fuſca, as being conſiderably larger than the viridis. If we examine one of them in ſummer, when the animals are moſt active, and prepared for propagation, ſome ſmall tubercles will be found proceeding from its ſides, which conſtantly increaſe in bulk, until at laſt in two or three days they aſſume the figure of ſmall polypes. When they firſt begin to ſhoot, the excreſcence becomes pointed, aſſuming a conical figure, and deeper colour than the reſt of the body. In a ſhort time it becomes truncated, and then cylindrical, after which the arms begin to ſhoot from the anterior end. The tail adheres to the body of the parent-animal, but gradually grows ſmaller, until at laſt it adheres only by a point, and is then ready to be ſeparated. When this is the caſe, both the mother and young ones fix themſelves to the ſides of the glaſs, and are ſeparated from each other by a ſudden jerk. The time requiſite for the formation of the young ones is very different, according to the warmth of the weather and the nature of the food eaten by the mother. Sometimes they are fully formed, and ready to drop off, in 24 hours; in other caſes, when the weather is cold, 15 days have been requiſite for bringing them to perfection.

It is remarkable, that there is a reciprocal communication of food betwixt the young and old before they be ſeparated. The young ones, as ſoon as they are furniſhed with arms, catch prey for themſelves, and communicate the digeſted food to the old ones, who on the other hand do the ſame to the young ones. This was fully verified by the following experiment: One of the large polypes of the *fuſca* kind being placed on a ſlip of paper in a little water, the middle of the body of a young one growing out from it was cut open; when the ſuperior part of that end which remained fixed to the parent was found to be open alſo. By cutting over the parent polype on each ſide of the ſhoot, a ſhort cylinder was obtained, open at both ends; which being viewed through a microſcope, the light was obſerved to come through the young one into the ſtomach of the old one. On cutting open the cylindrical portion lengthwiſe, not only the hole of communication was obſerved, but one might ſee through the end of the young one alſo. On changing the ſituation of the two pieces, the light was ſeen through the hole of communication. This may be ſeen between the parent polype and its young ones after feeding them; for, after the parents have eaten, the bodies of the young ones ſwell as if they themſelves had been eating.

The polypes produce young ones indiſcriminately from all parts of their bodies, and five or ſix young ones have frequently been produced at once; nay, Mr Trembley has obſerved nine or ten produced at the ſame time.

Nothing like copulation among theſe creatures was ever obſerved by Mr Trembley, though for two years he had thouſands of them under his inſpection. To be more certain on this ſubject, he took two young ones the moment they came from their parent, and placed them in ſeparate glaſſes. Both of them multiplied, not only themſelves, but alſo their offſpring, which were ſeparated and watched in the ſame manner to the ſeventh generation; they have even the ſame power of generation while adhering to their parent. In this ſtate the parent, with its children and grandchildren, exhibits a ſingular appearance, looking like a ſhrub thick ſet with branches. Thus ſeveral generations ſometimes are attached to one another, and all of them to one parent. Mr Adams gives a figure of one polype with *nineteen* young ones hanging at it; the whole group being about an inch broad, and an inch and an half in length: the old polype eat about twelve monoculi per day, and the young ones about 20 among them.

When a polype is cut tranſverſely or longitudinally into two or three parts, each part in a ſhort time becomes a perfect animal; and ſo great is this prolific power, that a new animal will be produced even from a ſmall portion of the ſkin of the old one. If the young ones be mutilated while they grow upon the parent, the parts ſo cut off will be reproduced, and the ſame property belongs to the parent. A truncated portion will ſend forth young ones before it has acquired a new head and tail of its own, and ſometimes the head of the young one ſupplies the place of that which ſhould have grown out of the old one. If we ſlit a polype longitudinally through the head to the middle of the body, we ſhall have one formed with two heads; and by ſlitting theſe again in the ſame manner we may form one with as many heads as we pleaſe.

A ſtill more ſurpriſing property of theſe animals is, that they may be grafted together. If the truncated portions of a polype be placed end to end, and gently puſhed together, they will unite into a ſingle one. The two portions are firſt joined together by a ſlender neck, which gradually fills up and diſappears, the food paſſing from the one part into the other; and thus we may form polypes not only from portions of the ſame, but of different animals; we may fix the head of one to the body of another, and the compound animal will grow, eat, and multiply, as if it had never been divided. By puſhing the body of one into the mouth of another, ſo far that their heads may be brought into contact, and kept there for ſome time, they will at laſt unite into one animal, only having double the number of arms which it would otherwiſe have had. The *hydra fuſca* may be turned inſide out like a glove, at the ſame time that it continues to live and act as before. The lining of the ſtomach now forms the outer ſkin, and the former epidermis conſtitutes the lining of the ſtomach. If previous to this operation the polype have young ones attached to it, ſuch as are but newly beginning to vegetate turn themſelves inſide out, while the larger ones continue to increaſe in ſize till they reach beyond the mouth of the parent, and are then ſeparated in the uſual manner from the body. When thus turned the polype combines itſelf in many different ways. The fore part frequently cloſes and becomes a ſupernumerary tail. The animal, which was at firſt ſtraight, now bends itſelf, ſo that the two tails reſemble the legs of a pair of compaſſes, which it can open and ſhut. The old mouth is placed as it were at the joint of the compaſſes, but loſes its power of action; to ſupply which, a new one is formed

Polypus. formed in its neighbourhood; and in a little time there is a new species of hydra formed with several mouths.

The sides of a polype, which has been cut through in a longitudinal direction, begin to roll themselves up, commonly from one of the extremities, with the outside of the skin inwards; but in a little time they unroll themselves, and the two cut edges join together, sometimes beginning at one extremity, and sometimes approaching throughout their whole length. As soon as the edges join, they unite so closely that no scar can be perceived. If a polype be partly turned back, the open part closes, and new mouths are formed in different places. Every portion of a polype is capable of devouring insects almost as soon as it is cut off: and the voracity of the whole genus is astonishing; for Mr Adams observes, that most of the insects on which they feed bear the same proportion to the mouth of a polype that an apple of the size of a man's head bears to his mouth.

The *hydra pallens* is very rarely met with, and is described only by M. Roesel. It is of a pale yellow colour, growing gradually smaller from the bottom; the tail is round or knobbed; the arms are about the length of the body, of a white colour, generally seven in number, and are apparently composed of a chain of globules. The young are brought forth from all parts of its body.

The *hydratula* is mentioned by many medical writers. Dr Tyson, in dissecting an antelope, found several hydatides or films, about the size of a pigeon's egg, filled with water, and of an oval form, fastened to the omentum; and some in the pelvis between the bladder of urine and rectum. He suspected them to be animals for the following reasons: 1. Because they were included in a membrane like a matrix, so loosely, that by opening it with the finger or a knife, the internal bladder, containing the serum or lympha, seemed nowhere to have any connection with it, but would very readily drop out, still retaining its liquor without spilling any. 2. This internal bladder had a neck or white body, more opaque than the rest, and protuberant from it, with an orifice at its extremity; by which, as with a mouth, it exhausted the serum from the external membrane, and so supplied its bladder or stomach. 3. On bringing this neck near the candle, it moved and shortened itself. It is found in the abdomen of sheep, swine, mice, &c. lying between the peritoneum and the intestines.

The *stentorea*, or funnel-like polype, is of three colours, green, blue, and white; but the last is the most common. They do not form clusters, but adhere singly by the tail to whatever comes in their way: the anterior end is wider than the posterior; and, being round, gives the animal somewhat of a funnel form, though the circle is interrupted by a kind of slit or gap. The edge of this gap is surrounded with a great number of little fimbrillæ, which by their motions excite a current of water, that forces into the mouth of the animal the small bodies that come within its reach. Mr Trembley says, that he has often seen a great number of animalcules fall into the mouths of these creatures; some of which were let out again at an opening which he could not describe. They can fashion their mouths into several different forms; and they multiply by dividing neither transversely nor longitudinally, but diagonally.

The *socialis* is described by Muller under the title of *vorticella*. They are found in clusters; and when viewed by a microscope, appear like a circle surrounded with crowns or ciliated heads, tied by small thin tails to a common centre, from whence they advance towards the circumference, and then turn like a wheel, occasioning a vortex which brings along with it the food proper for them. Polypus.

The *anastatica*, or clustering polypes, form a group resembling a cluster, or rather an open flower, supported by a stem, which is fixed by its lower extremity to some of the aquatic plants or extraneous bodies that are found in the water; the upper extremity is formed into eight or nine lateral branches, perfectly similar to each other, which have also subordinate branches, whose collective form much resembles that of a leaf. Every one of these assemblages is composed of one principal branch or nerve, which makes the main stem of the cluster an angle somewhat larger than a right one: the smaller lateral branches proceed from both sides of this nerve, and these are shorter the nearer their origin is to the principal branch. There is a polype at the extremity, and others on both sides of the lateral twigs, but at different distances from their extremities. They are all exceedingly small, and bell-shaped, with a quick motion about the mouth, though it is impossible to discern the cause of it. See ANIMALCULE, n° 24, 26, PULEX, and VORTICELLA.

The several strange properties recorded of this animal, though very surprising, are, however, none of them peculiar to it alone. The Surinam toad is well known to produce its young, not in the ordinary way, but in cells upon its back. Mr Sherwood has very lately discovered the small eels in sour paste to be without exception full of living young ones. And as to the most amazing of all its properties, the reproduction of its parts, we know the crab and lobster, if a leg be broken off, always produce a new one: and Monf. Bonet, Monf. Lyonet, Monf. de Reaumur, and Mr Folkes, have all found, by experiment, that several earth and water worms have the same property, some of them even when cut into thirty pieces. The urtica marina, or sea-nettle, has been also found to have the same; and the sea star-fish, of which the polype is truly a species, though it had long escaped the searches of the naturalists, was always well known by the fishermen to have it also.

Marine POLYPUS, is different in form from the fresh-water polype already described; but is nourished, increases, and may be propagated, after the same manner; Mr Ellis having often found, in his inquiries, that small pieces cut off from the living parent, in order to view the several parts more accurately, soon gave indications that they contained not only the principles of life, but likewise the faculty of increasing and multiplying into a numerous issue. It has been lately discovered and sufficiently proved by Peyssonel, Ellis, Jussieu, Reaumur, Donati, &c. that many of those substances which had formerly been considered by naturalists as marine vegetables or sea-plants, are in reality animal-productions; and that they are formed by polypes of different shapes and sizes, for their habitation, defence, and propagation. To this class may be referred the corals, corallines, keratophyta, eschara, sponges, and alcyonium: nor is it improbable, that the more compact bodies, known by

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the common appellations of *star-stones*, *brain-stones*, *petrified fungi*, and the like, brought from various parts of the East and West Indies, are of the same origin. To this purpose Mr Ellis observes, that the ocean, in all the warmer latitudes near the shore, and wherever it is possible to observe, abounds so much with animal life, that no inanimate body can long remain unoccupied by some species. In those regions, ships-bottoms are soon covered with the habitations of thousands of animals: rocks, stones, and every thing lifeless, are covered with them instantly; and even the branches of living vegetables that hang into the water are immediately loaded with the spawn of different animals, shell-fish of various kinds: and shell-fish themselves, when they become impotent and old, are the basis of new colonies of animals, from whose attacks they can no longer defend themselves. For a farther account of this system, see CORAL and CORALLINES.

POLYPUS of the Heart. See MEDICINE, n° 97, 98, 274, and 290.

POLYSARCIA, or CORPULENCY. See MEDICINE, n° 335.

POLYSCHIDES, or SEA HUNGER. See FUCUS.

POLYSPERMOUS (from πολυ and σπερμα *seed*), in botany, is applied to such plants as have more than four seeds succeeding each flower, without any certain order or number.

POLYSYLLABLE, in grammar, a word consisting of more than three syllables; for when a word consists of one, two, or three syllables, it is called a *monosyllable*, a *dissyllable*, and *trisyllable*.

POLYSYNDETON. See ORATORY, n° 67.

POLYTHEISM,

1 Definition.

THE doctrine of a plurality of gods or invisible powers superior to man.

"That there exist beings, one or many, powerful above the human race, is a proposition (says Lord Kames*) universally admitted as true in all ages and among all nations. I boldly call it *universal*, notwithstanding what is reported of some gross savages; for reports that contradict what is acknowledged to be general among men, require more able vouchers than a few illiterate voyagers. Among many savage tribes, there are no words but for objects of external sense: is it surprising that such people are incapable of expressing their religious perceptions, or any perception of internal sense? The conviction that men have of superior powers, in every country where there are words to express it, is so well vouched, that in fair reasoning it ought to be taken for granted among the few tribes where language is deficient."

* *Sketches of the Hist. of Man.*

2 Source of religious principles traced

These are judicious observations, of which every man will admit the force who has not some favourite system to build upon the unstable foundation which his Lordship overturns. Taking it for granted, then, that our conviction of superior powers has long been universal, the important question is, From what cause it proceeds? The same ingenious author shows, with great strength of reasoning, that the operations of nature and the government of this world, which to us loudly proclaim the existence of a Deity, are not sufficient to account for the universal belief of superior beings among savage tribes. He is therefore of opinion, that this universality of conviction can spring only from the image of Deity stamped upon the mind of every human being, the ignorant equally with the learned. "Nothing less (he says) is sufficient: and the original perception which we have of Deity must proceed (he thinks) from an internal sense, which may be termed the *sense of Deity*."

We have elsewhere expressed our opinion of that philosophy which accounts for every phenomenon in human nature, by attributing it to a particular instinct (see INSTINCT); but to this instinct or *sense of Deity*, considered as complete evidence, many objections, more than usually powerful, force themselves upon us. All nations, except the Jews, were once polytheists and idolaters. If therefore his Lordship's hypothesis be admitted, either the doctrine of polytheism must be true theology, or this instinct or sense is of such a nature as to have at different periods of the world misled all mankind. All savage tribes are at present polytheists and idolaters; but among savages every instinct appears in greater purity and vigour than among people polished by arts and sciences; and instinct never mistakes its object. The instinct or primary impression of nature, which gives rise to self-love, affection between the sexes, love of progeny, &c. has in all nations, and in every period of time, a precise and determinate object which it inflexibly pursues. How then comes it to pass, that this particular instinct, which if real is surely of as much importance as any other, should have uniformly led those who had no other guide to pursue improper objects, to fall into the grossest errors and the most pernicious practices? To no purpose are we told, that the sense of Deity, like the moral sense, makes no capital figure among savages. There is reason to believe that the feeling or perception, which is called the *moral sense*, is not wholly instinctive; but whether it be or not, a single instance cannot be produced in which it multiplies its objects, or makes even a savage express gratitude to a thousand persons for benefits which his prince alone had power to confer.

For these, and other reasons which might easily be assigned, we cannot help thinking, that the first religious principles must have been derived from a source different as well from internal sense as from the deductions of reason; from a source which the majority of mankind had early forgotten; and which, when it was banished from their minds, left nothing behind it to prevent the very first principle of religion from being perverted by various accidents or causes, or, in some extraordinary concurrence of circumstances, from being perhaps entirely obliterated. This source of religion every consistent Theist must believe to be revelation. Reason, 3 To revelation.
it is acknowledged, and we shall afterwards show (see RELIGION), could not have introduced savages to the knowledge of God; and we have just seen, that a *sense* of Deity is an hypothesis clogged with insuperable difficulties. Yet it is undeniable, that all mankind have believed in superior invisible powers: and if reason and instinct be set aside, there remains no other origin of this

Theism. this universal belief than primeval revelation, corrupted, indeed, as it passed by oral tradition from father to son, in the course of many generations. It is no slight support to this doctrine, that if there really be a Deity*, it is highly presumable that he would reveal himself to the first men—creatures whom he had formed with faculties to adore and to worship him. To other animals, the knowledge of a Deity is of no importance; to man, it is of the first importance. Were we totally ignorant of a Deity, this world would appear to us a mere chaos. Under the government of a wise and benevolent Deity, chance is excluded; and every event appears to be the result of established laws. Good men submit to whatever happens without repining, knowing that every event is ordered by Divine Providence: they submit with entire resignation; and such resignation is a sovereign balsam for every misfortune or evil in life.

* See *Sketches of the Hist. of Man.*

4 Which taught pure theism.

Admitting, then, that the knowledge of Deity was originally derived from revelation, and that the first men professed pure theism, it shall be our business in the present article to trace the rise and progress of *polytheism* and *idolatry*; and to ascertain, if we can, the real opinions of the Pagan world concerning that multitude of gods with which they filled heaven, earth, and hell. In this inquiry, though we shall have occasion to appeal to the writings of Moses, we shall attribute to them no other authority than what is due to records of the earliest ages, more ancient and authentic than any others which are now extant.

Whether we believe, with the author of the book of Genesis, that all men have descended from the same progenitors; or adopt the hypothesis of modern theorists, that there have been successive creations of men, and that the *European* derives his origin from one pair, the *Asiatic* from another, the woolly-headed *African* from a third, and the copper-coloured *American* from a fourth—polytheism and idolatry will be seen to have arisen from the same causes, and to have advanced nearly in the same order from one degree of impiety to another. On either supposition, it must be taken for granted, that the original progenitors were instructed by their Creator in the truths of genuine theism: and there is no room to doubt, but that those truths, simple and sublime as they are, would be conveyed pure from father to son as long as the race lived in one family, and were not spread over a large extent of country. If any credit be due to the records of antiquity, the primeval inhabitants of this globe lived to so great an age, that they must have increased to a very large number long before the death of the common parent, who would of course be the bond of union to the whole society, and whose dictates, especially in what related to the origin of his being and the existence of his Creator, would be listened to with the utmost respect by every individual of his numerous progeny.

Many causes, however, would conspire to dissolve this family, after the death of its ancestor, into separate and independent tribes, of which some would be driven by violence, or would voluntarily wander, to a distance from the rest. From this dispersion great changes would take place in the opinions of some of the tribes respecting the object of their religious worship. A single family, or a small tribe banished into a desert wilderness (such as the whole earth must then have been), would find employment for all their time in providing the means of subsistence, and in defending themselves from beasts of prey. In such circumstances they would have little *leisure* for meditation, and, being constantly conversant with objects of sense, they would gradually lose the *power* of meditating upon the spiritual nature of that Being by whom their ancestors had taught them that all things were created. The first wanderers would no doubt retain in tolerable purity their original notions of Deity; and they would certainly endeavour to impress those notions upon their children: but in circumstances infinitely more favourable to speculation than theirs could have been, the human mind dwells not long upon notions purely intellectual. We are so accustomed to sensible objects, and to the ideas of space, extension, and figure, which they are perpetually impressing upon the imagination, that we find it extremely difficult to conceive any being without assigning to him a form and a place. Hence a learned writer* has supposed, that the earliest generations of men (even those to whom he contends that frequent revelations were vouchsafed) may have been no better than *anthropomorphites* in their conceptions of the Divine Being.

Polytheism.

5 Circumstances which led to polytheism.

* *Bishop Law* in his *Considerations on the Theory of Religion.*

Be this as it may, it is not conceivable but that the members of those first colonies would quickly lose many of the arts and much of the science which perhaps prevailed in the parent state; and that, fatigued with the contemplation of intellectual objects, they would relieve their overstrained faculties, by attributing to the Deity a place of abode, if not a human form. To men totally illiterate, the place fittest for the habitation of the Deity would undoubtedly appear to be the sun, the most beautiful and glorious object of which they could form any idea; an object, too, from which they could not but be sensible that they received the benefits of light and heat, and which experience must soon have taught them to be in a great measure the source of vegetation. The great spirit therefore inhabiting the sun, which they would consider as the *power* of light and heat, was in all probability the first object of idolatrous adoration.

6 First steps in the progress.

From looking upon the sun as the habitation of their God, they would soon proceed to consider it as his body. Of pure mind entirely separated from matter, men in their circumstances could not long retain the faintest notion; but conscious each of power in himself, and experiencing the effects of power in the sun, they would naturally conceive that luminary to be animated as their bodies were animated. They would feel his influence when above the horizon; they would see him moving from east to west; they would consider him when set as gone to take his repose: and those exertions and intermissions of power being analogous to what they experienced in themselves, they would look upon the sun as a real animal. Thus would the Divinity appear to their untutored minds to be a compound being like man, partly corporeal and partly spiritual; and as soon as they imbibed such notions, though perhaps not before, they may be pronounced to have been absolute idolaters.

7 The spirit of light the first god of paganism.

When man had once got into this train, their gods would multiply upon them with wonderful rapidity. Darkness and cold they could not but perceive to be contrary to light and heat; and not having philosophy enough to distinguish between mere privations and positive effects, they would consider darkness and cold as entities equally real with light and heat; and attribute these different and contrary effects to different and contrary powers.

8 The spirit or power of darkness the second.

Hence the spirit or power of darkness was in all probability the second god in the Pagan calendar; and as they considered the power of light as a benevolent principle, the source of all that is good, they must have looked upon the contrary power of darkness as a malevolent spirit, the source of all that is evil. This we know from authentic history to have been the belief of the Persian magi, a very ancient sect, who called their good god *Yazdan*, and also *Ormuzd*, and the evil god *Abraman*.

9 Polytheism of the Persian magi.

Considering light as the symbol, or perhaps as the body, of *Ormuzd*, they always worshipped him before the fire, the source of light, and especially before the sun, the source of the most perfect light; and for the same reason fires were kept continually burning on his altars. That they sometimes addressed prayers to the evil principle, we are informed by Plutarch in his life of Themistocles; but with what particular rites he was worshipped, or where he was supposed to reside, is not so evident. Certain it is, that his worshippers held him in detestation; and when they had occasion to write his name, they always inverted it (uɐɯɐɹqⱯ), to denote the malignity of his nature.

The principles of the magi, though widely distant from pure theism, were much less absurd than those of other idolaters. It does not appear that they ever worshipped their gods by the medium of graven images, or had any other emblems of them than light and darkness. Indeed we are told by Diogenes Laertius and Clemens Alexandrinus, that they condemned all statues and images, allowing fire and water to be the only proper emblems or representatives of their gods. And we learn from Cicero*, that at their instigation Xerxes was said to have burnt all the temples of Greece, because the builders of those edifices impiously presumed to inclose within walls the gods, to whom all things ought to be open and free, and whose proper temple is the whole world. To these authorities we may add that of all the historians, who agree, that when magianism was the religion of the court, the Persian monarchs made war upon images, and upon every emblem of idolatry different from their own.

* *De Legibus*, lib. ii. § 10.

The Magi, however, were but one sect, and not the largest sect of ancient idolaters. The worship of the sun, as the source of light and heat, soon introduced into the calendar of divinities the other heavenly bodies,

10 Sabian polytheism

the moon, the planets, and the fixed stars. Men could not but experience great benefit from those luminaries in the absence of their chief god; and when they had proceeded so far as to admit two divine principles, a good and an evil, it was natural for minds clouded with such prejudices to consider the moon and the stars as benevolent intelligences, sent to oppose the power of darkness whilst their first and greatest divinity was absent or asleep. It was thus, as they imagined, that he maintained (for all held that he did maintain) a constant superiority over the evil principle. Though to astronomers the moon is known to be an opake body of very small dimensions when compared with a planet or a fixed star, to the vulgar eye she appears much more magnificent than either. By those early idolaters she was considered as the divinity second in rank and in power; and whilst the sun was worshipped as the king, she was adored as the queen, of heaven.

The earth, considered as the common mother of all things; the ocean, whose waters are never at rest; the air, the region of storms and tempests, and indeed all the elements—were gradually added to the number of divinities; not that mankind in this early age had so far degenerated from the principles of their ancestors as to worship brute matter. If such worship was ever practised, which to us is hardly conceivable, it was at a later period, when it was confined to the very lowest of the vulgar, in nations otherwise highly civilized. The polytheists, of whom we now treat, conceived every thing in motion to be animated, and animated by an intelligence powerful in proportion to the magnitude of the body moved.

This sect of idolaters, which remains in some parts of the East to this day, was known by the name of *Sabians*, which they pretend to have derived from *Sabius* a son of Seth; and among the books in which their sacred doctrines are contained, they have one which they call the book of *Seth*. We need hardly observe, that these are senseless and extravagant fables. The name *Sabian* is undoubtedly derived from the Hebrew word *Tsaba*, which signifies "a host or army;" and this class of polytheists was so called, because they worshipped "the host of heaven;" the *Tsaba hesemim*, against which Moses so pathetically cautions the people of Israel*.

* *Deut.* c. iv. 19.

11 Arose in Chaldea.

This species of idolatry is thought to have first prevailed in Chaldea, and to have been that from which Abraham separated himself, when, at the command of the true God, he "departed from his country, and from his kindred, and from his father's house." But as it nowhere appears that the Chaldeans had fallen into the savage state before they became polytheists and idolaters, and as it is certain that they were not savages at the call of Abraham, their early Sabiism may be thought inconsistent with the account which we have given of the origin of that species of idolatry. If a great and civilized nation was led to worship the host of heaven, why should that worship be supposed to have arisen among savages? Theories, however plausible, cannot be admitted in opposition to facts.

True: but we beg leave to reply, that our account of the origin of polytheism is opposed by no fact; because we have not supposed that the worship of the host of heaven arose among savages *only*. That savages, between whom it is impossible to imagine any intercourse to have had place, have universally worshipped, as their first and supreme divinities, the *sun*, *moon*, and *stars*, is a fact evinced by every historian and by every traveller; and we have shown how their rude and uncultivated state naturally leads them to that species of idolatry. But there may have been circumstances peculiar to the Chaldeans, which led them likewise to the worship of the heavenly host, even in a state of high civilization.—We judge of the philosophy of the ancients by that of ourselves, and imagine that the same refined system of metaphysics was cultivated by them as by the followers of *Descartes* and *Locke*. But this is a great mistake; for so gross were the notions of early antiquity, that it may be doubted whether there was a single man uninspired, who had any notion of mind as a being distinct

stinct and entirely separated from matter (see METAPHYSICS, Part III. c. 4). From several passages in the books of Moses, we learn, that when in the first ages of the world the Supreme Being condescended to manifest his presence to men, he generally exhibited some sensible emblem of his power and glory, and declared his will from the midst of a preternatural *fire*. It was thus that he appeared to the Jewish lawgiver himself, when he spoke to him from the midst of a burning bush; it was by a pillar of cloud and *fire* that he led the Israelites from Egypt to the Land of Promise; and it was in the midst of smoke, and *fire*, and thunderings, that the law was delivered from Mount Sinai.—That such manifestations of the Divine Presence would be occasionally made to the descendants of Noah who settled in Chaldea soon after the deluge, must appear extremely probable to every one who admits the authority of the Hebrew Scriptures: and he who questions that authority, has no right to make the objection to which we now reply; because it is only from the book of Genesis that we know the Chaldeans to have been a civilized people when they fell into idolatry. All histories agree in representing the inhabitants of Chaldea as at a very early period corrupted by luxury and sunk in vice. When this happened, we must suppose that the moral Governor of the universe would withdraw from them those occasional manifestations of himself, and leave them to their own inventions. In such circumstances, it was not unnatural for a people addicted to the study of astronomy, who had been taught to believe that the Deity frequently appeared to their ancestors in a flame of fire, to consider the sun as the place of his permanent residence, if not as his body. But when either opinion was firmly established, polytheism would be its inevitable consequence, and the progress of Sabiism would, in the most polished nation, be such as we have traced it among savage tribes.

From Chaldea the idolatrous worship of the host of heaven spread itself over all the East, passed into Egypt,
† *In Cratyl.* and thence into Greece; for Plato affirms †, that "the
12 Passed into Egypt, &c. first inhabitants of Greece seemed to him to have worshipped no other gods but the sun, moon, earth, stars, and heavens, as most barbarous nations (continues he) still do." That Sabiism, or the worship of the host of heaven, was the first species of idolatry, besides the probability of the thing, and the many allusions to it in sacred Scripture, we have the positive evidence of the most ancient pagan historians of whose writings any part
* Lib. i. cap. 131. has been transmitted to us. Herodotus *, speaking of the religion of the Persians, says, that "they worship the *sun*, *moon*, and *earth*, *fire*, *water*, and the *winds*; and this adoration they have all along paid from the beginning." He testifies the same thing of the savage
† Lib. iv cap. 188 Africans, of whom he affirms †, that they all worshipped the *sun* and *moon*, and no other divinity. Diodo-
‡ Lib. i rus Siculus, writing of the Egyptians ‡, tells us, that "the first men looking up to the world above them, and terrified and struck with admiration at the nature of the universe, supposed the sun and moon to be the principal and *eternal gods*." And Sanchoniathon the Phœnician, a more ancient writer than either of these, informs us, in the fragment of his history preserved by Eusebius, that "the two first mortals were Æon and Protogonus; and their children were Genus and Genea, who inhabited Phœnicia; and when they were scorched with the heat, they lifted up their hands to the sun, whom they believed to be the Lord of Heaven, and called him *Baal-samen*, the same whom the Greeks call Ζευς."

Hitherto those divinities were worshipped in person, or, as Dr Prideaux expresses it, in their *sacello*, or sacred tabernacles; for the votaries of each directed their devotions towards the planet which they supposed to be animated by the particular intelligence whom they meant to adore. But these orbs, by their rising and setting, being as much below the horizon as above it, and their grossly ignorant worshippers not supposing it possible that any intelligence, however divine, could ex- 13
ert its influence but in union with some body, statues And produced statue-worship.
or pillars were soon thought of as proper emblems of the absent gods. Sanchoniathon, in the fragment already quoted, informs us, that "*Hypsouranios* and his brother *Ousous*, Phœnician patriarchs, erected two pillars, the one to *fire* and the other to *air* or *wind*, and worshipped those pillars, pouring out to them libations of the blood of the wild beasts hunted down in the chace." As these early monuments of idolatry were called βαιτυλια, a word evidently derived from the Hebrew *Bethel*, the probability is, that they were altars of loose stones, such as that which was built by Jacob §, § *Genesis*,
and from him received the same name. As his was ch. xxxv.
consecrated to the true God, theirs were consecrated to the host of heaven; and the form of consecration seems to have been nothing more than the anointing of the stone or pillar with oil (A), in the name of the divinity whom it was intended to represent. When this ceremony was performed, the ignorant idolaters, who fancied that their gods could not hear them but when they were visible, supposed that the intelligences by which the sun and planets were animated, took possession, in some inexplicable manner, of the consecrated pillars, and were as well pleased with the prayers and praises offered up before those pillars, as with the devotions which were addressed towards the luminaries themselves.—Hence Sanchoniathon calls them *animated* or *living stones*, λιθους εμψυχους, from the portion of the Divine Spirit which was believed to reside in them; and as they were dedicated to the host of heaven, they were generally erected on the tops of mountains; or in countries which, like Egypt, were low and level, they were elevated to a great height by the labour of men.

It has been supposed, that this practice of raising the 14 With the
pillars on *high places* proceeded from a desire to make the idolatry
objects of worship conspicuous and magnificent: but we of *high*
are strongly inclined to believe, that the erectors of *places*.
βαιτυλια had something farther in view, and that they thought of nothing less than to bring the sacred stone or pillar as near as possible to the god whom it represented. Whatever be in this, we know that the practice itself prevailed universally through the east; and that

(A) Hence the proverb of a superstitious man, παντα λιθον λιπαρον προσκυνει, *he kisses or adores every anointed stone*; which Arnobius calls *lubricatam lapidem, et ex olivi unguine sordidatum*.—Stillingfleet's *Origines Sacræ*.

Dæmons.

there was nothing which the Jewish legislator more strictly enjoined his people to destroy, than the altars, statues, and pillars, erected for idolatrous worship upon mountains and high places. "Ye shall utterly destroy (says he) all the places wherein the nations which ye shall possess served their gods, upon the *high mountains*, and upon the *hills*, and under every green tree. And ye shall overthrow their *altars*, and break down their *pillars*, and burn their *groves* with fire *."

* *Deut.* xii. 23.

The mention of *groves* by the Hebrew lawgiver, brings to our recollection another species of idolatry, which was perhaps the second in order, as men deviating from the principles of pure theism were more and more intangled in the labyrinths of error. The Chaldeans, Egyptians, and all the eastern nations who believed in a superintending providence, imagined that the government of this world, the care of particular nations, and even the superintendence of groves, rivers, and mountains, in each nation, was committed by the gods to a class of spirits superior to the soul of man, but inferior to those heavenly intelligences which animated the sun, the moon, and the planets. These spirits were by the Greeks called δαίμονες, *dæmons*, and by the Romans *genii*. Timæus the Locrian, who flourished before Plato, speaking of the punishment of wicked men, says†, all these things hath Nemesis decreed to be executed in the second period, by the ministry of vindictive terrestrial dæmons, who are overseers of human affairs; to which dæmons the Supreme God, the ruler over all, hath committed the government and administration of this world, which is made up of *gods*, *men*, and *animals*.

† *De Anima Mundi*, inter script. a T. Gale, editos.

15
Origin of dæmon-worship

Concerning the origin of these intermediate beings, scholars and philosophers have framed various hypotheses. The belief of their existence may have been derived from five different sources.

1. It seems to have been impossible for the limited capacities of those men, who could not form a notion of a God divested of a body and a place, to conceive how the influence and agency of such a being could every instant extend to every point of the universe. Hence, as we have seen, they placed the heavenly regions under the government of a multitude of heavenly gods, the *sun*, the *moon*, and the *stars*. But as the nearest of those divinities was at an immense distance from the earth, and as the intelligence animating the earth itself had sufficient employment in regulating the general affairs of the whole globe, a notion insinuated itself into the untutored mind, that these superior governors of universal nature found it necessary, or at least expedient, to employ subordinate intelligences or *dæmons* as ministers to execute their behests in the various parts of their widely extended dominions.

2. Such an universal and uninterrupted course of action, as was deemed necessary to administer the affairs of the universe, would be judged altogether inconsistent with that state of *indolence*, which, especially in the east, was held an indispensable ingredient in perfect felicity. It was this notion, absurd as it is, which made Epicurus deny the *providence*, whilst he admitted the *existence*, of gods. And if it had such an effect upon a philosopher who in the most enlightened ages had many followers, we need not surely wonder if it made untaught idolaters imagine that the governor or governors of the universe had devolved a great part of their trouble on deputies and ministers.

3. When men came to reflect on the infinite distance between themselves and the gods, they would naturally form a wish, that there might somewhere exist a class of intermediate intelligences, whom they might employ as mediators and intercessors with their far distant divinities. But what men earnestly wish, they very readily believe. Hence the supposed distance of their gods would, among untutored barbarians, prove a fruitful source of intermediate intelligences, more pure and more elevated than human souls.

4. These three opinions may be denominated popular; but that which we are now to state, wherever it may have prevailed, was the offspring of philosophy.—On this earth we perceive a scale of beings rising gradually above each other in perfection, from mere brute matter through the various species of fossils, vegetables, insects, fishes, birds, and beasts, up to man. But the distance between man and God is infinite, and capable of admitting numberless orders of intelligences, all superior to the human soul, and each rising gradually above the other till they reach that point, wherever it may be, at which creation stops. Part of this immense chasm the philosophers perceived to be actually filled by the heavenly bodies; for in *philosophical* polytheism there was one invisible God supreme over all these: but still there was left an immense vacuity between the human species and the moon, which was known to be the lowest of the heavenly host; and this they imagined must certainly be occupied by invisible inhabitants of different orders and dispositions, which they called good and evil *dæmons*.

5. There is yet another source from which the universal belief of good and evil demons may be derived, with perhaps greater probability than from any or all of these. If the Mosaic account of the creation of the world, the peopling of the earth, and the dispersion of mankind, be admitted as true (and a more consistent account has not as yet been given or devised), some knowledge of good and evil *angels* must necessarily have been transmitted from father to son by the channel of oral tradition. This tradition would be corrupted at the same time, and in the same manner, with others of greater importance. When the true God was so far mistaken as to be considered, not as the sole governor of the universe, but only as the self-extant power of light and good, the Devil would be elevated from the rank of a rebellious created spirit to that of the independent power of darkness and evil; the angels of light would be transformed into good demons, and those of darkness into demons that are evil. This account of the origin of dæmonology receives no small support from Plato, who derives one branch of it wholly from tradition. "With respect to those demons (says he ‡) who inhabit the space between the earth and the moon, to understand and declare their generation is a task too arduous for my slender abilities. In this case we must credit the report of men of other times, who, according to their own account, were the descendants of the gods, and had, by some means or other, gained exact intelligence of that mystery from their ancestors. We must not question the veracity of the children of the gods, even though they should transgress the bounds

‡ *Timæus.*

Hero- of probability, and produce no evidence to support their assertions. We must, I say, notwithstanding, give them credit, because they profess to give a detail of facts with which they are intimately acquainted, and the laws of our country oblige us to believe them."

Though these dæmons were generally invisible, they were not supposed to be pure disembodied spirits.—Proclus, in his Commentary upon Plato's Timæus, tells us, that "every dæmon superior to human souls consisted of an intellectual mind and an ethereal vehicle." Indeed it is very little probable, that those who gave a body and a place to the Supreme God, should have thought that the inferior orders of his ministers were spirits entirely separated from matter. Plato himself divides the class of dæmons into three orders *; and whilst he holds their souls to be particles or emanations from the divine essence, he affirms that the bodies of each order of dæmons are composed of that particular element in which they for the most part reside. "Those of the first and highest order are composed of pure ether; those of the second order consist of grosser air; and dæmons of the third or lowest rank have vehicles extracted from the element of water. Dæmons of the first and second orders are invisible to mankind. The aquatic dæmons, being invested with vehicles of grosser materials, are sometimes visible and sometimes invisible. When they do appear, though faintly observable by the human eye, they strike the beholder with terror and astonishment." Dæmons of this last order were supposed to have passions and affections similar to those of men; and though all nature was full of them, they were believed to have local attachments to mountains, *rivers*, and *groves*, where their appearances were most frequent. The reason of these attachments seems to be obvious. Polytheism took its rise in countries scorched by a burning sun; and dæmons by their composition being necessarily subject in some degree to the influence of heat and cold, it was natural to suppose that they, like men, would delight in the shady grove and in the purling stream. Hence the earliest altars of paganism were generally built in the midst of *groves*, or on the banks of *rivers*; because it was believed that in such places were assembled multitudes of those intelligences, whose office it was to regulate the affairs of men, and to carry the prayers and oblations of the devout to the far-distant residence of the celestial gods. Hence too are to be derived the mountain and river gods, with the dryads and hamadryads, the satyrs, nymphs, and fawns, which held a place in the creed of ancient paganism, and make so conspicuous a figure in the Greek and Roman poets.

* *Epinomis.*

16 In groves, and on the banks of rivers.

These different orders of intelligences, which, though worshipped as gods or demigods, were yet believed to partake of human passions and appetites, led the way to the deification of departed heroes and other eminent benefactors of the human race. By the philosophers all souls were believed to be emanations from the divinity; but "gratitude † and admiration, the warmest and most active affections of our nature, concurred to enlarge the object of religious worship, and to make man regard the inventors of arts and the founders of society as having in them more than a common ray of the divinity. So that god-like benefits, bespeaking as it were a god-like mind, the deceased parent of a people was easily advanced into the rank of a dæmon. When the religious bias was in so good a train, natural affection would have its share in promoting this new mode of adoration. Piety to parents would naturally take the lead, as it was supported by gratitude and admiration, the *primum mobile* of the whole system: and in those early ages, the *natural father* of the tribe often happened to be the *political father* of the people, and the founder of the state. Fondness for the offspring would next have its turn; and a disconsolate father, at the head of a people, would contrive to sooth his grief for the untimely death of a favourite child, and to gratify his pride under the want of *succession*, by paying divine honours to its memory." "For a father ‡ afflicted with untimely mourning, when he had made an image of his child soon taken away, now honoured him as a god, who was then a dead man, and delivered to those that were under him ceremonies and sacrifices." That this was the origin and progress of the worship of departed souls, we have the authority of the famous fragment of Sanchoniathon already quoted, where the various motives for this species of idolatry are recounted in express words. "After many generations (says he) came *Chrysor*; and he invented many things useful to civil life, for which, after his decease, he was worshipped as a *god*. Then flourished *Ouranos* and his sister *Ge*, who deified and offered sacrifices to their father *Hypsistos*, when he had been torn in pieces by wild beasts. Afterwards *Cronos* consecrated *Muth* his son, and was himself consecrated by his subjects."

17 Deification of departed heroes,

† *Warburton's Div. Leg.*

‡ *Wisdom of Solomon*, xiv. 15.

In the reign of Cronos flourished a personage of great reputation for wisdom, who by the Egyptians was called *Thoth*, by the Phœnicians *Taautos*, and by the Greeks *Hermes*. According to Plutarch, he was a profound politician, and chief counsellor to Osiris, then the king, and afterwards the principal divinity, of Egypt: and we are told by *Philo Byblius*, the translator of Sanchoniathon, "that it was this *Thoth* or *Hermes* who first took the matters of religious worship out the hands of unskilful men, and brought them into due method and order." His object was to make religion serviceable to the interests of the state. With this view he appointed *Osiris* and other departed princes to be joined with the stars and worshipped as gods; and being by Cronos made king of Egypt, he was, after his death, worshipped himself as a god by the Egyptians. To this honour, if what is recorded of him be true, he had indeed a better title than most princes; for he is said to have been the inventor of letters, arithmetic, geometry, astronomy, and hieroglyphics, and was therefore one of the greatest benefactors of the human race which any age or country has ever produced.

18 A political invention, which introduced

That the gods of Greece and Rome were derived from Egypt and Phœnicia, is so universally known, that it is needless to multiply quotations in order to prove that the progress of polytheism among the Greeks and Romans was the same with that which we have traced in more ancient nations. The following translation, however, of the account given by Hesiod of the deification of departed heroes, with which we have been favoured by a learned and ingenious friend, is so just, and in our opinion so beautiful, that we cannot deny ourselves the pleasure of giving it to our readers.

"The gods who dwell on high Olympus' hill,
First fram'd a golden race of men, who liv'd
Under old Saturn's calm auspicious sway.
Like gods they liv'd, their hearts devoid of care,

Beyond

Hero-Worship.

Beyond the reach of pain and piercing woes;
Th' infirmities of age nor felt, nor fear'd.
Their nerves with youthful vigour strung, their days
In jocund mirth they past, remote from ills.—
Now when this godlike race was lodg'd in earth,
By Jove's high will to demigods they rose,
And airy dæmons, who benign on earth
Converse—the guides and guardians of mankind.
In darkness veil'd, they range earth's utmost bound,
Dispensing wealth to mortals. This reward
From bounteous Jove awaits illustrious deeds ||."

|| Εργα και ἡμεραι, lib. i. verf. 100, &c.

19 National and tutelar gods.

The deification of departed heroes and statesmen was that which in all probability introduced the universal belief of *national* and *tutelar* gods, as well as the practice of worshipping those gods through the medium of *statues* cut into a *human figure*. When the founder of a state or any other public benefactor was elevated to the rank of a god, as he was believed still to retain human passions and affections, it was extremely natural to suppose that he would regard with a favourable eye that nation for which he had done so much upon earth; that he would oppose its enemies, and protect the laws and institutions which he himself had given it. By indulging the same train of sentiment, each city, and even every family of consequence, found *Lares* and *Penates* among their departed ancestors, to whom they paid the warmest adoration, and under whose protection they believed their private affairs to be placed. As those national and household gods were believed to be in their deified state clothed with airy bodies, so those bodies were supposed to retain the form which their grosser bodies had upon earth. The image of a departed friend might perhaps be formed by the hand of sorrowful affection, before the statue or the shrine of a deity was thought of; but when that friend or benefactor became the object of religious adoration, it was natural for his votaries to enliven their devotion by the view of his similitude. Maximus Tyrius tells us §, that "there is no race of men, whether barbarian or Grecian, living on the sea-coast or on the continent, wandering in deserts or living in cities, which hath not consecrated some kind of symbol or other in honour of the gods." This is certainly true; but there is no good evidence that the first symbols of the gods were statues of men and women. Whilst the sun and other heavenly bodies continued to be the sole objects of religious worship, the symbols consecrated to them were pillars of a *conical* or *pyramidal* figure; and if such pillars are ever called *graven* images by Moses and other ancient writers, it was probably on account of the *allegoric figures* and *characters*, or hieroglyphic writing, with which they were inscribed.

§ Dissert. 38.

20 Hero-worship engrafted on the planetary,

Hitherto we have considered the souls of departed heroes as holding the rank only of demons or demigods; but they gradually rose in the scale of divinities, till they dethroned the heavenly bodies, and became themselves the *dii majorum gentium*. This revolution was effected by the combined operation of the prince and the priest; and the first step taken towards it seems to have been the complimenting of their heroes and public benefactors with the name of that being which was most esteemed and worshipped. "Thus a king for his beneficence was called the *sun*, and a queen for her beauty the *moon*. Diodorus relates, that Sol first reigned in Egypt, called so from the luminary of that name in the heavens. This will help us to understand an odd passage in the fragment of Sanchoniathon, where it is said that *Cronus had seven sons by Rhea, the youngest of whom was a* GOD *as soon as* BORN. The meaning probably is, that this youngest son was called after some luminary in the heavens to which they paid divine honours; and these honours came in process of time to be transferred to the terrestrial namesake. The same historian had before told us, that the sons of Genos, mortals like their father, were called by the names of the elements—*light, fire*, and *flame*, of which they had discovered the use."

"As this adulation advanced into an established worship, they turned the compliment the other way, and called the planet or luminary after the hero, the better to accustom the people, even in the act of *Planet-worship*, to this *new* adoration. Diodorus, in the passage already quoted, having told us, that by the first inhabitants of Egypt the sun and moon were supposed to be the principal and eternal gods, adds, that the former was called OSIRIS, and the latter ISIS. This was indeed the general practice; for we learn from Macrobius, that the Ammonites called the sun *Moloch*; the Syrians *Adad*, the Arabs *Dionysus*; the Assyrians *Belus*; the Phœnicians *Saturn*; the Carthaginians *Hercules*; and the Palmyrians *Elegabalus*. Again, by the Phrygians the moon was called *Cybele*, or the mother of the gods; by the Athenians *Minerva*; by the Cyprians *Venus*; by the Cretans *Diana*; by the Sicilians *Proserpine*; by others *Hecate, Bellona, Vesta, Urania, Lucina*, &c. Philo Byblius explains this practice: "It is remarkable (says he) that the ancient idolaters imposed on the *elements*, and on those parts of nature which they esteemed gods, *the names of their kings*: for the natural gods which they acknowledged were only the sun, moon, planets, elements, and the like; they being now in the humour of having gods of both classes, the *mortal* and the *immortal*."

21 Which in time it supplanted.

"As a farther proof that *hero*-worship was thus superinduced upon the *planetary*, it is worthy of observation, that the first statues consecrated to the *greater* hero-gods—those who were supposed to be *supreme*—were not of a human form, but *conical* or *pyramidal*, like those which in the earliest ages of idolatry were dedicated to the sun and planets. Thus the scholiast on the Vespæ of Aristophanes tells us, that the statues of Apollo and Bacchus were *conic* pillars or obelisks; and Pausanias, that the statue of Jupiter Meilichius represented a *pyramid*; that of the Argive Juno did the same, as appears from a verse of Phoronis quoted by Clemens Alexandrinus ‡; and indeed the practice was universal as well amongst the early barbarians as amongst the Greeks. But it is well known that the ancients represented the *rays of light* by pillars of a conical or pyramidal form; and therefore it follows, that when they erected such pillars as representatives of their hero-gods, these latter had succeeded to the titles, rights, and honours of the *natural* and *celestial divinities* *."

‡ Strom. l. I.

But though it seems to be certain that *hero*-worship was thus engrafted on the *planetary*, and that some of those heroes in process of time supplanted the planets themselves, this was such a revolution in theology as could not have been suddenly effected by the united influence of the prince and the priest. We doubt not the

* Warburton's Div. Leg. book 3. sect. 6.

Hero.

22 Progress of this revolution in theology.

the fact that SOL was believed to have reigned in Egypt, and was afterwards worshipped under the name of *Osiris*; but it was surely impossible to persuade any nation, however stupid or prone to idolatry, that a man, whom they *remembered* discharging the duties of their sovereign and legislator, was the identical sun whem they beheld in the heavens. Osiris, if there was in Egypt a king of that name, may have been deified immediately after his death, and honoured with that worship which was paid to good *dæmons*; but he must have been dead for ages before any attempt was made to persuade the nation that he was the *supreme God*. Even then great address would be requisite to make such an attempt successful. The prince or priest who entered upon it would probably begin with declaring from the oracle, that the divine intelligence which animates and governs the sun had descended to earth and animated the person of their renowned legislator; and that, after their laws were framed, and the other purposes served for which the descent was made, the same intelligence had returned to its original residence and employment among the celestials. The possibility of this double transmigration from heaven to earth and from earth to heaven, would without difficulty be admitted in an age when the pre-existence of souls was the universal belief. Having proceeded thus far in the apotheosis of dead men, the next step taken in order to render it in some degree probable that the early founders of states, and inventors of arts, were divine intelligences clothed with human bodies, was to attribute to one such benefactor of mankind the actions of many of the same name. Vossius, who employed vast erudition and much time on the subject, has proved, that before the æra of the Trojan wars most kings who were very powerful, or highly renowned for their skill in legislation, &c. were called *Jove*; and when the actions of all these were attributed to one *Jove of Crete*, it would be easy for the crafty priest, supported by all the power and influence of the state, to persuade an ignorant and barbarous people, that he whose wisdom and heroic exploits so far surpassed those of ordinary men must have been the supreme God in human form.

23 Vices of the pagan gods

This short sketch of the progress of polytheism and idolatry will enable the reader to account for many circumstances recorded of the pagan gods of antiquity, which at first view seem very surprising, and which at last brought the whole system into contempt among the philosophers of Athens and Rome. The circumstances to which we allude are the immoral characters of those divinities, and the abominable rites with which they were worshipped. Jupiter, Apollo, Mars, and the whole rabble of them, are described by the poets as ravishers of women and notorious adulterers. Hermes or Mercury was a thief, and the god of thieves. Venus was a prostitute, and Bacchus a drunkard. The malice and revenge of Juno were implacable; and so little regard was any of them supposed to pay to the laws of honour and rectitude, that it was a common practice of the Romans, when besieging a town, to evocate the tutelar deity, and to tempt him by a reward to betray his friends and votaries †. In a word, they were, in the language of the poet,

"Gods partial, changeful, passionate, unjust,
"Whose attributes were rage, revenge, and lust ‡."

† *T. Livii*, l. v. c. 21. et *Macrob. Satur.* lib. iii, c. 9.

Worship.

24 Accounted for.

This was the natural consequence of their origin. Having once animated human bodies, and being supposed still to retain human passions and appetites, they were believed, in their state of deification, to feel the same sensual desires which they had felt upon earth, and to pursue the same means for their gratification. As the men could not well attempt to surpass the gods in purity and virtue, they were easily persuaded by artful and profligate priests, that the most acceptable worship which could be rendered to any particular deity was to imitate the example of that deity, and to indulge in the practices over which he presided. Hence the worship of Bacchus was performed during the night by men and women mixing in the dark after intemperate eating and drinking ||. Hence too it was the practice in Cyprus and some other countries to sacrifice to Venus * the virginity of young women some days before their marriage, in order, as it was pretended, to secure their chastity ever afterwards; and, if Herodotus may be credited, every woman among the Babylonians was obliged once in her life to prostitute herself in the temple of the goddess *Mylitte* (Venus), that she might thenceforward be proof against all temptation.

25 Progress of idolatry regular and universal.

The progress of polytheism, as far as we have traced it, has been regular; and after the enormous error of forsaking the worship of the true God was admitted, every subsequent step appears to be natural. It would be no difficult task to prove that it has likewise been universal. Sir William Jones, the learned president of the Asiatic Society, has discovered such a striking resemblance between the gods of ancient Greece and those of the pagans of Hindostan †, as puts it beyond a doubt that those divinities had the same origin. The GANESA of the Hindoos he has clearly proved to be the JANUS of the Greeks and Romans. As the latter was represented with two and sometimes with four faces, as emblems of prudence and circumspection, the former is painted with an elephant's head, the well-known symbol among the Indians of sagacious discernment. The SATURN of Greece and Rome appears to have been the same personage with the MENU or SATYAVRATA of Hindostan, whose patronymic name is VAIVASWATA, or *child of the sun*; which sufficiently marks his origin. Among the Romans there were many Jupiters, of whom one appears from Ennius to have been nothing more than the firmament personified.

† *Asiatic Researches*, vol. i.

26 Indian idolatry.

Aspice hoc sublime candens, quem invocant omnes JOVEM.

But this Jupiter had the same attributes with the Indian god of the visible heavens called INDRA or the *king*, and DIVESPETIR or the *lord of the sky*, whose consort is *Sachi*, and whose weapon is *vajra* or the thunderbolt. INDRA is the regent of winds and showers; and though the east is peculiarly under his care, yet his Olympus is the north-pole, allegorically represented as a mountain of gold and gems. With all his power he is considered as a subordinate deity, and far inferior to the Indian triad BRAHMA, VISHNOU, and MAHADEVA or SIVA *, who are three forms of one and the same godhead. The president having traced the resemblance between the idolatry of Rome and India through many other gods, observes, that "we must not be surprised at finding, on a close examination, that the characters of all the pagan deities melt into each other, and at last

* Plate CCCCXI.

 into

Hero-Worship.

into one or two; for it seems a well-founded opinion, that the whole crowd of gods and goddesses in ancient Rome, and likewise in Hindostan, mean only the powers of nature, and principally those of the sun, expressed in a variety of ways, and by a multitude of fanciful names."

Nor is it only in Greece, Rome, Egypt, and India, that the progress of idolatry has been from planetary to hero-worship. From every account which modern travellers have given us of the religion of savage nations, it appears that those nations adore, as their first and greatest gods, the sun, moon, and stars; and that such of them as have any other divinities have proceeded in the same road with the celebrated nations of antiquity, from the worship of the heavenly bodies to that of celestial demons, and from celestial demons to the deification of dead men. It appears likewise that they universally believe their hero-gods and demigods to retain the passions, appetites, and propensities of men.

27 Scandinavian and Saxon idolatry.

That the Scandinavians and our Saxon ancestors had the same notions of the gods with the other pagans whose opinions we have stated, is evident from their calling the days of the week by the names of their divinities, and from the forms of the statues by which those divinities were represented*. 1. The idol of the sun, from which *Sunday* is derived, among the Latins *dies Solis*, was placed in a temple, and adored and sacrificed to; for they believed that the sun did co-operate with this idol. He was represented like a man half naked, with his face like the sun, holding a burning wheel with both hands on his breast, signifying his course round the world; and by its fiery gleams, the light and heat with which he warms and nourisheth all things.— 2. The idol of the moon, from which cometh our *Monday*, *dies Lunæ*, anciently *Moonday*, appears strangely singular, being habited in a short coat like a man. Her holding a moon expresses what she is; but the reason of her short coat and long-eared cap is lost in oblivion.— 3. *Tuisco*, the most ancient and peculiar god of the Germans, represented in his garment of a skin according to their ancient manner of clothing, was next to the sun and moon, the idol of highest rank in the calendar of northern paganism. To him the third day in the week was dedicated; and hence is derived the name *Tuesday*, anciently *Tuisday*, called in Latin *dies Martis*, though it must be confessed that Mars does not so much resemble this divinity as he does Odin or Woden.

* Plate CCCXI.

4. *Woden* was a valiant prince among the Saxons. His image was prayed to for victory over their enemies; which, if they obtained, they usually sacrificed the prisoners taken in battle to him. Our *Wednesday* is derived from him, anciently *Wodnesday*. The northern histories make him the father of *Thor*, and *Friga* to be his wife.

5. *Thor* was placed in a large hall, sitting on a bed canopied over, with a crown of gold on his head, and 12 stars over it, holding a sceptre in the right hand. To him was attributed the power over both heaven and earth; and that as he was pleased or displeased he could send thunder, tempests, plagues, &c. or fair, seasonable weather, and cause fertility. From him our *Thursday* derives its name, anciently *Thorsday*; among the Romans *dies Jovis*, as this idol may be substituted for Jupiter.

Brute-Worship.

6. *Friga* represented both sexes, holding a drawn sword in the right hand and a bow in the left; denoting that women as well as men should fight in time of need. She was generally taken for a goddess; and was reputed the giver of peace and plenty, and causer of love and amity. Her day of worship was called by the Saxons *Frigedeag*, now *Friday*, *dies Veneris*; but the habit and weapons of this figure have a resemblance of Diana rather than Venus.

7. *Seater*, or *Crodo*, stood on the prickly back of a perch. He was thin-visaged and long-haired, with a long beard, bare-headed and bare-footed, carrying a pail of water in his right hand wherein are fruit and flowers, and holding up a wheel in his left, and his coat tied with a long girdle. His standing on the sharp fins of this fish signified to the Saxons, that by worshipping him they should pass through all dangers unhurt; by his girdle flying both ways was shown the Saxons freedom; and by the pail with fruit and flowers, was denoted that he would nourish the earth. From him, or from the Roman deity Saturn, comes *Saturday*.

Such were the principal gods of the northern nations: but these people had at the same time inferior deities, who were supposed to have been translated into heaven for their heroic deeds, and whose greatest happiness consisted in drinking *ale* out of the skulls of their enemies in the *hall of Woden*. But the limits prescribed to the present article do not permit us to pursue this subject; nor is it necessary that we should pursue it. The attentive reader of the article MYTHOLOGY, of the histories given in this work of the various divinities of paganism, and of the different nations by whom those divinities were worshipped, will perceive that the progress of polytheism and idolatry has been uniform over the whole earth.

There is, however, one species of idolatry more wonderful than any thing that has yet been mentioned, of which our readers will certainly expect some account. 28 Brute-worship of the Egyptians.
It is the worship of *brutes*, *reptiles*, and *vegetables*, among the Egyptians. To the Greeks and Romans, as well as to us, that superstition appeared so monstrous, that to enumerate every hypothesis, ancient and modern, by which philosophers have endeavoured to account for it, would swell this article beyond all proportion. Brute-worship prevailed at so early a period in Egypt, that the philosophers of antiquity, whose writings have descended to us, had little or no advantage over the moderns in pursuing their researches into its origin; and among the modern hypotheses, those of *Mosheim* and *Warburton* appear to us by much the most probable of any that we have seen (B). The former of these learned writers attributes it wholly to the policy of the prince and

(B) There is, however, another hypothesis worthy of some attention, if it were only for the learning and ingenuity of its author. The celebrated Cudworth infers, from the writings of Philo and other Platonists of the Alexandrian school, that the ancient Egyptians held the Platonic doctrine of ideas existing from eternity, and constituting, in one of the persons of the godhead, the intelligible and archetypal world. (See PLATONISM.) Philo, Brute-Worship.

and the craft of the priest. The latter contends, with much earnestness and ingenuity, that it resulted from the use of hieroglyphic writing. We are strongly inclined to believe that both these causes contributed to the production of so portentous an effect; and that the use of hieroglyphics as sacred symbols, after they were laid aside in civil life,—completed that wonderful superstition which the craft of the priest and the policy of the prince had undoubtedly begun.

29
Introduced with a political view.

We learn from Herodotus *, that in his time the number of useful animals in Egypt was so small as hardly to be sufficient for tillage and the other purposes of civil life; whilst serpents and other noxious animals, such as the crocodile, wolf, bear, and hippopotamus, abounded in that country. From this fact Mosheim very naturally concludes †, that the founders of society and government in Egypt would by every art endeavour to increase the number of useful animals as the number of inhabitants increased; and that with this view they would make it criminal to kill or even to hurt sheep, cows, oxen, or goats, &c. whilst they would wage perpetual war upon the noxious animals and beasts of prey. Such animals as were assisting to them in the carrying on of this warfare would be justly considered as in a high degree useful to society. Hence the most grievous punishments were decreed against the killing, or so much as the wounding, of the *icbneumon* and *ibis*; because the former was looked upon as the instinctive enemy of the crocodile, and the latter of every species of serpents *. The learned writer, however, observes, that in Egypt as in other countries, people would be tempted to sacrifice the good of the public to the gratification of their own appetites, and sometimes even to the indulgence of a momentary caprice. Hence he thinks it was found necessary to strengthen the authority of the laws enacted for the preservation of useful animals by the sanctions of religion: and he says, that with this view the priests declared that certain animals were under the immediate protection of certain gods; that some of those animals had a divine virtue residing in them; and that they could not be killed without the most sacrilegious wickedness, incurring the highest indignation of the gods. When once the idolatrous Egyptians were persuaded that certain animals were sacred to the immortal gods, and had a divine virtue residing in them, they could not avoid viewing those animals with some degree of veneration; and the priests, taking advantage of the superstition of the people, appointed for each species of sacred animals appropriated rites and ceremonies, which were quickly followed with building shrines and temples to them, and approaching them with oblations, and sacrifices, and other rites of divine adoration.

* *Lib.* 2. c. 65.

† *Cudworth*, *Intellect Syst* cap. 4. n°. 158.

* See *Icbneumon* and *Ibis*.

To corroborate this hypothesis, he observes, that, besides the animals sacred over all Egypt, each province and each city had its particular animal to which the inhabitants paid their devotions. This arose from the universal practice among idolaters of consecrating to themselves *Lares* and *Penates*; and as the animals which were worshipped over the whole kingdom were considered as sacred to the *Dii majorum gentium*, so the animals whose worship was confined to particular cities or provinces were sacred to the *Lares* of those cities and provinces. Hence there was in Upper Egypt a city called *Lycopolis*, because its inhabitants worshipped the wolf, whilst the inhabitants of *Thebes* or *Heliopolis* paid their devotions to the eagle, which was probably looked upon as sacred to the sun. Our author, however, holds it as a fact which will admit of no dispute, that there was not one noxious animal or beast of prey worshipped by the Egyptians till after the conquest of their country by the Persians. That the earliest gods of Egypt were all benevolent beings, he appeals to the testimony of Diodorus Siculus; but he quotes Herodotus and Plutarch, as agreeing that the latter Egyptians worshipped an evil principle under the name of *Typhon*. This *Typhon* was the inveterate enemy of *Osiris*, just as *Abraman* was of *Ormuzd*; and therefore he thinks it in the highest degree probable that the Egyptians derived their belief of two self-existent principles, a good and an evil, from their Persian conquerors, among whom that opinion prevailed from the earliest ages.

From whatever source their belief was derived, Typhon was certainly worshipped in Egypt, not with a view of obtaining from him any good, for there was nothing good in his nature, but in hopes of keeping him quiet, and averting much evil. As certain animals had long been sacred to all the benevolent deities, it was natural for a people so besotted with superstition as the Egyptians to consecrate emblems of the same kind to their god Typhon. Hence arose the worship of *serpents*, *crocodiles*, *bears*, and other noxious animals and beasts of prey. It may indeed seem at first sight very inconsistent to deify such animals, after they had been in the practice for ages of worshipping others for being their

Philo, he observes, did not himself consider those ideas as so many distinct *substances* and *animals*, much less as *gods*; but he mentions others who deified the whole of this intelligible system as well as its several parts. Hence, when they paid their devotions to the *sensible sun*, they pretended to worship only the divine *idea* or *archetype* of that luminary: and hence, thinks our learned author, the ancient Egyptians, by falling down to bulls, and cows, and crocodiles, meant at first to worship only the divine and eternal *ideas* of those animals. He allows, indeed, that as few could entertain any thoughts at all of those eternal ideas, there were scarcely any who could persuade themselves that the *intelligible system* had so much reality in it as the *sensible things of nature*; and hence he thinks the devotion which was originally paid to the divine ideas had afterwards no higher object than the brutes and vegetables of which those ideas were the eternal patterns.

This hypothesis is ingenious, but not satisfactory. There is no evidence that the mysterious doctrine of Plato concerning *ideas* had anywhere been thought of for ages after brute-worship was established in Egypt. Of the state of Egyptian theology at that early period, Philo, and the other philosophers of the Alexandrian school, had no better means of forming a judgment than we have; and they laboured under many Grecian prejudices, which must have prevented them from judging with our impartiality.

Brute-Worship.

their destroyers; but it is to be remembered, that long before the deification of crocodiles, &c. the real origin of brute worship was totally forgotten by the people, if they were ever acquainted with it. The crafty priest who wishes to introduce a gainful superstition, must at first employ some plausible reason to delude the multitude; but after the superstition has been long and firmly established, it is obviously his business to keep its origin out of sight.

Such is Mosheim's account of the origin and progress of that species of idolatry which was peculiar to Egypt; and with respect to the *rise* of *brute* worship, it appears perfectly satisfactory. But the Egyptians worshipped several species of vegetables; and it surely could be no part of the policy of wise legislators to preserve *them* from destruction, as vegetables are useful only as they contribute to animal subsistence. We are therefore obliged to call in the aid of Warburton's hypothesis to account for this branch of Egyptian superstition.

30 Continued by the means of hieroglyphic writing, and

That learned and ingenious author having proved *, with great clearness and strength of argument, that hieroglyphic writing was prior to the invention of alphabetic characters; and having traced that kind of writing from such rude pictures, as those which were in use among the Mexicans, through all the different species of what he calls *curiologic*, *tropical*, and *symbolic* hieroglyphics (see HIEROGLYPHICS)—shows, by many quotations from ancient authors, that the Egyptian priests wrapt up their theology in the symbolic hieroglyphics, after alphabetic characters had banished from the transactions of civil life a mode of communicating information necessarily so obscure. These symbols were the figures of animals and vegetables, denoting, from some imaginary analogy, certain attributes of their divinities; and when the vulgar, forgetting this analogy, ceased to understand them as a species of writing, and were yet taught to consider them as sacred, they could not well view them in any other light than as emblems of the divinities whom they adored. But if rude sculptures upon stone could be emblematical of the divinities, it was surely not unnatural to infer, that the living animals and vegetables which those sculptures represented must be emblems of the same divinities more striking and more sacred. Hence the learned author thinks arose that wonderful superstition peculiar to the Egyptians, which made them worship not only animals and vegetables, but also a thousand chimeras of their own creation; such as figures with human bodies and the heads or feet of brutes, or with brutal bodies and the heads and feet of men.

* Div. Leg. book 4th, sect. 4th.

These two hypotheses combined together appear to us to account sufficiently for the idolatry of Egypt, monstrous as it was. We are persuaded, that with respect to the *origin* of brute-worship, Mosheim is in the right (c); and it was a very easy step for people in so good training to proceed upon the crutches of hieroglyphics to the worship of plants and those chimeras, which, as they never had a real existence in nature, could not have been thought of as emblems of the divinity, had they not been used in that symbolic writing which Warburton so ably and ingeniously explains.

To this account of the origin of brute-worship we are fully aware that objections will occur. From a learned friend, who perused the article in manuscript, we have been favoured with one which, as it is exceedingly plausible, we shall endeavour to obviate. "Brute-worship was not peculiar to Egypt. The Hindoos, it is well known, have a religious veneration for the cow and the alligator; but there is no evidence that in India the number of useful animals was ever so small as to make the interference of the prince and the priest necessary for their preservation; neither does it appear that the Hindoos adopted from any other people the worship of a self-existent principle of evil." Such is the objection. To which we reply,

That there is every reason to believe that brute-worship was introduced into India by a colony of Egyptians at a very remote period. That between these two nations there was an early intercourse, is universally allowed: and though the learned president of the Asiatic Society has laboured to prove, that the Egyptians derived all that wisdom for which they were famed, as well as the rudiments of their religious system, from the natives of Hindostan, he does not appear to us to have laboured with success. To examine his arguments at length would swell this article beyond its due proportion; and we have noticed some of them elsewhere (see PHILOLOGY, n° 33 and 39.). At present we shall only observe, that Sesostris undoubtedly made an inroad into India, and conquered part of the country, whilst we nowhere read of the Hindoos having at any time conquered the kingdom of Egypt. Now, though the victors have sometimes adopted the religion of the vanquished, the contrary has happened so much more frequently, and is in itself a process so much more natural, that this single circumstance affords a strong presumption that the Egyptian monarch would rather impose his gods upon the Hindoos than adopt theirs and carry them with him to Egypt. Brute-worship might likewise be introduced into Hindostan by those vast colonies of Egyptians who took refuge in that country from the tyranny and oppression of the shepherd kings. That such colonies did settle on some occasion or other in India, seems undeniable from monuments still remaining in that country of forms which could hardly have occurred to a native of Asia, though they are very natural as the workmanship of Africans. But we need not reason in this manner. We have seen a manuscript letter from Mr Burt, a learned surgeon in Bengal, and a member of the Asiatic Society, which puts it beyond a doubt that great numbers of Egyptians had at a very early

31 Carried from Egypt into India.

(c) To prove that it was merely to preserve and increase the breed of useful animals in Egypt, that the prince and the priest *first* taught the people to consider such animals as sacred, he argues thus: "Hæc ita esse, non ex eo tantum liquet, quod paulo ante observavi, nullas bestias universo Ægyptiorum populo sacras fuisse, præter eas, quæ manifestam regioni utilitatem comparant; sed inde quoque apparet, quod longe major ratio habita fuit femellarum inter animalia, quam marium. Boves diis immolare licebat, vaccas nullo modo. Canes fœminæ contumulabantur, non item mares." *Lege* HERODOT. *Histor.* lib. ii. cap. 41. & cap. 67.

early period not only ſettled in Hindoſtan, but alſo brought with them writings relating to the hiſtory of their country. As the ſhepherd-kings were enemies to the arts and to literature, it is probable that this ſettlement took place on their conqueſt of Egypt. Mr Burt's words are: "Mr Wilford, lieutenant of engineers, has extracted moſt wonderful diſcoveries from the Shanſcrit records; ſuch as the origin and hiſtory of the Egyptian pyramids, and even the account of the expence in their building." Upon our hypotheſis there is nothing incredible in this account; upon the hypotheſis of Sir William Jones, it is not eaſy to be conceived how the hiſtory of *Egyptian* pyramids could have found a place in the *Shanſcrit* records.

We may admit that the Hindoos have never adopted from the Perſians or Egyptians the worſhip of an independent principle of evil, and yet diſpoſe of the other part of the objection with very little difficulty. It will be ſeen by and bye, that the bramins believe a kind of triad of hypoſtaſes in the divine nature, of which one is viewed as the *deſtroyer*, and known by ſeveral names, ſuch as *Siva* and *Iſwara*. When brute-worſhip was introduced into Hindoſtan, it was not unnatural to conſider the alligator as emblematical of *Iſwara*; and hence in all probability it is that the Hindoos believe that a man cannot depart more happily from this world than by falling into the Ganges, and being devoured by one of thoſe ſacred animals. Upon the whole, the brute-worſhip of the Hindoos, inſtead of militating againſt our account of that monſtrous ſuperſtition as it prevailed in Egypt, ſeems to lend no ſmall ſupport to that account, as there was unqueſtionably an early intercourſe between the two nations, and as colonies of Egyptians ſettled in India. To him who is not ſatisfied with our reaſoning on this ſubject, we beg leave to recommend an attentive peruſal of Maurice's *Indian Antiquities*, where he will find many facts brought together, which tend to prove that Egypt has a juſt claim to a higher antiquity than India.

32 Polytheiſts acknowledged one ſupreme God,

Having thus traced the riſe and progreſs of polytheiſm and idolatry as they prevailed in the moſt celebrated nations of antiquity, we now proceed to inquire into the real opinions of thoſe nations concerning the nature of the gods whom they adored. And here it is evident from the writings of Homer, Heſiod, and the other poets, who were the principal theologians among the Greeks and Romans, that though heaven, earth, hell, and all the elements, were filled with divinities, there was yet one who, whether called *Jove*, *Oſiris*, *Ormuzd*, or by any other title, was conſidered as ſupreme over all the reſt. "Whence each of the gods was generated (ſays Herodotus*), or whether they have all exiſted from eternity, and what are their *forms*, is a thing that was not known till very lately; for Heſiod and Homer were, as I ſuppoſe, not above four hundred years my ſeniors; and theſe were they who introduced the theogony among the Greeks, and gave the gods their ſeveral names." Now Heſiod†, towards the beginning of his theogony, expreſsly invokes his muſe to celebrate in ſuitable numbers the generation of the immortal gods who had ſprung from the earth, the dark night, the ſtarry heavens, and the ſalt ſea. He calls upon her likewiſe to ſay, "in what manner the gods, the earth, the rivers, ocean, ſtars, and firmament, were generated, and what divine intelligences had ſprung from them of benevolent diſpoſitions towards mankind." From this invocation, it is evident that the poet did not conſider the gods of Greece as ſelf-exiſtent beings: neither could he look upon them as *creatures*; for of creation the ancient Greeks had no conception (ſee METAPHYSICS, n° 264.); but he conſidered them as emanations coeval with the earth and heavens, from ſome ſuperior principles; and by the divine intelligences ſprung from them, there cannot be a doubt but that he underſtood benevolent dæmons. The firſt principles of all things, according to the ſame Heſiod, were *Chaos*, and *Tartarus*, and *Love*; of which only the laſt being active, muſt undoubtedly have been conceived by this father of Grecian polytheiſm to be the greateſt and only ſelf-exiſting god. This we ſay muſt undoubtedly have been Heſiod's belief, unleſs by *Tartarus* we here underſtand a ſelf-exiſtent principle of evil; and in that caſe his creed will be the ſame with that of the ancient Perſians, who, as we have ſeen, believed in the ſelf-exiſtence as well of *Ahraman* as of *Ormuzd*.

* Lib. 2. c. 51.

† Verſ. 104—112.

33 from whom the other divinities were generated;

Heſiod is ſuppoſed to have taken his theology from Orpheus; and it is evident that his doctrine concerning the generation of the gods is the ſame with that taught in certain verſes* uſually attributed to Orpheus, in which Love and Chaos are thus brought together. "We will firſt ſing (ſays the poet) a pleaſant and delightful ſong concerning the ancient Chaos, how the heavens, earth, and ſeas, were formed out of it; as alſo concerning that all-wiſe *Love*, the oldeſt and ſelf-perfect principle, which actively produced all theſe things, ſeparating one from another." In the original paſſage, Love is ſaid not only to be πολυμητις of *much wiſdom* or *ſagacity*, and therefore a real intelligent ſubſtance; but alſo to be πρεσβυτατος and αυτοτελης the *oldeſt* and *ſelf-perfect*, and therefore a being of ſuperior order to the other divinities who were generated together with the elements over which they were conceived to preſide.

* Argonaut. pag. 17. ed. Steph.

With the theology of Homer our readers of all deſcriptions are ſo well acquainted, that we need not ſwell the article with quotations, to prove that the father of epic poetry held *Jove* to be the father of gods and men. But the doctrine of the poets was the creed of the vulgar Greeks and Romans; and therefore we may conclude, that thoſe nations, though they worſhipped gods and lords innumerable, admitted but one, or at the moſt two (D), ſelf-exiſtent principles; the one good and the other evil. It does not indeed appear, that in the ſyſtem

(D) Plutarch is commonly ſuppoſed, and we think juſtly ſuppoſed, to have been a believer in two ſelf-exiſtent principles, a good and an evil. His own opinion, whatever it was, he declares (*de Iſide et Oſiride*) to have been moſt ancient and univerſal, and derived from theologers and lawgivers by poets and philoſophers. "Though the firſt author of it be unknown, yet (ſays he) it hath been ſo firmly believed *everywhere*, that traces of it are to be found in the ſacrifices and myſteries both of the *barbarians* and the *Greeks*. There is a confuſed mixture of good and evil in every thing, and nothing is produced by nature *pure*. Wherefore system of vulgar paganism the subordinate gods were accountable to their chief for any part of their conduct, except when they transgressed the limits of the provinces assigned them. Venus might conduct the amours of heaven and earth in whatever manner she pleased; Minerva might communicate or with-hold wisdom from any individual with or without reason; and we find, that in Homer's battles the gods were permitted to separate into parties, and to support the Greeks or Trojans according as they favoured the one or the other nation. Jove indeed sometimes called them to order; but his interference was thought partial, and an instance of tyrannical force rather than of just authority. The vulgar Greeks, therefore, although they admitted but one, or at most two, self-existent principles, did not consider the inferior divinities as mediators between them and the supreme, but as gods to whom their worship was on certain occasions to be ultimately directed.

34 Though each was by the vulgar considered as unaccountable in his own province

35 Creed of the philosophers and

The creed of the philosophers seems to have been different. Such of them as were theists, and believed in the administration of Providence, admitted of but one God, to whom worship was ultimately due; and they adored the subordinate divinities as his children and ministers, by whom the course of Providence was carried on. With respect to the origin of those divinities, Plato is very explicit; where he tells us*, that "when all the gods, both those who move visibly round the heavens, and those who appear to us as often as they please, were generated, that God, who made the whole universe, spoke to them after this manner: Ye gods of gods, of whom I myself am father, attend." Cicero teaches the very same doctrine with Plato concerning the gods†; and Maximus Tyrius, who seems to have understood the genius of polytheism as thoroughly as any man, gives us the following clear account of that system as received by the philosophers.

* *Timæus.*

† *Tusc. Quest.* lib. i. c. 29. *et de Nat. Deorum, passim.*

"I will now more plainly declare my sense‡ by this similitude: Imagine a great and powerful kingdom or principality, in which all agree freely and with one consent to direct their actions according to the will and command of one supreme king, the oldest and the best; and then suppose the bounds and limits of this empire not to be the river Halys, nor the Hellespont, nor the Meotian lake, nor the shores of the ocean; but heaven above, and the earth beneath. Here then let that great king sit immoveable, prescribing to all his subjects laws, in the observance of which consist their safety and happiness: the partakers of his empire being many, both visible and invisible gods; some of which that are nearest, and immediately attending on him, are in the highest regal dignity, feasting as it were at the same table; others again are their ministers and attendants; and a third sort are inferior to them both: and thus you see how the order and chain of this government descends down by steps and degrees from the supreme God to the earth and men." In this passage we have a plain acknowledgment of one supreme God, the sovereign of the universe, and of three inferior orders of gods, who were his ministers in the government of the world; and it is worthy of observation, that the same writer calls these intelligences θεους θεου παιδας και φιλους, *gods, the sons and friends of God.* He likewise affirms, that all ranks of men, and all nations on earth, whether barbarous or civilized, held the same opinions respecting one supreme Numen and the generation of the other gods.

‡ *Dissert.* I.

"If there were a meeting (says he*) called of all these several professions, a painter, a statuary, a poet, and a philosopher, and all of them were required to declare their sense concerning *the God;* do you think that the painter would say one thing, the statuary another, the poet a third, and the philosopher a fourth? No; nor the Scythian neither, nor the Greek, nor the Hyperborean. In other things we find men speaking very discordantly, all men as it were differing from all. But amidst this war, contention, and discord, you may find everywhere, throughout the whole world, one uniform law and opinion, that there is ONE GOD, THE KING AND FATHER OF ALL, and many gods, the SONS OF GOD, who reign with God. These things both the Greek and barbarian affirm, both the inhabitants of the continent and of the sea-coast, both the wise and the unwise."

* *Ibid.*

36 Indian Bramins.

This account of philosophical polytheism receives no small support from the Asiatic Researches of Sir William Jones. "It must always be remembered (says that accomplished scholar), that the learned Indians, as they are instructed by their own books, acknowledge only

fore it is not one only dispenser of things, who, as it were, out of several vessels distributeth these several liquors of good and evil, mingling them together, and dashing them as he pleases; but there are two distinct and contrary powers or principles in the world, one of them always leading, as it were, to the right hand, but the other tugging the contrary way. For if nothing can be made without a cause, and that which is good cannot be the cause of evil, there must needs be a distinct principle in nature for the production of evil as well as good."

That this is palpable manicheism (see MANICHEISM), appears to us so very evident, as to admit of no debate. It appeared in the same light to the learned Cudworth; but that author labours to prove that Plutarch mistook the sense of Pythagoras, Empedocles, Heraclitus, Anaxagoras, and Plato, when he attributed to them the same opinions which were held by himself. Mosheim, on the other hand, has put it beyond a doubt, that whatever was Plutarch's belief respecting the origin of evil and the existence of two independent principles, it was taken implicitly from the writings of Plato. But the pious chancellor of *Gottingen*, actuated by the same motives with Cudworth, wishes to persuade his readers, that by Plato and Plutarch nothing *active* was understood by their evil principle but only *that tendency to confusion*, which was then deemed inseparable from matter. But that something more was meant seems undeniable; for immediately after the words which we have quoted, Plutarch proceeds to affirm that the wisest men declare θεους ειναι δυο καθαπερ αντιτεχνους, *that there are two gods, as it were of contrary trades or crafts*, of which one is the author of all good and the other of all evil. See *Mosheim. ed. Cudworth. System. Intellect.* lib. i. cap. 4. § 13.

The Principal Idols of the Saxons worshipped in Britain.

Theogony. Plate CCCCXI.

only one supreme Being, whom they call Brahme, or the great one, in the neuter gender. They believe his essence to be infinitely removed from the comprehension of any mind but his own; and they suppose him to manifest his power by the operation of his divine spirit, whom they name Vishnou the *pervader*, and Ne'ra'yan or *moving on the waters*, both in the masculine gender; whence he is often denominated the *first male*. When they consider the divine power as exerted in *creating* or giving existence to that which existed not before, they call the deity Brahma'; when they view him in the light of *destroyer*, or rather *changer of forms*, they give him a thousand names, of which Siva, Iswara, and Mahadeva, are the most common; and when they consider him as the preserver of created things, they give him the name of Vishnou. As the soul of the world, or the pervading *mind*, so finely described by Virgil, we see Jove represented by several Roman poets; and with great sublimity by Lucan in the well known speech of Cato concerning the Ammonian oracle. 'Jupiter is wherever we look, wherever we move.' This is precisely the Indian idea of Vishnou: for since the power of preserving created things by a superintending providence belongs eminently to the godhead, they hold that power to exist transcendantly in the *preserving* member of the triad, whom they suppose to be everywhere always, not in substance, but in spirit and energy." This supreme god Brahme, in his triple form, is the only selfexistent divinity acknowledged by the philosophical Hindoos. The other divinities Genesa, Indra, Cuvera, &c. are all looked upon either as his creatures or his children; and of course are worshipped only with inferior adoration.

37 Why the philosophers worshipped the inferior divinities.

It was upon this principle of the generation of the gods, and of their acting as ministers to the supreme *Numen*, that all the philosophers of Greece, who were not atheists, worshipped many divinities, though they either openly condemned or secretly despised the traditions of the poets respecting the amours and villanies of Jupiter, Venus, Mercury, and the rest of the tribe. It was the same principle sincerely admitted, and not an ill-timed jest, as has been absurdly supposed, that made Socrates, after he had swallowed the poison, request his friend to offer a votive cock for him to Esculapius.

But a theogony was not peculiar to the Greeks, Romans, and the Hindoos; it made part of every system of polytheism. Even the Egyptians themselves, the grossest of all idolaters, believed in one self-existing God, from whom all their other divinities descended by generation. This appears probable from the writings of Horus Apollo, Jamblicus, Porphyry, and many other ancient authors; but if the inscription on the gates of the temple of *Neith* in *Sais*, as we have it from Plutarch and Proclus, be genuine, it will admit of no doubt. This famous inscription, according to the last of these writers, was to this purpose: "I am whatever is, whatever shall be, and whatever hath been. My veil no man hath removed. The offspring which I brought forth was the sun (E)"

The Persian magi, as we have seen, believed in two self-existent principles, a good and an evil: but if Diogenes Laertius deserves to be credited, they held that fire, earth, and water, which they called gods, were generated of these two. It was observed in the beginning of this article, that the first object of idolatrous worship was probably the sun, and that this species of idolatry took its rise in Chaldea or Persia. But when it became the practice of eastern monarchs to conceal themselves wholly from their people, the custom, as implying dignity, was supposed to prevail as well in heaven as on earth; and Zoroaster, the reformer of the Persian theology, taught*, that "Ormuzd was as far removed from the sun as the sun is removed from the earth." According to this modification of magianism, the sun was one of the generated gods, and held the office of prime minister or vicegerent to the invisible fountain of light and good. Still, however, a self-existent principle of evil was admitted; but though he could not be destroyed or annihilated by any power, it was believed that he would at last be completely vanquished by Ormuzd and his ministers, and rendered thenceforward incapable of producing any mischief.

* *Plutarch, de Iside et Osir.*

From this short view of polytheism, as we find it delineated by the best writers of antiqnity, we think ourselves warranted to conclude, that the whole pagan world believed in but *one*, or at most *two*, self-existent gods, from whom they conceived all the other divinities to have descended in a manner analogous to human generation. It appears, however, that the vulgar pagans considered each divinity as supreme and unaccountable within his own province, and therefore intitled to worship, which rested ultimately in himself.

38 Vulgar polytheists less culpable than the philosophers.

The philosophers, on the other hand, seem to have viewed the inferior gods as accountable for every part of their conduct to him who was their sire and sovereign, and to have paid to them only that inferior kind of devotion which the church of Rome pays to departed saints. The vulgar pagans were sunk in the grossest ignorance, from which statesmen, priests, and poets, exerted their utmost influence to keep them from emerging; for it was a maxim which, however absurd, was universally received, that "there were many things true in religion *, which it was not convenient for the vulgar to know; and some things which, though false, it was yet expedient that they should believe." The polytheism and idolatry of the vulgar, therefore, was their misfortune rather than their fault. But the philosophers were wholly "without excuse *; because that when they knew God, they glorified him not as God, neither were thankful, but became vain in their imaginations, and their foolish heart was darkened. Professing themselves wise, they became fools, and worshipped and served the creature more than the Creator, who is God blessed for ever."

* *Varro apud D. August. de Civ. Dei.*

* *Rom. i. 20, 21, 22, 25.*

POLY-

(E) Τα οντα, και τα εσομενα, και τα γιγνοντα, εγω ειμι. Τον εμον χιτωνα ουδεις ανεκαλυψεν. Ον εγω καρπον ετεκον, ηλιος εγενετο. The antiquity of this inscription is admitted by Cudworth, denied by Mosheim, and doubted by Jablonski. The reader who wishes to know their arguments may consult Mosheim's edition of the *Intellectual System*, and Jablonski's *Pantheon Ægyptiorum*.

POLYTRICHUM, in botany: A genus of the order of musci, belonging to the cryptogamia class of plants. The anthera is operculated, and placed upon a very small apophysis or articulation; the calyptra villous; the star of the female is on a distinct individual. There are three species; the most remarkable of which is the commune, or great golden maiden-hair, frequently to be met with in the bogs and wet places of this country. It grows in patches, the stalks erect, generally single and unbranched, from three inches to a foot, or even a yard high. The leaves are numerous, stiff, lanceolate, acute, growing round the stalk without order, and, if viewed with a microscope, appear to have their edges finely serrated. They are of a bright green when young and fresh, but reddish when dried or in decay: the filaments, or peduncles, are of a shining red, or orange colour, from two to four inches long, arising singly from the top of the stalks, and surrounded at their base with a cylindrical tubular vagina, or perichætium. The anthera, or capsule, is quadrangular, green at first, afterwards yellow, and red when ripe, having an annular pedestal, or apophysis, at its base. The operculum is flat, with a projecting point in the centre; and underneath is a whitish circular membrane, placed in the middle of the capsule's orifice, and sustained there by numerous arched threads, or cilia, connected by one end to the circumference of this membrane, and by the other fastened to the ring of the anthera. The pollen, or, as others term it, the seed, is freed from the anthera or capsule through the space between the cilia. The calyptra is twofold, an internal and external one; both which at first entirely cover and hang over the anthera. The internal one is conical, membranaceous, and smooth; the external one is composed only of tawny hairs, connected into a sort of mat, lacerated at the base, and serving like a roof of thatch to defend the other. Besides the stalks before described, there are commonly some others near at hand, which are destitute both of filaments and capsules, but are terminated with a kind of rosaceous cup, either of a bright red or yellowish colour, composed of leaves of different sizes, the outermost broad, the innermost lanceolate, growing gradually more and more fine and slender to the centre. This cup is looked upon by Linnæus as the female flower of this moss; but Haller is of opinion, that it is only the gem or origin of a new stalk, which frequently rises from its centre, and this again becomes sometimes proliferous. There are two varieties of this moss: the first has much shorter stalks than the preceding, and often branched; the leaves stiffer, erect, and more crowded; in other respects the same. The other has a stalk scarcely more than half an inch high, terminated with a cluster of linear, erect, rigid leaves, for the most part entire on the edges, and tipped each with a white hair. The filament is about an inch high, and the capsule quadrangular. The female flower, or gem, is of a bright red colour.

The first kind, when it grows long enough for the purpose, is sometimes used in England and Holland to make brooms or brushes. Of the female sort the Laplanders, when obliged to sleep in desert places, frequently make a speedy and convenient bed. Their manner of doing it is curious: Where this moss grows thick together, they mark out, with a knife, a piece of ground, about two yards square, or of the size of a common blanket; then beginning at one corner, they gently sever the turf from the ground, and as the roots of the moss are closely interwoven and matted together, they by degrees strip off the whole circumscribed turf in one entire piece; afterwards they mark and draw up another piece, exactly corresponding with the first; then, shaking them both with their hands, they lay one upon the ground, with the moss uppermost, instead of a matrass, and the other over it, with the moss downwards, instead of a rug; and between them both take a comfortable nap, free from fleas and bugs, and without fear of contagious distempers. It is probable they might take the hint of making such a bed from the bear, a cohabitant of their country, which prepares his winter-quarters with a large collection of this same moss. See Musci, p. 473. and Plate CCCXXI.

POLYXÆNUS, or Polyænus. See Polyænus.

POLYXO, a priestess of Apollo's temple in Lemnos. She was likewise nurse to queen Hypsipyle. It was by her advice that the Lemnian women murdered all their husbands.——There was another Polyxo, a native of Argos, who married Tlepolemus son of Hercules. She followed him to Rhodes after the murder of his uncle Licymnius; and when he departed for the Trojan war with the rest of the Greek princes, she became the sole mistress of the kingdom. After the Trojan war, Helen fled from Peloponnesus to Rhodes, where Polyxo reigned. Polyxo detained her; and to punish her as being the cause of a war in which Tlepolemus had perished, she ordered her to be hanged on a tree by her female servants, disguised in the habit of Furies.

POMACEÆ, (*pomum* "an apple,") the name of the 36th order in Linnæus's Fragments of a Natural Method, the genera of which have a pulpy esculent fruit of the apple, berry, and cherry kind. See Botany, Sect. vi. p. 465.

POMATUM, an unguent generally used in dressing the hair. It is also used as a medicine. See Pharmacy, n° 636, &c.

POMEGRANATE. See Punica.

POMERANIA, a province of Germany, in the circle of Upper Saxony, with the title of a duchy. It is bounded on the north by the Baltic Sea, on the east by Prussia and Poland, on the south by the marquisate of Brandenburg, and on the west by the duchy of Mecklenburg; and is about 250 miles in length, and in some places 75 miles and in others 50 in breadth. It is watered by several rivers, the most considerable of which are the Oder, the Pene, the Rega, the Persant, the Wipper, the Stolp, the Lupo, and the Lobo. The air is cold; but the soil abounds in pastures, and produces corn, of which a great deal is exported. It is a flat country; containing many lakes, woods, and forests, and has several good harbours. It is divided into the Hither and Farther Pomerania, and the territories of the kings of Sweden and Prussia in this duchy are divided by the river Pene.

POMET (Peter), an able druggist at Paris, was born in 1658. He collected at a great expence from all countries drugs of every kind, and rendered himself celebrated by his book entitled *Histoire Generale des Drogues*,

Drogues, which is the most complete book on the subject that has yet been printed. He gave demonstrations with respect to his drugs in the king's garden, and a catalogue of all the drugs contained in his work, with a list of all the rarities of his cabinet, which he proposed to publish by subscription; but was prevented by his death, which happened in 1699, upon the very day when the patent for a pension granted him by Louis XIV. was made out.

POMFRET (John), an English poet, son of the rector of Luton in Bedfordshire, was born in 1667, and educated at Cambridge; after which he took orders, and was presented to the living of Malden in Bedfordshire. About 1703 he went to London for institution to a larger and very considerable living; but was stopped some time by Compton, then bishop of London, on account of these four lines of his poem, entitled the Choice:

"And as I near approach'd the verge of life,
Some kind relation (for I'd have no wife)
Should take upon him all my wordly care,
While I did for a better state prepare."

The parentheses in these lines were so maliciously represented, that the good bishop was made to believe that Pomfret preferred a mistress to a wife. But he was soon convinced that this representation was the mere effect of malice, as Pomfret at that time was actually married. The opposition, however, which his slanderers had made to him had its effect; for, being by this obliged to stay in London longer than he intended, he catched the smallpox, and died of it, aged 35.

He published a volume of his poems in 1699, with a very modest and sensible preface. Two pieces of his were published after his death by his friend Philalethes; one intitled Reason, and written in 1700, when the disputes about the Trinity ran high; the other *Dies Novissima*, or the "Last Epiphany," a Pindaric ode. His versification is not unmusical; but there is not the force in his writings which is necessary to constitute a poet. A dissenting teacher of his name, and who published some rhimes upon spiritual subjects, occasioned fanaticism to be imputed to him; but his friend Philalethes has justly cleared him from the imputation. Pomfret had a very strong mixture of devotion in him, but no fanaticism.

"The Choice (says Dr Johnson) exhibits a system of life adapted to common notions, and equal to common expectations; such a state as affords plenty and tranquillity, without exclusion of intellectual pleasures. Perhaps no composition in our language has been oftener perused than Pomfret's Choice. In his other poems there is an easy volubility; the pleasure of smooth metre is afforded to the ear, and the mind is not oppressed with ponderous, or intangled with intricate, sentiment. He pleases many; and he who pleases many must have merit."

POMME', or POMMETTE', in heraldry, is a cross with one or more balls or knobs at each of the ends.

POMMEL, or PUMMEL, in the manege, a piece of brass or other matter at the top and in the middle of the saddle-bow.

POMMERCULLIA, in botany: A genus of the monogynia order, belonging to the triandria class of plants; and in the natural method ranking under the 4th order, *Gramina*. The calyx is bivalved, and shaped like a top; the valvula quadrifid, and bearded on the back. The corolla has two unequal valves; the filaments three, with long pointed antheræ; the style simple. The whole flower forms itself into a sharp point, and the corolla serves as a covering to the seed, which is long, clear, and smooth. There is only one species, viz. the Dianthoides.

POMŒRIUM, in Roman antiquity, was, according to Livy, that space of ground, both within and without the walls, which the augurs, at the first building of cities, solemnly consecrated, and on which no edifices were allowed to be raised. Plutarch gives this account of the ceremony of drawing the pomœrium: "They dug a trench, and threw into it the first-fruits of all things, either good by custom, or necessary by nature; and every man taking a small turf of earth of the country from whence he came, they cast them in promiscuously. Then making this trench their centre, they described the city in a circle round it. After this, the founder yoking a bull and a cow together, ploughed a deep furrow, with a brazen ploughshare, round the bounds. The attendants took care that all the clods fell inwards, *i. e.* toward the city. This furrow they called *pomœrium*, and built the wall upon it."—Plutarch, in this account, is to be understood as speaking of Rome.

POMOERIUM Proferre, signifies to extend or enlarge a city, which could not be done by any, but those who had taken away some part of an enemy's country in war. But this qualification was sometimes dispensed with. *Pomœrium* is *quasi pone mœnia*, "behind the walls."

POMONA, in fabulous history, the tutelar deity of orchards and fruit-trees. See VERTUMNUS.

POMPEII (anc. geog.), a town of Campania near Herculaneum, and destroyed along with it by the great eruption of Vesuvius in the time of Titus. See HERCULANEUM. It is about 15 miles from Naples, and six or seven from Portici—So much has been said and written on the discovery of this place, as makes it unnecessary for us to say much: we shall therefore only give a short extract on the subject from an anonymous work lately published, apparently of considerable merit. "On entering the city (says our author ||), the first object is a pretty square, with arcades, after the present manner of Italy. This was, as it is imagined, the quarter of the soldiers; numbers of military weapons being found here.

|| *Comparative Sketch of England and Italy, with Disquisitions on National Advantages.*

"A narrow, but long street, with several shops on each side, is now perfectly cleansed from its rubbish, and in good preservation. Each house has a court. In some of them are paintings al fresco, principally in chiaroscuro; and their colours not in the least injured by time. The few colours which the ancients knew were extracted only from minerals; and this may be a sufficient reason for their freshness. The street is paved with irregular stones of a foot and half or two feet long, like the Appian way.

"In discovering this city, it was at first doubted whether it were actually Pompeii: but the name inscribed over the gateway put it beyond all doubt. The

skeletons

skeletons found were innumerable. It is said that many had spades in their hands, endeavouring, probably at first, to clear away the torrent of ashes with which they were deluged. Indeed the satisfaction which is felt at the view of ancient habitations, is much allayed by inevitable reflections on this frightful scene of desolation, though at the distance of so many centuries.

"An ancient villa is also seen entire at a little distance from Pompeii. The house is really elegant and spacious, but only two stories high. The pavement of the chambers is composed of tesselated marble, and, when polished, displays the design perfectly well.—There is some at the museum of Portici brought from this place, which the eye would really mistake for painting. Under the house is a fine triangular cellar, of which each part is 100 feet long, well filled with amphoræ. The skeletons of 29 persons were found here, supposed to have fled to it for safety. Each house is filled with ashes: they have almost penetrated through every crevice; and it is incredible how such a volume of them could have been thrown out by Vesuvius with sufficient force to have reached so far." See Swinburne's *Travels in the Two Sicilies*, vol. 2. p. 98, &c.; Lady Miller's *Letters*, or *De La Lande;* Captain Sutherland's *Tour up the Straits, from Gibraltar to Constantinople*, p. 75. &c.; Dr Smith's *Sketch of a Tour on the Continent*, in 1786 and 1787, vol. 2. p. 118, &c.; and Watkins's *Tour through Swisserland, Italy*, &c.

POMPEY the GREAT, (Cneius Pompeius Magnus), the renowned rival of Julius Cæsar. Being defeated by him at the battle of Pharsalia, owing to the defection of his cavalry, he fled to Egypt by sea, where he was basely assassinated by order of Theodotus, prime minister to Ptolemy the Younger, then a minor, 48 B. C *.

* See *Rome*.

POMPEYS (Cneius and Sextus), his sons, commanded a powerful army when they lost their illustrious father. Julius Cæsar pursued them into Spain, and defeated them at the battle of Munda, in which Cneius was slain, 45 B. C. Sextus made himself master of Sicily; but being defeated in the celebrated naval engagement at Actium by Augustus and Lepidus, he fled to Asia with only 7 ships, the remains of his fleet, which consisted of more than 350; and from thence, unable to continue the war, he was obliged to retire to Lesbos, where renewing the war by raising an army, and seizing on some considerable cities, Marcus Titius, in the interest of Marc Antony, gave him battle, defeated him, took him prisoner, and basely put him to death, 35 B. C. See ROME.

POMPEY's-Pillar. See ALEXANDRIA, p. 393.

POMPILUS, in ichthyology, a species of CORYPHOENA.

POMPONATIUS (Peter), an eminent Italian philosopher, was born at Mantua in 1462. He was of so small a stature, that he was little better than a dwarf; yet he possessed an exalted genius, and was considered as one of the greatest philosophers of the age in which he lived. He taught philosophy, first at Padua and afterwards at Bologna, with the highest reputation. He had frequent disputations with the celebrated Achillini, whose puzzling objections would have confounded him, had it not been for his skill in parrying them by some joke. His book *De Immortalitate Animæ*, published in 1516, made a great noise. He maintained, that the immortality of the soul could not be proved by philosophical reasons; but solemnly declared his belief of it as an article of faith. This precaution did not, however, save him; many adversaries rose up against him, who did not scruple to treat him as an atheist; and the monks procured his book, although he wrote several apologies for it, to be burnt at Venice. His book upon Incantations was also thought very dangerous. He shows in it, that he believed nothing of magic and sorcery; and he lays a prodigious stress on occult virtues in certain men, by which they produced miraculous effects. He gives a great many examples of this; but his adversaries do not admit them to be true, or free from magic.—Paul Jovius says, that he died in 1525, in his grand climacteric. He was three times married; and had but one daughter, to whom he left a large sum of money. He used to apply himself to the solution of difficulties so very intensely, that he frequently forgot to eat, drink, sleep, and perform the ordinary functions of nature: nay, it made him almost distracted, and a laughing-stock to every one, as he himself tells us.

POMPONIUS MELA. See MELA.

POMUM, an APPLE; a species of seed-vessel, composed of a succulent fleshy pulp; in the middle of which is generally found a membranous capsule, with a number of cells, or cavities, for containing the seeds. Seed-vessels of this kind have no external opening or valve. At the end opposite to the foot-stalk is frequently a small cavity, called by the gardeners the *eye of the fruit*, and by botanists *umbilicus*, the "navel," from its fancied resemblance to the navel in animals. Gourd, cucumber, melon, pomegranate, pear, and apple, furnish instances of the fruit or seed-vessel in question.

POND, or *FISH-Pond*. See *FISH-Ponds*.

POND, is a small pool or lake of water from whence no stream issues. In the *Transactions of the Society instituted at London for the Encouragement of Arts, Manufactures, and Commerce*, vol. viii. and printed in the year 1790, there is a short account of a machine for draining ponds without disturbing the mud. It was communicated to the society, together with a drawing and model of the machine, by Lieutenant-colonel Dansey. The model was made from the description of a machine used by a gentleman near Taunton for many years before, for supplying a cascade in his pleasure-grounds.—The colonel's regiment was then lying at Windsor; and thinking that the invention might be useful to supply the grand cascade at Virginia-water, he made the model, and presented it to the king, who was graciously pleased to approve of it. In consequence of which, by his majesty's desire, a penstock on that principle was constructed from the model at one of the ponds in the neighbourhood.—The colonel thinks the machine may be useful in the hands of men of science, and applicable to silk, cotton, and other mills, where a steady and uniform velocity of water is wanted; which might be regulated at pleasure, occasioning no current to disturb the mud or fish, as the stream constantly runs from the surface. He says he has often made the experiment by the model in a tub of water.

Of this machine we have given an engraving, taken from the above-mentioned Transactions; and we shall now add the description which accompanies the plate in that work.

In figure 1. A is the pipe, loaded with a rim of lead, Plate CCCCXIII

of

of such weight as serves to sink it below the surface of the water. B is the discharging pipe, laid through the bank HI. C is the joint on which the pipe A turns its form, which is shown fig. 2. D is the ball or float, which, swimming on the surface of the pond, prevents the pipe A from descending deeper than the length of the chain by which they are connected. E is a chain winding on the windlass F, and serving to raise the tube A above the surface of the water, when the machinery is not in use. G is a stage. HI is the bank, represented as if cut through at I, to show the tube B lying within it. K is a post to receive the tube A when lowered, and to prevent its sinking in the mud. In figure 2. A is a cast cylinder, with a plate or cheek, B, which is fastened to the timber of the tube on one side, but not on the other, as the part of the cylinder C turns in the hollow of the wooden tube when it is immerged. A piece of strong sole leather is put inside the brass-plate B, to prevent leaking.

Pond-Weed, in botany. See Potamogeton.

PONDICHERRY, is a large town of Asia, in the peninsula on this side the Ganges, and on the coast of Coromandel. Its situation is low, and the ships anchor about a mile and a half from it; nor can the boats or canoes come nearer it than a musket-shot, on account of the breakers, so that the blacks come in flat-bottomed boats to carry the men and merchandises to the fleet. The fort is 200 paces from the sea, and very irregular; built with bricks, and covered with fine plaster, resembling white marble. The huts of the blacks lie here and there, and the walls are of bamboos mixed with the branches of trees. The French are greatly addicted to women, from whom they catch diseases that render them pale, livid, and meagre, with a frightful aspect. However, several of the French are married to a sort of Portuguese women, who are of a mixed breed, being a kind of Mulattoes. The country about it is barren, and consequently most of their provisions are brought from other places. Their trade consists of cotton-cloth, silks, pepper, saltpetre, and other merchandises that are brought from Bengal. With regard to the religion of the natives, the most numerous are the Gentoos; but there are Mahometans or Moors who hold a great many ridiculous opinions. The Gentoos are of different sects, and that of the Brahmins are priests. The custom of women burning themselves with the bodies of their dead husbands was very common, but of late much discountenanced. The slaves or servants are very numerous, and their chief food is rice. This place was taken, and the fortifications demolished, by Colonel Coote; it was restored to the French by the peace of 1763; and was retaken in the beginning of the present war with the French republic. It is 60 miles south of Fort St George. E. Long. 79. 58. N. Lat. 11. 42.

PONDICO, an island of the Archipelago, lying on the gulph of Ziton, near the coast of Negropont. It is small and uninhabited, as well as two others that lie near it.

PONG-hou *Isles*, in the province of Fo-kien in China, form an archipelago between the port of Emouy and the island of Formosa. A Chinese garrison is kept here, with one of those mandarines who are called *limsati*, whose principal employment is to watch the trading vessels which pass from China to Formosa, or from Formosa to China.

As these islands are only sand-banks or rocks, the inhabitants are obliged to import every necessary of life; neither shrubs nor bushes are seen upon them; all their ornament consists of one solitary tree. The harbour is good, and sheltered from every wind; it has from 20 to 25 feet depth of water. Although it is an uncultivated and uninhabited island, it is absolutely necessary for the preservation of Formosa, which has no port capable of receiving vessels that draw above eight feet of water.

PONIARD, a little pointed dagger, very sharp edged; borne in the hand, or at the girdle, or hid in the pocket. The word is formed from the French *poignard*, and that from *poignée*, "handful."—The poniard was anciently in very great use; but it is now in a good measure set aside, except among assassins.—Sword and poniard were the ancient arms of duelists; and are said to continue still so among the Spaniards. The practice of sword and poniard still make a part of the exercise taught by the masters of defence.

PONS, a town of France, in Saintonge, very famous in the time of the Huguenots. It is seated on a hill, near the river Suigne, 10 miles from Saintes. W. Long. 0. 30. N. Lat. 45. 36.

PONT-du-gard, is a bridge of France, in Lower Languedoc, built over the river Gardon, which served for an aqueduct. It is a very remarkable and a most magnificent work, and was raised by the ancient Romans. It consists of three bridges, one above another; the uppermost of which was the aqueduct, to convey water to the city of Nismes, which is eight miles to the south. They are altogether 192 feet high, and the uppermost 580 feet long. They are constructed between two rocks. E. Long. 4. 26. N. Lat. 43. 58.

PONTEDERIA, in botany: A genus of the monogynia order, belonging to the hexandria class of plants; and in the natural method ranking under the sixth order, *Ensatæ*. The corolla is monopetalous, sexfid, bilabiate; there are three stamina inserted into the top, and three into the tube of the corolla; the capsule is bilocular.

PONTEFRACT, or Pomfret, a town of the West Riding of Yorkshire in England, situated on the river Are. It is said to take its name from a broken bridge, which is supposed to have been laid anciently over that marshy spot called the *Wash*. Here are the ruins of a noble old castle, where Richard II. was barbarously murdered, and two of Edward V.'s uncles. The collegiate chapel of St Clement, which had a dean, three prebendaries, &c. is still distinguishable in it. This town has a good market, and fairs for horses, sheep, and other cattle. It is a corporation, governed by a mayor, recorder, aldermen, and burgesses, and gives title of earl to the family of Fermor. In the reign of Queen Elizabeth, 200 l. was left by George Talbot, earl of Shrewsbury, to be lent for ever, at 5 l. a time, on proper security, for three years, to the poor artificers of the town; and Thomas Wentworth, Esq; ancestor to the marquis of Rockingham, left 200 l. to the charity-school. A branch of the great Roman military way called *Erminstreet*, which passed from Lincoln to York, may be traced betwixt

Pontifex ‖ Pont.

town and Doncaster. The adjacent country yields plenty of limestone, together with liquorice and skirrets. W. Long. 1. 5. N. Lat. 53. 42.

PONTIFEX, Pontiff, or *High-priest*, a person who has the superintendance and direction of divine worship, as the offering of sacrifices and other religious solemnities. The Romans had a college of pontiffs; and over these a sovereign pontiff, or pontifex maximus, instituted by Numa, whose function it was to prescribe the ceremonies each god was to be worshipped withal, compose the rituals, direct the vestals, and for a good while to perform the business of augury, till, on some superstitious occasion, he was prohibited intermeddling therewith. The office of the college of pontiffs was to assist the high-priest in giving judgment in all causes relating to religion, inquiring into the lives and manners of the inferior priests, and punishing them if they saw occasion, &c. The Jews too had their pontiffs; and among the Romanists, the pope is still styled the *sovereign pontiff*.

PONTIFICATE, is used for the state or dignity of a pontiff or high-priest; but more particularly in modern writers for the reign of a pope.

PONTIUS (Pilate.) See Pilate.

PONTON, or Pontoon, in war, a kind of flat bottomed boat, whose carcase of wood is lined within and without with tin: they serve to lay bridges over rivers for the artillery and army to march over. The French pontoons, and those of most other powers, are made of copper on the outside: though these cost more at first, yet they last much longer than those of tin; and when worn out, the copper sells nearly for as much as it cost at first; but when ours are rendered useless, they sell for nothing. Our pontoons are 21 feet long, five feet broad, and depth within two feet 1.5 inches.

Pontoon-Carriage, is made with two wheels only, and two long side-pieces, whose fore-ends are supported by a limber; and serves to carry the pontoon, boards, cross-timbers, anchors, and every other thing necessary for making a bridge.

Pontoon-Bridge, is made of pontoons slipped into the water, and placed about five or six feet asunder; each fastened with an anchor, when the river has a strong current; or to a strong rope that goes across the river, running through the rings of the pontoons. Each boat has an anchor, cable, baulks, and chests. The baulks are about five or six inches square, and 21 feet long. The chests are boards joined together by wooden bars, about three feet broad and 12 feet long. The baulks are laid across the pontoons at some distance from one another, and the chests upon them joined close; which makes a bridge in a very short time, capable of supporting any weight.

PONT St Esprit, is a town of France, in Languedoc, in the diocese of Usez. It is seated on the river Rhone, over which is one of the finest bridges in France. It is 840 yards long, and consists of 26 arches. Each pier is pierced with an aperture, in order to facilitate the passage of the water where the river is high. The town is large, but the streets are narrow and ill-built. It formerly contained several churches and convents. It is 17 miles south of Viviers, and 55 north-east of Montpelier. E. Long. 4. 46. N. Lat. 44. 13.

Pontus.

PONTUS, the name of an ancient kingdom of Asia, originally a part of Cappadocia; bounded on the east by Colchis, on the west by the river Halys, on the north by the Euxine Sea, and on the south by Armenia Minor. Some derive the name of Pontus from the neighbouring sea, commonly called by the Latins *Pontus Euxinus*; others from an ancient king named *Pontus*, who imparted his name both to the country and the sea; but Bochart deduces it from the Phœnician word *botno*, signifying a filberd, as if that nut abounded remarkably in this place. But this derivation seems to be very far fetched; and the common opinion that the country derived its name from the sea, seems by far the most probable. The kingdom was divided into three parts; the first, named *Pontus Galaticus*, extending from the river Halys to the Thermodon; the second, named *Pontus Polemonaicus*, extended from the Thermodon to the borders of *Pontus Cappadocicus*; and this last extended from Pontus Polemonaicus to Colchis, having Armenia Minor and the upper stream of the Euphrates for its southern boundary.

1 Etymology of the name.

It is commonly believed, that the first inhabitants of Pontus were descended from Tubal; but in process of time mixed with Cappadocians, Paphlagonians, and other foreign nations, besides many Greek colonies, which settled in those parts, and maintained their liberty till the time of Mithridates the Great and Pharnaces. The first king of this country whom we find mentioned in history is Artabazes, who had the crown bestowed on him by Darius (A) Hystaspes. The next was Rhodobates, who reigned in the time of Darius Nothus. After him came Mithridates, who, refusing to pay the usual tribute to the Persians, was defeated by Artaxerxes Mnemon; but a peace was soon after concluded by the mediation of Tissaphernes. Besides this, we hear nothing of him farther than that he was treacherously taken prisoner by Clearchus afterwards tyrant of Heraclea, and obliged to pay a large sum for his ransom.

2 Artabazes the first king.

3 Mithridates I.

Mithridates I. was succeeded by Ariobarzanes, who being appointed by Artaxerxes governor of Lydia, Ionia, and Phrygia, employed the forces that were under his care in the extending of his own dominions, and subduing those of his natural prince. The king of Persia sent one Autophrodates against him; but Ariobarzanes, having with great promises prevailed on Agesilaus and Timothæus the Athenian to come to his assistance, obliged Autophrodates to retire. He then rewarded Agesilaus with a great sum of money, and bestowed on Timothæus the cities of Sestos and Abydos, which he had lately taken from the Persians. He used his utmost endeavours to reconcile the Lacedemonians and Thebans; but not being able to bring the latter to

(A) This country, together with the adjacent provinces, was in different periods under the dominion of the Assyrians, Medes, and Persians; the last of whom divided Cappadocia into satrapies or governments, and bestowed that division which was afterwards called *Pontus* on one of the ancestors of Mithridates. This regulation was effected in the reign of Darius the son of Hystaspes, and has been regarded as the date of the kingdom.

Pontus. to any reasonable terms, he assisted the Lacedemonians with vast sums of money. The Athenians showed so much respect for this prince, that they not only made him free of their city, but granted both him and his children whatever they asked of them. He was murdered in the 28th year of his reign by one Mithridates, whom authors suppose to have been his son. This happened at the time that Alexander the Great invaded Asia, so that Pontus for a time fell under the power of the Macedonians.

4 Ariobarzanes shakes off the Macedonian yoke.

In the reign of Antigonus, Mithridates the son of Ariobarzanes shook off the Macedonian yoke; the particulars of which event are related as follow. Antigonus having dreamed that he had a field in which gold grew after the manner of corn, and that Mithridates cut it down and carried it into Pontus, began to be very jealous of him, and ordered him to be put to death privately. But Mithridates, having got notice of the king's intention, withdrew into Paphlagonia, attended only by six horsemen. Here, being joined by many others, he possessed himself of Ciniatum, a strong hold situated near mount Olgasys; from whence, as his army continually increased, he made an irruption into Cappadocia; and having driven the commanders of Antigonus from that part which borders upon Pontus, he entered his paternal kingdom, which, in spite of the utmost efforts of Antigonus, he held for the space of 26 years, and transmitted to his posterity.

Under the reigns of Mithridates III. Ariobarzanes II. and Mithridates IV. the immediate successors of Mithridates II. nothing remarkable happened. But Mithridates V. made war on the inhabitants of Sinope, a city on the coast of Paphlagonia. He made himself master of all the adjacent places; but finding the whole peninsula, on which Sinope itself stood, well fortified and garrisoned, not only by the inhabitants, but by their allies the Rhodians, he abandoned the enterprise. He afterwards proved a great friend to the Rhodians, and assisted them with money to repair the losses they had sustained by an earthquake. He entered also into a strict alliance with Antiochus the Great, who married one of his daughters named *Laodice*.

5 Pharnaces I. differs with the Romans.

After the death of Mithridates V. his son Pharnaces I. attacking the city of Sinope, unexpectedly took it by storm. On this the Rhodians sent ambassadors to Rome, complaining of the behaviour of the king of Pontus; but Pharnaces was so far from being intimidated by their threats, that he invaded the territories of Eumenes their great ally. The latter sent ambassadors to Rome, and entered into an alliance with Ariarathes king of Cappadocia. Pharnaces, in his turn, sent ambassadors to Rome, complaining of Eumenes and Ariarathes; upon which some Romans were sent into Asia to inquire into the state of matters. These found Eumenes and his associates willing to accommodate the difference, but Pharnaces in a quite opposite disposition, which they accordingly reported at Rome.

6 Concludes a most disadvantageous peace.

In the mean time a war was commenced between Eumenes and Pharnaces; but the latter, being disappointed of assistance from Seleucus king of Syria, whom the Romans would not allow to join him, was at last forced to sue for peace; which was granted him upon the following conditions: That he should forthwith withdraw his forces from Galatia, and disannul all engagements and alliances with the inhabitants of that country; that he should in like manner evacuate Paphlagonia, and send back such as he had from thence carried into slavery; that he should restore to Ariarathes all the places which he had taken during the war, the hostages of both kings, all their prisoners without ransom, and moreover should deliver up to them such of their subjects as from the first breaking out of the war had fled to him; that he should return to Morzias, a petty king in these parts, and to Ariarathes, 900 talents which he had seized in the war, and pay down 300 more to Eumenes as a fine for invading his dominions without provocation. Mithridates, king of Armenia, having in this war joined Pharnaces, was, by the articles of the treaty, obliged to pay 300 talents to Ariarathes for having assisted his enemy contrary to an alliance at that time subsisting between them. Soon after Pharnaces died, and left the kingdom to his son Mithridates VI. more weakened by this peace than by the most destructive war.

7 His son enters into alliance with the Romans.

The new king entered into an alliance with the Romans, and proved such a faithful friend, that he was rewarded by the senate with Phrygia Major, and honoured with the title of the friend and ally of the people of Rome. After a long and prosperous reign, he was murdered by some of his intimate acquaintance, and was succeeded by his son Mithridates VII. surnamed the *Great*.

8 Mithridates the Great a cruel prince.

The new prince, though not exceeding 13 years of age, began his reign with most inhuman acts of cruelty to his mother and nearest relations. His father, by his last will, had appointed him and his mother joint heirs to the kingdom; but he, claiming the whole, threw her into prison, where she soon died through the hard usage she met with. Those to whom the care of his education was committed, observing him to be of a cruel and unruly temper, made various attempts on his life, but could never effect their design, as the king was always on his guard, and armed, in that tender age, against all kind of treachery, without showing the least diffidence.

9 His extraordinary qualities.

In his youth Mithridates took care to inure himself to hardships, passing whole months in the open air, employed in the exercise of hunting, and often taking his rest amidst the frozen snow. When he came of age, he married his sister named *Laodice*, by whom he had a son named *Pharnaces*. After this he took a journey through many different kingdoms of Asia, having nothing less in view than the whole continent. He learned their different languages, of which he is said to have spoken 22; took an estimate of their strength; and above all viewed narrowly their strong holds and fortified towns. In this journey he spent three years; during which time, a report being spread abroad that he was dead, his wife Laodice had a criminal conversation with one of the lords of her court, and had a son by him. When her husband returned, she presented him with a poisoned bowl; but Mithridates had accustomed himself to take poison from his infancy, so that it had now no other effect than to hasten the destruction of his wife, which very soon took place, together with all those who had been any way accessory to her disloyalty and incontinence.

The king now began to put in execution his schemes of conquest. However, he certainly took the wrong method by attacking first those nations which were immediately

10 **Conquers several countries.**

mediately under the protection of Rome, and thus at once provoking that powerful people to fall upon him. He began with Paphlagonia, which the Romans had declared a free state. This country he easily reduced, and divided between himself and Nicomedes king of Bithynia, at that time his ally. The Romans remonstrated; but Mithridates, instead of paying any regard to their remonstrances, invaded Galatia, which was immediately under their protection. This he also reduced, and then turned his eyes on Cappadocia. But as the kingdom of Cappadocia was at that time held by Ariarathes, who was a great favourite of the Romans, and married to the sister of Mithridates, the latter hired an assassin to dispatch Ariarathes, after which he thought he might succeed better in his designs. After the death of Ariarathes, Cappadocia was invaded by Nicomedes king of Bithynia, who drove out the son, and married the widow of Ariarathes. This gave Mithridates a plausible pretence for invading Cappadocia; which he instantly did, and drove Nicomedes quite out of the country. Thus Mithridates gained considerable reputation, not only as a warrior, but as a just and good-natured prince; for as it was not known that he had any hand in the murder of Ariarathes, every one imagined that he had undertaken the war against Nicomedes, merely to revenge the quarrel of his nephew, and to restore him to his right. To keep up the farce a little longer, Mithridates actually withdrew his troops out of the country, and left the young prince master of the kingdom. In a short time, however, he began to press the young king of Cappadocia to recal the assassin Gordius, who had murdered his father: but this the king of Cappadocia refused with indignation; and Mithridates, being determined on a quarrel at all events, took the field with an army of 80,000 foot, 10,000 horse, and 600 chariots armed with scythes. With this force he imagined he should carry all before him: but finding the king of Cappadocia ready to oppose him with a force no way inferior to his own, he had recourse to treachery; and inviting his nephew to a conference, stabbed him, in the sight of both armies, with a dagger which he had concealed in the plaits of his garment. This barbarous and unexpected piece of treachery had such an effect on the Cappadocians that they threw down their arms, and suffered Mithridates, without opposition, to seize upon all their strong holds. He resigned the kingdom, however, to his son, a child of eight years of age. The care of the young prince, and of the whole kingdom, he committed to Gordius; but the Cappadocians, disdaining to be ruled by such a scandalous assassin, placed on the throne the brother of Ariarathes, who had kept himself concealed in some part of Asia. His reign, however, was of short duration; he being soon after driven out by Mithridates, and the Cappadocians again reduced. The unhappy prince died of grief; and in him ended the family of Pharnaces, who had ruled Cappadocia from the time of Cyrus the Great.

11 **Causes the king of Cappadocia to be murdered.**

12 **Assassinates his own nephew.**

13 **Nicomedes king of Bithynia attempts to deceive the Romans.**

Nicomedes, king of Bithynia, being now greatly afraid of Mithridates, and supposing that his own dominions would next fall a prey to the ambitious conqueror, suborned a youth of a comely and majestic aspect to pretend that he was a third son of Ariarathes, to go to Rome, and demand the kingdom of Cappadocia as his just right. He was received by the senate with the greatest kindness, and Laodice the wife of Nicomedes even confirmed the deceit by her oath. But in the mean time Mithridates having got intelligence of the plot, sent notice of it by Gordius to the Romans, so that the imposture was soon known at Rome also. The consequence of this was, that the senate commanded Mithridates to relinquish Cappadocia, and Nicomedes that part of Paphlagonia which he possessed; declaring both these countries free. The Cappadocians protested that they could not live without a king; upon which they were allowed to choose one of their own nation. Mithridates used all his interest in favour of Gordius; but he being excluded by the Romans, one Ariobarzanes was chosen by the majority of votes.

14 **The deceit exposed by Mithridates.**

15 **Ariobarzanes settled on the throne of Cappadocia by the Romans, but driven out by Mithridates.**

To enforce this election, Sylla was sent into Cappadocia. He had the character of an ambassador, but the real intent of his coming was to disappoint the ambitious designs of Mithridates. With an handful of forces he defeated a numerous army of Cappadocians and Armenians commanded by Gordius, and settled Ariobarzanes on the throne. But no sooner was Sylla gone than Mithridates stirred up Tigranes king of Armenia against Ariobarzanes, who, without making any resistance, fled to Rome, and Tigranes restored the kingdom to Ariarathes the son of Mithridates. At the same time died the king of Bithynia; upon which Mithridates immediately invaded that country, and drove out Nicomedes the natural son of the late king. But the expelled prince, having fled to Rome, and being assisted by that powerful republic, the king of Pontus was soon obliged to abandon Bithynia and Cappadocia.

16 **Who engages in a war with the Romans.**

The Romans now being exceedingly jealous of the power and ambition of Mithridates, resolved to humble him at all events. For this purpose they sent ambassadors to the kings of Bithynia and Cappadocia, desiring them to make frequent inroads into the neighbouring territories of Mithridates, and behave there as they pleased; assuring them of powerful assistance in case they should have occasion. Ariobarzanes could not by any means be induced to provoke so powerful a neighbour; but Nicomedes being induced, partly by promises and partly by menaces, to comply, entered Pontus, where he laid waste whole provinces with fire and sword. Mithridates complained to the Roman legates: but they replied, that he himself had been the first aggressor; that Nicomedes had only paid him in his own coin, and that they would not allow him to hurt their friend and ally. Upon this Mithridates, entering Cappadocia with a numerous army, put to flight the united forces of Ariobarzanes and Altinius the Roman legate; thus making himself once more master of this kingdom. In the mean time he sent ambassadors to Rome, complaining of the proceedings of Nicomedes: but his ambassadors met with a very indifferent reception; being enjoined to tell their master, that he must either restore the kingdom of Cappadocia to Ariobarzanes, and make peace with Nicomedes, or be accounted an enemy of the Roman people. With this answer they were commanded to depart the city that very day, and told that no more ambassadors could be admitted till such time as their commands were obeyed.

17 **Defeats Ariobarzanes and Altinius.**

In the mean time both parties prepared for war. The Roman legates in Asia drew together all the forces they could muster in Bithynia, Cappadocia, Paphlagonia, and Galatia; and, being joined by Cassius governor of of Asia, took the field against Mithridates in the year 89 B. C. They divided their army into several small bodies: Cassius encamped on the confines of Bithynia and Galatia; Manius Aquilius with his body possessed himself of the avenues leading from Pontus into Bithynia; Quintus Oppius secured the entrance into Cappadocia; and the admirals Minucius Rufus and C. Popilius lay with a fleet of 300 sail at Byzantium, to prevent the enemy from entering the Euxine sea. Each ... generals had under his command an army of ... men; besides a body of 50,000 foot and 6000 ... brought to their assistance by Nicomedes.

... other hand, Mithridates having invited several neighbouring nations to join him, collected an ... 50,000 foot, 50,000 horse, 130 chariots ... scythes; besides 300 ships and 100 galleys. ... force he detached against Nicomedes; and ... d him, though much superior in number, ... g possession of an advantageous post by ... Another part he detached against ... whom he also defeated with the loss ... n the spot, and 3000 taken prisoners; ... r Roman generals abandoned their ... dispersed, and most of the ships were ... sunk by the admirals of Mithridates.

Asia Minor.

The king of Pontus now resolving to improve the opportunity, and drive the Romans entirely out of Asia, over-ran all Phrygia, Mysia, Asia Proper, Caria, Lycia, Pamphylia, Paphlagonia, and Bithynia, with all the rest of the countries which had either belonged to or sided with the Romans, as far as Ionia. He was received everywhere with the greatest demonstrations of joy; the inhabitants flocking to him in white garments, and calling him their father, deliverer, their god, and the great and sole lord of all Asia. What gained him the affections of the people was his kind usage to the prisoners he had taken in the two engagements above-mentioned; for he not only sent them all home without ransom, but furnished them with plenty of provisions, and money sufficient to defray their expences by the way. Ambassadors flocked to him from all parts; and among others, from Laodicea on the Lycus, to whom the king promised his protection, provided they delivered up to him Q. Oppius governor of Pamphylia, who had fled thither for protection. This request was readily complied with; Oppius was sent to him in chains, with lictors walking before him in derision of the Roman pride and ostentation. Mithridates was overjoyed to see a Roman general and proconsul in his power; and his joy was soon after increased by the arrival of Manius Aquilius, whom the Lesbians, revolting from the Romans, sent to him in fetters, together with many other Romans of distinction who had taken shelter among them. As he had been the chief author of the war, Mithridates led him about with him wherever he went, either bound on an ass, or on foot coupled with one Bastarnes a public malefactor, compelling him to proclaim to the crowds who came to see him, that he was Manius Aquilius the Roman legate. When he came to Pergamus, he caused him first to be publicly whipped, then to be put on the rack, and lastly melted gold to be poured down his throat.

20
Puts Aquilius to death.

Mithridates being now looked upon as invincible, all the free cities of Asia received him as their sovereign, contributing large sums towards the defraying the expences of the war; by which means he became possessed of such treasures as enabled him to keep several numerous armies in the field for five years without levying any taxes on his subjects. As many Roman citizens were dispersed in the provinces which Mithridates had subdued, he considered these as so many spies who would not fail to send an account of his proceedings to Rome: for which reason he resolved to cut them all off at once by a general massacre; which barbarous policy, it is said, had never been heard of till his time, but has been since practised by other nations. He dispatched private letters to all the governors and magistrates of the cities where the Romans resided, enjoining them on pain of death, and the entire destruction of their country, to cause all the Italian race, women and children not excepted, to be murdered on the 30th day from the date of his letters, and to let their bodies lie unburied in the open fields. One moiety of their goods was to be forfeited to the king, and the other bestowed as a reward on the assassins. Whatever slave murdered his master was to receive his liberty, and one half of the debt was to be remitted to the debtor that should kill his creditor. Whoever concealed an Italian, under any pretence whatever, was to be punished with immediate death. On the fatal day, all the gates of the cities being shut, and the avenues kept with soldiers, the king's orders were proclaimed, which caused an universal horror, not only among the unhappy victims themselves, but among those who had any feelings of humanity, at seeing themselves obliged either to betray and murder their innocent guests, friends, and relations, or to become liable to a cruel death. However, as most of the Asiatics bore a mortal hatred to the Romans, and were moreover animated by the promise of an ample reward, the orders were without delay put in execution. The inhabitants of Ephesus, where Mithridates then resided, dragged such as had taken sanctuary in the temple of Diana from the very statue of the goddess, and put them to the sword. The Pergamenians discharged showers of darts upon them as they embraced the statues in the temple of Esculapius. At Adramyttium in Mysia many were murdered in the water, while they were attempting, with their children on their backs, to swim over to the island of Lesbos. The Caunians, who not long before had been delivered from the yoke of the Rhodians, and restored to their ancient privileges, excelled all the rest in cruelty: for, as if they had apostatised from human nature, they took pleasure in tormenting and butchering the innocent children before their mothers eyes; some of them running distracted, and others dying with grief at a sight which nature could not bear. The Trallians were the only people on the continent who would not have the cruelty to imbrue their hands in the blood of the innocent Italians. However, as the king's orders were peremptory, they hired one Theophilus a Paphlagonian to dispatch the few Romans that lived among them. He, having shut them all up together in the temple of Concord, first cut off their hands as they embraced the statues of the gods, and then hacked them in pieces. Many Romans were saved on the floating islands of Lydia called *Calaminæ*, where they concealed themselves till such time as they found an opportunity of escaping out of Asia. Nevertheless,

21
Cruelly massacres all the Romans in Asia.

Pontus.

theless, according to Plutarch and Dion, 150,000 Roman citizens were massacred on that day; but, according to others, only 80,000.

Mithridates having now got rid of those whom he was in dread of on the continent, embarked great part of his forces in order to reduce the islands of the Archipelago. At Cos he was gladly received, and had delivered up to him the young Alexander, son of Alexander king of Egypt, who being driven out of that country, was killed by Chareas a sea-captain as he was retiring in a small vessel to Cyprus. With the young prince, they put into the king's hands vast sums of money, with all the golden vessels and jewels, to an immense value, which his grandmother Cleopatra had been amassing for many years. To the young prince Mithridates gave an education suitable for a king's son, but kept the treasures to himself. Here likewise he found 800 talents in ready money, which, at the first breaking out of the war, had been deposited by the Jews of Asia, and were designed for the temple of Jerusalem.

22 Reduces the island of Cos,

From Cos Mithridates steered his course for Rhodes, where at that time all the Romans who had escaped the massacre above-mentioned found a sanctuary, and, amongst others, L. Cassius the proconsul. The Rhodians, however, being very expert in maritime affairs, Mithridates did not think proper to venture an engagement. As the enemy's fleet advanced, therefore, he retired; but six of the Rhodian ships coming up with 25 of his, a sharp action ensued, in which the Rhodians sunk two of the king's ships, and put the rest to flight. In this encounter, though Mithridates had never seen a sea-fight before, he behaved with great intrepidity; but one of the ships of his own squadron falling foul of that which carried him, he was very near being taken prisoner. From this time forth he abhorred the sea, and took an aversion to all the Chians, because the pilot of that ship was a Chian. However, he again appeared before the island; but was forced anew to leave it with disgrace, and to give over all thoughts of reducing it.

23 But fails in his attempt upon Rhodes.

Mithridates now retired into Asia, with a design to settle the civil government of the countries which he had conquered, committing the care of the war to his generals. Archelaus, his generalissimo, was sent into Greece with an army of 120,000 men; where, by treachery, he made himself master of Athens, and either put to the sword or sent to Mithridates all those who favoured or were suspected to favour the Romans. From Athens he dispatched parties to reduce the neighbouring castles and the island of Delos, which they did accordingly; but Orobius, a Roman general, hearing that the enemy kept no guards, but passed their time in carousing and debauchery, fell upon them unexpectedly, and cut off the whole party, except Apellicon the commander.

24 His generals reduce all Greece.

In the mean time, Metrophanes, another of the king's generals, entering Eubœa, laid waste the whole country, exerting his rage chiefly against the cities of Demetrias and Magnesia, which refused to open their gates to him. But as he was sailing off with a great booty, Bryttius, the prætor or governor of Macedonia, coming up with him, sunk some of his ships, and took others, putting all the prisoners to the sword. Mithridates, upon the news of this loss, sent his son Ariarathes with a powerful army to invade Macedonia; which he soon reduced, together with the kingdom of Thrace, driving the Romans everywhere before him. The generals whom he sent into other quarters were no less successful; so that Mithridates had, according to Aulus Gellius, 25 different nations who paid him homage. The same author adds, that he was skilled in every one of their various languages, so that he could converse with the natives without an interpreter. Among these nations we find the Rhoxani, now the Russians or Muscovites, whom Deiphontus, one of the king's generals, brought under subjection, after having slain in an engagement 50,000 of the barbarians.

Pontus.

All this time the Romans had been too much taken up with their own domestic quarrels to take such effectual measures as they otherwise would have done for checking the progress of Mithridates. But at last, having received certain advice that the king designed to invade Italy, and that he had even been solicited to do so by some of the revolted Italians, they sent against him Lucius Sylla, who had already given sufficient proofs of his courage, conduct, and experience in war. He had with him only five legions and a few cohorts. With this inconsiderable force he landed in Attica, and in a short time made himself master of the capital; Archelaus not daring, or, according to others, through treachery, not caring, to engage him. As Sylla had but a few frigates, he sent Lucullus to the island of Rhodes, with orders to the Rhodians to join him with their fleet. The undertaking was very dangerous, as the king's fleet in a manner covered the sea. However, Lucullus, despising all danger, ventured out, and sailed, without meeting with any perverse accident, to Syria, Egypt, Libya, and Cyprus; from whence he returned with such supplies of ships and experienced mariners, as enabled Sylla, after their conjunction with the Rhodians, to act offensively by sea also. Archelaus now dispatched messengers to Taxiles, who commanded in Thrace and Macedon, desiring him to join him with all his forces; which the other readily did, and between both mustered an army of 120,000 men. Sylla met them near Cheronæa with only 15,000 foot and 1500 horse; but gave them a most dreadful overthrow, no fewer than 110,000 of the Asiatics being slaughtered, while the Romans lost only 12 men.

25 Sylla sent against him,

26 Who totally defeats his generals in Greece.

This success having raised envy and jealousy against Sylla in Rome, the senate sent Lucius Valerius Flaccus, the consul of that year, with two legions into Asia, in appearance to attack Mithridates on that side, but with private instructions to fall upon Sylla himself, if they found him disaffected to the senate. As Flaccus was a man of no experience in war, C. Fimbria, a senator of great repute among the soldiery, was appointed to attend him with the character of legate and lieutenant-general. Sylla was at that time in Bœotia; but, hearing what had happened at Rome, he marched with all expedition into Thessaly, with a design to meet Flaccus, who, he expected, was to land in that province. But no sooner had he left Bœotia, than the country was over-run by an army of Asiatics, under the command of Dorylaus the king's chief favourite. On this advice Sylla returned into Bœotia, where he gained two signal victories, which put an end to the war in Greece. In the first of these Dorylaus lost 150,000 of his men according to some, or 200,000 according to others; and in the next all the rest. In this last engagement

27 Flaccus and Fimbria sent into Asia.

28 Sylla gains two other victories in Greece.

20,000

20,000 were driven into a river, where they all perished; an equal number were pursued into a marsh, and entirely cut off; the rest were killed in the heat of battle, the Romans giving no quarter to men who had treated their fellow-citizens after such a barbarous manner in Asia. Plutarch tells us, that the marshes were dyed with blood; that the course of the river was stopped by the dead bodies; and that even in his time, that is, near 200 years after, a great number of bows, helmets, coats of mail, and swords, were found buried in the mud. Archelaus, who had joined Dorylaus with a body of 10,000 men a few days before the battle, lay three days stripped among the slain till he found a small vessel which carried him to Eubœa, where he gathered what forces he could, but was never again able to appear in the field. Indeed Livy tells us, that Archelaus betrayed the king's cause; and Aurelius Victor, that the king's fleet was intercepted by Sylla through the treachery of Archelaus: adding, that there was a good understanding between the two commanders, as was plain from Sylla's bestowing upon Archelaus 10,000 acres of land near the city of Chalcis in Eubœa. Strabo also informs us, that Archelaus was afterwards greatly esteemed and caressed by Sylla and the senate; but Sylla himself in his commentaries, and Dio, endeavour to clear Archelaus from all suspicion of treachery.

In the mean time, Sylla having given up Bœotia to be plundered by his soldiers, marched into Thessaly, where he took up his winter-quarters, caused his old ships to be refitted and several new ones built, in order to pass over into Asia in the beginning of the spring, that he might drive from thence not only Mithridates, but his rival Flaccus also, whom the senate, out of opposition to him, had appointed governor of that province. But before he arrived, some differences having arisen between Flaccus and Fimbria, the latter was by the consul deprived of his command. Upon this Fimbria, having gained over the soldiery to his side, made war on the consul, took him prisoner, put him to death, and assumed the command of all the Roman forces in Asia. In this station he behaved with the greatest cruelty, insomuch that his name became more odious than even that of Mithridates itself. This hatred the king of Pontus endeavoured to improve to his own advantage; and therefore commanded his son, by name also *Mithridates*, to join Taxiles, Diophantes, and Menander, three of his most experienced commanders, to return at the head of a numerous army into Asia; not doubting but the inhabitants, thus harassed by Fimbria, would shake off the Roman yoke when they saw such a powerful army in the field ready to protect them. But Fimbria, distrusting the Asiatics, marched out to meet the enemy, and offered them battle before they entered the province. As the king's army was greatly superior to the Romans in number, the latter suffered greatly in the engagement, but held out till night parted them, when they withdrew to the opposite side of a river, which was at a small distance from the field of battle. Here they designed to intrench themselves: but in the mean time a violent storm arising, Fimbria laid hold of that opportunity to repass the river and surprise the enemy: of whom he made such havock as they lay in their tents, that only the commanders and some few troops of horse escaped. Among these was the king's son; who, attended by a few horse, got safe to Pergamus, where his father resided. But Fimbria, pursuing him night and day without intermission, entered Pergamus sword in hand; and hearing that both Mithridates and his son had fled from thence a few hours before, he continued his pursuit, and would have taken the king himself, had he not entered Pitane with a considerable body of horse. The place was closely invested by Fimbria; but as he had no ships to block it up by sea also, he sent a messenger to Lucullus, who commanded the Roman navy in Asia, intreating him, as he tendered the welfare of the republic, to make what haste he could to Pitane, and assist him in taking the most inveterate enemy the Romans had. But Lucullus, preferring the gratification of a private pique to the good of his country, refused to come: and thus allowed the fleet of Mithridates to carry him in safety to Mitylene.

29 Fimbria puts Flaccus to death.

30 Defeats the forces of Mithridates,

31 And besieges the king;

32 Who is suffered by Lucullus to escape.

Soon after the king's departure, Fimbria took Pitane by storm, and reduced most of the cities of Asia, particularly Troy, which he also took by storm in eleven days, and put most of the inhabitants to the sword, because they had sent an embassy to Sylla, offering to submit to him rather than to Fimbria.—To add to the misfortunes of Mithridates, his fleet was entirely defeated in two engagements by Lucullus; so that he began to be weary of the war, and therefore desired Archelaus to conclude a peace upon as honourable terms as he could. The king himself had afterwards also a conference with Sylla, and a peace was concluded in 85 B. C. on the following terms, viz. That Mithridates should relinquish all his conquests, and content himself with his paternal dominions, which were confined within the limits of Pontus: that he should immediately resign Bithynia to Nicomedes, and Cappadocia to Ariobarzanes, and release without ransom all the prisoners he had taken during the war: that he should pay to the Romans 2000, or as others will have it 3000, talents, and deliver up to Sylla 80 ships with all their arms and ammunition, and 500 archers; and lastly, that he should not molest such cities or persons as had during the war revolted from him and sided with the Romans.

33 Peace concluded.

Sylla, having thus concluded the war with great glory to himself and advantage to the republic, turned his army against Fimbria; but the latter, finding himself in no condition to oppose his rival by force, had recourse to treachery, and attempted to get Sylla murdered. The plot miscarried, and Fimbria put an end to his own life; upon which Sylla, having now an uncontrouled power in Asia, declared the Chians, Rhodians, Lycians, Magnesians, and Trojans, free, and friends of the people of Rome, by way of reward for their having sided with the Romans: but on the other cities he laid heavy fines; condemning them in one year to pay 20,000 talents, and quartering his soldiers in the houses of those who had shown disaffection to the Romans. Each private man was to receive of his landlord 16 drachmas a-day, and each officer 50; and besides, both were to be supplied with provisions, not only for themselves, but for such of their friends as they thought proper to invite. By these impositions most of the people of Asia were reduced to beggary; especially the inhabitants of Ephesus, who had above all others shown their hatred to the Romans. Sylla then, having collected immense treasure, set sail for Italy; leaving behind him Lucullus with

Pontus. with the character of *quæstor*, and Muræna with that of *prætor*.

The two legions which Fimbria had commanded were given to Muræna, because Sylla suspected them of an inclination to the faction of Marius, whose party he was going to crush at Rome.

34 Mithridates reduces the nations which had revolted from him.

Mithridates in the mean time no sooner returned into Pontus, than he set about the reduction of those nations which had revolted from him during the war. He began with the Colchi; who immediately submitted, upon condition that Mithridates would give his son for a king over them. This was complied with; but the old king had thenceforward a jealousy of his son, and therefore first imprisoned and then put him to death. Soon after this, the king having made great preparations under pretence of reducing the Bosphori, a warlike nation who had revolted from him, the Romans began to be jealous. Their jealousy was further increased by Archelaus, who fled to them, and assured them that the preparations of Mithridates were not at all designed against the Bosphori. On hearing this, Muræna invaded Pontus without any farther provocation. The king put him in mind of the articles of peace concluded with Sylla: but Muræna replied that he knew of no such articles; for Sylla had set nothing down in writing, but contented himself with the execution of what had been agreed upon. Having given this answer, the Roman general began to lay waste and plunder the country, without sparing even the treasures or temples consecrated to the gods. Having put all to fire and sword on the frontiers of Pontus towards Cappadocia, he passed the river Halys, and on that side possessed himself of 400 villages without opposition; for Mithridates was unwilling to commit any hostilities before the return of an ambassador whom he had sent to Rome to complain of the conduct of Muræna. At last the ambassador returned, and with him one Callidius; who, in public assembly, commanded Muræna to forbear molesting a friend and ally of the Roman people; but afterwards, calling him aside, he had a private conference with him, in which it is supposed, as he brought no decree of the senate, that he encouraged him to pursue the war. Whatever might be in this, it is certain that Muræna still continued to practise the same hostilities, and even made an attempt on Sinope, where the king resided and the royal treasures were kept. But as the town was well fortified, he was forced to retire with some loss. In the mean time Mithridates himself taking the field, appeared at the head of a powerful army, drove the Romans out of their camp, and forced them with great slaughter to save themselves over the mountains into Phrygia; which sudden victory again induced many cities to join Mithridates, and gave him an opportunity once more of driving the Romans out of Cappadocia.

35 The Romans invade his territories without provocation,

36 But are defeated.

In the mean time, Sylla, being created dictator at Rome, sent a messenger to Muræna, charging him in his name not to molest Mithridates, whom he had honoured with the title of a friend and ally of Rome. Muræna did not think proper to disregard this message; and therefore immediately abandoned all the places he had seized, and Mithridates again renounced Cappadocia, giving his own son as an hostage of his fidelity. Being then at leisure to pursue his other plans, Mithridates fell upon the Bosphori; and, having soon subdued them, appointed Machares one of his sons king of the country. But leading his army from thence against the Achæans, a people bordering on the Colchi, and originally descended from the Greeks, who returning from Troy had mistaken their way into Greece and settled there, he was defeated with the loss of three-fourths of his men. On his return to Pontus, however, he recruited his army, and made vast preparations to invade them anew; but in the mean time, hearing of Sylla's death, he came to the imprudent resolution of entering into a second war with the Romans. Having therefore induced his son-in-law Tigranes, king of Armenia, to invade Cappadocia, he himself entered Paphlagonia at the head of 120,000 foot disciplined after the Roman manner, 16,000 horse, and 100 chariots armed with scythes. This country readily submitted; after which the king marched into Bithynia, which also submitted without opposition; the province of Asia followed the example of the rest; for these countries being oppressed with exorbitant taxes, looked upon him as their deliverer. In entering the cities of Asia, he caused M. Marius or Varius, whom Sertorius had sent him out of Spain to discipline his troops, walk before him with the ensigns of consular dignity as if he was the chief magistrate; the king following as one of his attendants. He made several cities free; but at the same time acquainted the inhabitants, that they were indebted to Sertorius for their liberty; and thus, by the connivance of that general, many cities revolted from the Romans without knowing that they had done so. But in the mean time Julius Cæsar, being at that time at Rhodes, whither he had gone to study oratory, and hearing what havock the king's officers made in the adjacent countries, he collected what troops he could, and falling unexpectedly upon them, drove them quite out of the province of Asia.

37 Engages in a new war with the Romans.

The Roman senate, now finding a war unavoidable, appointed Lucullus to manage it. The other consul Cotta, having solicited an employment in this war, was sent with a fleet to guard the Propontis and defend Bithynia. Lucullus having raised one legion in Italy, passed over with it into Asia, where he was joined by four others, two of which, as they had served under Fimbria, proved at first very mutinous and refractory; nor were the other two much better, having been immersed in the Asiatic luxuries. The disciplining of these troops took up a considerable time, which was prejudicial to the Roman affairs; for almost all the Asiatics were ready to revolt, and Mithridates was making the greatest preparations. One of his armies was ordered to march into Cappadocia, under the command of Diophantus Matharus, in order to oppose Lucullus if he should attempt to enter Pontus on that side; another, commanded by Mithridates in person, consisted of 150,000 foot, 12,000 horse, and 100 chariots armed with scythes; a third army, commanded by Marius and Eumachus, two generals of great experience in war, was encamped in the neighbourhood of Heraclea in Pontus.

38 Lucullus and Cotta sent against him.

The beginning of the war proved favourable to Mithridates. Cotta being desired by Lucullus to keep his fleet within the harbour, as being inferior to that of Mithridates, resolved to take the first opportunity of fighting the king by land, not doubting of an easy victory. Having for this purpose collected all the forces he could, Cotta dispatched his legate, P. Rutilius, with a

39 Mithridates is at first successful,

Pontus. a considerable body to observe the motions of the enemy. This commander being met by Marius and Eumachus, an engagement ensued, in which the Romans were defeated, and the greatest part of them, together with their commander, cut in pieces. The same misfortune befel several other officers of distinction sent out to oppose Mithridates; who, being elated with success, ordered his admiral to sail into the very harbour, and fire the Roman fleet. This was accordingly performed without the least opposition from Cotta; and 60 ships were taken, sunk, or burnt, on that occasion.

These victories having increased the rebellious disposition of the Asiatics, made Lucullus hasten his march in order to stop the progress of the enemy. But finding the king's army much more numerous than he expected, he thought proper to decline an engagement. However, several skirmishes happened, in which the Romans had always so much the advantage, that they became impatient for a general engagement. But Lucullus did not at this time choose to run so great a risk; and therefore Mithridates, seeing he could not force the Romans to a battle, decamped in the night-time, and by day-break reached Cyzicum, a most important city, and greatly attached to the Romans. Lucullus pursued him; and, falling on his rear, killed 10,000, and took 13,000 prisoners. After this, the Roman general, by a manœuvre, gained an important pass, which enabled him to cut off all communication between the army of Mithridates and the neighbouring country. The king, seeing himself thus in danger of famine, redoubled his efforts to gain the city; but finding that he could not batter down the walls, he resolved to undermine them. In this also he was unsuccessful; the besieged sunk countermines, and had very near taken the king himself in one of his own mines. In the mean time, winter coming on, the army of Mithridates was so distressed for want of provisions, that many died of hunger, while the survivors were forced to feed on the flesh of their dead companions. The famine was followed by a plague; which destroyed such numbers, that Mithridates was obliged to think of a retreat; and even this was become very dangerous. However, he laid hold of the opportunity when Lucullus went away to besiege a neighbouring castle, and sent off the greatest part of his cavalry in the night; ordering them not to halt till they were out of the reach of the enemy. But Lucullus having got intelligence of their march, suddenly returned, and pursued them so close, that he came up with them as they were passing a river, took 600 horse, all their beasts of burden, 15,000 men, and put the rest to the sword. On his return he fell in with Aristonicus the king's admiral, whom he took, just as he was ready to sail with a large sum of money designed to bribe the Roman army. In the mean time Mithridates, finding himself reduced to the last extremity, embarked in the night-time with the greatest part of the forces, while Marius and Eumachus, with 30,000 men, made the best of their way to Lampsacus. But being closely pursued by the Romans, they were overtaken at the river Æsopus, which at that time was not fordable, by reason of its having been swelled by heavy rains. Twenty thousand were killed on the spot; nor could a single man have escaped, had not the Asiatics scattered great quantities of gold and silver in the way, that the march of the Romans might be retarded by their stopping to gather it up. Lucullus on his return entered Cyzicum amidst the acclamations of the citizens; who afterwards instituted public sports in honour of him, which they called *Lucullea*. The city was declared free, and all the privileges, exemptions, and immunities, bestowed upon the citizens which were enjoyed by the inhabitants of Rome itself.

40 But is reduced to great straits by Lucullus,

41 Who cuts off great numbers of his men.

42 Lucullus gains a great victory at sea.

From Cyzicum, Lucullus marched along the coast of the Hellespont till he came to Troas; where he equipped his fleet, and put to sea in quest of Marius, Alexander, and Dionysius, three of the king's generals, who had a fleet of 50 ships, with 10,000 land-forces on board. Lucullus came up with them near the island of Lemnos, took 32 of their ships, and put a great number of their land-forces to the sword. The day after the engagement the three generals were discovered in a cave where they had concealed themselves, and dragged from thence to Lucullus; who, after having severely upbraided Marius for fighting against his country, caused him to be put to death. Alexander and Dionysius were reserved for the triumph; but the latter poisoned himself to avoid that disgrace. Lucullus then steered his course for Bithynia, on receiving intelligence that Mithridates had appeared with his fleet on those coasts: but the king having notice of his approach, made what haste he could to gain Pontus, and arrived at Heraclea on board a pirate named *Selemus*; with whom he was obliged to trust himself, his fleet being dispersed by a violent storm, and the ship that carried him cast away.

43 Farther successes of Lucullus.

In the mean time Mithridates was no less unfortunate by land than by sea. Triarius, one of the officers of Lucullus, reduced the cities of Apamea, Prusa, Prusias, and Nicæa. From thence he marched with all expedition to Nicomedia, where the king himself was, and near which place Cotta lay encamped. But before the two armies could be joined, Mithridates escaped, first to Heraclea, which was betrayed to him, and from thence to Sinope. Nor was Lucullus himself all this time inactive. Having reduced all Paphlagonia and Bithynia, he marched through Cappadocia, and joined Cotta and Triarius at Nicomedia, with a design to invade Pontus; but hearing that Heraclea was in the hands of Mithridates, he dispatched Cotta to reduce that city. Triarius was ordered with the fleet to the Hellespont and Propontis, to intercept the king's fleet, which was daily expected from Spain with supplies from Sertorius. Lucullus himself, with the main strength of the army, pursued his march into Pontus. His army was greatly harassed, especially in the narrow passes between Cappadocia and Pontus, by flying parties of the enemy. But the greatest inconvenience was the want of provisions, as the king's troops had laid waste all the country round; insomuch that Lucullus having lost almost all his beasts of burden, was obliged to take along with the army 30,000 Galatians, each of them carrying a sack of corn on his back. At last, however, he gained the plains of Pontus; where provisions were so plentiful, that an ox was sold for a drachma, and every thing else in proportion.

The Roman general having now carried the war into the enemy's country, divided his forces, and at the same time invested a very strong town named *Amisus*; another called *Eupatoria*, built by Mithridates, and made the

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the place of his residence; and another, named *Themiscyra*, situated on the banks of the Thermodoon. Eupatoria was soon taken, but Themiscyra made a vigorous resistance. The townsmen galled the Romans to such a degree, that, not daring to approach the walls openly, they contented themselves with undermining them: but in this too they met with no small difficulty; for the enemy countermined, and often engaged them, under ground, letting into the mines bears and other wild beasts, with swarms of bees, which obliged them to abandon their works. However, the town was at last obliged to surrender for want of provisions. As for Amisus, Lucullus himself sat down before it: but finding it strongly fortified and garrisoned with the flower of the king's troops, the Roman general thought proper to reduce it by famine; and on this occasion his countrymen first complained of him as protracting the war for his own advantage.

In the mean time Mithridates having recruited his shattered army, advanced to Cabiræ, a city not far distant from Amisus. Lucullus, leaving part of the army to continue the siege, marched at the head of the rest to oppose Mithridates. But the king having drawn his cavalry into a general engagement, defeated them with considerable loss, and drove them back to the mountains, through the passes of which Lucullus had lately marched to attack him. This check obliged the Roman general to retire to a rising ground near the city of Cabiræ, where the enemy could not force him to an engagement. Here provisions beginning to grow scarce, Lucullus sent out strong parties from his army into Cappadocia, the only place from whence he could have supplies. One of these parties entirely defeated Taxiles and Diophantes, two of the king's generals, who had been stationed there to prevent Lucullus from having any communication with the country. The king, upon the news of this defeat, resolved to break up his camp and retire, not questioning but that Lucullus would attack him as soon as his forces returned. This resolution he no sooner imparted to his nobles, than they began privately to send away their most valuable goods; which being found out by the soldiers, they took it in such bad part that no intelligence had been given them, that they plundered their baggage, and put those who had the care of it to the sword. After this they betook themselves to flight, crowding out of the gates in the utmost confusion. The king hastened to stop their flight; but nobody showing him the least respect, he was carried away by the crowd, and in great danger of being trampled to death. Having with difficulty made his escape, he retired with a small retinue, first to Cabiræ, and then to his son-in-law Tigranes king of Armenia. Lucullus dispatched the best part of his cavalry to pursue the fugitives; while he himself, with the rest, invested the camp of Mithridates, where those remained who could not fly with the rest. The camp was easily taken; but most of the soldiers made their escape, while the Romans, contrary to their general's orders, were busied in plundering. Lucullus then pursued hard after the king; who, being overtaken by a company of Galatians, caused a mule loaded with part of his treasures to be driven in among them, by which means he made his escape while they quarrelled about the booty. Mithridates, remembering in his flight, that he had left his sisters, wives, and concubines at Pharnacia, dispatched an eunuch, named *Bacchur* or *Bacchides*, with orders to put them all to death, lest they should fall into the hands of the enemy; which was accordingly done.

44 The army of Mithridates mutinies, which obliges the king to fly into Armenia.

After the flight of Mithridates, the Romans no longer met with any opposition; the king's governors flocking from all parts to put themselves under the protection of the conqueror. Among these was the grandfather of Strabo the geographer, whom the king had disobliged by putting to death his cousin-german Tibias, and his son Theophilus. He was a man of such credit, that it was no sooner heard that he had abandoned the king's party, than 15 other commanders delivered up to Lucullus the places with which they had been intrusted; and about the same time Triarius falling in with the king's fleet near the island of Tenedos, obtained a complete victory, having either taken or sunk 60 of the enemy's vessels.

All this time Cotta had been employed without success in besieging Heraclea, which he could never have reduced without the assistance of Triarius. That commander, having defeated the fleet, soon reduced the town to such distress, that a third part of the garrison died of hunger; upon which the governor, Conacorix, privately agreed with Triarius to deliver one of the gates to him. This was accordingly done; and the Romans, entering, made a terrible slaughter of the helpless inhabitants. But in the mean time Cotta, provoked at seeing himself deprived both of all share of the booty, and the honour of reducing a place before which he had sat so long, fell upon his countrymen as they were busied in plundering; which would have occasioned a great deal of bloodshed, had not Triarius promised to divide the booty equally. Conacorix, in order to conceal his treachery, after marching out of Heraclea, seized on two forts belonging to the Romans; and Triarius being sent to recover them, Cotta, in his absence, plundered the city anew, rifled the temples which the other had spared, put all the citizens he could meet with to the sword, and having carried off every thing valuable, at last set fire to the city in several places, by which means it was soon reduced to ashes. Cotta then, having no farther occasion for his troops, dismissed the auxiliaries, resigned his legions to Lucullus, and put to sea himself in order to return to Rome. But he had scarce got out of the harbour, when part of his ships, being overloaded with the spoils of the city, sunk; and the others were by a violent north wind dashed against the shore, which occasioned the loss of a great part of the booty. However, on his return to Rome, he was highly applauded by the senate, and honoured with the title of *Ponticus*.

Lucullus, having now reduced Pontus, marched against the Chaldeans, Tibarenians, and inhabitants of Armenia Minor; who voluntarily submitted to him, and put him in possession of all their strong holds. From Armenia, he returned before Amisus, which still held out; Callimachus, governor of the place, having harassed the Romans to such a degree by engines of his own contriving, that they had given over their assaults, and contented themselves with blocking it up by land, though the garrison was at the same time plentifully supplied with provisions by sea. Lucullus, on his arrival, summoned the city to surrender, offer-

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ing the inhabitants very honourable terms; but, being refused, he made a general assault at the time when he knew that Callimachus used to draw off great part of his troops to give them some respite. The Romans applying their scaling ladders, got over the wall before Callimachus could come to the assistance of those whom he had left to guard it; however, by setting the city on fire, he found means in that confusion to make his escape. Lucullus commanded his men to use their utmost endeavours to save the city; but they being intent only upon plundering, regarded nothing but the furniture. At last the fire was extinguished by a violent shower; and Lucullus, having with much ado restrained his soldiers from committing any farther excesses, repaired the city in some measure before he left it, and suffered the inhabitants to enjoy their possessions in peace.

45 Tigranes defeated by Lucullus.

Nothing was now wanting but the captivity of Mithridates himself to put a final period to the war; and therefore Lucullus demanded him from his son-in-law Tigranes. But though that prince could not be prevailed to see Mithridates on account of his misconduct, he could as little be induced to deliver him up to his enemies. After this refusal, however, he for the first time condescended to see his father-in-law, after he had resided a year and eight months in his dominions. In a private conference held by the two kings, it was agreed, that Tigranes should march against the Romans, and Mithridates with 10,000 horse return into Pontus, where he should make what levies he could, and rejoin Tigranes, before Lucullus, who was then employed in the siege of Sinope, could enter Armenia. But, in the mean time, Sinope having surrendered, Lucullus with all possible expedition marched against Tigranes, and, having drawn him into a general engagement, gave him an entire defeat, as is related under the article Armenia.

Mithridates was marching to his assistance, when he met his son-in-law flying with a small retinue to shelter himself in some remote corner of the kingdom.

46 But resolves to try another campaign.

He encouraged him to raise new forces; not doubting but that another campaign would repair all former losses, provided he would commit to his management every thing relating to the war. To this Tigranes agreeing, as he thought him more fit to deal with the Romans than himself, orders were issued out for raising a new army, and all the Armenians able to bear arms summoned to meet at the place of the general rendezvous. Out of these Mithridates chose 70,000 foot and 35,000 horse; and having trained them up during the winter, after the Roman discipline, in the beginning of the spring he left part of them with Tigranes, and marched himself with the rest into Pontus, where he recovered many important places, and overcame in a pitched battle M. Fabius, whom Lucullus had appointed governor of that province. Being flushed with this success, as soon as the wounds he received in the engagement suffered him to move, he pursued Fabius, and besieged him in the city of Cabira, whither he had retired; but in the mean time Triarius, who was marching out of Asia to join Lucullus, hearing what distress the Romans were in, hastened to their relief, and appearing unexpectedly on the neighbouring hill, struck such terror into the enemy, that they raised the siege, and made the best of their way into Cappadocia. Triarius pursued them, and got so near them as to be parted only by a river. Here he halted, with a design to pass the river after he had allowed his men some rest; for they were tired out with long marches. But Mithridates was before-hand with him, and crossing the river on a bridge, where he had placed a strong guard, attacked the Romans with great resolution before they had time to refresh themselves.

47 Mithridates defeated.

The battle was bloody, and the event doubtful, till the bridge breaking down with the weight of the multitude that passed, the king's troops who had engaged, relying chiefly on their numbers, began to lose courage, seeing they could receive no further assistance; and the Romans charging them with fresh vigour, they betook themselves to a precipitate flight. After this engagement, as winter came on, both armies were glad to retire to their winter-quarters.

During the winter, Mithridates raised new forces; and having received considerable supplies from Tigranes, took the field early in the spring, in hopes of driving the Romans quite out of Pontus, before Lucullus, who had work enough on his hands in Armenia, could come to their assistance. With this view he marched straight against Triarius and Sornatius, to whom Lucullus had committed the care and defence of that province; and finding them encamped near the city of Gaziursa, proffered them battle; which they declining, he sent a strong detachment to besiege a castle where the Romans had left all their baggage, hoping they would rather venture an engagement to relieve the place, than lose all they had got with so much toil and labour during the war: neither was he disappointed in his hopes; for though Triarius was for keeping close in his camp till the arrival of Lucullus, whom he daily expected, having acquainted him with the danger, the soldiers hearing that the castle was besieged, declared in a tumultuous manner, that if he did not lead them they would march to the relief of the place without his leave.

48 Defeats Triarius.

Triarius being thus forced by his own men to fight, drew out his forces against the king, whose army was three times his number; but while they were upon the point of engaging, both armies were by a violent storm forced to retire to their respective camps; but Triarius receiving that very day intelligence of the approach of Lucullus, and fearing he would snatch the victory out of his hands, resolved to make a bold push, and next morning by break of day attack the king in his camp. If he conquered, the glory he thought would be entirely his own; if he were overcome, the enemy could reap no great advantage from his victory, Lucullus being at hand with a powerful army. The king, in that surprise, putting himself at the head of a few troops of his guards, sustained the brunt of the Romans, till the rest of his army drawing up came to his relief, and attacked the enemy with such fury, that the Roman foot were forced to give way, and were driven into a morass, where they were surrounded, and great numbers of them cut in pieces.

Their horse were likewise put to flight, and pursued with great slaughter, till a Roman centurion in the king's service, pitying his countrymen, attempted to kill him. The king's life was saved by his breastplate; but as he received a deep wound in the thigh, he was obliged to give over the pursuit himself, and those that were about him caused the retreat to be

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founded, which, as it was unexpected, occasioned a great confusion in the whole army. The centurion was immediately cut in pieces; but the Roman horse in the mean time getting the start of the enemy, found means to make their escape. Above 7000 of the Romans were killed in that battle; and among them 150 centurions and 24 tribunes, the greatest number of officers that had been lost in any engagement to that day.

49 All the Romans in the service of Mithridates massacred.

Mithridates being cured of his wound, that he might not for the future be exposed to such dangers, caused all the Romans that served in his army to be formed into one body, as if they were to be sent out on a party, and then ordered them to retire to their tents, where they were all to a man cut in pieces.

The king, however elated with success, yet would not engage Lucullus; but with long marches hastened into Armenia Minor, and encamped upon a hill near the town of Talura, expecting Tigranes, who was advancing with a strong army to join him. Lucullus, in pursuit of Mithridates, marched over the field of battle, leaving those unburied who had fallen in the engagement, which alienated the minds of the soldiery from him, and they began to be very mutinous; being stirred up by Appius Claudius, whom Lucullus had turned out of his command for his vile behaviour, notwithstanding he was nearly related to him, Lucullus having married his sister. The discontent that prevailed in the army came to such a height, that Lucullus was obliged to lie still in his camp all that summer; the soldiers declaring in a mutinous manner, that they would not follow him any longer, nor serve under a general who refused to share the booty with them.

50 Lucullus recalled, which retrieves the affairs of Mithridates.

These complaints, and the general discontent that reigned in the army, obliged the senate to recal Lucullus, and appoint Manius Acilius Glabrio, consul of that year, in his room. Glabrio arriving in Bithynia, gave notice by public criers to all the cities, that the senate had discharged Lucullus and his army, and confiscated his goods for protracting the war and refusing to comply with their injunctions. Hereupon Lucullus was abandoned by the greater part of his army, and forced to retire into Galatia, not being in a condition to make head against the joint forces of the two kings; who, laying hold of that opportunity, recovered the best part of Pontus, Bithynia, Cappadocia, and Armenia Minor: for though Glabrio had hastened into Pontus, as if he had intended to engage the enemy and rob Lucullus of the victory, yet, upon the first news of the approach of the two kings, he thought fit to retire and leave the country open on all sides to the enemy.

51 Pompey sent agr... him.

When this was heard at Rome, a law was enacted there by C. Manilius, a tribune of the people, whereby the management of the war against Mithridates and Tigranes was committed to Pompey, and likewise the provinces of Cilicia, then under Quintus Marcius, and of Bithynia under Glabrio. By the same law he was continued in that unlimited power by sea, with which he was invested when he first set out against the pirates of Cilicia. In virtue of this law, Pompey, who had just then ended the war with the Cilician pirates, took upon him the command of the army, and directed all the allies of the Roman people to join him with all possible expedition: but before he took the field, he renewed the alliance which Sylla and Lucullus had concluded with Phrahates king of Parthia, and then sent friendly proposals to Mithridates; who at first seemed inclined to give ear to them, and accordingly dispatched an ambassador to the Roman army to treat of a peace. Pompey required of him to lay down his arms if he was in earnest, and deliver up to him all those who had revolted from the Romans during the war. This demand was no sooner reported abroad in the king's camp, but the deserters, who were very numerous in the king's army, betaking themselves to their arms, threatened to put Mithridates himself to death; and would have occasioned a great disturbance, had not the king appeased the growing tumult, by assuring them, that he had sent ambassadors, not to treat of a peace, but only to take, under pretence of suing for peace, a view of the enemy's strength. He moreover obliged himself, by a solemn oath in the presence of the whole army, never to enter into any treaty of friendship with the Romans, nor to deliver up to them such as had ever served under him.

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52 Mithridates rejects his proposals of peace.

Pompey, finding his proposals rejected, advanced against the king with an army of 30,000 foot and 20,000 horse, as Plutarch writes, or 30,000, as we read in Appian, all chosen troops; for he discharged most of those who had served under Glabrio and Lucullus. As he entered Galatia, he was met by Lucullus, who endeavoured to persuade him to march back, the war being near finished, and even deputies sent by the republic to settle the province of Pontus; but not being able to prevail with him, after mutual complaints against each other, they parted; and Pompey removing his camp, commanded the troops that were with Lucullus to join him, except 1600 whom he left to attend Lucullus in his triumph. From thence Lucullus set out for Rome, where he was received by the senate with great marks of esteem, most men thinking him highly injured by the authors of the Manilian law. Pompey pursued his march into Pontus; but finding that he could not by any means draw the king to a battle, he marched back into Armenia Minor, with a design either to reduce that province, or oblige Mithridates to venture a battle in order to relieve it. Mithridates followed him at some distance; and entering Armenia, encamped on a hill over-against the Romans, and, by intercepting their convoys, reduced them to such distress, that they were obliged to remove to a more convenient place, the king cutting off many in their rear, and harassing them with frequent attacks, till he fell into an ambuscade laid by Pompey, whose personal courage and prudent conduct on that occasion confirmed the king in his resolution not to hazard a general engagement. The two armies encamped over-against each other; Pompey on one hill, and the king on another, near the city of Dastira, in the province of Acisilene, at a small distance from the Euphrates, which divides Acisilene from Armenia Minor.

53 Is besieged by Pompey.

Here Pompey, seeing he could neither draw the king to a battle, nor force his camp, which was pitched on a steep and craggy mountain, began to block him up with a ditch which he carried round the bottom of the hill where the king was encamped; and meeting with no opposition, finished his work, and quite cut off the enemy's communication with the country. Pompey was amazed to see the king thus tamely suffer himself to be shut up; and could not help saying, That he was either a great fool or a great coward: a fool, if he did not

not apprehend the danger he was in; a coward, if, being appriſed of it, he did not to the utmoſt of his power prevent it. By this ditch, which was 150 furlongs in circuit, and defended by many forts raiſed at ſmall diſtances from each other, the king was ſo cloſely beſieged, that he could neither ſend out parties to forage, nor receive the ſupplies that came to him from Pontus. He was thus beſieged for the ſpace of 45 or 50 days; and his army reduced to ſuch ſtraits, that, having conſumed all their proviſions, they were at laſt forced to live on their dead horſes. Hereupon Mithridates reſolved at

54 **But breaks through the Roman lines.**

all events to break through the Roman fortifications: and accordingly, having put to the ſword all thoſe that were ſick or diſabled, that they might not fall into the enemy's hands, he attacked in the dead of the night the Roman guards; and having overpowered them with his numbers, got ſafe into the open fields, and continued his march all night towards Armenia Major, where he was expected by Tigranes.

Pompey next morning by break of day purſued the enemy with his whole army; and having with much ado overtaken them, found the king encamped on a hill, to which there was but one aſcent, and that guarded by a ſtrong body of foot. The Romans encamped over-againſt them; but Pompey, fearing the king ſhould make his eſcape in the night-time, privately decamped, and taking the ſame rout the enemy were to hold in order to gain Armenia, poſſeſſed himſelf of all the eminences and defiles through which the king was to

55 **Is over-reached by Pompey, and totally defeated.**

paſs. Mithridates thinking that Pompey was returned to his former camp, purſued his march, and about the duſk of the evening entered a narrow valley, which was ſurrounded on all ſides by ſteep hills. On theſe hills the Romans lay concealed, expecting the ſignal to fall upon the enemy and attack them on all ſides at once, while they were tired with their march, and ſeemingly, as they had ſent out no ſcouts, in great ſecurity. Pompey was at firſt for putting off the attack till the next morning, thinking it not ſafe to engage in the night-time among ſuch ſteep and craggy mountains; but was at laſt prevailed upon, by the earneſt prayers and intreaties of all the chief officers of the army, to fall upon the enemy that very night. It was therefore agreed, that in the dead of the night all the trumpets ſhould at once ſound the charge, that this ſignal ſhould be followed by an univerſal ſhout of the whole army, and that the ſoldiers ſhould make what noiſe they could, by ſtriking their ſpears againſt the braſs veſſels that were uſed in the camp. The king's army at this ſudden and unexpected noiſe, which was echoed again by the mountains, imagined at firſt that the gods themſelves were come down from heaven to deſtroy them; and the Romans charging them on all ſides with ſhowers of ſtones and arrows from the tops of the hills, they betook themſelves to a precipitate flight; but finding all the paſſes beſet with ſtrong bodies of horſe and foot, were forced to fly back into the valley, where, for many hours together, they were expoſed to the enemy's ſhot, without being able, in that confuſion, either to attack them or defend themſelves. They attempted indeed to make ſome reſiſtance when the moon roſe; but the Romans running down upon them from the hills, did not give them time to draw up, and the place was ſo narrow that they had not room even to make uſe of their ſwords. The king loſt on that occaſion 10,000 men, according to Appian, but 40,000, according to Eutropius and others. On Pompey's ſide there fell between 20 and 30 private men, and two centurions. 56

Diſtreſs of Mithridates.

Mithridates, at the head of 800 horſe, broke through the Roman army, and being after this effort abandoned by all the reſt, becauſe they were cloſely purſued by the enemy, he travelled all night attended by three perſons only, *viz.* his wife, or, as Plutarch calls her, his *concubine*, by name *Hypſicratia*, his daughter Dripetine, and an officer. At day-break he fell in with a body of mercenary horſe, and 3000 foot, who were marching to join him. By theſe he was eſcorted to the caſtle of Sinoria, ſituated on the borders of the two Armenias. As great part of his treaſures were lodged here, he rewarded very liberally thoſe who accompanied him in his flight; and taking 6000 talents, withdrew into Armenia. As ſoon as he entered the borders, he diſpatched ambaſſadors to Tigranes, acquainting him with his arrival; but that prince, who was then on the point of concluding a ſeparate peace with the Romans, clapped his ambaſſadors in irons, pretending that his ſon Tigranes had, at the inſtigation of Mithridates, revolted firſt to the Parthians, and then to the Romans. Mithridates finding himſelf thus abandoned, even by his ſon-in-law, left Armenia; and directing his courſe towards Colchis, which was ſubject to him, and not as yet invaded by the Romans, paſſed the Euphrates the fourth day, and got ſafe into his own territories.

Pompey ſent out ſeveral parties in purſuit of the king; but remained himſelf with the main body of the army in the field of battle, where he built a city, calling it from that remarkable victory *Nicopolis*. This city, with the adjoining territory, he beſtowed upon ſuch of his ſoldiers as were old or diſabled; and many flocking to it from the neighbouring countries, it became in a ſhort time a very conſiderable place. This battle was certainly attended with very fatal conſequences for 57

He flies into Scythia, and from thence into other countries.

Mithridates; who was forced, his army being entirely either cut off or diſperſed, to abandon his own dominions, and fly for ſhelter to the moſt remote parts of Scythia. Pompey having concluded a peace with Tigranes, as we have related in the hiſtory of Armenia, and ſettled the affairs of that kingdom, began his march in purſuit of Mithridates through thoſe countries that lie about mount Caucaſus. The barbarous nations through which he paſſed, chiefly the Albanians and Iberians, attempted to ſtop his march, but were ſoon put to flight. However, he was obliged, by the exceſſive cold and deep roads, to paſs the winter near the river Cyrus. Early in the ſpring he purſued his march; but meeting with great oppoſition from the Iberians, a warlike nation, and entirely devoted to Mithridates, he was employed moſt part of the ſummer in reducing them. In the mean time, Mithridates, who had wintered at Dioſcurias, on the iſthmus between the Euxine and Caſpian ſeas, and had been joined there by ſuch of his troops as had made their eſcape from the late unfortunate battle, continued his flight through the countries of the Achæans, Zygians, Heniochians, Cercetans, Moſchi, and Colchians. Of theſe nations ſome received him kindly, and even entered into alliance with him; through others he was forced to make himſelf a way with his ſword.

Pompey took the ſame rout, directing his courſe by

Pontus.

58 Pompey's further conquests.

by the stars, especially in the northern parts of Scythia, and carrying with him even provision of water, to supply the army in the vast deserts through which he marched. He spent two years in warring with these nations, and was often in danger of losing both his life and his army: but at last he overcame them all; and believing Mithridates, of whom he could have no account, to be dead, he marched back into Armenia Minor, where he allowed some rest to his soldiers, who were quite worn out with the hardships they had endured in that expedition. Having refreshed his army, he marched into Pontus, to reduce some strongholds which were still garrisoned by the king's troops. While he was at Aspis in Pontus, many of the king's concubines were brought to him; but he sent them all home to their parents, without offering them the least injury, and thereby gained the affection of the chief lords of Pontus, whose daughters they were. The strong castle of Symphori was delivered up to him by Stratonix, one of the king's concubines, upon no other terms than that he would spare her son Xiphares, who was with the king, in case he should fall into his hands. She likewise discovered to him great treasures hid under ground, which he, with great generosity, bestowed upon her, reserving for himself only some vessels to set off his triumph. Having taken another fort, called the *New Castle*, and to that time looked upon as impregnable, he found in it great store of gold, silver, and other valuable things, which he afterwards consecrated to Jupiter Capitolinus. Here, in looking over the king's manuscripts, he came to discover where the rest of his treasures were concealed, what troops he could raise and maintain, what sums were yearly paid him by his subjects and tributaries, &c. whereby he could make a true estimate of his whole power and wealth. Amongst other manuscripts he found some books of physic, wrote by Mithridates himself, which he commanded Lenæus, a learned grammarian, to translate into Latin.

Pompey, having thus reduced all Pontus, marched into Syria, with a design to recover that kingdom, and passing through Arabia to penetrate as far as the Red Sea. But while he was employed in this expedition, news was brought him that Mithridates, whom he believed dead, had appeared unexpectedly in Pontus at the head of a considerable army, and surprised Panticapæum, a famous empory at the mouth of the Euxine Sea. He had lain all this time concealed in the territories of a Scythian prince, adjoining to the Palus Mœotis; but hearing that Pompey had left Pontus, and was engaged in other wars, he ventured out of his hiding-place, resolved either to recover his paternal kingdom, or die in the attempt. He returned privately into Pontus and managed matters there so dexterously, that the Roman garrisons knew nothing of his arrival till he appeared with a considerable army in the field. He advanced first to the castle of Symphori; and understanding that Stratonix had delivered it up to Pompey, on condition he would save the life of her son in case he should take him prisoner, the king immediately caused the youth, who was in his army, to be put to death, and his body to be left unburied, Stratonix beholding from the walls the cruel and unnatural murder, for he was her son by Mithridates, and had served him with great fidelity.

59 Mithridates appears again at the head of a considerable army.

At the same time he sent ambassadors to Pompey to treat of a peace, offering to pay a yearly tribute to the republic, on condition he restored to him his kingdom. Pompey replied, that he would hearken to no proposals whatsoever, without the king came to treat with him in person, as Tigranes had done. This Mithridates looked upon as nowise consistent with his dignity; and therefore laying aside all thoughts of an accommodation, began to make what preparations he could for renewing the war.

60 Recovers several places.

He summoned all his subjects that were able to bear arms to meet at an appointed place; and having chosen out of the whole multitude 60 cohorts, each consisting of 100 men, he incorporated them with the regular troops that were already on foot. Being now in a condition to act offensively, for Pompey had left but a small number of troops in Pontus, he possessed himself of Phanagorium, Chersonesus, Theodosia, Nymphæum, and several other important places. But in the mean time, Castor, whom Mithridates had appointed governor of Phanagorium, falling out with Tripho, one of the king's favourite eunuchs, killed him, and dreading the king's resentment, stirred up the inhabitants to a revolt: by which means Phanagorium was again lost; but the castle, which was defended by four of the king's sons, Artaphernes, Darius, Xerxes, and Oxathres, held out for some time. The king hastened to their relief; but the castle being set on fire by the rebels, they were forced to surrender themselves to Castor before his arrival. These four sons, with one of the king's daughters, by name *Cleopatra*, Castor sent to the Romans; and fortifying himself in the town, persuaded most of the neighbouring cities, which were oppressed with heavy taxes, and strangely harassed by the king's collectors, to join in the rebellion.

61 His subjects discontented.

Mithridates finding that he could neither rely upon the soldiery, most of them being forced into the service, nor on his other subjects, who were dissatisfied by reason of the exorbitant taxes, sent ambassadors to invite the princes of Scythia to his relief, and with them his daughters, to be bestowed in marriage upon such as showed themselves most inclined to assist him. But as the ambassadors he employed on this occasion were eunuchs, a race of men no less abhorred by the army than favoured by the king, over whom they had a great ascendant, especially in his old age, the soldiers who were sent to attend them on their journey, put them all to the sword as soon as they were out of the king's reach, and delivered his daughters up to the Romans. Mithridates, finding himself thus deprived of his children, betrayed by his army, and forsaken even by those on whom he chiefly relied, could not yet be induced to submit to the Romans, though Pompey promised him honourable conditions, provided he came to treat with him in person. In this desperate condition, he left no stone unturned to stir up the princes of Asia against the Romans, especially the Parthians; but finding them awed by the great opinion they all had of Pompey, he had recourse at last to the European Gauls, whom he understood to be at war with the Romans; and having sent before some of his trusty friends to engage them in his favour, taking leave of his own kingdom, he began his long march, designing to pass through Bosphorus, Cimmerius, Scythia,

62 His extraordinary design of invading Italy.

Pontus. thia, Panonia, &c. and joining the Gauls, pass the Alps, and invade Italy.

This design was no sooner known in the army, but the soldiers openly began to complain and mutiny; exaggerating the boldness of the attempt, the length of the march, and the unsurmountable difficulties that must necessarily attend such a desperate enterprise. The chief commanders did all that lay in their power to divert him from it; representing to him, that if he was not able to cope with the Romans in his own kingdom, much less would he be a match for them in Italy or Gaul, where they could daily receive new supplies; whereas he would lose the greatest part of his army in so long and difficult a march, and the rest perhaps in the first engagement, without any possibility of repairing the loss. But all was to no purpose; for they found him so unalterably fixed in his resolution, that he caused those to be put to death who with most warmth remonstrated against it, not sparing even his own son Exipodras, for dropping some unguarded expressions on that occasion. Thus they were forced to let him pursue his own measures, till they found a more proper opportunity to oppose them, which soon after offered, as they were encamped at Bosphorus Cimmerius, on their march into Scythia.

63 His son Pharnaces revolts. Here Pharnaces, the king's favourite son, whom he had appointed to succeed him, observing the general discontent that reigned in the army, began to entertain thoughts of placing the crown on his own head; and not doubting but the soldiery would stand by him, if he declared against the intended expedition into Italy, openly protested among the Roman deserters, who were a considerable part of the army, that if they would follow him he would return into Pontus. The Romans, who were well apprised of the danger that attended such an undertaking, and had most of all exclaimed against it, promised to support him to the utmost of their power, and even encouraged him, upon some expressions which he purposely dropped, to assume the title of *king*, a title which his father seemed determined to hold till he had destroyed, by his rash and desperate attempts, himself, his friends, and his army. Pharnaces, finding he could depend on the Romans, engaged the same night most of the chief commanders in his party, and by their means the greater part of the soldiery. It was agreed, that next morning by break of day all those who had declared in his favour should appear in arms, and with a loud shout proclaim Pharnaces king; which was done accordingly, and the shout returned even by those whom Pharnaces had not thought fit to let into the secret. The king, who had taken up his quarters in the city, being awaked by the noise, sent out some of his domestics to know what had happened in the army. Neither did the officers or soldiers dissemble the matter, but boldly answered, that they had chosen a young king instead of an old dotard governed by eunuchs.

Hereupon Mithridates mounting on horseback, and attended by his guards, went out to appease the tumult: but his guards forsaking him, and his horse being killed under him, he was obliged to fly back into the city; from whence he sent several of his attendants one after another to desire of his son a safe conduct for himself and his friends. But as none of the messengers returned, some being slain, and others siding with the new king, Mithridates endeavoured to move his son to compassion, by signifying to him from the walls the distressed condition he was reduced to by a son whom he had favoured above the rest of his children; but finding him nowise affected by his speech, turning to the gods, he beseeched them with many tears to make his son know one day by experience the grief and agony which a father must feel in seeing his love and tenderness requited with such ungrateful and monstrous returns. Having thus spoke, he thanked in a very obliging manner those who had stood by him to the last, and exhorted them to make their submission to the new king on the best terms they could procure; adding, that as for himself, he was determined not to outlive the rebellion of a son whom he had always distinguished with particular marks of paternal affection.

64 Mithridates attempts to destroy himself. After this, he withdrew into the apartment of his wives and concubines, where he first took poison himself, and then presented it to them, and to his favourite daughters Mithridatis and Nissa, who not long before had been betrothed to the kings of Egypt and Cyprus. To the women it proved immediate death; but on the king, who from his infancy had inured his constitution to poisonous potions, it had so slow an operation, that he was forced, through fear of falling into the rebels hands, to recur to his sword. Neither did the wound, as he was greatly weakened by the poison, prove mortal: so that the rebels, having in the mean time stormed the town, and broke into the house, found the king wallowing in his blood, but still alive, and in his senses; which Pharnaces hearing, sent some of those that were about him to dress his wounds, with a design to deliver him up to the Romans, and thereby ingratiate himself with Pompey.—

65 A Gaul puts an end to his life out of compassion. But, in the mean time, a Gaul, who served in the army, by name *Bitætus*, or *Bithocus*, entering the king's room in quest of booty, and being touched with compassion in seeing him forsaken by all his friends, and struggling on the bare ground with the pangs of death, drawing his sword, put an end to his present agonies, and prevented the insults which he chiefly apprehended if he should fall alive into his son's hands. The barbarian is said, when he first saw the king, to have been so awed with the majesty of his countenance, that, forgetful of his booty, he fled out of the room; but being called back, and earnestly intreated by the dying prince to put an end to his misery, he summoned all his courage to perform, as he did, with a trembling hand, that office; and immediately retired without touching any thing that belonged to the king, though the hopes of a rich booty was the only motive that had led him thither.

Pompey, who was at that time engaged in a war with the Jews, received the first notice of the death of Mithridates as he was on his march to Jerusalem. The messenger who brought the joyful tidings was sent by Pharnaces, and appeared unexpectedly before Pompey with the branch of a laurel, as was customary on the like occasions, twisted round the head of his javelin.

66 Excessive joy of the Romans at his death. When he heard what had happened at Panticapæum, he was so impatient to impart it to the soldiery, that he could not even wait till they had raised him a mount of turf from whence to speak to the army, according to the custom of the camp; but ordered those

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those who were by him to form a kind of mount with their saddles, and from thence acquainted the soldiery that Mithridates had laid violent hands on himself, and his son Pharnaces was ready to acknowledge the kingdom as a gift of the people of Rome, or resign it if they were unwilling he should reign. This news was received with joyful shouts of the whole army, and the day solemnized with feasts and sacrifices throughout the camp, as if in Mithridates alone all the enemies of the republic had died. Pompey dispatched without delay a messenger with letters to the senate, acquainting them with the death of Mithridates, and the submission of his son Pharnaces. When his letters were read, the senators were so overjoyed, that they appointed, at the proposal of Cicero, then consul, 12 days for returning due thanks to the gods, who had delivered them from such an insulting and powerful enemy; and the tribunes of the people enacted a law, whereby Pompey, in consideration of his eminent service in the Mithridatic war, was to wear a crown of laurel, with the triumphal gown at the Circensian sports, and a purple gown at the scenical plays.

Pharnaces, when he heard of his father's death, caused his body to be preserved in brine, proposing to present it to Pompey, who had promised to return into Pontus after the reduction of Judæa, and there settle matters to his satisfaction. And accordingly having taken the city and temple of Jerusalem, he set out with two legions for Pontus; and being arrived at Sinope, he was there met by ambassadors from Pharnaces, acquainting him, that their master had forbore assuming the title of king till his will and pleasure were known; that he put both himself and the kingdom entirely into his hands; and that he was willing to attend him at what time or place he thought fit to appoint. The same ambassadors delivered up to Pompey those who had taken Manius Aquilius the Roman legate, whom Mithridates had put to a cruel death, all the prisoners, hostages, and deserters, whether Romans, Greeks, or Barbarians, and the body of Mithridates, with his rich apparel and arms, which were greatly admired by Pompey and the other Romans. Both soldiers and officers flocked to see the king's body; but Pompey declined that sight; and, saying that all enmity between that great prince and the people of Rome was ended with his life, he returned the body to the ambassadors, and caused it to be interred with the utmost pomp and magnificence among his ancestors in the burying-place of the kings of Pontus, Pompey defraying all the charges of that ceremony, which was the most costly and pompous that ever had been seen in those parts. With the body Pompey restored his wearing apparel and armour; but the scabbard of his sword, which cost 400 talents, was stolen by Rublius a Roman, and sold to Ariarathes king of Cappadocia; and his cap or turban, which was a very curious piece of workmanship, was privately taken by one Caius, who presented it to Faustus the son of Sylla, in whose house it was kept, and shown for many years after among the many rarities which Sylla had brought out of Asia.

67
Submissive embassy of Pharnaces to Pompey;

Pompey bestowed the kingdom of Bosphorus on Pharnaces, and honoured him with the title of a friend and ally of the people of Rome. Pharnaces being thus acknowledged king of Bosphorus, sent orders to all the garrisons of Pontus to submit themselves, with the castles and treasures with which they were entrusted, to Pompey, who by that means amassed an immense booty. In the city of Talaura, which Mithridates used to call his wardrobe, he found 2000 cups of onyx set in gold, with such store of gold and silver vessels, of costly furniture, of saddles, bridles, and trappings, set with jewels and precious stones, that the Roman commissaries spent 30 days in taking the inventory of the whole. In another castle he found three large tables with nine salvers of massy gold, enriched with precious stones to an inestimable value; the statues of Minerva, Mars, and Apollo, of pure gold and most curious workmanship; and a pair of gaming-tables of two precious stones, three feet broad, and four feet long, on which was a moon of gold weighing 30 pounds, with their men, all of the same precious stone. In a fort situated among the mountains, were delivered up to him the king's statue of massy gold, eight cubits high, his throne and sceptre, and the bed of Darius the son of Hystaspes. Most of these treasures had been transmitted to him from his ancestors, chiefly from Darius king of Persia; some belonged to the Ptolemies of Egypt, and had been deposited by Cleopatra, as we have hinted above, in the hands of the Coans, who delivered them to Mithridates; and great part of them had been collected by the king himself, who was very fond of rich and stately furniture.

68
Who bestows upon him the kingdom of Bosphorus.

Pompey having thus got entire possession of Pontus, and reduced it to the form of a Roman province, marched into *Asia* properly so called; and having wintered at Ephesus, early in the spring set out for Italy, with a fleet of 700 ships. As he brought over his army with him, the senate was under no small apprehension lest he should make himself absolute, and rule without controul. But he no sooner landed at Brundusium, than he disbanded the army, without waiting for any decree either of the senate or people; what neither his friends nor his enemies had believed. His triumph lasted two whole days; and though he was attended in his triumphal chariot by 324 captives of distinction, among whom were five sons and two daughters of Mithridates, yet he would not suffer any of them to be put to death, as had been done by others; but sent them all back, except such as were of royal extraction, to their respective countries, and even supplied them with money to defray the charges of their journey. After his triumph he delivered into the treasury 20,000 talents, though, at the dismissing of the army, he had divided 16,000 talents among the tribunes and centurions, 2000 sestertiums among the quæstors, and had given to each soldier 50 sestertiums.

69
Pharnaces falls out with the Romans.

Pompey had no sooner left Asia, but Pharnaces fell unexpectedly upon the Phanagorenses, a people of Bosphorus, whom Pompey had declared free, because they had revolted the first of all from Mithridates, and by their example induced others to abandon the king's party. Pharnaces besieged their chief city Phanagoria, and kept them blocked up till, for want of provisions, they were forced to sally out, and put all to the issue of a battle; which proving unsuccessful, they delivered up themselves and their city to the conqueror. Some years after, the civil war breaking out between Cæsar and Pompey, he laid hold of that opportunity

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to recover the provinces which his father had formerly possessed; and having raised a considerable army, overran Pontus, Colchis, Bithynia, Armenia, and the kingdom of Moschis, where he plundered, as Strabo observes, the temple of the goddess Leucothea. He took the strong and important city of Sinope, but could not reduce Amisus. But, in the mean time, Cæsar having got the better of Pompey and his party, appointed Cn. Domitius Calvinus governor of Asia, enjoining him to make war upon Pharnaces with the legions that were quartered in that province. Domitius immediately dispatched ambassadors to Pharnaces, commanding him to withdraw his troops from Armenia and Cappadocia. The king returned answer, that he was willing to abandon Cappadocia, but as for the kingdom of Armenia Minor, it was part of his hereditary dominions; and therefore he would not resign it till he had an opportunity of laying his pretensions before Cæsar himself, whom he was ready to obey in all things. Hereupon Domitius drawing together what forces he could, marched into Cappadocia, which he recovered without opposition, Pharnaces having abandoned it to make a stand in Armenia, which lay nearer his own dominions. Thither Domitius pursued him; and having overtaken him near Nicopolis, found his army drawn up in battle-array, and the king ready to come to an engagement; which Domitius not declining, both armies advanced.

70
And defeats them.

The king, at the head of a choice body of men, fell upon the Romans left wing, consisting mostly of raw and undisciplined Asiatics; and having without much ado put them to flight, penetrated to the centre, where the thirty-fifth legion, the only one which Domitius had, after a faint resistance, gave ground, and, retiring to the neighbouring mountains, left their allies to shift for themselves, who were all cut off. Domitius with the remains of his scattered army marched back into Cappadocia; and from thence, winter drawing on, into the province of Asia. The king being puffed up with this victory, and hearing that Cæsar, with the flower of the Roman forces, was engaged at the siege of Alexandria, appointed one Asander governor of Bosphorus, and marched himself into Cappadocia in pursuit of Domitius, with a design to invade Asia, and recover all the provinces which had been once subdued by his father. Bithynia and Cappadocia readily submitted; but Armenia the Lesser, which was held by Dejotarus, made so vigorous a resistance, that he was forced to give over the enterprise, lest the Romans should in the meantime strengthen themselves in Asia, whither he was in haste to march, in hopes of meeting there with the same success as his father Mithridates had done. But before he reached that province, he was informed that Asander had revolted, in hopes of gaining thereby the good-will of the Romans, and obtaining of them the kingdom of Bosphorus for himself. At the same time, he received intelligence that Cæsar, having at last reduced Alexandria, and settled the affairs of Egypt and Syria, was marching into Armenia.

71
Attempts to outwit Julius Cæsar,

He was not a little dismayed at this news, and therefore without delay dispatched ambassadors to sue for peace; hoping that Cæsar, who was hastening into Italy with a design to pass over into Africa, would willingly give ear to any proposals of that nature.—Cæsar courteously entertained the ambassadors; and though he did not propose to agree to their conditions, yet, that he might come upon Pharnaces unawares, he showed himself very desirous of entering into a treaty of peace. But, in the mean time, he pursued his march with all possible expedition; and arriving on the confines of Pontus, ordered all the troops that were quartered in the neighbouring provinces to join him; for he had brought from Alexandria but one legion, namely, the sixth, and that consisting of 1000 men only, the rest having been killed at the siege of Alexandria. Besides this veteran legion, he found at the place of general rendezvous three others, but all of them very indifferently armed, and worse disciplined. With these forces, however, such as they were, he advanced against Pharnaces; who being greatly frightened at his approach, by reason of the success that had attended him in all his expeditions, again dispatched ambassadors to him with a crown of gold, offering him his daughter in marriage, and promising to do whatever he should require. The ambassadors took care to let him know that their master, though highly obliged to Pompey, yet had never been prevailed upon to send him any supplies during the civil war, which Dejotarus, king of Armenia the Lesser, whom he had honoured with his friendship, had done. Cæsar returned for answer, that he was willing to conclude a peace with Pharnaces, provided he retired without delay from Pontus, returned all the captives and hostages whether Roman or their allies, and restored the goods of the Roman citizens and publicans which he had seized since he first took up arms. He added, that as to his not sending supplies to Pompey, they ought rather to have concealed such an ungrateful proceeding of their master, than alleged it as any merit, since the forsaking of one to whom he was indebted for his crown, bespoke him a man of mean, selfish, and unworthy principles.

Pharnaces, upon the return of his ambassadors, acquainted Cæsar that he agreed to the conditions; but finding that Cæsar's affairs called him into Italy, he required a longer term of time for the performance of what was stipulated between them, starting daily new difficulties, in hopes that Cæsar would in the mean time be obliged to depart, and leave the affairs of Pontus in the same posture he had found them. Cæsar seeing himself disappointed, and put off from day to day, could not longer brook the king's deceitful behaviour. Wherefore he determined to put himself at the head of his small army, and attack the enemy in his camp when he least expected it. And accordingly, marching out in the night, he came by break of day in sight of the king's army; and uttering these words, *Shall this treacherous parricide go unpunished?* broke into the camp at the head of 1000 horse. The king's chariots, which were armed with scythes, caused some small disorder among Cæsar's horse; but in the mean time the rest of his army coming up, he put the enemy to flight, and obtained a complete victory. This battle was fought near the place where Mithridates had routed with great slaughter the Roman army under the command of Triarius. Most of the king's army were either taken or cut in pieces; but Pharnaces himself had the good luck to make his escape while the Romans were busy in plundering the camp. This victory was so quick, that Cæsar

72
By whom he is entirely defeated.

Cæsar in a letter to his friend Aminitius, or Anitius, at Rome, expressed it in three words, thus: "I came, I saw, I conquered." He ever afterwards used to call Pompey a fortunate rather than a great commander, since he had gained his chief glory in the Mithridatic war, fighting with so cowardly an enemy. He divided the rich booty and the spoils of the camp among his soldiers; and because Mithridates had erected a trophy near that place as a monument of his victory over Triarius, which Cæsar, as it was consecrated to the gods, did not think lawful to pull down, he set up another over-against it to transmit to posterity his victory over Pharnaces. After this victory he recovered and restored to the allies of the people of Rome all the places which Pharnaces had possessed himself of during the war, declared Amisus a free city, and appointed Mithridates Pergamenus king of Bosphorus in the room of Pharnaces.

Having thus settled the affairs of Pontus, he set sail for Italy; leaving Domitius Calvinus to pursue the war against Pharnaces, if he should appear again in the field. Pharnaces had retired after the battle to Sinope with 1000 horse, where he was quickly besieged by Domitius, to whom he surrendered the town, upon no other condition than that he should be suffered to retire into Bosphorus with the small body that attended him. This Domitius willingly granted; but caused all the king's horses to be killed, since he had asked a safe-conduct only for his horsemen. With these and a band of Scythians and Sarmatians he attempted to recover the kingdom of Bosphorus; but being met between Theodocia and Panticapeum, both which cities he had redu-

73 Is killed in another engagement.

ced, by Asander, who was still in possession of the kingdom, a sharp engagement ensued, wherein the king's men, as not being used to fight on foot, were put to flight, and Pharnaces himself, who remained alone in the field, was surrounded by the enemy, and cut in pieces, after having reigned in Bosphorus Cimmerius, the kingdom which Pompey had bestowed upon him, according to Appian, fifteen years, according to others, seventeen.

74 Pontus again made a kingdom by Marc Antony.

Upon the death of Pharnaces the kingdom of Pontus was again reduced to the form of a province, and so continued to the triumvirate of Marc Antony, who after the battle at Philippi conferred it upon Darius the son of Pharnaces for his services during the civil war. He continued faithful to the Romans; but did nothing during his reign worth mentioning.

Darius was succeeded in the kingdom by Polemon, likewise preferred to that honour by Marc Antony. He was the son of Zeno, a famous orator of Laodicea, and greatly favoured by Antony. From him that part of Pontus which borders on Cappadocia borrowed the name of *Polemoniacus*. He attended Marc Antony in his expedition against the Parthians; and being taken prisoner in that unsuccessful battle fought by Statianus, he was sent by the king of the Medes, an ally of the Parthians, to conclude a peace with the Romans. In which embassy he acquitted himself so well, that Antony added the kingdom of Armenia to his own dominions. In the war between Antony and Augustus he sided with the former: but after the battle of Actium he was received into favour by the latter; and being sent by Agrippa against Scribonius, who upon the death of Asander had usurped the kingdom of Bosphorus, he overcame him, and reduced the kingdom of Colchis, which was bestowed upon him by Agrippa, who likewise honoured him with the title of *friend and ally of the people of Rome*. He afterwards waged war with the neighbouring barbarians refusing to live in subjection to the Romans; but was overcome, taken, and put to death, by the Aspungitani, a people bordering, according to Strabo, on the Palus Mœotis.

Upon his death his son Polemon II. was by the emperor Caligula raised to the throne of Bosphorus and Pontus. But the emperor obliged him to exchange the kingdom of Bosphorus with part of Cilicia; and Nero, with his consent, reduced that part of Pontus which he enjoyed to the form of a province. He fell in love with Berenice, daughter to Agrippa king of Judæa; and in order to marry her embraced the Jewish religion. But as she soon became tired of his riotous way of living, and returned to her father; so he renounced his new religion, and again embraced the superstitions of Paganism.

Polemon dying without issue, the ancient kingdom of Pontus was parcelled out into several parts, and added to the provinces of Bithynia, Galatia, and Cappadocia, only that part of it which was called *Pontus Polemoniacus* retaining the dignity of a distinct and separate province. 75 Is parcelled out into several provinces.

During the civil discords between Vespasian and Vitellius, one Anicetus, first a slave, afterwards freedman, to king Polemon, and lastly commander of the royal navy, took up arms with a design to rescue the kingdom from the Roman bondage; and being joined by great multitudes drawn together with the prospect of spoil, over-ran the country, and possessed himself of Trapesund, a city founded by the Grecians on the utmost confines of Pontus. Here he cut in pieces a cohort made up of the inhabitants, but which had been formerly presented with the privilege of Roman citizens. He likewise burnt the fleet, and with scorn and insults scoured the sea; Mucianus having called to Byzantium most of the Roman galleys. Hereupon Vespasian, who was at that time in Syria, sent Verdius Gemnius into Pontus with a choice body of auxiliaries from the legions. He assailing the enemy while they were in disorder, and roaming asunder in pursuit of prey, drove them into their vessels; then with some galleys chased Anicetus into the mouth of the river Chobus, where he thought himself safe under the protection of Sedochus king of the Lazians, whose alliance he had purchased with large sums and rich presents. Sedochus at first refused to deliver him up to the Romans; but was soon prevailed upon, partly by threats, partly by presents, to surrender both him and all the other fugitives who had taken sanctuary in his dominions. Thus ended that servile war; and the kingdom of Pontus continued to be a province of the empire till the time of David and Alexis Comneni, who being driven from Constantinople by the French and Venetians A. D. 1204, under the command of Baldwin earl of Flanders, settled, the one at Heraclea, the other at Trebisond. The troubles that arose among the Latins gave Alexis Comnenus an opportunity of erecting here a new empire, which comprehended great part of Pontus, and was known by the name of the *empire of Trebisond*. The Comneni held it about 250 years, till the time of Mohammed II. who carried David Comnenus, the last emperor of Trebisond, prisoner to Constantinople, A. D. 1462, with all his family, and subjected his empire to that of Constanti-

nople;

ople; in which abject slavery Trebisond and all Pontus have continued ever since.

PONTYPOOL, a town of Monmouthshire in England, seated between two hills. It is but a small place, though noted for its iron-mills, great manufacture of japanned mugs, &c. W. Long. 3. 6. N. Lat. 51. 42.

PONZA, or PONTIA, is a small island of the Tuscan Sea, well known to be the place to which many illustrious Romans were formerly banished. It is situated on the coast of Italy near Terracina, and in the neighbourhood of other small islands or rocks named *Palmarole*, *Zannone*, &c. between the island of Ventotienne and Monte Circello. All these islands were visited by Sir William Hamilton in the year 1785; and an account of his journey is given in a letter to Sir J. Banks, which appeared in the Phil. Transf. vol. lxxvi. p. 365. Sir William arrived at Ponza on the 20th August; and, according to his account, it lies about 30 miles from Ventotienne. On the 21st he went round it in a boat. Its length is about five miles, but its breadth is nowhere above half a mile, and in some places not more than 500 feet. It is surrounded by a multitude of detached rocks, some of them very high, and most of them composed of a compact lava. There are many irregularly formed basaltes, but none in large columns. In some places they have a reddish tinge from iron ochre, are very small, and irregularly laid over one another. Some stand perpendicularly, others obliquely, and some lie horizontally. The rocks themselves in which these masses are found are lava of the same nature with the basaltes. At first sight they appear like the ruins of ancient Roman brick or tyle buildings. One rock is composed of large spherical basalts, and in other places our author found the lava inclined to take the like spherical form, though on a much smaller scale, some of the former basalts being near two feet in diameter. All these rocks, in our author's opinion, have been detached by the sea from this island, which is entirely composed of volcanic matter, lavas, and tufas of various qualities and colours, as green, yellow, black, and white. Some of these matters are more compact in their texture than others; and in some parts great tracts seem to have undergone similar operations, which still subsist at a spot called the *Pisciarelli*, on the outside of the Solfatara, near Puzzole, and where a hot sulphureous vitriolic acid vapour converts all which it penetrates, whether lavas, tufas, volcanic ashes, or pumice-stones, into a pure clay, mostly white, or with a tint of red, blue, green, or yellow.

In one part of this island there is a sort of tufa remarkably good for the purpose of building. It is as hard as Bath-stone, and nearly of the same colour, without any mixture of lava or pumice-stone, which usually abound in the tufas of Naples, Baia, and Puzzoli.

The island of Palmarole which is about four miles from Ponza, is not much more than a mile in circumference. It is composed of the same volcanic matter, and probably was once a part of Ponza; and in our author's opinion it looks as if the island of Zannone, which lies about the same distance from Ponza, was once likewise a part of the same; for many rocks of lava rise above water in a line betwixt the two last-mentioned islands, and the water there is much more shallow than in the gulf of Terracina.

Zannone is much larger and higher than Palmarole; and that half of it next the continent is composed of a lime-stone similar to that of the Apennines near it; the other half is composed of lavas and tufas, resembling in every other respect the soil of the islands just described. Neither Palmarole nor Zannone are inhabited; but the latter furnishes abundance of brushwood for the use of the inhabitants of Ponza, whose number, including the garrison, amounts to near 1700. The uninhabited island of St Stefano in like manner furnishes wood for the people of Ventotienne. It is probable that all these islands and rocks may in time be levelled by the action of the sea. Ponza, in its present state, is the mere skeleton of a volcanic island; little more than its hard or vitrified parts remaining, and they seem to be slowly and gradually mouldering away. The governor of the castle of Ponza, who had resided there 53 years, told our author that the island was still subject to earthquakes; that there had been one violent shock there about four years before; but that the most violent one he ever felt was on the very day and at the hour that Lisbon was destroyed. Two houses out of three which were then on the island were thrown down. "This (says our author) seems to prove that the volcanic matter which gave birth to these islands is not exhausted."

Fig. 1. Plate CCCCXII. is a plan of the island of Ponza as it is given in the Philosophical Transactions. Fig. 2. is a view of the inside of the harbour of the island. A in the same figure is a rock of lava. In many parts it is formed into regular basaltes of a reddish colour, tinged in all probability with some ochre. Most of the detached rocks of the island resemble this. BB represents a tract of volcanic country, converted by a hot sulphureous vitriolic acid vapour into a pure clay, the ground colour of which is mostly white.—Fig. 3. is a view from the outside of the harbour, near the lighthouse. C is a rock of volcanic matter converted to pure clay; D is a rock of the same kind, with strata of pumice-stone: E is a rock of lava, inclining to take basaltic forms; and F is a rock composed of spherical basaltes.

POOD is a Russian weight, equal to 40 Russian or 36 English pounds.

POOL is properly a reservoir of water supplied with springs, and discharging the overplus by sluices, defenders, weirs, and other causeways.

POOL, a sea-port town of Dorsetshire in England. It is surrounded on all sides by the sea, except on the north, where there is an entrance through a gate. It was formerly nothing but a place where a few fishermen lived: but in the reign of Henry VI. it was greatly enlarged, and the inhabitants had the privilege to wall it round. It was also made a county of itself, and sent two members to parliament. It is governed by a mayor, a senior bailiff, four other justices, and an indeterminate number of burgesses. The town consists of a church and about 600 houses, with broad paved streets; and has a manufactory of knit hose. It is 47 miles west-south-west of Winchester, and 110 west-by-south of London. W. Long. 2. 0. N. Lat. 50. 42.

POOLE (Matthew), a very learned writer in the 17th century, was born at York in 1624. He was educated at Emanuel-college, Cambridge, and afterwards incorporated in the university of Oxford. He succeeded Dr Anthony Tuckney in the rectory of St Michael de Quern, in London, about 1648. In 1658 he he set on foot a project for maintaining youths of great parts at the universities, and had the approbation of the heads of houses in both of them. He solicited the affair with so much vigour, that in a short time 900 l. *per annum* was procured for that purpose; but this design was laid aside at the Restoration. In 1662 he was ejected from his living for nonconformity. He was ten years employed in composing his *Synopsis Criticorum*, &c. Besides this great work he published several other pieces. When Dr Oates's depositions concerning the popish plot were printed, our author found his name in the list of those who were to be cut off, on the account (as was supposed) of what he had written against the papists in his *Nullity of the Romish Faith*. So that he was obliged to retire into Holland, where he died in 1679, and left behind him the character of a very able critic and casuist.

POOP, the stern of a ship; or the highest, uppermost, and hinder part of a ship's hull. See STERN.

POOR, in law, an appellation given to all those who are in such a low and mean condition, that they either are or may become a burden to the parish.

They who rank pity amongst the original impulses of our nature rightly contend, that when it prompts us to the relief of human misery, it indicates sufficiently the Divine intention, and our duty. Indeed, the same conclusion is deducible from the existence of the passion, whatever account be given of its origin. Whether it be instinct, or a habit founded in association (see PASSION), it is in fact a property of our nature which God appointed: and the final cause for which it was appointed is to afford to the miserable, in the compassion of their fellow-creatures, a remedy for those inequalities and distresses to which many are necessarily exposed under every possible rule for the distribution of property. That the poor have a claim upon the rich, founded in the law of nature, can be questioned by no man who admits the benevolence of the Deity, and considers his purpose in creating the world (see THEOLOGY, Part I. Sect. ii.); and upon this claim the Christian Scriptures are more explicit than almost upon any other.

The rights of the poor, however, to be relieved by the rich, as they originate in nature, and are sanctioned by Christianity, are evidently of that kind which is called *imperfect* (See MORAL *Philosophy*, n° 151.) It is surely needless to warn our readers in this place, that imperfect rights are in themselves as sacred, and the duties resulting from them as obligatory in *foro conscientiæ*, as the most rigid claims of justice. Every one knows, that they are called *imperfect* only because the extent of them in particular instances cannot be ascertained by positive laws, nor the breach of them be punished by the civil magistrate. Hence the apostle, tho' he enjoins a weekly contribution to be made for the poor in the church of Corinth, yet leaves the sum to be contributed by each individual wholly undetermined. "Now concerning the collection for the saints, as I have given order to the churches of Galatia, even so do ye. Upon the first day of the week let every one of you lay by him in store as God hath *prospered him*." By which St Paul certainly recommends to every man to contribute, not a fixed sum, but as much as, from a deliberate comparison of his fortune, with the reasonable expences and expectations of his family, he finds he can spare for charitable purposes.

It is well known that those weekly contributions were laid at the feet of the apostles, who transferred the management of the fund thence arising to deacons elected by the people, and ordained by them to see that the money was properly distributed. Hence, under Christianity, the maintenance of the poor became chiefly an ecclesiastical concern; and when that holy and benevolent religion was established in the Roman empire, a fourth part of the tithes was in some countries of Europe, and particularly in England, set apart for that purpose. Afterwards, when the tithes of many parishes were appropriated to the monasteries, these societies were the principal resource of the poor, who were farther relieved by voluntary contributions. Judge Blackstone observes, that till the statute 26 Hen. VIII. cap. 26. he finds no compulsory method for providing for the poor; but upon the total dissolution of the monasteries, abundance of statutes were made in the reign of King Henry VIII. Edward VI. and Elizabeth, which at last established the

Poor's Rate, or legal assessment for the support of the poor. The sums that had been appropriated for charitable uses before the reformation were immense, and the wealth that had been accumulated through a succession of ages by mendicant orders of religious persons was inconceivably great; nor was it in the power of any laws to confine men who were in the possession of such wealth from gratifying those desires which money can so easily find means of supplying. Yet among the various abuses to which this opulence had given rise, these religious orders had never so far lost sight of their original institution as ever to neglect the poor. These were indeed provided for by them with an indiscriminate profusion of largesse, better proportioned to their own opulence than to the wants of the claimants, who were too often, without examination, all equally served, whether deserving or undeserving of that bounty which they claimed.

When the *religious houses*, as they were called, were entirely suppressed at the reformation, and the wealth that belonged to them was diverted into other channels, the poor, who had been in use to receive their support from thence, were of course left entirely destitute; and this soon became a grievance so intolerable not only to the poor themselves, but to the whole nation, as to excite a universal desire to have it remedied. Accordingly, by the 14 Eliz. cap. 5. power was given to the justices to lay a general assessment; and this hath continued ever since. For by 43 Eliz. cap. 2. the churchwardens and overseers of the poor of every parish, or the greater part of them (with the consent of two justices, one of whom is of the quorum, dwelling in or near the parish), are empowered to raise weekly, or otherwise, by taxation of every inhabitant, parson, vicar, and other, and of every occupier of lands, houses, &c. materials for employing the poor, and competent sums for their relief. Notice shall be given in church of every such rate the next Sunday after it is allowed, which may be inspected by every inhabitant, paying 1 s. and copies of it granted on demand, 6d. being paid for every 24 names; and a churchwarden or overseer refusing, shall forfeit 20 l. to the party aggrieved. The rate

Island of Ponza. Fig. 3. Plate CCCCXII.

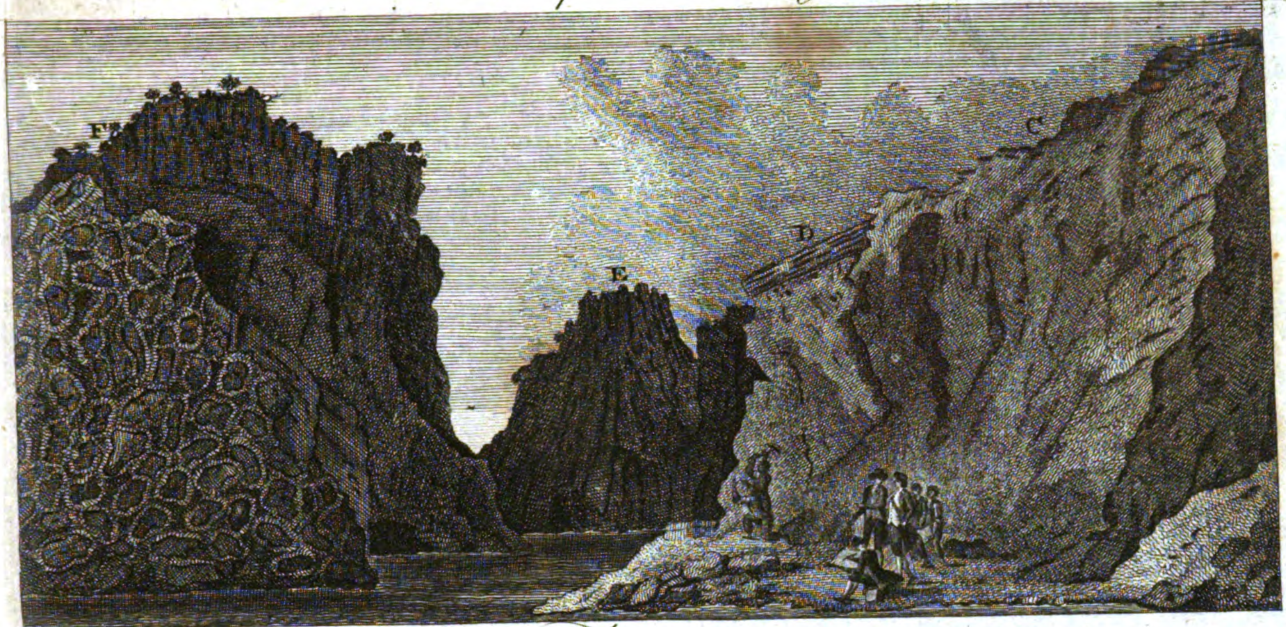

Fig. 2.

Fig. 1.

rate is to be levied by diſtreſs on thoſe who refuſe to pay it; and, by 17 Geo. II. cap. 2. cap. 38. appeals againſt it are allowed.

If the juſtices find that the inhabitants of any pariſh are not able to levy among themſelves ſufficient ſums for the purpoſes ſpecified in the act, they may aſſeſs any other pariſh within the hundred; and if the hundred be unable to grant neceſſary relief, they may rate and aſſeſs any pariſh within the county. 43 Eliz. cap. 2.

In order to compel huſbands and parents to maintain their own families, the law hath provided, that all perſons running away out of their pariſhes, and leaving their families upon the pariſh, ſhall be deemed and ſuffer as incorrigible rogues (7 Jac. cap. 4.) And if a perſon merely threatens to run away and leave his wife and children upon the pariſh, he ſhall, upon conviction, before one juſtice by confeſſion, or oath of one witneſs, be committed to the houſe of correction for any time not exceeding one month (17 Geo. II. cap. 5.) For the farther maintenance of the poor, there are many fines and forfeitures payable to their uſe; as for ſwearing, drunkenneſs, deſtroying the game, &c. And alſo parts of waſtes, woods, and paſtures, may be incloſed for the growth and preſervation of timber and underwood for their relief. See *Work-Houſe*.

The famous ſtatute of the 43d of Elizabeth, which is the baſis of all the poor-laws in England, was conſtructed with a cautious forethought that can perhaps be equalled by few laws that ever were enacted; and if proſpective reaſoning alone were to be relied on in matters of legiſlation, it ſeemed impoſſible to amend it: yet experience has now proved, with a moſt demonſtrative certainty, that it is not ſo ſalutary as was undoubtedly expected.

The perſons who compoſed that law had before their eyes ſuch a recent proof of the abuſe that had been made of the charitable beneficence of individuals, that they ſeem to have been chiefly ſolicitous to obviate ſimilar abuſes in future; and to guard againſt that partial kind of ſeduction, they rather choſe to eſtabliſh a deſpotic power which ſhould be authoriſed to wreſt from every individual in the nation whatever ſums it might think proper to call for, truſting to a few feeble devices which they contrived, for curbing that power which was virtually armed with force ſufficient to ſet all theſe aſide whenever it pleaſed. The conſequence has been, that the ſums levied for the relief of the poor, which were at firſt but ſmall, are now enormous, and that the demands are increaſing in ſuch a rapid manner as to give riſe to the moſt ſerious and well-grounded apprehenſions. In the year 1774, parliament inſtituted an inquiry into the amount of the poor's-rates in England and Wales, and again in 1783. On comparing theſe together, the riſe during that ſhort period was found to be in England upwards of 850,000 l. *per annum*, being nearly in the proportion of one-third of the rate at the firſt period. In Wales, during the ſame period of time, the rates were more than doubled. Nor was this a temporary ſtart, but a part only of a gradual progreſſion. Mr Wenderdon, in his View of England, obſerves, that "in the year 1680 the poor's-rates produced no more than 665,390l. in 1764 they ſtood at 1,200,000 l. and in 1773 they were eſtimated at 3,000,000 l." It is a known fact (ſays Mr Beaufoy, in the debate on Mr Gilbert's poor bill, April 17th 1788), that within the laſt nine years, the poor's-rates have increaſed one-third, and ſhould they continue increaſing in the ſame proportion for 50 or 53 years, they would amount to the enormous ſum of 11,230,000 l. a burden which the country could not poſſibly bear. It was therefore, he added, highly neceſſary that ſomething ſhould be attempted to prevent this alarming addition, if not to annihilate the preſent glaring miſconduct in the management of the poor."

Such has been the fate of England with regard to poor laws.

In Scotland, the reformation having been carried forward with a ſtill more violent precipitancy than in England, and the funds of the regular clergy being more entirely alienated, the caſe of the poor there became ſtill more ſeemingly deſperate, and the clamours were alſo there conſiderable at that time. Then alſo it was that the Scottiſh court, imitating as uſual at that time the practice of England, made ſeveral feeble attempts to introduce a ſyſtem of compulſory poor's-rates into that country, but never digeſted the ſyſtem ſo thoroughly as to form a law that could in any caſe be carried into effect. Many crude laws on this head were indeed enacted; but all of them ſo evidently inadequate for the purpoſe, that they never were, even in one inſtance that we have heard of, attempted at the time to be carried into effect. Indeed it ſeems to have been impoſſible to carry them into effect; for they are all ſo abſurd and contradictory to each other, that hardly a ſingle clauſe of any one of them can be obeyed without tranſgreſſing others of equal importance.

The laſt ſtatute which in Scotland was enacted on this ſubject bears date September 1ſt 1691, William and Mary, parl. 1. ſeſſ. 7. chap. 21. and it "ratifies and approves *all* former acts of parliament and proclamations of council for repreſſing of beggars, and maintaining and employing the poor." If this law therefore were now in force, and it never was repealed, no perſon could with impunity countervail any one of thoſe ſtatutes which it ratifies; but to be convinced how impoſſible it is to obſerve them all, the attentive reader needs only to conſider thoſe laws and proclamations with reſpect to the following particulars, *viz.*

1. *The perſons appointed to make up the poor's roll.* By the act 1579 this duty is entruſted to the provoſt and bailies within burgh, and the judge conſtitute be the king's commiſſion in paroches to landwart. By act 1663, it is the heritors of each pariſh. By act 1672, it is the miniſters and elders of each pariſh who are to make up this liſt. By the proclamation of 1692, it is the heritors, miniſters, and elders of every pariſh. By that of 1693, it is the magiſtrates of royal burghs, and the heritors of vacant [country] pariſhes; in both caſes without either miniſter or elders. Among this chaos of contradictions how is it poſſible to act without tranſgreſſing ſome law.

2. Not leſs contradictory are the enactments in regard *to the perſons who are to pay*, and the mode of apportioning the ſums among them. By act 1579, the haill inhabitants of the parochin ſhall be taxed and ſtented according to the eſtimation of their ſubſtance, without exception of perſons. By that of 1663, the one-half is to be paid by the heritors, and the other half by the tenants and poſſeſſors, according to their means and ſubſtance. By the proclamation of 1692, the one-half is to

to be paid by the heritors, the other by the householders of the parish. By that of 1693, in burghs royal, the magistrates are to stent themselves, conform to such order and custom used and wont in laying on stents, annuities, or other public burdens, in the respective burgh, as may be most effectual to reach all the inhabitants; and the heritors of several vacant [landwart] parishes to stent themselves for the maintenance of the respective poor.

3. A still greater diversity takes place in regard to the *application of the sums so stented*. By the act 1579, it would seem that the whole of the money assessed was to be applied to the use of the helpless poor alone, and no part of it for the relief of those who were capable of working. By the act 1663, on the contrary, the whole of this assessment is to be applied for the support of those *only who are able to work*. This is still more specially provided for by the act 1672; where the poor who are unable to work are to be supported by the weekly collections at the kirk doors; and the stented assessments to be applied to the support of those in the correction houses.

It would be tiresome to enumerate all the contradictions that these laws authorise. In regard *to the persons who are required to carry these acts into execution*, it is at different times the chancellor; magistrates; commissioners of excise; sheriffs; justices of the peace; ministers and elders; the presbyteries; heritors, ministers, and elders; heritors alone; commissioners nominated by presbyteries and appointed by the king; the lords of the privy council: in short, no two laws can be found that do not vary from each other in this respect one way or other.

The same variations take place with regard to the building of correction-houses, confinement and punishment of vagrants, application of their work, awarding their services and those of children. In short, there is not one particular in which these laws do not vary from and contradict each other; so that, let any person try to act in virtue of any one of them, it is impossible for him to avoid going in direct opposition to the enactments of some other law which is of equal force with that he has chosen for his guide. In these circumstances, it is so far from being surprising that these acts have been suffered to remain in perpetual desuetude, that it would have been truly wonderful if this had not been the case. They have, however, been permitted to remain on the statute-book as a disgrace to the times when they were formed, and as a stumbling-block to those that were to follow. That not one of them is now in force was lately proved by a learned and public-spirited gentleman, to whom his country is on that and many other accounts deeply indebted. Refusing to pay the poor's tax, with which he was assessed by the overseers of the parish in which he happened to reside, he stood an action in the court of session, and prevailed, upon the broad ground, *that there is no law* IN FORCE *in Scotland by which an* INVOLUNTARY *poor's rate can be established in any parish*.

But how, it will be asked by our English readers, are the poor in Scotland really maintained? We answer, by the private alms of individuals, and by certain funds under the management of the *kirk-sessions* (see PRESBYTERIANS). It is the universal practice, each Lord's day, in every parish, for such of the audience as are in easy circumstances, to give to the poor such an offering of alms as they shall deem proper. This offering is generally dropped into a bason placed at the church-door, and under the immediate care of an elder. When the service is begun, the elder removes with the bason, which he keeps under his charge till the congregation be dismissed. The session then meets, and the money is told over, its amount marked down in the session account book, and deposited in a box kept for that purpose. This box has usually a small slit in the top, through which the pieces of money can be dropped without opening it; and it is closed with two locks, the key of one of which is usually kept by the minister and the other by the kirk-treasurer, so that it can never be opened but in the presence of these two at least.

A kirk-session, when regularly constituted, must always consist of the minister, elders, session-clerk, and kirk-treasurer. None of these ever receive any salary except the session-clerk, who is usually the schoolmaster of the parish, and has a small salary allowed for minuting the transactions. The kirk-treasurer is for the most part one of the elders; and he is an important member of this court. Without his intervention no distribution of the poor's funds is deemed legal; nor can any payments be made, receipts granted, or money transferred, but by him; the minister and session being personally liable to make good all money that may otherwise be given away, should it ever afterwards be challenged by any heritor in the parish.

The precautions taken for the distribution of the poor's funds are likewise simple and excellent, and are as follow.

No money can be legally issued from the poor's funds even by the treasurer and session, unless legal proof can be brought that public intimation has been given from the pulpit immediately after divine service, and before the congregation has dispersed, that a distribution of poor's money is to be made by the session, at such a time and place, specifying the same, and inviting all who have interest in the case to attend if they shall incline. This intimation must be made a full fortnight before the time of distribution; and as every heritor (owner of landed property) in the parish has a right to vote in the distribution of the poor's funds, they may all, if they so incline, then attend and exercise that right: but if none of them should attend, which is often the case, the session has then a right to proceed; and whatever they shall thus do, is deemed strictly legal, and is liable to no challenge. But should they proceed without having given this previous intimation, they may, if the heritors should afterwards challenge it, be made to repay out of their own pockets every shilling they shall have so issued. It sometimes happens, that young ministers, through heedlessness in this respect, expose themselves and families to considerable trouble and loss, which by attention might be easily avoided. In the same way, should a minister and session, without the intervention of a treasurer regularly constituted, lend upon bond or otherwise any of the poor's funds, and should the person so borrowing afterwards fail, these lenders are personally liable to make good the whole, and any heritor in the parish who chooses it can compel him to do so.

The members of the session are also liable to pay all losses, and to account for all sums that it can be instructed they received, if they neglect to keep regular books, in which every transaction shall be entered: Or, if these books have not been revised and approved of by the presbytery (A); but if they shall have been so revised, they cannot be challenged for omission of forms, and can only be made to account for errors, or frauds, or evident dilapidations.

Under this wise and economical system of management, it has been found by the experience of more than 200 years, that in the low parts of the country, where the parishes are in general of such moderate extent as to admit of the people of every part of the parish generally to attend divine service every Lord's day, the ordinary funds have been amply sufficient to supply all the real demands of the poor, and in most parishes a fund has been accumulated from the savings of ordinary years to help the deficiencies that may arise in years of uncommon scarcity.

Besides the weekly collections, the extra offerings at the administration of the Lord's supper, the pious donations of charitable individuals, which are all voluntary, together with some small fees paid for the use of a *mort-cloth* (a black velvet pall) at funerals, which is generally purchased with the poor's money, go to make up this parochial fund. Nor must any one believe that the money which comes through the hands of the administrators of the poor's funds is all that is bestowed upon the poor in Scotland; far from it: there are a thousand other channels through which the indigent derive consolation and support, all of them tending to produce the happiest effects upon society. A son feels himself ashamed to think that his parents should require the assistance of another to support them; he therefore strains every nerve when in the vigour of life to spare a little of his earning to render their old age more easy than it might have been; and sweet to a parent is the bread that is given by the pious attention of a child. If there are several children, they become emulous who shall discover most kindness. It is a pious contention which serves to unite them the closer to each other, by commanding their mutual esteem.

Directly contrary to this is the effect of the poor laws of England, where, in London at least, it is not uncommon to see men in good business neglecting their aged and diseased parents for no better reason than that the parish is bound to find them bread. These laws have other pernicious consequences; for they are obviously subversive of industry as well as morality among the lower orders of the people. "This is a heavy charge, but no less true than heavy. Fear of want is the only effectual motive to industry with the labouring poor: remove that fear, and they cease to be industrious. The ruling passion of those who live by bodily labour, is to save a pittance for their children, and for supporting themselves in old age. Stimulated by desire of accomplishing those ends, they are frugal and industrious: and the prospect of success is a continual feast to them. Now, what worse can malice invent against such a man, under colour of friendship, than to secure bread to him and his children whenever he takes a dislike to work; which effectually deadens his sole ambition, and with it his honest industry? Relying on the certainty of a provision against want, he relaxes gradually till he sinks into idleness; idleness leads to profligacy: profligacy begets diseases; and the wretch becomes an object of public charity before he has run half his course. Wisely therefore is it ordered by Providence, that charity should in every instance be voluntary, to prevent the idle and profligate from depending on it for support. During the reign of Elizabeth, when the monasteries were recently suppressed, and all their revenues squandered, some compulsion might be necessary to prevent the poor from starving. A temporary provision for this purpose, so contrived as not to supersede voluntary charity, but rather to promote it, would have been a measure extremely proper. Unlucky it is for England that such a measure was overlooked; but the queen and her parliaments had not the talent of foreseeing consequences without the aid of experience. A perpetual tax for the poor was imposed, the most pernicious tax, says Lord Kames (B), that ever was imposed in any country."

POPA-MADRE, is a town of South America, in Terra Firma. In this place there is a convent and chapel dedicated to the Virgin Mary, to whose image the Spaniards in those parts go in pilgrimage, particularly those who have been at sea. It is seated on a high mountain, 50 miles east of Carthagena. W. Long. 74. 32. N. Lat. 10. 15.

POPÆ. See VICTIMARIUS.

POPAYAN, a province of South America, in the kingdom of New Granada, between the audience of Panama, that of Quito, and the South Sea; 400 miles in length, and 300 in breadth. A chain of barren mountains runs through the country from north to south; and near the sea the soil is so soaked with almost continual rains, that few care to reside there, except for the sake of the gold that is met with in great plenty in the sands of the rivulets. This bewitching metal brings many in search of it, though it is a great doubt whether they ever return back alive or not. For this reason the savage Americans are still masters of a great part of it, and continually annoy the Spaniards.

POPAYAN, the capital town of a province of that name in South America, with a bishop's see, a Spanish governor, and where the courts of justice are held. The inhabitants are almost all Creoles. It is 220 miles north-east of Quito. W. Long. 75. 55. N. Lat. 2. 35.

POPE, a name which comes from the Greek word Παπα, and signifies *Father*. In the east this appellation is given to all Christian priests; and in the west, bishops were called by it in ancient times: but now for many

(A) The presbytery is by law appointed auditor of the poor's accounts of the several parishes within its bounds; and if they find any difficult case occur in the discharge of this duty, they may lay it before the synod for advice.

(B) See *Sketches of Man*, book ii. sketch 10. where many other arguments equally forcible are urged against all involuntary *poor-rates*, and where many ingenious expedients are proposed for gradually abolishing them where they are established.

many centuries it has been appropriated to the bishop of Rome, whom the Roman Catholics look upon as the common father of all Christians.

Much has been said, much written, and many warm disputes have been carried on concerning the pope, and the power belonging to him, within these two or three last centuries. We shall here, without entering into controversy, lay down distinctly, from the best authority, what the Roman Catholics really believe concerning the *pope*, after having described the manner of his election; and we shall give some other particulars relating to this subject that seem to deserve notice, and are in this country not generally known.

All in communion with the see of Rome unanimously hold, that our Saviour Jesus Christ constituted St Peter the apostle chief pastor under himself, to watch over his whole flock here on earth, and to preserve the unity of it; giving him the power requisite for these ends. They also believe, that our Saviour ordained, that St Peter should have successors with the like charge and power, to the end of time. Now, as St Peter resided at Rome for many years, and suffered martyrdom there, they consider the bishops of Rome as his successors in the dignity and office of the universal pastor of the whole Catholic church. There have been some varieties in the manner of choosing the bishop of Rome in different ages, as alterations may be made in discipline; but still the clergy of Rome have justly had the chief part in that election: and that clergy is now represented by, or in some manner consists of, *the cardinals*, who have for several centuries been the sole electors of the pope.

These *cardinals* or *principal persons* of the church of Rome are 70 in number, when the *sacred college*, as it is called, is complete. Of these six are cardinal bishops, the bishops of Ostia, of Porto, Albano, Sabino, Tusculum or Frascati, and Prænefte or Palestrina; which are the six suburbicarian churches; fifty are cardinal priests, who have all titles from parish churches in Rome; and fourteen are cardinal deacons, who have their titles from churches in Rome of less note, called *Diaconias* or *Deaconries*. These cardinals are created by the pope when there happen to be vacancies; and sometimes he names one or two only at a time; but commonly he defers the promotion until there be ten or twelve vacancies or more; and then at every second such promotion the emperor, the kings of Spain and France, and of Britain, when Catholic, are allowed to present one each, to be made cardinal, whom the pope always admits if there be not some very great and evident objection. These cardinals are commonly promoted from among such clergymen as have borne offices in the Roman court; some are assumed from religious orders; eminent ecclesiastics of other countries are likewise often honoured with this dignity, as the archbishops of Toledo and Vienna are at present cardinal priests of Rome. Sons of sovereign princes have frequently been members of the sacred college; and there ends the direct line of the royal family of Stuart. Their distinctive dress is scarlet, to signify that they ought to be ready to shed their blood for the faith and church, when the defence and honour of either require it. They wear a scarlet cap and hat: the cap is given to them by the pope if they are at Rome, and is sent to them if they are absent; but the hat is never given but by the pope's own hand. These cardinals form the pope's standing council or *consistory* for the management of the public affairs of church and state. They are divided into different *congregations* for the more easy dispatch of business; and some of them have the principal offices in the pontifical court, as that of cardinal-vicar—penitentiary—chancellor—camerlingo or chamberlain—prefect of the signature of justice—prefect of memorials—and secretary of state. They have the title given them of *eminence* and *most eminent*. But here we consider them principally as the persons entrusted with the choice of the pope. See Cardinal.

On the demise of a pope his pontifical seal is immediately broken by the chamberlain, and all public business is interrupted that can be delayed: messengers are dispatched to all the Catholic sovereigns to acquaint them of the event, that they may take what measures they think proper; and that the cardinals in their dominions, if any there be, may hasten to the future election if they choose to attend; whilst the whole attention of the sacred college is turned to the preservation of tranquillity in the city and state, and to the necessary preparations for the future election. The cardinal chamberlain has, during the vacancy of the holy see, great authority; he coins money with his own arms on it, lodges in the pope's apartments, and is attended by body-guards. He, and the first cardinal bishop, the first cardinal priest, and the first cardinal deacon, have, during that time, the government almost entirely in their hands. The body of the deceased pope is carried to St Peter's, where funeral service is performed for him with great pomp for nine days, and the cardinals attend there every morning. In the mean time, all necessary preparations for the election are made; and the place where they assemble for that purpose, which is called the *conclave*, is fitted up in that part of the Vatican palace which is nearest to St Peter's church, as this has long been thought the most convenient situation. Here is formed by partitions of wood a number of cells or chambers equal to the number of cardinals, with a small distance between every two, and a broad gallery before them. A number is put on every cell, and small papers with corresponding numbers are put into a box: every cardinal, or some one for him, draws out one of these papers, which determines in what cell he is to lodge. The cells are lined with cloth; and there is a part of each one separated for the conclavists or attendants, of whom two are allowed to each cardinal, and three to cardinal princes. They are persons of some rank, and generally of great confidence; but they must carry in their master's meals, serve him at table, and perform all the offices of a menial servant. Two physicians, two surgeons, an apothecary, and some other necessary officers, are chosen for the conclave by the cardinals.

On the 10th day after the pope's death, the cardinals, who are then at Rome, and in a competent state of health, meet in the chapel of St Peter's, which is called the *Gregorian chapel*, where a sermon on the choice of a pope is preached to them, and mass is said for invoking the grace of the Holy Ghost. Then the cardinals proceed to the conclave in procession two by two, and take up their abode. When all is properly settled, the conclave is shut up, having boxed *wheels* or places of communication in convenient quarters: there are also strong guards placed all around. When any foreign

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foreign cardinal arrives after the inclosure, the conclave is opened for his admission. In the beginning every cardinal signs a paper, containing an obligation, that if he shall be raised to the papal chair he will not alienate any part of the pontifical dominion; that he will not be prodigal to his relations; and any other such stipulations as may have been settled in former times or framed for that occasion.

We come now to the election itself; and that this may be effectual, two thirds of the cardinals present must vote for the same person. As this is often not easily obtained, they sometimes remain whole months in the conclave. They meet in the chapel twice every day for giving their votes; and the election may be effectuated by *scrutiny*, *accession*, or *acclamation*. Scrutiny is the ordinary method; and consists in this: every cardinal writes his own name on the inner part of a piece of paper, and this is folded up and sealed; on a second fold of the same paper a conclavist writes the name of the person for whom his master votes. This, according to agreements observed for some centuries, must be one of the sacred college. On the outer side of the paper is written a sentence at random, which the voter must well remember. Every cardinal, on entering into the chapel, goes to the altar and puts his paper into a large chalice.

When all are convened, two cardinals number the votes; and if there are more or less than the number of cardinals present, the voting must be repeated. When that is not the case, the cardinal appointed for the purpose reads the outer sentence, and the name of the cardinal under it, so that each voter hearing his own sentence and the name joined with it, knows that there is no mistake. The names of all the cardinals that are voted for are taken down in writing, with the number of votes for each; and when it appears that any one has two-thirds of the number present in his favour the election is over: but when this does not happen, the voting papers are all immediately burnt without opening up the inner part. When several trials of coming to a conclusion by this method of *scrutiny* have been made in vain, recourse is sometimes had to what is called *accession*. By it, when a cardinal perceives that one or very few votes are wanting to any one for whom he had not voted at that time, he may say that he *accedes* to the one who has near the number of votes requisite; and if his one vote suffices to make up the two-thirds, or if he is followed by a sufficient number of *acceders* or new voters for the said cardinal, the election is accomplished. Lastly, a pope is sometimes elected by *acclamation*; and that is, when a cardinal, being pretty sure that he will be joined by a number sufficient, cries out in the open chapel, that such an one shall be pope. If he is supported properly, the election becomes unanimous; those who would perhaps oppose it foreseeing that their opposition would be fruitless, and rather hurtful to themselves. It is to be observed, that the emperor of Germany and the kings of France and Spain claim a right of excluding one cardinal from being pope at every election. Hence, when the ambassador at Rome of any of these sovereigns perceives that any cardinal, disagreeable to his master, according to the instructions he has received, is like to be made pope, he demands an audience of the conclave, is admitted, and there declares his master's will, which is always attended to for the common good. But each of those sovereigns is allowed thus to exclude only one at one time; and they unwillingly and seldom put this right in execution.

When a pope is chosen in any of the three abovementioned ways, the election is immediately announced from the balcony in the front of St Peter's, homage is paid to the new pontiff, and couriers are sent off with the news to all parts of Christendom. The pope appoints a day for his coronation at St Peter's, and for his taking possession of the patriarchal church of St John Lateran; all which is performed with great solemnity. He is addressed by the expression of *Holiness*, and *most holy Father*.

Let us now proceed to see what authority Roman Catholics attribute to the pope thus chosen. They believe, then, that the bishop of Rome is, under Christ, supreme pastor of the whole church; and as such is not only the first bishop in order and dignity, but has also a power and jurisdiction over all Christians, in order to preserve unity and purity of faith and moral doctrine, and to maintain order and regularity in all churches. Wherefore they hold, that when the pope understands that any error has been broached against faith or manners, or that any considerable difference on such subjects has arisen in any part of Christendom, it belongs to him, after due deliberation and consultation, to issue out his pastoral decree, condemning the error, clearing up the doubt, and declaring what has been delivered down, and what is to be believed. Some Catholic divines are of opinion that the pope cannot err, when he thus addresses himself *to all the faithful* on matters of doctrine. They well know, that as a private doctor he may fall into mistakes as well as any other man; but they think, that when he teaches the whole church Providence must preserve him from error; and they apprehend, that this may be deduced from the promises of Christ to St Peter, and from the writings of the ancient fathers. However, this infallibility of the pope, even when he pronounces in the most solemn manner, is only an opinion, and not an article of Roman Catholic faith. Wherefore, when he sends for the doctrinal decrees, the other bishops, who are also guardians of the faith in an inferior degree, may, with due respect, examine these decrees; and if they see them agree with what has been always taught, they either formally signify their acceptance, or they tacitly acquiesce, which, considering their duty, is equivalent to a formal approbation. When the acceptation of the generality of the bishops has been obtained, either immediately or after some mutual correspondence and explanation, the decrees of the pope thus accepted come to be the sentence of the whole church, and are believed to be beyond the possibility of error!

Sometimes it may happen that the disputes and difference may be so great and intricate, that to the end it may be seen more clearly what has really been delivered down; and to give all possible satisfaction, it may appear proper to convene all the bishops who can conveniently attend to one place, to learn from them more distinctly what has been taught and held in their respective churches. Roman Catholics believe that it belongs to the pope to call such general councils, and to preside in them in person or by his legates. They likewise hold, that when the pope has approved the decrees of such councils concerning faith or manners, such

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such decrees are then final, and must be received as such by all Catholics. In all this they believe, that the particular assistance of the Holy Ghost is with the pastors of the church, that so *the gates of hell may never prevail against her*.

The see of Rome, according to Roman Catholics, is the centre of Catholic unity. All their bishops communicate with the pope, and by his means with one another, and so form one body. However distant their particular churches may be, they all meet at Rome either in person or by their delegates, or at least by their letters. And, according to the discipline of the latter ages, though they are presented to the pope for their office from their respective countries, yet from him they must receive their bulls of consecration before they can take possession of their sees.

In matters of church discipline, the pope, as chief pastor, not only ought to take care that the canons actually in force be observed in all churches, but he may also make new canons and regulations when he sees it necessary or expedient for the spiritual benefit of the faithful, according to times and circumstances. But in doing this he must not infringe the established rights or customs with injury to any person; which if, through mistake or wrong information, he should ever do, the persons who think themselves aggrieved may remonstrate with respect and sue for redress. He may establish new episcopal sees, where there have been none before; and he may alter the limits of former dioceses; but in such alterations he always of course consults the temporal sovereign, if in communion with him. He sends pastors to preach the gospel to all countries where the Catholic religion is not by law established; and to him appeals may be made from all parts of Christendom in ecclesiastical causes of great importance.

The pope may dispense with the observation of ecclesiastical canons when there are just reasons for it, as may frequently happen; he may also dispense with vows when they are made with that express or tacit condition (A) that he really may dispense with them; he may also on some occasions declare that obligations have really ceased when that is truly the case, from a great alteration of circumstances: But he can never grant any dispensation, to the injury of any third person, and can never allow any one to do what is unjust, or to say what he knows to be false, whatever advantage might be expected from it.

The pope is also a temporal prince, and possesses considerable dominions in the middle part of Italy, besides Avignon, which the French have lately taken from him, and the duchy of Benevento inclosed within the kingdom of Naples. It is also supposed that the kingdoms of Naples and Sicily, and the duchies of Parma and Placentia, are still held of him in fief as they were before. His predecessors have acquired these possessions at different times and on different occasions, by various donations, concessions, treaties, and agreements, in like manner as has happened with regard to the establishment of other sovereignties; and his title to them is like to that of other potentates to their respective possessions. The revenue arising from this estate, and what he receives for various reasons from Catholic countries, which is now much reduced, is employed for the support of government, in salaries to the officers of his court, for the education of clergymen, and for the maintaining of missionaries in infidel countries. Great sums are particularly expended for the propagation of the Christian faith in different parts of Asia, especially in Armenia, Syria, and China. Nor is it much to be wondered at, if the families, of which the sovereign pontiffs happen to have been born, acquire greater riches and splendor from that connection. The princely families of Barberini, Borghese, Chigi, Corsini, Albani, are examples of this kind: but regulations have been made in later times to prevent excessive nepotism. Beyond the limits of his own temporal dominions the pope has no temporal power or jurisdiction, excepting what any nation may be pleased to allow him: when any thing of that kind has been granted or brought in by custom, it is evident that it ought not to be taken away rashly nor without just reason. But, as chief pastor of the church, he has no right to any temporal jurisdiction over his flock. As such, his power is entirely spiritual, and has no means of coercion originally or necessarily connected with it, but only ecclesiastical censures. It must be owned, that the popes, in some ages, sometimes imagining that they could do much good, sometimes by the consent, or even at the desire, of the sovereigns, and sometimes no doubt out of ambitious views, have interfered a great deal in the temporal affairs of the different kingdoms of Europe, which has frequently given scandal and done harm to religion. But it is known to those most versant in history, that their faults of this kind have been exaggerated, and their conduct often misunderstood or misrepresented. However, in this a Roman Catholic is not obliged to approve what they have done; nay, without acting contrary to his religion, he may judge of them freely, and blame them if he think they deserve it; only he will do it with respect and regret. Thus a Roman Catholic may either apologise, if he think he can do it, for the conduct of Innocent III. in deposing king John of England; or, without being guilty of any offence against his religion, he may blame the pontiff for what he did on that occasion; because the power of the pope to depose princes, or to absolve subjects from their allegiance, was never proposed as an article of faith, or made a term of communion with the church of Rome. Some Catholic divines, indeed, especially among the Jesuits, are universally known to have held this extravagant and dangerous opinion; but by far the greater part of them condemn and abhor it as absurd and impious: and surely it is but fair and just to allow them to know best what they themselves believe. And here, to conclude, we shall add, that it is very desirable that Christians of all denominations endeavour to understand one another better than they have often done; and instead of supposing imaginary differences, strive to remove real ones, for the general good of mankind, for the glory of God, and honour of religion; and that all vie with one another to excel in just and charitable sentiments, language, and behaviour.

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(A) Any other man may unquestionably do the same when they are made with that express condition.

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The reader, who wishes to know what can be urged for and against the supremacy of the pope, and who is fitted by his knowledge of ecclesiastical history to understand the nature of the question at issue, may consult, on the one hand, the works of Bellarmine, together with a small tract lately published in English, under the title of *The Divine Economy of Christ in his Kingdom or Church;* and on the other, Barrow's treatise *on the Pope's Supremacy*, together with Chillingworth's *Religion of Protestants*, &c.

Pope (Alexander), a celebrated English poet, was descended from good families, and born the 8th of June 1688, at London, where his father was then a considerable merchant. He was taught to read very early by an aunt; and learned to write without any assistance, by copying printed books. The family being of the Romish religion, he was put, at eight years of age, under one Taverner, a priest, who taught him the rudiments of the Latin and Greek tongues together; and soon after was sent to a Popish seminary at Winchester, from whence he was removed to a school at Hyde-Park Corner. He discovered early an inclination to versifying; and the translations of Ogilby and Sandys from Virgil and Ovid first falling in his way, they were his favourite authors. At twelve he retired with his parents to Binfield, in Windsor Forest; and there became acquainted with the writings of Spenser, Waller, and Dryden. Dryden struck him most, probably because the cast of that poet was most congenial with his own; and therefore he not only studied his works intensely, but ever after mentioned him with a kind of rapturous veneration. He once obtained a sight of him at a coffee-house, but never was known to him: a misfortune which he laments in these short but expressive words, *Virgilium tantum vidi.* Though Pope had been under more tutors than one, yet it seems they were so insufficient for the purpose of teaching, that he had learned very little from them: so that, being obliged afterwards to begin all over again, he may justly be considered as one of the αὐτοδίδακτοι or *self-taught*. At fifteen he had acquired a readiness in the two learned languages; to which he soon after added the French and Italian. He had already scribbled a great deal of poetry in various ways; and this year set about an epic poem called *Alcander*. He long after communicated it to Atterbury, with a declared intention to burn it; and that friend concurred with him: "Though (adds he) I would have interceded for the first page, and put it, with your leave, among my curiosities." What the poet himself observes upon these early pieces is agreeable enough; and shows, that though at first a little intoxicated with the waters of Helicon, he afterwards arrived to great sobriety of thinking. "I confess (says he) there was a time when I was in love with myself; and my first productions were the children of Self-love upon Innocence. I had made an epic poem, and panegyrics on all the princes; and I thought myself the greatest genius that ever was. I cannot but regret these delightful visions of my childhood, which, like the fine colours we see when our eyes are shut, are vanished for ever." His pastorals, begun in 1704, first introduced him to the wits of the time; among which were Wycherly and Walsh. This last gentleman proved a sincere friend to him; and soon discerning that his talent lay, not so much in striking out new thoughts of his own, as in improving those of other men, and in an easy versification, told him, among other things, that there was one way left open for him to excel his predecessors in, which was correctness: observing, that though we had several great poets, yet none of them were correct. Pope took the hint; and turned it to good account; for no doubt the distinguishing harmony of his numbers was in a great measure owing to it. The same year, 1704, he wrote the first part of his Windsor Forest, though the whole was not published till 1710. In 1708, he wrote the Essay on Criticism: which production was justly esteemed a masterpiece in its kind, and showed not only the peculiar turn of his talents, but that those talents, young as he was, were ripened into perfection. He was not yet twenty years old; and yet the maturity of judgment, the knowledge of the world, and the penetration into human nature, displayed in that piece, were such as would have done honour to the greatest abilities and experience. But whatever may be the merit of the Essay on Criticism, it was still surpassed, in a poetical view, by the Rape of the Lock, first completely published in 1712. The former excelled in the didactic way, for which he was peculiarly formed; a clear head, strong sense, and a sound judgment, being his characteristical qualities; but it is the creative power of the imagination that constitutes what is properly called a *poet;* and therefore it is in the Rape of the Lock that Pope principally appears one, there being more *vis imaginandi* displayed in this poem than perhaps in all his other works put together. In 1713, he gave out proposals for publishing a translation of Homer's Iliad, by subscription; in which all parties concurred so heartily, that he acquired a considerable fortune by it. The subscription amounted to 6000 l. besides 1200 l. which Lintot the bookseller gave him for the copy. Pope's finances being now in good condition, he purchased a house at Twickenham, whither he removed with his father and mother in 1715: where the former died about two years after. As he was a Papist, he could not purchase, nor put his money to interest on real security; and as he adhered to the cause of King James, he made it a point of conscience not to lend it to the new government; so that, though he was worth near 20,000 l. when he laid aside business, yet, living afterwards upon the quick stock, he left but a slender subsistance to his family. Our poet, however, did not fail to improve it to the utmost: he had already acquired much by his publications, and he was all attention to acquire more. In 1717, he published a collection of all he had printed separately; and proceeded to give a new edition of Shakespeare; which, being published in 1721, discovered that he had consulted his fortune more than his fame in that undertaking. The Iliad being finished, he engaged upon the like footing to undertake the Odyssey. Mr Broome and Mr Fenton did part of it, and received 500 l. of Mr Pope for their labours. It was published in the same manner, and on the same conditions to Lintot; excepting that, instead of 1200 l. he had but 600 l. for the copy. This work being finished in 1725, he was afterwards employed with Swift and Arbuthnot in printing some volumes of Miscellanies. About this time he narrowly escaped losing his life, as he was returning home in a friend's chariot; which, on passing a bridge, happened to be overturned, and thrown with the horses into the river.

The glasses were up, and he was not able to break them: so that he had immediately been drowned, if the postilion had not broke them, and dragged him out to the bank. A fragment of the glass, however, cut him so desperately, that he ever after lost the use of two of his fingers. In 1727 his Dunciad appeared in Ireland; and the year after in England, with notes by Swift, under the name of *Scriblerus*. This edition was presented to the king and queen by Sir Robert Walpole; who, probably about this time, offered to procure Pope a pension, which however he refused, as he had formerly done a proposal of the same kind made him by Lord Halifax. He greatly cultivated the spirit of independency; and "Unplac'd, unpension'd, no man's heir or slave," was frequently his boast. He somewhere observes, that the life of an author is a state of warfare: he has shown himself a complete general in this way of warring. He bore the insults and injuries of his enemies long; but at length, in the Dunciad, made an absolutely universal slaughter of them: for even Cibber, who was afterwards advanced to be the hero of it, could not forbear owning, that nothing was ever more perfect and finished in its kind than this poem. In 1729, by the advice of Lord Bolingbroke, he turned his pen to subjects of morality; and accordingly we find him, with the assistance of that noble friend, who furnished him with the materials, at work this year upon the Essay on Man. The following extract of a letter to Swift discovers the reason of his Lordship's advice: "Bid him (says Bolingbroke) talk to you of the work he is about, I hope in good earnest; it is a fine one, and will be, in his hands, an original. His sole complaint is, that he finds it too easy in the execution. This flatters his laziness: it flatters my judgement; who always thought, that, universal as his talents are, this is eminently and peculiarly his, above all the writers I know, living or dead; I do not except Horace." Pope tells the dean in the next letter, that "the work Lord Bolingbroke speaks of with such abundant partiality, is a system of ethics, in the Horatian way." In pursuing the same design, he wrote his Ethic Epistles: the fourth of which, upon Taste, giving great offence, as he was supposed to ridicule the duke of Chandos under the character of Timon, is said to have put him upon writing satires, which he continued till 1739. He ventured to attack persons of the highest rank, and set no bounds to his satirical rage. A genuine collection of his letters was published in 1737. In 1738, a French translation of the Essay on Man, by the Abbé Resnel, was printed at Paris; and Mr Crousaz, a German professor, animadverted upon this system of ethics, which he represented as nothing else but a system of naturalism. Mr Warburton, afterwards bishop of Gloucester, wrote a commentary upon the Essay; in which he defends it against Crousaz, whose objections he supposes owing to the faultiness of the Abbé Resnel's translation. The poem was republished in 1740, with the commentary. Our author now added a fourth book to the Dunciad, which was first printed separately in 1742: but the year after, the whole poem came out together, as a specimen of a more correct edition of his works. He had made some progress in that design, but did not live to complete it. He had all his life long been subject to the head-ach; and that complaint, which he derived from his mother, was now greatly increased by a dropsy in his breast, under which he expired the 30th of May 1744, in the 56th year of his age. In his will, dated December 12. 1743, Miss Blount, a lady to whom he was always devoted, was made his heir during her life: and among other legacies, he bequeathed to Mr Warburton the property of all such of his works, already printed, as he had written, or should write commentaries upon, and which had not otherwise been disposed of or alienated; with this condition, that they were published without future alterations. In discharge of this trust, that gentleman gave a complete edition of all Mr Pope's works, 1751, in 9 vols, 8vo. A work, entitled, *An Essay on the Writings and Genius of Pope*, by Mr Warton, 2 vols 8vo, will be read with pleasure by those who desire to know more of the person, character, and writings of this excellent poet. Lord Orrery's account of him is very flattering: "If we may judge of him by his works (says this noble author) his chief aim was to be esteemed a man of virtue. His letters are written in that style; his last volumes are all of the moral kind; he has avoided trifles, and consequently has escaped a rock which has proved very injurious to Swift's reputation. He has given his imagination full scope, and yet has preserved a perpetual guard upon his conduct. The constitution of his body and mind might really incline him to the habits of caution and reserve. The treatment which he met with afterwards, from an innumerable tribe of adversaries, confirmed this habit; and made him slower than the dean in pronouncing his judgment upon persons and things. His prose-writings are little less harmonious than his verse; and his voice, in common conversation, was so naturally musical, that I remember honest Tom Southern used to call him the *little nightingale*. His manners were delicate, easy, and engaging; and he treated his friends with a politeness that charmed, and a generosity that was much to his honour. Every guest was made happy within his doors; pleasure dwelt under his roof, and elegance presided at his table."

Yet, from Dr Johnson's account of his domestic habits, we have reason to doubt the latter part of this character. His parsimony (he informs us) appeared in very petty matters, such as writing his compositions on the backs of letters, or in a niggardly reception of his friends, and a scantiness of entertainment—as the setting a single pint on the table to two friends, when, having himself taken two small glasses, he would retire, saying, I leave you to your wine. He sometimes, however, the Doctor acknowledges, made a splendid dinner; but this happened seldom. He was very full of his fortune, and frequently ridiculed poverty; and he seems to have been of an opinion not very uncommon in the world, that to want money is to want every thing. He was almost equally proud of his connection with the great, and often boasted that he obtained their notice by no meanness or servility. This admiration of the great increased in the advance of life; yet we must acknowledge, that he could derive but little honour from the notice of Cobham, Burlington, or Bolingbroke.

By natural deformity, or accidental distortion, his vital functions were so much disordered, that his life was a long disease; and from this cause arose many of his peculiarities and weaknesses. He stood constantly in need of female attendance; and to avoid cold, of which he was very sensible, he wore a fur doublet under his shirt, &c. The indulgence and accommodation which his sickness required, had taught him all the unpleasing and unsocial qualities of a valetudinary man.—When he wanted to sleep, he nodded in company; and once slumbered at his own table when the prince of Wales was talking of poetry. He was extremely troublesome to such of his friends as asked him out, which many of them frequently did, and plagued the servants beyond description. His love of eating is another fault to which he is said to have fallen a sacrifice. In all his intercourse with mankind, he had great delight in artifice, and endeavoured to attain all his purposes by indirect and unsuspected methods.

In familiar conversation it is said he never excelled; and he was so fretful and so easily displeased, that he would sometimes leave Lord Oxford's silently without any apparent reason, and was to be courted back by more letters and messages than the servants were willing to carry.

Dr Johnson also gives a view of the intellectual character of Pope, and draws a parallel between Dryden and him. For particulars, however, we must refer our readers to *Johnson's Lives of the Poets*.

Pope's Dominions, or *Ecclesiastical States*, a country of Italy, bounded on the north by the gulph of Venice and the Venetian dominions, on the south by the Mediterranean, on the east by the kingdom of Naples and the Adriatic, and on the west by Tuscany and Modena. It is 400 miles long on the coast of the Adriatic from Naples to the Venetian territory. It is but narrow, however, from north to south, not being more than 80 miles broad from the gulph of Venice to the Tuscan sea.

The soil, in general, of the pope's dominions is very fertile, but ill cultivated; and there are many fens and marshy grounds which are very prejudicial to the air. That the lands are badly cultivated and inhabited, the air bad, and the inhabitants poor, idle, lazy, and grossly superstitious, is owing to a variety of causes. With respect to the accommodations of life, this country is but in a very indifferent condition; for, notwithstanding the fertility of its soil, its advantageous situation for traffic, the large sums spent in it by travellers, or remitted to it from foreign countries, and its having, for its ruler, the successor of St Peter, the prince of the apostles, and the vicar of Jesus Christ; yet it is poor and thin of inhabitants, ill cultivated, and without trade and manufactures. This is partly owing to the great number of holidays, of sturdy beggars called *pilgrims*, and of hospitals and convents, with the amazing but perhaps useless wealth of churches and convents, and the inquisition: but the chief cause is the severity of the government, and the grievous exactions and hardships to which the subjects are exposed. The legates, though mostly clergymen, whose thoughts should be chiefly employed about laying up treasures in heaven, and who ought to set an example to the laity of disinterestedness and a contempt of this world, too often, it is said, scruple no kind of rapaciousness: even the holy father himself, and the cardinals, frequently make the enriching of their nephews and other relations, and the aggrandizing their families, too much the business of their lives. The extensive claims and great pretensions of the pope are well known, and by a large part of Christendom, are now treated with contempt and mockery. The Reformation gave a great blow to his spiritual power; and the French revolution has lessened it still more. His temporal dominions, however, still continue much the same; though how long this may be the case, considering how much he hath lost, and is daily losing, of his ghostly empire, and the veneration in which he was formerly held, it is difficult to say. See Pope, p. 378. col. 1.—The Campania of Rome is under the pope's immediate government; but the other provinces are governed by legates and vice-legates, and there is a commander in chief of the pope's forces in every province. The pope is chosen by the cardinals in the conclave: See this particularly described under Pope. The pope holds a consistory of cardinals on ecclesiastical affairs; but the cardinals do not meddle with his civil government. The pope's chief minister is the cardinal-patron, usually his nephew, who amasses an immense estate, if the reign be of any long duration. The cardinal that is chosen pope must generally be an Italian, and at least 55 years of age. The spiritual power of the pope, though far short of what it was before the Reformation, is still considerable. It is computed that the monks and regular clergy, who are absolutely at his devotion, do not amount to less than 2,000,000 of people, dispersed through all the Roman Catholic countries, to assert his supremacy over princes, and promote the interest of the church. The revenues of these monks do not fall short of L. 20,000,000 Sterling, besides the casual profits arising from offerings, and the people's bounty to the church, who are taught that their salvation depends on this kind of benevolence.

The pope's revenues, as a temporal prince, may amount to about L. 1,000,000 Sterling *per annum*, arising chiefly from the monopoly of corn, the duties on wine and other provisions. Over and above these, vast sums are continually flowing into the papal treasury from all the Roman Catholic countries, for dispensations, indulgences, canonizations, annates, the pallia, and investitures of archbishops, bishops, &c.

The pope has a considerable body of regular forces, well clothed and paid; but his fleet consists only of a few galleys His life-guards are 40 Switzers, 75 cuirassiers, and as many light horse. Since the beginning of this war, we are told, he has likewise had a guard of English horse.

POPERY, in ecclesiastical history, comprehends the religious doctrines and practices adopted and maintained by the church of Rome. The following summary, extracted chiefly from the decrees of the council of Trent, continued under Paul III. Julius III. and Pius IV. from the year 1545 to 1563, by successive sessions, and the creed of pope Pius IV. subjoined to it, and bearing date November 1564, may not be unacceptable to the reader. One of the fundamental tenets, strenuously maintained by popish writers, is the infallibility of the church of Rome; though they are not agreed whether this privilege belongs to the pope or a general council, or to both united; but they pretend that an infallible living judge is absolutely necessary to determine controversies, and to secure peace in the Christian church. However, Protestants allege, that the claim of infallibility in any church is not justified by by the authority of Scripture; much less does it pertain to the church of Rome; and that it is inconsistent with the nature of religion, and the personal obligations of its professors; and that it has proved ineffectual to the end for which it is supposed to be granted, since popes and councils have disagreed in matters of importance, and they have been incapable, with the advantage of this pretended infallibity, of maintaining union and peace.

Another essential article of the popish creed is the supremacy of the pope, or his sovereign power over the universal church. See POPE.

Farther, the doctrine of the seven sacraments is a peculiar and distinguishing doctrine of the church of Rome: these are baptism, confirmation, the eucharist, penance, extreme unction, orders, and matrimony.

The council of Trent (sess. 7. can. 1.) pronounces an anathema on those who say, that the sacraments are more or fewer than seven, or that any one of the above number is not truly and properly a sacrament. And yet it does not appear that they amounted to this number before the 12th century, when Hugo de St Victore and Peter Lombard, about the year 1144, taught that there were seven sacraments. The council of Florence, held in 1438, was the first council that determined this number. These sacraments confer grace, according to the decree of the council of Trent (sess. 7. can. 8.) *ex opere operato*, by the mere administration of them: three of them, viz. baptism, confirmation, and orders, are said (can. 9.) to impress an indelible character, so that they cannot be repeated without sacrilege; and the efficacy of every sacrament depends on the intention of the priest by whom it is administered (can. 11.) Pope Pius expressly enjoins, that all these sacraments should be administered according to the received and approved rites of the Catholic church. With regard to the eucharist in particular, we may here observe, that the church of Rome holds the doctrine of transubstantiation; the necessity of paying divine worship to Christ under the form of the consecrated bread, or host; the propitiatory sacrifice of the mass, according to their ideas of which Christ is truly and properly offered as a sacrifice as often as the priest says mass; it practises likewise solitary mass, in which the priest alone, who consecrates, communicates, and allows communion only in one kind, viz. the bread, to the laity. Sess. 14.

The doctrine of merits is another distinguishing tenet of popery; with regard to which the council of Trent has expressly decreed (sess. 6. can. 32.) that the good works of justified persons are truly meritorious; deserving not only an increase of grace, but eternal life, and an increase of glory; and it has anathematized all who deny this doctrine. Of the same kind is the doctrine of satisfactions; which supposes that penitents may truly satisfy, by the afflictions they endure under the dispensations of Providence, or by voluntary penances to which they submit, for the temporal penalties of sin, to which they are subject, even after the remission of their eternal punishment. Sess. 6. can. 30. and sess. 14. can. 8. and 9. In this connection we may mention the popish distinction of venial and mortal sins: the greatest evils arising from the former are the temporary pains of purgatory; but no man, it is said, can obtain the pardon of the latter without confessing to a priest, and performing the penances which he imposes.

The council of Trent (sess. 14. can. 1.) has expressly decreed, that every one is accursed, who shall affirm that penance is not truly and properly a sacrament, instituted by Christ in the universal church, for reconciling those Christians to the divine majesty, who have fallen into sin after baptism: and this sacrament, it is declared, consists of two parts, the matter and the form; the matter is the act of the penitent, including contrition, confession, and satisfaction; the form of it is the act of absolution on the part of the priest. Accordingly it is enjoined, that it is the duty of every man, who hath fallen after baptism, to confess his sins once a year, at least, to a priest: that this confession is to be secret; for public confession is neither commanded nor expedient: and that it must be exact and particular, including every kind and act of sin, with all the circumstances attending it. When the penitent has so done, the priest pronounces an absolution; which is not conditional or declarative only, but absolute and judicial. This secret, or auricular confession, was first decreed and established in the fourth council of Lateran, under Innocent III. in 1215, (cap. 21.) And the decree of this council was afterwards confirmed and enlarged in the council of Florence, and in that of Trent; which ordains, that confession was instituted by Christ, that by the law of God it is necessary to salvation, and that it has been always practised in the Christian church. As for the penances imposed on the penitent by way of satisfaction, they have been commonly the repetition of certain forms of devotion, as pater-nosters, or ave-marias, the payment of stipulated sums, pilgrimages, fasts, or various species of corporal discipline. But the most formidable penance, in the estimation of many who have belonged to the Romish communion, has been the temporary pains of purgatory. But under all the penalties which are inflicted or threatened in the Romish church, it has provided relief by its indulgences, and by its prayers or masses for the dead, performed professedly for relieving and rescuing the souls that are detained in purgatory.

Another article that has been long authoritatively enjoined and observed in the church of Rome, is the celibacy of her clergy. This was first enjoined at Rome by Gregory VII. about the year 1074, and established in England by Anselm archbishop of Canterbury about the year 1175; though his predecessor Lanfranc had imposed it upon the prebendaries and clergy that lived in towns. And though the council of Trent was repeatedly petitioned by several princes and states to abolish this restraint, the obligation of celibacy was rather established than relaxed by this council; for they decreed, that marriage contracted after a vow of continence, is neither lawful nor valid; and thus deprived the church of the possibility of ever restoring marriage to the clergy. For if marriage, after a vow, be in itself unlawful, the greatest authority upon earth cannot dispense with it, nor permit marriage to the clergy, who have already vowed continence.

To the doctrines and practices above recited may be farther added the worship of images, of which Protestants accuse the Papists. But to this accusation the Papist replies, that he keeps images by him to preserve

Popery.

Papist Misrepresented and Represented.

in his mind the memory of the persons represented by them; as people are wont to preserve the memory of their deceased friends by keeping their pictures. He is taught (he says) to use them so as to cast his eyes upon the pictures or images, and thence to raise his heart to the things represented, and there to employ it in meditation, love, and thanksgiving, desire of imitation, &c. as the object requires.

These pictures or images have this advantage, that they inform the mind by one glance of what in reading might require a whole chapter. There being no other difference between them, than that reading represents leisurely and by degrees; and a picture, all at once. Hence he finds a convenience in saying his prayers with some devout pictures before him, he being no sooner distracted, but the sight of these recals his wandering thoughts to the right object; and as certainly brings something good into his mind, as an immodest picture disturbs his heart with filthy thoughts. And because he is sensible that these holy pictures and images represent and bring to his mind such objects as in his heart he loves, honours, and venerates; he cannot but upon that account love, honour, and respect, the images themselves.

The council of Trent likewise decreed, that all bishops and pastors who have the cure of souls, do diligently instruct their flocks, *that it is good and profitable to desire the intercession of saints reigning with Christ in heaven.* And this decree the Papists endeavour to defend by the following observations. They confess that we have but one Mediator of redemption; but affirm that it is acceptable to God that we should have many mediators of intercession. Moses (say they) was such a mediator for the Israelites; Job for his three friends; Stephen for his persecutors. The Romans were thus desired by St Paul to be his mediators; so were the Corinthians, so the Ephesians, *Ep. ad* Rom. Cor. Eph. so almost every sick man desires the congregation to be his mediators, by remembering him in their prayers. And so the Papist desires the blessed in heaven to be his mediators; that is, that they would pray to God for him. But between these living and dead mediators there is no similarity: the living mediator is present, and certainly hears the request of those who desire him to intercede for them; the dead mediator is as certainly absent, and cannot possibly hear the requests of all those who at the same instant may be begging him to intercede for them, unless he be possessed of the divine attribute of omnipresence; and he who gives that attribute to any creature is unquestionably guilty of idolatry. And as this decree is contrary to one of the first principles of natural religion, so does it receive no countenance from Scripture, or any Christian writer of the three first centuries. Other practices peculiar to the Papists are the religious honour and respect that they pay to sacred relicks; by which they understand not only the bodies and parts of the bodies of the saints, but any of those things that appertained to them, and which they touched; and the celebration of divine service in an unknown tongue: to which purpose the council of Trent hath denounced an anathema on any one who shall say that mass ought to be celebrated only in the vulgar tongue; sess. 25. and sess. 22. can. 9. Though the council of Lateran under Innocent III. in 1215 (can. 9.) had expressly decreed, that because in many parts within the same city and diocese there are many people of different manners and rites mixed together, but of one faith, the bishops of such cities or dioceses should provide fit men for celebrating divine offices, according to the diversity of tongues and rites, and for administering the sacraments.

Ibid.

We shall only add, that the church of Rome maintains, that unwritten traditions ought to be added to the holy Scriptures, in order to supply their defect, and to be regarded as of equal authority; that the books of the Apocrypha are canonical scripture; that the vulgate edition of the Bible is to be deemed authentic; and that the Scriptures are to be received and interpreted according to that sense which the holy mother church, to whom it belongs to judge of the true sense, hath held, and doth hold, and according to the unanimous consent of the fathers.

Such are the principal and distinguishing doctrines of Popery, most of which have received the sanction of the council of Trent, and that of the creed of pope Pius IV. which is received, professed, and sworn to by every one who enters into holy orders in the church of Rome; and at the close of this creed, we are told that the faith contained in it is so absolutely and indispensably necessary, that no man can be saved without it.

Many of the doctrines of Popery were relaxed, and very favourably interpreted by M. de Meaux, bishop of Condom, in his Exposition of the Doctrine of the Catholic Church, first printed in the year 1671: but this edition, which was charged with perverting, in endeavouring to palliate, the doctrine of the church, was censured by the doctors of the Sorbonne, and actually suppressed; nor does it appear that they ever testified their approbation in the usual form of subsequent and altered editions. It has, however, been lately published in this country, by a clergyman of the Romish church, whose integrity, piety, and benevolence, would do honour to any communion.

Popery, Popham.

POPHAM (Sir John), lord chief justice of the common pleas in the reign of Queen Elizabeth, was the eldest son of Edward Popham, Esq; of Huntworth in Somersetshire, and born in the year 1531. He was some time a student of Baliol college in Oxford; "being then (says Ant. Wood) given at leisure hours to many sports and exercises." After quitting the university, he fixed in the Middle Temple; where, during his novitiate, he is said to have indulged in that kind of dissipation to which youth and a vigorous constitution more naturally incline than to the study of voluminous *reports*: but, satiated at length with what are called the *pleasures of the town*, he applied sedulously to the study of his profession, was called to the bar, and in 1568 became summer or autumn reader. He was soon after made serjeant at law, and solicitor-general in 1579. In 1581, he was appointed attorney-general, and treasurer of the Middle Temple. In 1592, he was made lord chief justice of the king's bench, and the same year received the honour of knighthood. In the year 1601, his lordship was one of the council detained by the unfortunate earl of Essex, when he formed the ridiculous project of defending himself in his house: and, on the earl's trial, he gave evidence against him relative to their detention. He died in the year 1607, aged 76; and was buried in in the south aisle of the church at Wellington in Somersetshire, where he generally resided as often as it was in his power to retire. He was thought somewhat severe in the execution of the law against capital offenders: but his severity had the happy effect of reducing the number of highway robbers. He wrote, 1. Reports and cases adjudged in the time of Queen Elizabeth. 2. Resolutions and judgments upon cases and matters agitated in all the courts at Westminster in the latter end of Queen Elizabeth's reign.

POPLAR, in botany. See POPULUS.

POPLITÆUS, in anatomy, a small muscle obliquely pyramidal, situated under the ham. See ANATOMY, *Table of the Muscles*.

POPPY, in botany. See OPIUM and PAPAVER.

POPULAR, something that relates to the common people.

POPULATION, means the state of a country with respect to the number of people. See *Bills of* MORTALITY and POLITICAL-*Arithmetic*.

The question concerning the number of men existing upon earth, has been variously determined by different writers. Riccioli states the population of the globe at 1000 millions, Vossius at 500; the Journalists of Trevoux at 720; and the editor (Xavier de Feller) of the small Geographical Dictionary of Vosgien, reprinted at Paris in 1778, at 370 millions. This last estimate is perhaps too low, although the writer professes to have taken considerable pains to ascertain the point with as much accuracy as the nature of the subject will admit. It may, perhaps, not be deemed unworthy the attention of the curious speculatist to observe, that assuming the more probable statement of the learned Jesuits of Trevoux, and that the world has existed about 6006 years in its present state of population, then the whole number of persons who have ever existed upon earth since the days of Adam amounts only to about one hundred and thirty thousand millions; because $720,000,000 \times 182$ (the number of generations in 6006 years) $= 131,040,000,000$. See on this subject the authors above mentioned, as likewise Beausobre's *Etude de la Politique*.

With regard to the population of England, the reader may consult, together with our article POLITICAL-*Arithmetic*, An Inquiry into the present State of Population, &c. by W. Wales, F. R. S. and Mr Howlett's Examination of Dr Price's Essay, on the same subject.

POPULUS, the POPLAR: A genus of the octandria order, belonging to the diœcia class of plants; and in the natural method ranking under the 50th order, *Amentaceæ*. The calyx of the amentum is a lacerated, oblong, and squamous leaf; the corolla is turbinated, oblique, and entire. The female has the calyx of the amentum and corolla the same as in the male; the stigma is quadrifid; the capsule bilocular, with many pappous seeds.

The poplar, one of the most beautiful of the aquatic trees, has frequently been introduced into the poetical descriptions of the ancients; as by Virgil, *Ecl.* vii. 66. ix. 41. *Georg.* ii. 66. iv. 511. *Æn.* viii. 31. 276. by Ovid, *Amom. Parid.* 27. by Horace, *Carm.* ii. 3. and by Catulus, *Nupt. Pil. et Thet.* 290, &c. &c.

Species. 1. The alba, or abele-tree, grows naturally in the temperate parts of Europe. Its leaves are large, and divided into three, four, or five lobes, indented on their edges, of a very dark colour on their upper side, but very white and downy on the under side; standing upon footstalks an inch long. The young branches have a purple bark, and are covered with a white down; but the bark of the stem and older branches is grey. In the beginning of April, the male flowers or catkins appear, which are cylindrical, and about three inches long. About a week after come out the female flowers or catkins, which have no stamina like those of the male. Soon after these come out, the male catkins fall off; and in five or six weeks after the female flowers will have ripe seeds inclosed in a hairy covering. The catkins will then drop, and the seeds be wafted by the winds to a great distance. 2. The major, or white poplar, has its leaves rounder than the first, and not much above half their size: they are indented on their edges, and are downy on their under side, but not so white as those of the former, nor are their upper surfaces of such a deep green colour. 3. The nigra, or black poplar, has oval heart-shaped leaves, slightly crenated on their edges; they are smooth on both sides, and of a light green colour. 4. The tremula, or aspen-tree, has roundish, angularly indented leaves: they are smooth on both sides, and stand on long footstalks, and so are shaken by the least wind; from whence it has the title of the *trembling poplar*, or *aspen-tree*. 5. The balsamifera, or Carolina poplar, is a native of Carolina, where it becomes a large tree. The shoots of this sort grow very strong in Britain, and are generally angular; with a light green bark like the willow. The leaves on young trees, and also those on the lower shoots, are very large, almost heart-shaped, and crenated; but those upon the older trees are smaller: as the trees advance, their bark becomes lighter, approaching to a greyish colour. 6. The tacamahaca, grows naturally in Canada and other parts of North America. This is a tree of a middling growth, sending out on every side many short thick shoots, which are covered with a light brown bark, garnished with leaves differing from one another in shape and size; most of them are almost heart-shaped; but some are oval, and others nearly spear-shaped; they are whitish on their under side, but green on their upper.

Culture. These trees may be propagated either by layers or cuttings, as also from suckers which the white poplars send up from their roots in great plenty. The best time for transplanting these suckers is in October, when their leaves begin to decay. These may be placed in a nursery for two or three years, to get strength before they are planted out where they are designed to remain; but if they are propagated from cuttings, it is better to defer the doing of that until February, at which time truncheons of two or three feet long should be thrust about a foot and a half into the ground.—These will readily take root; and if the soil in which they are planted be moist, they will arrive at a considerable bulk in a few years. The black poplar is less apt to take root from large truncheons; therefore it is a better method to plant cuttings of it about a foot and a half in length, thrusting them a foot deep in the ground. This sort will grow almost on any soil, but will thrive best in moist places. The Carolina poplar may also be propagated by cuttings or layers; but the last is the method generally practised, and the plants raised

Populus.

raised by it are less moist than others. The shoots of this tree, while young, are frequently killed down to a considerable length by the frost in winter; but as the trees grow older, their shoots are not so vigorous, and become more ligneous, so are not liable to the same disaster. But the trees should be planted in a sheltered situation: for as their leaves are very large, the wind has great power over them; and the branches being tender, they are frequently broken or split by the winds in summer, when they are much exposed. The tacamahaca sends up a great number of suckers from its roots, by which it multiplies in plenty; and every cutting which is planted will take root.

Uses. The wood of these trees, especially of the abele, is good for laying floors, where it will last for many years; and on account of its extreme whiteness is by many preferred to oak; yet, on account of its soft contexture, being very subject to take the impression of nails, &c. it is less proper on this account than the harder woods. The abele likewise deserves particular notice, on account of the virtue of its bark in curing intermitting fevers. The Reverend Mr Stone, in Phil. Trans. vol. LIII. p. 195. tells us, that he gathers the bark in summer when it is full of sap, and having dried it by a gentle heat, gives a dram powdered every four hours betwixt the fits. In a few obstinate cases, he mixed one-fifth part of Peruvian bark with it. It is remarkable how nature has adapted remedies to diseases. Intermitting fevers are most prevalent in wet countries; and this tree grows naturally in such situations. The bark of it is an object well worthy the attention of physicians; and if its success upon a more enlarged scale of practice prove equal to Mr Stone's experiments, the world will be much indebted to him for communicating them. This bark will also tan leather.

The inner bark of the black poplar is used by the inhabitants of Kamschatka as a material for bread; and paper has sometimes been made of the cottony down of the seeds. The roots have been observed to dissolve into a kind of gelatinous substance, and to be coated over with a tubular crustaceous spar, called by naturalists *osteocolla* *, formerly imagined to have some virtue in producing the callus of a fractured bone. The buds of the sixth species are covered with a glutinous resin, which smells very strong, and is the gum tacamahaca of the shops. The best, called, from its being collected in a kind of gourd-shells, *tacamahaca in shells*, is somewhat unctuous and softish, of a pale yellowish or greenish colour, an aromatic taste, and a fragrant delightful smell, approaching to that of lavender or ambergrise. This sort is very rare; that commonly found in the shops is in semitransparent globes or grains, of a whitish, yellowish, brownish, or greenish colour, of a less grateful smell than the foregoing. This resin is said to be employed externally by the Indians for discussing and maturating tumours, and abating pains in the limbs. It is an ingredient in some anodyne, hysteric, cephalic, and stomachic plasters; but the fragrance of the finer sort sufficiently points out its utility in other respects.

* See *Osteocolla*.

M. Fougeroux de Bondaroy, from a set of experiments on the subject, gives an account of the uses of the several kinds of poplar, the substance of which is as follows: He finds that the wood of the black poplar is good and useful for many purposes; that the Lombardy poplar, *populus fastigata*, is of very little value; that the Virginia poplar, *populus Virginiana*, affords a wood of excellent quality, that may be applied to many uses. The Carolina poplar, *populus Carolinensis—heterophilla*, (Linn.) is a very quick grower; beautiful when found, but liable to be hurt by cold. Its wood appeared to M. de Bondaroy to be of little value; but M. Malesherbes, who cut down a large tree of this sort, was assured by his carpenter that the wood was very good.—That the tacamahaca, *populus tacamahaca balsamifera*, is a dwarfish plant (A), of little value.—That the liard, *populus Canadensis*, is a large tree, the wood light, not easy to be split, and fit for several uses.—That the white poplar, *populus alba*, is a large growing tree, affording a wood of excellent quality, and is among the most valuable of this species.—That the trembling poplar, *populus tremula*, (Linn.) is neither so large a tree nor affords such wood as the former. These are in few words the principal result of the experiments of this gentleman on this class of plants. A few other sorts are mentioned, but nothing decisive with regard to them is determined.

From some experiments made by M. Dambourney, it appears that the poplar may be usefully employed in dyeing. The Italian poplar gives a dye of as fine a lustre, and equally durable, as that of the finest yellow wood, and its colour is more easily extracted. It is likewise very apt to unite with other colours in composition. Beside the *populus fastigata*, M. Dambourney tried also the black poplar, the Virginian *ditto*, the balsam *ditto* or *liard*, the white *ditto*, and the trembling poplar; and found that all these dyed wool of a nut-colour, fawn-colour (*vigogne*), Nankin, musk, and other grave shades, according to the quantity of wood employed, and the length of time it was boiled.

POQUELIN or POCQUELIN (John Baptist.) See MOLIERE.

PORANA, in botany; a genus of the monogynia order, belonging to the pentandria class of plants. The corolla is campanulated; the calyx is quinquefid, and larger than the fruit; the style semibifid, long, and permanent; the stigmata globular; the perianthium bivalved.

1 What is called porcelain.

PORCELAIN, a fine kind of earthen ware, chiefly manufactured in China, and thence called *China-ware*. All earthen wares which are white and semitransparent are generally called *porcelains:* but amongst these, so great differences may be observed, that, notwithstanding the similarity of their external appearance, they cannot be considered as matters of the same kind. These differences are so evident, that even persons who are not connoisseurs in this way prefer much the porcelain of some countries to that of others.

2 Origin of the name.

The word *porcelain* is of European derivation; none of the syllables which compose it can even be pronounced or written by the Chinese, whose language comprehends

(A) We have seen it above 30 feet high.

Porcelain. prehends no such sounds. It is probable that we are indebted to the Portuguese for it: the word *porcellana*, however, in their language, signifies properly a cup or dish; and they themselves distinguish all works of porcelain by the general name of *loca*. Porcelain is called in China *tsé-ki*.

3 Art of making it in greater perfection in the East than in Europe.

The art of making porcelain is one of those in which Europe has been excelled by oriental nations. The first porcelain that was seen in Europe was brought from Japan and China. The whiteness, transparency, fineness, neatness, elegance, and even the magnificence of this pottery, which soon became the ornament of sumptuous tables, did not fail to excite the admiration and industry of Europeans; and their attempts have succeeded so well, that in different parts of Europe earthen wares have been made so like the oriental, that they have acquired the name of *porcelain*. The first European porcelains were made in Saxony and in France; and afterwards in England, Germany, and Italy: but as all these were different from the Japanese, so each of them had its peculiar character.

4 Best Chinese porcelain at King-te-tching.

The finest and best porcelain of China is made in a village called *King-te-tching*, in the province of Kiang-si. This celebrated village is a league and a half in length, and we are assured that it contains a million of inhabitants. The workmen of King-te-tching, invited by the attracting allurements of the European trade, have established manufactories also in the provinces of Fo-kien and Canton; but this porcelain is not esteemed.—The emperor Kang-hi was desirous of having some made under his own inspection at Pe-king. For this purpose he collected workmen, together with tools, and all materials necessary; furnaces were also erected, but the attempt miscarried. The village of *King-te-tching* still continues the most celebrated place in the empire for beautiful porcelain, which is transported to all parts of the world, and even to Japan.

5 Origin of the art.

We are unable to discover who first found out the art of making porcelain, nor is it known whether the Chinese were indebted to chance for it, or to the repeated efforts of inventive genius; we cannot even determine its antiquity with precision; we know only from the annals of Feou-leang, a city in the district to which King-te-tching belongs, that, since the year 442 of our era, the workmen of this village have always furnished the emperors with porcelain; and that one or two mandarins were sent from court to inspect their labours. It is, however, supposed that the invention of porcelain is much older than that epocha.

6 F. d'Entrecolles first gave an account of Chinese porcelain.

We are indebted to Father d'Entrecolles, a Romish missionary, for a very accurate account of the manner in which porcelain is made in China; and as he lived in King-te-tching, his information must have been the very best possible. We shall therefore give his account of the Chinese manner of making it, as abridged by Grosier in his *General Description of China*.

7 Nature of the materials, and mode of preparing the paste.

The principal ingredients of the fine porcelain are *pe-tun-tse* and *kao-lin*, two kinds of earth from the mixture of which the paste is produced. The *kao-lin* is intermixed with small shining particles; the other is purely white, and very fine to the touch. These first materials are carried to the manufactories in the shape of bricks. The pe-tun-tse, which is so fine, is nothing else but fragments of rock taken from certain quarries, and reduced to powder. Every kind of stone is not fit for this purpose. The colour of that which is good, say the Chinese, ought to incline a little towards green. A large iron club is used for breaking these pieces of rock: they are afterwards put into mortars; and, by means of levers headed with stone bound round with iron, they are reduced to a very fine powder. These levers are put in action either by the labour of men, or by water, in the same manner as the hammers of our paper-mills. The dust afterwards collected is thrown into a large vessel full of water, which is strongly stirred with an iron shovel. When it has been left to settle for some time, a kind of cream rises on the top, about four inches in thickness, which is skimmed off, and poured into another vessel filled with water: the water in the first vessel is stirred several times; and the cream which arises is still collected, until nothing remains but the coarse dregs, which, by their own weight, precipitate to the bottom: these dregs are carefully collected, and pounded anew.

With regard to what is taken from the first vessel, it is suffered to remain in the second until it is formed into a kind of crust at the bottom. When the water above it seems quite clear, it is poured off by gently inclining the vessel, that the sediment may not be disturbed; and the paste is thrown into large moulds proper for drying it. Before it is entirely hard, it is divided into small square cakes, which are sold by the hundred. The colour of this paste, and its form, have occasioned it to receive the name of *pe tun-tse*.

The kao-lin, which is used in the composition of porcelain, requires less labour than the pe-tun-tse. Nature has a greater share in the preparation of it. There are large mines of it in the bosoms of certain mountains, the exterior strata of which consist of a kind of red earth. These mines are very deep, and the kao-lin is found in small lumps, that are formed into bricks after having gone through the same process as the pe-tun-tse. Father d'Entrecolles thinks, that the earth called *terre de Malte*, or St Paul's earth, has much affinity to the kao-lin, although those small shining particles are not observed in it which are interspersed in the latter.

It is from the kao-lin that fine porcelain derives all its strength; if we may be allowed the expression, it stands it instead of nerves. It is very extraordinary, that a soft earth should give strength and consistency to the pe-tun-tse, which is procured from the hardest rocks. A rich Chinese merchant told F. d'Entrecolles, that the English and Dutch had purchased some of the pe-tun-tse, which they transported to Europe with a design of making porcelain; but having carried with them none of the kao-lin, their attempt proved abortive, as they have since acknowledged. "They wanted (said this Chinese, laughing) to form a body, the flesh of which should support itself without bones."

8 A new substance discovered and used by the Chinese.

The Chinese have discovered, within these few years, a new substance proper to be employed in the composition of porcelain. It is a stone, or rather species of chalk, called *hoa-che*, from which the physicians prepare a kind of draught that is said to be detersive, aperient, and cooling. The manufacturers of porcelain have thought proper to employ this stone instead of kao-lin. It is called hoa, because it is glutinous, and has a great resemblance to soap. Porcelain made with hoa-che is very rare, and much dearer than any other. It has an exceeding fine grain, and, with regard to the painting, if it be compared with that of the common porcelain, it

Porcelain. it appears to surpass it as much as vellum does paper. This porcelain is, besides, so light, that it surprises those who are accustomed to handle other kinds; it is also much more brittle; and it is very difficult to hit upon the proper degree of tempering it.

Hoa-che is seldom used in forming the body of the work; the artist is contented sometimes with making it into a very fine size, in which the vessel is plunged when dry, in order that it may receive a coat before it is painted and varnished: by these means it acquires a superior degree of beauty.

When hoa-che is taken from the mine, it is washed in rain or river water, to separate it from a kind of yellow earth which adheres to it. It is then pounded, put into a tub filled with water to dissolve it, and afterwards formed into cakes like kao-lin. We are assured that hoa-che, when prepared in this manner, without the mixture of any other earth, is alone sufficient to make porcelain. It serves instead of kao-lin; but it is much dearer. Kao-lin costs only ten-pence Sterling; the price of hoa-che is half-a-crown: this difference, therefore, greatly enhances the value of porcelain made with the latter.

9 The splendor and whiteness of their porcelain derived from oil or varnish.

To pe-tun-tse and kao-lin, the two principal elements, must be added the oil or varnish from which it derives its splendor and whiteness. This oil is of a whitish colour, and is extracted from the same kind of stone which produces the pe-tun-tse, but the whitest is always chosen, and that which has the greenest spots. The oil is obtained from it by the same process used in making the pe-tun-tse: the stone is first washed and pulverized; it is then thrown into water, and after it has been purified it throws up a kind of cream. To 100 pounds of this cream is added one pound of che-kao, a mineral something like alum, which is put into the fire till it becomes red-hot and then pounded. This mineral is a kind of runnet, and gives a consistence to the oil, which is however carefully preserved in its state of fluidity. The oil thus prepared is never employed alone, another oil must be mixed with it, which is extracted from lime and fern ashes, to 100 pounds of which is also added a pound of che-kao. When these two oils are mixed, they must be equally thick; and in order to ascertain this, the workmen dip into each of them some cakes of the pe-tun-tse, and by inspecting their surfaces closely after they are drawn out, thence judge of the thickness of the liquors. With regard to the quantity necessary to be employed, it is usual to mix 10 measures of stone-oil with one measure of the oil made from lime and fern ashes.

10 Their mode of mixing the substances,

The first labour consists in again purifying the pe-tun-tse and the kao-lin. The workmen then proceed to mix these two substances together. For fine porcelain they put an equal quantity of the kao-lin and the pe-tun-tse; for the middling sort they use four parts of the kao-lin and six of the pe-tun-tse. The least quantity put of the former is one part to three of the pe-tun-tse. When this mixture is finished, the mass is thrown into a large pit, well paved and cemented in every part; it is then trod upon, and kneaded until it becomes hard. This labour is so much the more fatiguing, as it must be continued without intermission: were it interrupted, all the other labourers would remain unemployed. From this mass, thus prepared, the workmen detach different pieces, which they spread out upon large slates, where they knead and roll them in every direction, carefully observing to leave no vacuum in them, and to keep them free from the mixture of any extraneous body. A hair or a grain of sand would spoil the whole work. When this paste has not been properly prepared, the porcelain cracks, and melts or becomes warped.

11 And of fashioning the works.

All plain works are fashioned with the wheel. When a cup has undergone this operation, the outside of its bottom is quite round. The workman first gives it the requisite height and diameter, and it comes from his hands almost the moment he has received it. He is under the necessity of using expedition, as he is paid not quite a farthing per board, and each board contains 26 pieces. This cup passes then to a second workman, who forms its base. A little after it is delivered to a third, who applies it to his mould, and gives it a proper form; when he takes it off the mould, he must turn it very softly, and be careful not to press it more on one side than on another; without this precaution it would become warped or disfigured. A fourth workman polishes it with a chissel, especially around the edges, and diminishes its thickness, in order to give it a certain degree of transparency. At length, after having passed through all the hands necessary for giving it all its ornaments, it is received, when dry, by the last workman, who fashions its bottom with a chissel. It is astonishing to see with what dexterity and expedition the workmen convey these vases from one to another. We are assured, that a piece of porcelain, before it is finished, must pass through the hands of 70 persons.

12 Large works executed in parts and cemented.

Large works are executed in parts which are fashioned separately. When all the pieces are finished, and almost dry, they are put together and cemented with paste made of the same substance, and softened with water. Some time after, the seams are polished with a knife, both without and within; and when the vessel is covered with varnish, it entirely conceals them, so that the least trace of them is not to be seen. It is in this manner that spouts, handles, rings, and other parts of the same nature, are added. This is the case, particularly in those pieces which are fashioned upon moulds or modelled with the hands, such as embossed works, grotesque images, idols, figures of trees or animals, and busts, which the Europeans order. All these are formed of four or five pieces joined together, which are afterwards brought to perfection with instruments proper for carving, polishing, and finishing, the different traces which the mould has left imperfect. With regard to those flowers and ornaments which are not in relief, they are either engraven or imprinted with a stamp. Ornaments in relief, prepared separately, are also added to pieces of porcelain, almost in the same manner as lace is put upon a coat.

13 Their manner of painting porcelain;

After a piece of porcelain has been properly fashioned, it then passes into the hands of the painters. These hoa-pei, or painters in porcelain, are equally indigent as the other workmen; they follow no certain plan in their art, nor are they acquainted with any of the rules of drawing; all their knowledge is the effect of practice, assisted by a whimsical imagination. Some of them, however, show no inconsiderable share of taste in painting flowers, animals, and landscapes, on porcelain, as well as upon the paper of fans, and the silk used for filling up the squares of lanterns. The labour of painting, in in the manufactories of which we have spoken, is divided among a great number of hands. The business of one is entirely confined to tracing out the first coloured circle, which ornaments the brims of the vessel; another designs the flowers, and a third paints them; one delineates waters and mountains, and another birds and other animals: human figures are generally the worst executed.

14 And of making it appear covered with veins.

The tsou-you, which is a kind of oil procured from white flint, has the peculiar property of making those pieces of porcelain upon which it is laid appear to be covered with an infinitude of veins in every direction; at a distance one would take them for cracked vases, the fragments of which have not been displaced. The colour communicated by this oil is a white, somewhat inclining to that of ashes. If it be laid upon porcelain, entirely of an azure blue, it will appear in the same manner to be variegated with beautiful veins. This kind of porcelain is called *tsoui-ki*.

15 A singular secret which they have now lost.

The Chinese make vases also ornamented with a kind of fret-work, perforated in such a manner as to resemble very fine lace. In the middle is placed a cup proper for holding any liquid; and this cup makes only one body with the former, which appears like lace wrapped round it. The Chinese workmen had formerly the secret of making a still more singular kind of porcelain: they painted upon the sides of the vessel fishes, insects, and other animals, which could not be perceived until it was filled with water. This secret is in a great measure lost: the following part of the process is, however, preserved. The porcelain, which the workman intends to paint in this manner, must be extremely thin and delicate. When it is dry, the colour is laid on pretty thick, not on the outside, as is generally done, but on the inside. The figures painted upon it, for the most part, are fishes, as being more analogous to the water with which the vessel is filled. When the colour is thoroughly dry, it is coated over with a kind of size, made from porcelain-earth; so that the azure is entirely inclosed between two laminæ of earth. When the size becomes dry, the workman pours some oil into the vessel, and afterwards puts it upon a mould and applies it to the lath. As this piece of porcelain has received its consistence and body within, it is made as thin on the outside as possible, without penetrating to the colour; its exterior surface is then dipped in oil, and when dry it is baked in a common furnace. The art of making these vases requires the most delicate care, and a dexterity which the Chinese perhaps do not at present possess. They have, however, from time to time made several attempts to revive the secret of this magic painting, but their success has been very imperfect. This kind of porcelain is known by the name of *kia-tsing*, "pressed azure."

16 Their mode of baking porcelain.

After the porcelain has received its proper form, its colours, and all the intended ornaments, it is transported from the manufactory to the furnace, which is situated sometimes at the other end of King-te-tching. In a kind of portico, which is erected before it, may be seen heaps of boxes and cases made of earth, for the purpose of inclosing the porcelain. Each piece, however inconsiderable it may be, has its case; and the Chinese workman, by this procedure, imitates nature, which, in order to bring the fruits of the earth to proper maturity, clothes them in a covering, to defend them from the excessive heat of the sun during the day, and from the severity of the cold during the night.

In the bottom of these boxes is put a layer of fine sand, which is covered over with powder of the kao-lin, to prevent the sand from adhering too closely to the bottom of the vessel. The piece of porcelain is then placed upon this bed of sand, and pressed gently down, in order that the sand may take the form of the bottom of the vessel, which does not touch the sides of its case: the case has no cover. A second, prepared in the same manner, and containing its vessel, is fitted into the first, so that it entirely shuts it, without touching the porcelain which is below; and thus the furnace is filled with piles of cases, which defend the pieces they contain from the too direct action of the fire.

With regard to small pieces of porcelain, such as tea-cups, they are inclosed in common cases about four inches in height. Each piece is placed upon a saucer of earth about twice as thick as a crown-piece, and equal in breadth to its bottom. These small bases are also sprinkled over with the dust of the kao-lin. When the cases are large, the porcelain is not placed in the middle, because it would be too far removed from the sides, and consequently from the action of the fire.

These piles of cases are put into the furnace, and placed upon a bed of coarse sand, half a foot in thickness; those which occupy the middle space are at least seven feet high. The two boxes which are at the bottom of each pile remain empty, because the fire acts too feebly upon them, and because they are partly covered by the sand. For the same reason, the case placed at the top of each pile is also suffered to be empty. The piles which contain the finest porcelain are placed in the middle part of the furnace; the coarsest are put at its farther extremity; and those pieces which have the most body and the strongest colouring are near its mouth.

These different piles are placed very closely in the furnace; they support each other mutually by pieces of earth, which bind them at the top, bottom, and middle; but in such a manner that a free passage is left for the flame to insinuate itself everywhere around them.

Before each of these furnaces for baking porcelain there is a long porch, which conveys air, and supplies in certain respects the place of a bellows. It serves for the same purposes as the arch of a glasshouse. "These furnaces (says Father d'Entrecolles), which were formerly only six feet in height and the same in length, are constructed now upon a much larger plan: at present they are two fathoms in height, and almost four in breadth; and the sides and roof are so thick, that one may lay the hand upon them without being incommoded by the heat. The dome or roof is shaped like a funnel, and has a large aperture at the top, through which clouds of flame and smoke incessantly issue. Besides this principal aperture, there are five others smaller, which are covered with broken pots, but in such a manner that the workman can increase or diminish the heat according as it may be found most convenient; through these also he is enabled to discover when the porcelain is sufficiently baked. Having uncovered that hole which is nearest the principal aperture, he takes a pair of pincers, and opens one of the cases: if he observes a bright fire in the furnace, if all the cases be red-

17 Nature of their furnaces.

Porcelain. red-hot, and if the colours of the porcelain appear with full lustre, he judges that it is in a proper state; he then discontinues the fire, and entirely closes up the mouth of the furnace for some time. In the bottom of the furnace there is a deep hearth about two feet in breadth, over which a plank is laid, in order that the workman may enter to arrange the porcelain. When the fire is kindled on this hearth, the mouth of the furnace is immediately closed up, and an aperture is left only sufficient for the admission of faggots about a foot in length, but very narrow. The furnace is first heated for a day and night; after which two men keep continually throwing wood into it, and relieve each other by turns: 180 loads are generally consumed for one baking. As the porcelain is burning hot, the workman employs for the purpose of taking it out long scarfs or pieces of cloth, which are suspended from his neck."

18 Their different classes of porcelain.

The Chinese divide their porcelain into several classes, according to its different degrees of fineness and beauty. The whole of the first is reserved for the emperor. None of these works ever come into the hands of the public, unless they have blemishes or imperfections which render them unworthy of being presented to the sovereign. It is much to be doubted whether any of the largest and finest porcelain of China has ever been brought to Europe; the missionaries at least assure us that none of that kind is sold at Canton. The Chinese set some value upon the Dresden porcelain, and still more upon that which comes from the manufactories of France.

19 Porcelain first examined scientifically by Reaumur

The illustrious Reaumur first attended to the manufacture of porcelain as a science, and communicated his researches in two memoirs before the Academy of Sciences in 1727 and 1729. He did not satisfy himself with considering the external appearance, the painting and gilding, which are only ornaments not essential to the porcelain, but he endeavoured to examine it internally; and having broken pieces of the Japanese, Saxon, and French porcelains, he examined the difference of their grains (which name is given to their internal structure). The grain of the Japanese porcelain appeared to him to be fine, close, compact, moderately smooth, and somewhat shining. The grain of the Saxon porcelain was found to be still more compact, not granulous, smooth, shining like enamel. Lastly, the porcelain of St Cloud had a grain much less close and fine than that of Japan; not, or but little, shining; and resembling the grain of sugar.

20 Different kinds of it.

From these first observations Mr Reaumur perceived that porcelains differed considerably. That he might examine them further, he exposed them to a violent heat. More essential differences than those of the grain appeared upon this trial; for the Japanese porcelain was unalterable by the fire, and all the European were melted.

This essential difference betwixt the Japanese and European porcelains suggested to Mr Reaumur a very ingenious thought, and in many respects true, concerning the nature of porcelain in general. As all porcelains somewhat resemble glass in consistence and transparency, though they are less compact and much less transparent, Mr Reaumur considered them as semivitrifications. But every substance may appear, and may actually be, in a semivitrified state in two ways: for, first, it may be entirely composed of vitrifiable or fusible matters; and in this case, by exposing it to the action of fire, it will be actually melted or vitrified, if the heat be sufficiently strong and long continued. But as this change is not made instantly, especially when the heat is not very violent; and as it passes through different stages or degrees, which may be more easily observed as the heat is better managed: hence, by stopping in proper time the application of heat to porcelain made in this manner, we may obtain it in an intermediate state betwixt those of crude earths and of completely vitrified substances, and also possessed of the semitransparency and of the other sensible qualities of porcelain. We know also, that if such porcelain be exposed to a stronger degree of heat, it will then be completely fused and entirely vitrified. But the European porcelains tried by Mr Reaumur had this fusibility; from which he concluded, that their composition is founded upon the above-mentioned principle.

21 Its true composition discovered by Reaumur,

In the second place, a paste of porcelain may be composed of fusible and vitrifiable matter, mixed with a certain proportion of another matter which is absolutely unfusible in the fires of our furnaces. We may easily perceive, that if such a mixture be exposed to a heat sufficient to melt entirely the vitrifiable ingredient, that this matter will actually melt: but as it is intermixed with another matter which does not melt, and which consequently preserves its consistency and opacity, the whole must form a compound partly opaque and partly transparent, or rather a semitransparent mass; that is, a semivitrified substance or porcelain, but of a kind very different from the former; for as the fusible part of this latter has produced all its effect, and as it has been as much fused as it can be during the baking of the porcelain, the compound may be exposed a second time to a more violent fire, without approaching nearer to a complete vitrification, or without departing from its state of porcelain. But as oriental porcelain has precisely these appearances and properties, Mr Reaumur concludes with reason, that it is composed upon this principle; and he afterwards confirmed his opinion by undeniable facts.

Mr Reaumur examined the pe-tun-tse and kao-lin of the Chinese, and having exposed them separately to a violent fire, he discovered that the pe-tun-tse had fused without addition, and that the kao-lin had given no sign of fusibility. He afterwards mixed these matters, and formed cakes of them, which by baking were converted into porcelain similar to that of China. Mr Reaumur easily found, that the pe-tun-tse of the Chinese was a hard stone of the kind called *vitrifiable*, but much more fusible than any of those which were known in Europe; and that the kao-lin was a talky matter, reduced to a very fine powder. From that time he hoped to make a porcelain of the same kind as the Chinese with materials found in France. Whether he could not find any materials equal to those of China, particularly that material analogous to the pe-tun-tse of the Chinese, or because other occupations prevented the continuance of his researches, we do not know; but we find, from his second memoir upon porcelain, that he afterwards attempted to make an artificial pe-tun-tse, by mixing our vitrifiable stones with salts capable of rendering them fusible, or even by substituting for it glass ready formed, and by adding to these such sub-

stances

Porcelain stances as he thought might be substituted for kao-lin. But he probably found he could not execute these intentions; for he did not resume this subject from the year 1729 to 1739, when he gave a process for converting common glass to a singular kind of porcelain, to which he had given his name, and of which an account is given under CHEMISTRY, n° 591—594. See also the article *Glass-Porcelain*.

22 Who converted glass into a kind of porcelain.

23 He is mistaken in some particulars.

Although Mr Reaumur has surmounted many difficulties, and has given just notions concerning this subject, yet he has been mistaken, or rather misled, in two important points. His first error concerns the Saxon porcelain, which he confounds with the other fusible porcelains made in Europe. Formerly, indeed, a porcelain might be made in Saxony, composed entirely of fusible or vitrifiable materials, the vitrification of which was stopt in proper time, and which Mr Reaumur had examined. But now we are certainly informed, that all of that country is capable of resisting the most violent fires without fusion, as well at least as those of China and Japan. Mr Reaumur might have been misled by the appearance of the internal texture of this porcelain. For when a piece of it is broken, its internal surface does not appear granulous, but compact, uniform, smooth, shining, and much resembling white enamel. But this appearance, so far from showing that Saxon porcelain is a fused or vitrified substance, proves that it is not entirely composed of fusible matters. All who have considered attentively this subject know, that the internal surface of the most fusible porcelains is also the least dense and least compact; the reason of which is, that no vitreous matter can be smooth and dense internally, unless it has been completely fused. But if the density and shining appearance of the internal surface of the Saxon porcelain were only the effects of the fusion of a vitreous matter, how could we conceive that vessels formed of that matter should have sustained the necessary fusion for giving this density and shining appearance, without having entirely lost their shape? The impossibility of this is evident to any persons who have been conversant in these matters and in the fusion of glass.

24 Difference between Saxon and oriental porcelain

This quality of the Saxon porcelain must therefore proceed from another cause. It does indeed contain, as every porcelain does, particularly those of China and Japan, a fusible substance, which has been even completely fused during the baking. Its density also, and its internal lustre, proceed chiefly from this fused matter: but we are also certain, that it contains a large quantity of a substance absolutely unfusible, from which it receives its admirable whiteness, its firmness and solidity, during the baking; in a word, which supplies the place of the oriental kao-lin, and which has the property of contracting its dimensions considerably while it incorporates with the fusible substance. If it be subjected to the most decisive trial, namely, the action of a violent fire, capable of melting every porcelain composed of fusible matters alone, "I affirm (says Mr Macquer), after many experiments, that it cannot be fused, unless by a fire capable also of melting the best Japanese porcelain." The Saxon porcelain is therefore not to be confounded with those which are vitreous and fusible; but is in its kind as excellent as that of Japan, and perhaps superior, as we shall see when we enumerate the qualities which constitute the excellence of porcelain. The subject of Mr Reaumur's second error, or at least that which he has not sufficiently explained, is the kao-lin of China. According to him, this matter is a fine talky powder, from the mixture of which with pe-tun-tse the oriental porcelain is formed. Possibly a very finely ground talky substance mixed with pe-tun-tse might form a porcelain similar to the oriental; but persons acquainted with the manufacture of any porcelain must perceive the impossibility of forming vessels, unless the paste of which they are made be so ductile and tenacious that it may be worked upon a potter's lathe, or at least that it may be moulded. But talks, or any kinds of stones, however finely ground, cannot acquire the requisite tenacity, which clays only, of all known earthy substances, possess. The Chinese porcelain vessels evidently appear to be turned upon the lathe, since they retain the marks of it: hence they must have been formed of a very tenacious paste, and consequently the kao-lin is not a purely talky matter, but is mixed with clay; or else the pe-tun-tse and kao-lin are not, as Mr Reaumur supposes, the only ingredients of which Chinese porcelain is formed, but a sufficient quantity of some binding matter, unknown to Father d'Entrecolles and Mr Reaumur, must be also added.

Chem. Dict.

25 Manufactories of porcelain in different countries.

Although, since Mr Reaumur, no scientific person has written concerning porcelain, many have attempted to make it. Manufactories have been established in almost all the states of Europe. Besides that of Saxony, which has been long established, porcelain is also made at Vienna, at Frankendal, and lately in the neighbourhood of Berlin. All these German porcelains are similar to the Saxon; and are made of materials of the same kind, although they differ somewhat from each other. England and Italy also have their porcelains, the chief of which are those of Chelsea and of Naples. M. de la Condamine, in his last journey into Italy, visited a manufacture of porcelain established at Florence by the marquis de la Ginori, then governor of Leghorn. M. de la Condamine observed particularly the large size of some pieces of this porcelain. He says he saw statues and groups half as large as nature, modelled from some of the finest antiques. The furnaces in which the porcelain was baked were constructed with much art, and lined with bricks made of the porcelain materials. The paste of this porcelain is very beautiful; and from the grain of broken pieces, it appears to have all the qualities of the best Chinese porcelain. A whiter glazing would be desirable, which they might probably attain, if the Marquis Ginori was not determined to use those materials only which were found in that country.

But in no state of Europe have such attempts been made to discover porcelain, or so many manufactories of it been established, as in France. Before even Mr Reaumur had published on this subject, porcelain was made at St Cloud, and in the suburb of St Antoine at Paris, which was of the vitreous and fusible kind, but considerably beautiful. Since that time, considerable manufactories of it have been established at Chantilly, at Villeroi, and at Orleans; the porcelains of which have a distinguished merit. But the porcelain produced in the king's manufacture at Sevres holds at present the first rank from its shining white, its beautiful glazing, and coloured grounds, in which no porcelain has

has ever equalled it. The magnificence of the gilding, the regularity and elegance of its forms, surpass every thing of the kind.

26
M. Guettard's discoveries.

Mr Guettard has published an account of his discoveries on this subject, in the Memoirs of the Academy of Sciences for the year 1765. The kao-lin which he employed was a white argillaceous earth, filled with mica, which he found in the neighbourhood of Alençon; and his pe-tun-tse is a hard, quartzose, grit stone, found abundantly in the same country, with which the streets of Alençon are paved. We also know that Mr Guettard had begun to make his experiments on porcelain with these materials in the year 1751, together with the then Duke of Orleans, to whom he was attached. The Count de Lauraguais, of the Academy of Sciences, engaged in the pursuit of porcelain for several years with uncommon ardour and constancy. He spared no trouble nor expence to attain his purpose, which was to make porcelain equal in all respects to that of China and Japan. He showed some pieces made by him in the year 1766 to the members of the Academy of Sciences. The persons appointed by them to examine it gave their opinion, "that of all the porcelains made in the country, that of the Count de Lauraguais most resembles the porcelain of China and Japan in solidity, grain, and unfusibility." It were to be wished that it possessed equally the other qualities essential to the excellence of porcelain, namely, the whiteness and lustre observable in the ancient Japanese porcelain.

27
In what the perfection of porcelain consists.

We shall now show what those qualities are which constitute the perfection of porcelain. We must first carefully distinguish the qualities which only contribute to the beauty and external appearance, from the intrinsic and essential properties in which the goodness and solidity of porcelain consist. All persons who have made experiments in this way have soon discovered the possibility of making compounds very white, beautifully semi-transparent, and covered with a shining glazing; but which cannot be worked for want of tenacity, are not sufficiently compact, are essentially fusible, are subject to break by sudden application of heat and cold; and, lastly, the glazing of which cracks, becomes rough, and consequently loses its lustre by use, because it is too soft.

On the other side, we shall also find it not difficult to compose very tenacious pastes which shall be capable of being easily worked and well baked; which in the baking shall acquire the desirable hardness and density; which are unfusible, and capable of sustaining very well the sudden change of heat and cold; and, in a word, which shall have all the qualities of the most excellent porcelain excepting whiteness and beauty. We shall soon see that the materials fit for the composition of such porcelains may be found abundantly in every country. The only difficulty, then, in this inquiry concerning porcelain, is to unite beauty and goodness in one composition; and indeed nature seems to be very sparing of materials fit for this purpose, and therefore perfect porcelain will always be a dear and valuable commodity.

28
Stone-ware a kind of porcelain.

Those potteries which we call *stone-ware* are not of modern invention, and have all the essential qualities of the best Japanese. For if we except whiteness, on which alone the semi-transparency depends, and compare all the properties of Japanese porcelain with those of our stone-ware, no difference can be found betwixt them. The same grain appears internally in both; the same sound is produced by striking them when properly suspended; the same density, the same hardness by which they strike fire with steel, the same faculty of sustaining the heat of boiling liquors without breaking, and the same unfusibility in fire, are observable. Lastly, if the earths of which stone-ware is made were free from heterogeneous colouring matters, which prevent their whiteness and semi-transparency; if vessels were carefully formed; if all the proper attentions were given; and if these vessels were covered over with a fine glazing—they would be as perfect porcelain as that of Japan. The most perfect porcelain, therefore, is nothing else than a fine white stone-ware.

Earths of this kind are probably more rare in Europe than in Japan and China. And probably also the want of these earths was the cause that the first makers of porcelain in this country confined themselves to an external imitation, by employing nothing but vitrifiable matters with fusible salts and a small quantity of white earth, from which fusible and vitreous porcelains were composed, which might be called *false porcelains*. But things are much changed since these first attempts. Besides the discoveries of the Count de Lauraguais and of Mr Guettard, genuine white porcelains have been made a long time ago in Germany, especially in Saxony and at Frankendal.

29
Genuine porcelain made in some countries of Europe.

These porcelains are not inferior in any respect to the oriental; they are even much superior in beauty and whiteness to the modern oriental porcelain, which has much degenerated in these respects; they seem even to excel the oriental in the most valuable quality of porcelain, namely, the property of sustaining the sudden change of heat and cold. We cannot judge of the quality of porcelain by a slight trial: for so many circumstances concur to make a piece of porcelain capable or incapable of sustaining the sudden application of heat and of cold, that if at the same time boiling water be poured into two vessels, one of which is good porcelain and the other bad, the former may possibly break and the latter remain entire. The only true method of discovering good porcelain in this respect is, to examine several pieces of it which are daily used; for instance, a set of coffee-cups. But it has been observed, that in many such pieces of oriental porcelain, which have been long and daily used, cracks in the direction of their height may be always perceived, which are never seen in the good European porcelains.

30
Excellency of the ancient Japanese porcelain.

Every one talks of porcelain, and yet few are connoisseurs of it. None can be considered as such but those who have long made it an object of their inquiries. That the ancient Japanese porcelain is the most perfect is a general opinion. This porcelain is indeed very beautiful, and we must also acknowledge that its quality is excellent. It has been our model, and has long been the object of our admiration and emulation; but which we have been never able to equal, and which many persons believe never can be equalled. Some persons even decry the Saxon porcelain for a quality which really gives it a superiority to the Japanese, namely, the greater smoothness, lustre, and less granulous appearance of its internal surface than the oriental. The resemblance of this surface to that of glass has evidently suggested this notion; and it would be well founded if the density

Porcelain. density and lustre of this porcelain proceeded only from a fusible and vitreous quality; but as they do not, and as this porcelain is as fixed and as unfusible as the Japanese, its density, so far from being a fault, is a valuable quality: for we must allow, that of porcelains equal in other respects, those are best which are most firm and compact. Hence the interior substance of the Japanese porcelain is esteemed for its greater density, compactness, and lustre, than our vitreous sand or fritt porcelains; because these qualities indicate greater cohesion, and more intimate incorporation of its parts. For the same reason also the superior density of the Saxon porcelain ought to give it the preference to the Japanese. Besides, nothing would be easier than to give the Saxon porcelain the granulous texture of the Japanese, by mixing with the paste a certain quantity of sand. But the persons who perfected that manufacture were certainly sensible that such a conformity to the Japanese porcelain would lessen the merit of theirs: for we know, that in general porcelains are better in proportion as they contain a larger proportion of clay or earth, and less of sand, flints, or other matters of that kind.

What we have said concerning porcelain in general, and the principal kinds of it, seems sufficient to give just notions of it, if not to persons who without considering the subject are determined to prefer the most ancient, to those, at least, who have made experiments on this subject, or who, having a sufficient knowledge of chemistry, are capable of studying and examining it thoroughly. We shall finish this article by giving a short description of the method of manufacturing porcelain as practised in Europe.

31 Of making fusible or vitreous porcelains.

The basis of the porcelains which we have called *fusible*, *vitreous*, or *false porcelains*, is called by artists a *fritt;* which is nothing else than a mixture of sand or of powdered flints, with salts capable of disposing them to fusion, and of giving them a great whiteness by means of a sufficient heat. This fritt is to be then mixed with as much, and no more, of a white tenacious earth of an argillaceous or marly nature, than is sufficient to make it capable of being worked upon the wheel. The whole mixture is to be well ground together in a mill, and made into a paste, which is to be formed, either upon the wheel or in moulds, into pieces of such forms as are required.

Each of these pieces, when dry, is to be put into a case made of earthen ware (A); which cases are to be ranged in piles one upon another, in a furnace or kiln, which is to be filled with these to the roof. The furnaces are chambers or cavities of various forms and sizes; and are so disposed, that their fire-place is placed on the outside opposite to one or more openings, which communicate within the furnace. The flame of the fuel is drawn within the furnace, the air of which rarefying, determines a current of air from without inwards, as in all furnaces. At first a very little fire is made, that the furnace may be heated gradually, and is to be increased more and more till the porcelain is baked, that is, till it has acquired its proper hardness and transparency; which is known by taking out of the furnace from time to time, and examining, small pieces of porcelain, placed for that purpose in cases which have lateral openings. When these pieces show that the porcelain is sufficiently baked, the first is no longer to be supplied with fuel, the furnace is to be cooled, and the porcelain taken out, which in this state resembles white marble not having a shining surface, which is afterwards to be given by covering them with a vitreous composition called the *glazing*.

32 Porcelain sculptures.

The porcelain when baked and not glazed is called *biscuit*, which is more or less beautiful according to the nature of the porcelain. The manufacture of Sévres excels all others in this respect, and it is therefore the only one which can produce very fine pieces of sculpture; that is, in which all the fineness of the workmanship is preserved, and which are preferable in smoothness and whiteness to the finest marble of Italy.

As no piece of sculpture of this kind can preserve all the delicacy of its workmanship when covered with a glazing, and as sculptors avoid polishing their marble figures, because the lustre of the polish is disadvantageous; therefore, in the manufactures of Sévres, all figures or little statues, and even some ornamental vases, are left in the state of biscuit. The other pieces of porcelain are to be glazed in the following manner.

33 Method of glazing or colouring porcelain.

A glass is first to be composed suited to the nature of the porcelain to which it is to be applied; for every glass is not fit for this purpose. We frequently find that a glass which makes a fine glazing for one porcelain shall make a very bad glazing for another porcelain; shall crack in many places, shall have no lustre, or shall contain bubbles. The glazing, then, must be appropriated to each porcelain, that is, to the hardness and density of the ware, and to the ingredients of its composition, &c.

These glazings are prepared by previously fusing together all the substances of which they consist, so as to form vitreous masses. These masses are to be ground very finely in a mill. This vitreous powder is to be mixed with a sufficient quantity of water, or other proper liquor, so that the mixture shall have the consistence of cream of milk. The pieces of porcelain are to be covered with a thin stratum of this matter; and when very dry, they are to be again put into the furnace in the same manner as before for the forming of the biscuit, and to be continued there till the glazing be well fused. The necessary degree of fire for fusing the glazing is much less than that for baking the paste.

The pieces of porcelain which are intended to remain white are now finished; but those which are to be painted and gilded must undergo further operations. The colours to be applied are the same as those used for enamel painting. They all consist of metallic calces bruised and incorporated with a very fusible glass. Crocus

(A) The cases are called by English potters *seggars*. They are generally formed of coarser clays, but which must be also capable of sustaining the heat required without fusion. By means of these cases the contained porcelain is preserved from the smoke of the burning fuel. The whiteness of the porcelain depends much on their compactness of texture, by which the smoke is excluded, and on the purity of the clay of which they are made.

Porcelain, Porch.

cus of iron furnishes a red colour; gold * precipitated by tin makes the purple and violet; copper calcined by acids and precipitated by an alkali gives a fine green; zaffre makes the blue; earths slightly ferruginous produce a yellow; and, lastly, brown and black colours are produced by calcined iron, together with a deep blue of zaffre. These colours being ground with gum-water, or with oil of spike, are to be employed for the painting of the porcelain with designs of flowers and other figures. For gilding, a powder or calx of gold is to be applied in the same manner as the coloured enamels. The painted and gilded porcelains are to be then exposed to a fire capable of fusing the glass, with which the metallic colours are mixed. Thus the colours are made to adhere, and at the same time acquire a gloss equal to that of the glazing. The gold alone has not then a shining appearance, which must be afterwards given to it by burnishing with a blood-stone.

* See Chemistry, n° 227.

34 Preparation of unfusible porcelain.

The operations for the unfusible porcelains, and also for such as are of the nature of stone-ware, are somewhat more simple. The sands and stones which enter into their composition are to be ground in a mill: the earths or clays are to be washed: the materials are to be well mixed, and formed into a paste: the pieces are first rudely formed upon a potter's wheel; and when dry, or half dry, they are turned again upon the wheel, and their form is made more perfect: they are then placed in the furnace; not to bake them, but only to apply a sufficient heat to give them such a solidity that they may be handled without breaking, and may receive the glazing. As the pieces of porcelain after this slight heat are very dry, they imbibe water readily. This disposition assists the application of the glazing. The vitrifiable or vitrified matter of this glazing, which has been previously ground in a mill, is to be mixed with such a quantity of water, that the liquor shall have the consistence of milk. The pieces of porcelain are hastily dipt in this liquor, the water of which they imbibe, and thus on their surface is left an uniform covering of the glazing materials. This covering, which ought to be very thin, will soon become so dry, that it cannot stick to the fingers when the pieces are handled.

The pieces of this porcelain are then put into the furnace to be perfectly baked. The heat is to be raised to such a height, that all within the furnace shall be white, and the cases shall be undistinguishable from the flame. When, by taking out small pieces, the porcelain is known to be sufficiently baked, the fire is discontinued, and the furnace cooled. If the baking has been well performed, the pieces of porcelain will be found by this single operation to be rendered compact, sonorous, close-grained, moderately glossy, and covered externally with a fine glazing. The painting and gilding of this porcelain are to be executed in a manner similar to that already described.

Porcelain-Shell, a species of Cypræa.

PORCH, in architecture, a kind of vestibule supported by columns; much used at the entrance of the ancient temples, halls, churches, &c.

A porch, in the ancient architecture, was a vestibule, or a disposition of insulated columns usually crowned with a pediment, forming a covert place before the principal door of a temple or court of justice. Such is that before the door of St Paul's, Covent-Garden, the work of Inigo Jones. When a porch had four columns in front, it was called a *tetrastyle*; when six, *hexastyle*; when eight, *octostyle*, &c.

Porch || Porella.

Porch, in Greek στοα, a public portico in Athens adorned with the pictures of Polygnotus and other eminent painters. It was in this portico that Zeno the philosopher taught; and hence his followers were called *Stoics*. See Stoics and Zeno.

PORCUPINE, in zoology. See Hystrix.

Porcupine-Man, the name by which one Edward Lambert, who had a distempered skin, went in London. We have the following account of him in the Philosophical Transactions for 1755, by Mr Henry Baker, F. R. S. "He is now (says he) 40 years of age, and it is 24 years since he was first shown to the society. The skin of this man, except on his head and face, the palms of his hands, and the soles of his feet, is covered with excrescences that resemble an innumerable company of warts, of a brown colour and cylindrical figure; all rising to an equal height, which is about an inch, and growing as close as possible to each other at their basis; but so stiff and elastic as to make a rustling noise when the hand is drawn over them. These excrescences are annually shed, and renewed in some of the autumn or winter months. The new ones, which are of a paler colour, gradually rise up from beneath as the old ones fall off; and at this time it has been found necessary for him to lose a little blood, to prevent a slight sickness which he had been used to suffer before this precaution was taken. He has had the smallpox, and he has been twice salivated, in hopes to get rid of this disagreeable covering; but though just when the pustules of the smallpox had scaled off, and immediately after his salivations, his skin appeared white and smooth, yet the excrescences soon returned by a gradual increase, and his skin became as it was before. His health, during his whole life, has been remarkably good: but there is one particular of this case more extraordinary than all the rest; this man has had six children, and all of them had the same rugged covering as himself, which came on like his own about nine weeks after the birth. Of these children only one is now living, a pretty boy, who was shown with his father. It appears, therefore, as Mr Baker remarks, that a race of people might be propagated by this man, as different from other men as an African is from an Englishman; and that if this should have happened in any former age, and the accidental original have been forgotten, there would be the same objections against their being derived from the same common stock with others: it must therefore be admitted possible, that the differences now subsisting between one part of mankind and another may have been produced by some such accidental cause, long after the earth has been peopled by one common progenitor."

PORE, in anatomy, a little interstice or space between the parts of the skin, serving for perspiration.

PORELLA, in botany; a genus of the natural order of musci, belonging to the cryptogamia class of plants. The antheræ are multilocular, full of natural pores, with an operculum; there is no calyptra, nor pedicle; the capsules contain a powder like those of the other mosses; and their manner of shedding this powder is not by separating into two parts, like those of the selago and lycopodium, but by opening into several holes on all sides.

PORENTRU, is a town of Swifferland, in Elsgaw, and capital of the territory of the bifhop of Bafle. It has a good caftle, where he refides. It has in it, however, nothing elfe worth taking notice of, except the cathedral. The bifhop is a prince of the empire. It is feated on the river Halle, near mount Jura, 22 miles fouth of Bafle. E. Long. 7. 2. N. Lat. 47. 34.

PORISM, in geometry, is a name given by the ancient geometers to two claffes of mathematical propofitions. Euclid gives this name to propofitions which are involved in others which he is profeffedly inveftigating, and which, although not his principal object, are yet obtained along with it, as is expreffed by their name *porifmata*, " acquifitions." Such propofitions are now called *corollaries*. But he gives the fame name, by way of eminence, to a particular clafs of propofitions which he collected in the courfe of his refearches, and felected from among many others on account of their great fubferviency to the bufinefs of geometrical inveftigation in general. Thefe propofitions were fo named by him, either from the way in which he difcovered them, while he was inveftigating fomething elfe, by which means they might be confidered as gains or acquifitions, or from their utility in acquiring farther knowledge as fteps in the inveftigation. In this fenfe they are porifmata; for πορίζω fignifies both to inveftigate and to acquire by inveftigation. Thefe propofitions formed a collection, which was familiarly known to the ancient geometers by the name of Euclid's *porifms*; and Pappus of Alexandria fays, that it was a moft ingenious collection of many things conducive to the analyfis or folution of the moft difficult problems, and which afforded great delight to thofe who were able to underftand and to inveftigate them.

Unfortunately for mathematical fcience, however, this valuable collection is now loft, and it ftill remains a doubtful queftion in what manner the ancients conducted their refearches upon this curious fubject. We have, however, reafon to believe that their method was excellent both in principle and extent, for their analyfis led them to many profound difcoveries, and was reftricted by the fevereft logic. The only account we have of this clafs of geometrical propofitions, is in a fragment of Pappus, in which he attempts a general definition of them as a fet of mathematical propofitions diftinguifhable in kind from all others; but of this diftinction nothing remains, except a criticifm on a definition of them given by fome geometers, and with which he finds fault, as defining them only by an accidental circumftance, " *Porifma eft quod deficit hypothefi a theoremate locali.*"

Pappus then proceeds to give an account of Euclid's porifms; but the enunciations are fo extremely defective, at the fame time that they refer to a figure now loft, that Dr Halley confeffes the fragment in queftion to be beyond his comprehenfion.

The high encomiums given by Pappus to thefe propofitions have excited the curiofity of the greateft geometers of modern times, who have attempted to difcover their nature and manner of inveftigation. M. Fermat, a French mathematician of the laft century, attaching himfelf to the definition which Pappus criticifes, publifhed an introduction (for this is its modeft title) to this fubject, which many others tried to elucidate in vain. At length Dr Simfon of Glafgow, by patient inquiry and fome lucky thoughts, obtained reftoration of the porifms of Euclid, which has all the appearance of being juft. It precifely correfponds to Pappus's defcription of them. All the lemmas which Pappus has given for the better underftanding of Euclid's propofitions are equally applicable to thofe of Dr Simfon, which are found to differ from local theorems precifely as Pappus affirms thofe of Euclid to have done. They require a particular mode of analyfis, and are of immenfe fervice in geometrical inveftigation; on which account they may juftly claim our attention.

While Dr Simfon was employed in this inquiry, he carried on a correfpondence upon the fubject with the late Dr M. Stewart, profeffor of mathematics in the univerfity of Edinburgh; who, befides entering into Dr Simfon's views, and communicating to him many curious porifms, purfued the fame fubject in a new and very different direction. He publifhed the refult of his inquiries in 1746, under the title of General Theorems, not caring to give them any other name, left he might appear to anticipate the labours of his friend and former preceptor. The greater part of the propofitions contained in that work are porifms, but without demonftrations; therefore, whoever wifhes to inveftigate one of the moft curious fubjects in geometry, will there find abundance of materials, and an ample field for difcuffion.

Dr Simfon defines a porifm to be " a propofition, in which it is propofed to demonftrate, that one or more things are given, between which, and every one of innumerable other things not given, but affumed according to a given law, a certain relation defcribed in the propofition is fhown to take place."

This definition is not a little obfcure, but will be plainer if expreffed thus: " A porifm is a propofition affirming the poffibility of finding fuch conditions as will render a certain problem indeterminate, or capable of innumerable folutions." This definition agrees with Pappus's idea of thefe propofitions, fo far at leaft as they can be underftood from the fragment already mentioned; for the propofitions here defined, like thofe which he defcribes, are, ftrictly fpeaking, neither theorems nor problems, but of an intermediate nature between both; for they neither fimply enunciate a truth to be demonftrated, nor propofe a queftion to be refolved, but are affirmations of a truth in which the determination of an unknown quantity is involved. In as far, therefore, as they affert that a certain problem may become indeterminate, they are of the nature of theorems; and, in as far as they feek to difcover the conditions by which that is brought about, they are of the nature of problems.

We fhall endeavour to make our readers underftand this fubject diftinctly, by confidering them in the way in which it is probable they occurred to the ancient geometers in the courfe of their refearches: this will at the fame time fhow the nature of the analyfis peculiar to them, and their great ufe in the folution of problems.

It appears to be certain, that it has been the folution of problems which, in all ftates of the mathematical fciences, has led to the difcovery of geometrical truths: the firft mathematical inquiries, in particular, muft have occurred in the form of queftions, where fomething was given, and fomething required to be done; and by the reafoning

Porism. reasoning necessary to answer these questions, or to discover the relation between the things given and those to be found, many truths were suggested, which came afterwards to be the subject of separate demonstrations.

The number of these was the greater, because the ancient geometers always undertook the solution of problems, with a scrupulous and minute attention, insomuch that they would scarcely suffer any of the collateral truths to escape their observation.

Now, as this cautious manner of proceeding gave an opportunity of laying hold of every collateral truth connected with the main object of inquiry, these geometers soon perceived, that there were many problems which in certain cases would admit of no solution whatever, in consequence of a particular relation taking place among the quantities which were given. Such problems were said to become impossible: and it was soon perceived, that this always happened when one of the conditions of the problem was inconsistent with the rest. Thus, when it was required to divide a line, so that the rectangle contained by its segments might be equal to a given space, it is evident that this was possible only when the given space was less than the square of half the line; for when it was otherwise, the two conditions defining, the one the magnitude of the line, and the other the rectangle of its segments, were inconsistent with each other. Such cases would occur in the solution of the most simple problems; but if they were more complicated, it must have been remarked, that the constructions would sometimes fail, for a reason directly contrary to that just now assigned. Cases would occur, where the lines, which by their intersection were to determine the thing sought, instead of intersecting each other as they did commonly, or of not meeting at all as in the above mentioned case of impossibility, would coincide with one another entirely, and of course leave the problem unresolved. It would appear to geometers upon a little reflection, that since, in the case of determinate problems, the thing required was determined by the intersection of the two lines already mentioned, that is, by the points common to both; so in the case of their coincidence, as all their parts were in common, every one of these points must give a solution, or, in other words, the solutions must be indefinite in number.

Upon inquiry, it would be found that this proceeded from some condition of the problem having been involved in another, so that, in fact, there was but one, which did not leave a sufficient number of independent conditions to limit the problem to a single or to any determinate number of solutions. It would soon be perceived, that these cases formed very curious propositions of an intermediate nature between problems and theorems; and that they admitted of being enunciated in a manner peculiarly elegant and concise. It was to such propositions that the ancients gave the name of *porisms*. This deduction requires to be illustrated by an example: suppose, therefore, that it were required to resolve the following problem.

Plate CCCCXIII. A circle ABC (fig. 1.), a straight line DE, and a point F, being given in position, to find a point G in the straight line DE such, that GF, the line drawn from it to the given point, shall be equal to GB, the line drawn from it touching the given circle.

Suppose G to be found, and GB to be drawn touching the given circle ABC in B, let H be its centre, join HB, and let HD be perpendicular to DE. From D draw DL, touching the circle ABC in L, and join HL; also from the centre G, with the distance GB or GF, describe the circle BKF, meeting HD in the points K and K′. Then HD and DL are given in position and magnitude; and because GB touches the circle ABC, HBG is a right angle; and since G is the centre of the circle BKF, therefore HB touches the circle BKF, and $HB^2 =$ the rectangle $K'HK$; which rectangle $+DK^2 = HD^2$, because $K'K$ is bisected in D, therefore $HL^2+KD^2=DH^2=HL^2$ and $=LD^2$; therefore $DK^2 = DL^2$, and $DK=DL$; and since DL is given in magnitude, DK is also given, and K is a given point: for the same reason K′ is a given point, and the point F being given by hypothesis, the circle BKP is given by position. The point G, the centre of the circle, is therefore given, which was to be found. Hence this construction:

Having drawn HD perpendicular to DE, and DL touching the circle ABC, make DK and DK′ each equal to DL, and find G the centre of the circle described through the points K′FK; that is, let FK be joined and bisected at right angles by MN, which meets DE in G, G will be the point required; that is, if GB be drawn touching the circle ABC, and GF to the given point, GB is equal to GF.

The synthetical demonstration is easily derived from the preceding analysis; but it must be remarked, that in some cases this construction fails. For, first, if F fall anywhere in DH, as at F′, the line MN becomes parallel to DE, and the point G is nowhere to be found; or, in other words, it is at an infinite distance from D.—This is true in general; but if the given point F coincides with K, then MN evidently coincides with DE; so that, agreeable to a remark already made, every point of the line DE may be taken for G, and will satisfy the conditions of the problem; that is to say, GB will be equal to GK, wherever the point G be taken in the line DE: the same is true if F coincide with K. Thus we have an instance of a problem, and that too a very simple one, which, in general, admits but of one solution; but which, in one particular case, when a certain relation takes place among the things given, becomes indefinite, and admits of innumerable solutions. The proposition which results from this case of the problem is a porism, and may be thus enunciated:

"A circle ABC being given by position, and also a straight line DE, which does not cut the circle, a point K may be found, such, that if G be any point whatever in DE, the straight line drawn from G to the point K shall be equal to the straight line drawn from G touching the given circle ABC."

The problem which follows appears to have led to the discovery of many porisms.

A circle ABC (fig. 2.) and two points D, E, in a diameter of it being given, to find a point F in the circumference of the given circle; from which, if straight lines be drawn to the given points E, D, these straight lines shall have to one another the given ratio of α to β, which is supposed to be that of a greater to a less.—Suppose the problem resolved, and that F is found, so that FE has to FD the given ratio of α to β, produce EF towards B, bisect the angle EFD by FL, and DFB by FM: therefore EL : LD :: EF : FD, that is in a given ratio, and since ED is given, each of the segments

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ments EL, LD, is given, and the point L is also given; because DFB is bisected by FM, EM:MD :: EF:FD, that is, in a given ratio, and therefore M is given. Since DFL is half of DFE, and DFM half of DFB, therefore LFM is half of (DFE+DFB), therefore LFM is a right angle; and since the points L, M, are given, the point F is in the circumference of a circle described upon LM as a diameter, and therefore given in position. Now the point F is also in the circumference of the given circle ABC, therefore it is in the intersection of the two given circumferences, and therefore is found. Hence this construction: Divide ED in L, so that EL may be to LD in the given ratio of α to β, and produce ED also to M, so that EM may be to MD in the same given ratio of α to β; bisect LM in N, and from the centre N, with the distance NL, describe the semicircle LFM; and the point F, in which it intersects the circle ABC, is the point required.

The synthetical demonstration is easily derived from the preceding analysis. It must, however, be remarked, that the construction fails when the circle LFM falls either wholly within or wholly without the circle ABC, so that the circumferences do not intersect; and in these cases the problem cannot be solved. It is also obvious that the construction will fail in another case, viz. when the two circumferences LFM, ABC, entirely coincide. In this case, it is farther evident, that every point in the circumference ABC will answer the conditions of the problem, which is therefore capable of numberless solutions, and may, as in the former instances, be converted into a porism. We now inquire, therefore, in what circumstances the point L will coincide with A, and also the point M with C, and of consequence the circumference LFM with ABC. If we suppose that they coincide EA : AD :: α : β :: EC : CD, and EA : EC :: AD : CD, or by conversion EA : AC :: AD : CD—AD :: AD : 2DO, O being the centre of the circle ABC; therefore, also, EA : AO :: AD : DO, and by composition EO : AO :: AO : DO, therefore $EO \times OD = AO^2$. Hence, if the given points E and D (fig. 3.) be so situated, that $EO \times OD = AO^2$, and at the same time $\alpha : \beta$ :: EA : AD :: EC : CD, the problem admits of numberless solutions; and if either of the points D or E be given, the other point, and also the ratio which will render the proble.. indeterminate, may be found. Hence we have this porism:

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"A circle ABC, and also a point D being given, another point E may be found, such that the two lines inflected from these points to any point in the circumference ABC, shall have to each other a given ratio, which ratio is also to be found." Hence also we have an example of the derivation of porisms from one another, for the circle ABC, and the points D and E remaining as before (fig. 3.), if, through D, we draw any line whatever HDB, meeting the circle in B and H; and if the lines EB, EH, be also drawn, these lines will cut off equal circumferences BF, HG. Let FC be drawn, and it is plain from the foregoing analysis, that the angles DFC, CFB, are equal; therefore if OG, OB, be drawn, the angles BOC, COG, are also equal; and consequently the angles DOB, DOG. In the same manner, by joining AB, the angle DBE being bisected by BA, it is evident that the angle AOF is equal to AOH, and therefore the angle FOB to HOG, that is, the arch FB to the arch HG. This proposition appears to have been the last but one in the third book of Euclid's Porisms, and the manner of its enunciation in the porismatic form is obvious.

The preceding proposition also affords an illustration of the remark, that the conditions of a problem are involved in one another in the porismatic or indefinite case; for here several independent conditions are laid down, by the help of which the problem is to be resolved. Two points D and E are given, from which two lines are to be inflected, and a circumference ABC, in which these lines are to meet, as also a ratio which these lines are to have to each other. Now these conditions are all independent on one another, so that any one may be changed without any change whatever in the rest. This is true in general; but yet in one case, viz. when the points are so related to one another that their rectangle under their distances from the centre is equal to the square of the radius of the circle; it follows from the preceding analysis, that the ratio of the inflected lines is no longer a matter of choice, but a necessary consequence of this disposition of the points.

From what has been already said, we may trace the imperfect definition of a porism which Pappus ascribes to the later geometers, viz. that it differs from a local theorem, by wanting the hypothesis assumed in that theorem.—Now, to understand this, it must be observed, that if we take one of the propositions called *loci*, and make the construction of the figure a part of the hypothesis, we get what was called by the ancient geometers a *local theorem*. If, again, in the enunciation of the theorem, that part of the hypothesis which contains the construction be suppressed, the proposition thence arising will be a porism, for it will enunciate a truth, and will require to the full understanding and investigation of that truth, that something should be found, viz. the circumstances in the construction supposed to be omitted.

Thus, when we say, if from two given points E, D, (fig. 3.) two straight lines EF, FD, are inflected to a third point F, so as to be to one another in a given ratio, the point F is in the circumference of a given circle, we have a locus. But when conversely it is said, if a circle ABC, of which the centre is O, be given by position, as also a point E; and if D be taken in the line EO, so that $EO \times OD = AO^2$; and if from E and D the lines EF, DF be inflected to any point of the circumference ABC, the ratio of EF to DF will be given, viz. the same with that of EA to AD, we have a local theorem.

Lastly, when it is said, if a circle ABC be given by position, and also a point E, a point D may be found, such that if EF, FD be inflected from E and D to any point F in the circumference ABC, these lines shall have a given ratio to one another, the proposition becomes a porism, and is the same that has just now been investigated.

Hence it is evident, that the local theorem is changed into a porism, by leaving out what relates to the determination of D, and of the given ratio. But though all propositions formed in this way from the conversion of loci, are porisms, yet all porisms are not formed from the conversion of loci; the first, for instance, of the preceding cannot by conversion be changed into a locus; therefore

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therefore Fermat's idea of porisms, founded upon this circumstance, could not fail to be imperfect.

To confirm the truth of the preceding theory, it may be added, that professor Dr Stewart, in a paper read a considerable time ago before the Philosophical Society of Edinburgh, defines a porism to be "A proposition affirming the possibility of finding one or more conditions of an indeterminate theorem;" where, by an indeterminate theorem, he meant one which expresses a relation between certain quantities that are determinate and certain others that are indeterminate; a definition which evidently agrees with the explanations which have been here given.

If the idea which we have given of these propositions be just, it follows, that they are to be discovered by considering those cases in which the construction of a problem fails, in consequence of the lines which by their intersection, or the points which by their position, were to determine the problem required, happening to coincide with one another. A porism may therefore be deduced from the problem to which it belongs, just as propositions concerning the *maxima* and *minima* of quantities are deduced from the problems of which they form limitations; and such is the most natural and obvious analysis of which this class of propositions admits.

The following porism is the first of Euclid's, and the first also which was restored. It is given here to exemplify the advantage which, in investigations of this kind, may be derived from employing the *law of continuity* in its utmost extent, and pursuing porisms to those extreme cases where the indeterminate magnitudes increase *ad infinitum*.

This porism may be considered as having occurred in the solution of the following problem: Two points A, B, (fig. 4.) and also three straight lines DE, FK, KL, being given in position, together with two points H and M in two of these lines, to inflect from A and B to a point in the third, two lines that shall cut off from KF and KL two segments, adjacent to the given points H and M, having to one another the given ratio of α to β. Now, to find whether a porism be connected with this problem, suppose that there is, and that the following proposition is true. Two points A and B, and two straight lines DE, FK, being given in position, and also a point H in one of them, a line LK may be found, and also a point in it M, both given in position, such that AE and BE inflected from the points A and B to any point whatever of the line DE, shall cut off from the other lines FK and LK segments HG and MN adjacent to the given points H and M, having to one another the given ratio of α to β.

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First, let AE′, BE′, be inflected to the point E′, so that AE′ may be parallel to FK, then shall E′B be parallel to KL, the line to be found; for if it be not parallel to KL, the point of their intersection must be at a finite distance from the point M, and therefore making as β to α; so this distance to a fourth proportional, the distance from H at which AE′ intersects FK, will be equal to that fourth proportional. But AE does not intersect FK, for they are parallel by construction; therefore BE′ cannot intersect KL, which is therefore parallel to BE′, a line given in position. Again, let AE″, BE″, be inflected to E″, so that AE′ may pass through the given point H: then it is plain that BE″ must pass through the point to be found M; for if not, it may be demonstrated just as above, that AE″ does not pass through H, contrary to the supposition. The point to be found is therefore in the line E′B, which is given in position. Now if from E there be drawn EP parallel to AE′, and ES parallel to BE′, BS : SE : : BL : $\mathrm{LN}=\frac{\mathrm{SE}\times\mathrm{BL}}{\mathrm{BS}}$, and AP : PE : : AF : $\mathrm{FG}=\frac{\mathrm{PE}\times\mathrm{AF}}{\mathrm{AP}}$; therefore FG : LN : : $\frac{\mathrm{PE}\times\mathrm{AF}}{\mathrm{AP}}$: $\frac{\mathrm{SE}\times\mathrm{BL}}{\mathrm{BS}}$: : PE×AF ×BS : SE×BL×AP; wherefore the ratio of FG to LN is compounded of the ratios of AF to BL, PE to ES, and BS to AP; but PE : SE : : AE′ : BE′, and BS : AP : : DB : DA for DB : BS : : DE′ : E′E : : DA : AP; therefore the ratio of FG to LN is compounded of the ratios of AF to BL, AE′ to BE′, and DB to DA. In like manner, because E″ is a point in the line DE and AE″, BE″ are inflected to it, the ratio of FH to LM is compounded of the same ratios of AF to BL, AE′ to BE′, and DB to DA; therefore FH : LM : : FG : NL (and consequently) : : HG : MN; but the ratio of HG to MN is given, being the same as that of α to β; the ratio of FH to LM is therefore also given, and FH being given, LM is given in magnitude. Now LM is parallel to BE′, a line given in position; therefore M is in a line QM, parallel to AB, and given in position; therefore the point M, and also the line KLM, drawn through it parallel to BE′, are given in position, which were to be found. Hence this construction: From A draw AE′ parallel to FK, so as to meet DE in E′; join BE′, and take in it BQ, so that $\alpha : \beta$: : HF : BQ, and through Q draw QM parallel to AB. Let HA be drawn, and produced till it meet DE in E″, and draw BE″, meeting QM in M; through M draw KML parallel to BE′, then is KML the line and M the point which were to be found. There are two lines which will answer the conditions of this porism; for if in QB, produced on the other side of B, there be taken $Bq = BQ$, and if $q\,m$ be drawn parallel to AB, cutting MB in m; and if $m\,n$ be drawn parallel to BQ, the part $m\,n$, cut off by EB produced, will be equal to MN, and have to HG the ratio required. It is plain, that whatever be the ratio of α to β, and whatever be the magnitude of FH, if the other things given remain the same, the lines found will be all parallel to BE′. But if the ratio of α to β remain the same likewise, and if only the point H vary, the position of KL will remain the same, and the point M will vary.

Another general remark which may be made on the analysis of porisms is, that it often happens, as in the last example, that the magnitudes required may all, or a part of them, be found by considering the extreme cases; but for the discovery of the relation between them, and the indefinite magnitudes, we must have recourse to the hypothesis of the porism in its most general or indefinite form; and must endeavour so to conduct the reasoning, that the indefinite magnitudes may at length totally disappear, and leave a proposition asserting the relation between determinate magnitudes only.

For this purpose Dr Simson frequently employs two statements of the general hypothesis, which he compares together. As for instance, in his analysis of the last porism,

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rism, he assumes not only E, any point in the line DE, but also another point O, anywhere in the same line, to both of which he supposes lines to be inflected from the points A, B. This double statement, however, cannot be made without rendering the investigation long and complicated; nor is it even necessary, for it may be avoided by having recourse to simpler *porisms*, or to *loci*, or to propositions of the *data*. The following porism is given as an example where this is done with some difficulty, but with considerable advantage both with regard to the simplicity and shortness of the demonstration. It will be proper to premise the following lemma.

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Let AB (fig. 7.) be a straight line, and D, L any two points in it, one of which D is between A and B; let CL be any straight line. $\frac{LB}{CL}\cdot AD^2+\frac{LA}{CL}\cdot BD^2=\frac{LB}{CL}\cdot AL^2+\frac{LA}{CL}\cdot BL^2+\frac{AB}{CL}\cdot DL^2$. Place CL perpendicular to AB, and through the points A, C, B, describe a circle; and let CL meet it again in E, and join AE, BE. Draw DG parallel to CE, meeting AE and BE in H and G. Draw EK parallel to AB. $CL : LB :: (LA : LE ::)\ LA^2 : LA\times LE=\frac{LB}{CL}\cdot LA^2$

$CL : LA :: (LB : LE ::)\ LB^2 : LB\times LE=\frac{LA}{CL}\cdot BL^2$.

Now $CL : LB :: LA : LE :: (EK)\ LD : KH$, and $CL : LA :: LB : LE :: (EK)\ LD : KG$; therefore, (V. 24.) $CL : AB :: (LD : GH ::)\ LD^2 : EK\times GH=\frac{AB}{CL}\cdot LD^2$; therefore $\frac{LB}{CL}\cdot LA^2+\frac{LA}{CL}\cdot L+\frac{AB}{CL}\cdot LD^2=AB\times LE+EK\times GH$. Again, $CL : LA :: (LB : LE :: DB : DG ::)\ DB^2 : DB\times DG=\frac{LA}{CL}\cdot DB^2$, and $CL : LB :: (LA : LE :: DA : DH ::)\ DA^2 : DA\times DH=\frac{LB}{CL}\cdot DA^2$; therefore $\frac{LB}{CL}DA^2+\frac{LA}{CL}DB^2=AD\times DH+DB\times DG=AB\times LE+EK\times GH$; wherefore $\frac{LB}{CL}DA^2+\frac{LA^2}{CL}DB^2=\frac{LB}{CL}LA^2+\frac{LA}{CL}LB^2+\frac{AB}{CL}LD^2$. *Q. E. D.*

Let there be three straight lines AB, AC, CB given in position (fig. 5.); and from any point whatever in one of them, as D, let perpendiculars be drawn to the other two, as DF, DE, a point G may be found, such, that if GD be drawn from it to the point D, the square of that line shall have a given ratio to the sum of the squares of the perpendiculars DF and DE, which ratio is to be found.

Draw AH, BK perpendicular to BC and AC; and in AB take L, so that $AL : LB :: AH^2 : BK^2 :: AC^2 : CB^2$. The point L is therefore given; and if N be taken, so as to have to AL the same ratio that AB^2 has to AH^2, N will be given in magnitude. Also, since $AH^2 : BK^2 :: AL : LB$, and $AH^2 : AB^2 :: AL : N$, *ex equo* $BK^2 : AB^2 :: LB : N$. Draw LO, LM perpendicular to AC, CB; LO, LM are therefore given in magnitude. Now, because $AB^2 : BK^2 :: AD^2 : DF^2$, $N : LB :: AD^2 : DF^2$, and $DF^2=\frac{LB}{N}\cdot AD^2$; and for the same reason $DE^2=\frac{AL}{N}\cdot BD^2$; but, by the preceding lemma, $\frac{LB}{N}\cdot AD^2+\frac{AL}{N}\cdot BD^2=\frac{LB}{N}\cdot AL^2+\frac{AL}{N}\cdot BL^2+\frac{AB}{N}\cdot DL^2$; that is, $DE^2+DF^2=LO^2+LM^2+\frac{AB}{N}\cdot DL^2$. Join LG then by hypothesis LO^2+LM^2, as to LG^2, the same ratio as DF^2+DE^2 has to DG^2; let it be that of R to N, then $LO^2+LM^2=\frac{R}{N}\cdot LG^2$; and therefore $DE^2+DF^2=\frac{R}{N}\cdot LG^2+\frac{AB}{N}\cdot DL^2$; but $DE^2+DF^2=\frac{R}{N}\cdot DG^2$; therefore, $\frac{R}{N}\cdot LG^2+\frac{BA}{N}\cdot DL^2=\frac{R}{N}\cdot DG^2$, and $\frac{AB}{N}\cdot DL^2=\frac{R}{N}(DG^2-LG^2)$; therefore DG^2-LG^2 has to DL^2 a constant ratio, viz. that of AB to R. The angle DLG is therefore a right angle, and the ratio of AB to R that of equality, otherwise LD would be given in magnitude, contrary to the supposition. LG is therefore given in position: and since $R : N :: AB : N :: LO^2+LM^2 : LG^2$; therefore the square of LG, and consequently LG, is given in magnitude. The point G is therefore given, and also the ratio of DE^2+DF^2 to DG^2, which is the same with that of AB to N.

The construction easily follows from the analysis, but it may be rendered more simple; for since $AH^2 : AB^2 :: AL : N$, and $BK^2 : AB^2 :: BL : N$; therefore $AH^2+BK^2 : AB^2 :: AB : N$. Likewise, if AG, BG, be joined, $AB : N :: AH^2 : AG^2$, and $AB : N :: BK^2 : BG^2$; wherefore $AB : N :: AK^2+BK^2 : AG^2+BG^2$ and $AG^2+BG^2=AB^2$; therefore the angle AGB is a right one, and $AL : LG :: LG : LB$. If therefore AB be divided in L, so that $AL : LB :: AH^2 : BK^2$; and if LG, a mean proportional between AL and LB, be placed perpendicular to AB, G will be the point required.

The step in the analysis, by which a second introduction of the general hypothesis is avoided, is that in which the angle GLD is concluded to be a right angle; which follows from DG^2-GL^2, having a given ratio to LD^2, at the same time that LD is of no determinate magnitude. For, if possible, let GLD be obtuse (fig. 6.), and let the perpendicular from G to AB meet it in V, therefore V is given: and since $GD^2-LG^2=LD^2+2DL\times LV$; therefore, by the supposition, $LD^2+2DL\times LV$ must have a given ratio to LD^2; therefore the ratio of LD^2 to $DL\times VL$, that is, of LD to VL, is given, so that VL being given in magnitude, LD is also given. But this is contrary to the supposition; for LD is indefinite by hypothesis, and therefore GLD cannot be obtuse, nor any other than a right angle. The conclusion here drawn immediately from the indetermination of LD would be deduced, according to Dr Simson's method, by assuming another point D' any how, and from the supposition that $GD'^2-GL^2 : LD'^2 :: GD^2-GL^2 : LD^2$, it would easily appear that GLD must be a right angle, and the ratio that of equality.

These porisms facilitate the solution of the general problems from which they are derived. For example, let three straight lines AB, AC, BC (fig. 5.), be given in posi-

position, and also a point R, to find a point D in one of the given lines, so that DE and DF being drawn perpendicular to BC, AC, and DR, joined; DE^2+DF^2 may have to DR^2 a given ratio. It is plain, that having found G, the problem would be nothing more than to find D, such that the ratio of GD^2 to DR^2, and therefore that of GD to DR, might be given, the point D being in the circumference of a given circle, as is well known to geometers.

The same porism also assists in the solution of another problem. For if it were required to find D such that DE^2+DF^2 might be a given space; having found G, DG^2 would have to DE^2+DF^2 a given ratio, and DG would therefore be given; whence the solution is obvious.

The connection of this porism with the impossible case of the problem is evident; the point L being that from which, if perpendiculars be drawn to AC and CB, the sum of their squares is the least possible. For since $DF^2+DE^2 : DG^2 :: LO^2+LM^2 : LG^2$; and since LG is less than DG, LO^2+LM^2 must be less than DF^2+DE^2. It is evident from what has now appeared, that in some instances at least there is a close connection between these propositions and the *maxima* or *minima*, and of consequence the impossible cases of problems. The nature of this connection requires to be farther investigated, and is the more interesting because the transition from the indefinite to the impossible case seems to be made with wonderful rapidity. Thus in the first proposition, though there be not properly speaking an impossible case, but only one where the point to be found goes off *ad infinitum*, it may be remarked, that if the given point F be anywhere out of the line HD (fig. 1.), the problem of drawing GB equal to GF is always possible, and admits of just one solution; but if F be in DH, the problem admits of no solution at all, the point being then at an infinite distance, and therefore impossible to be assigned. There is, however, this exception, that if the given point be at K in this same line, DH is determined by making DK equal to DL. Then every point in the line DE gives a solution, and may be taken for the point G. Here therefore the case of numberless solutions, and of no solution at all, are as it were *conterminal*, and so close to one another, that if the given point be at K the problem is indefinite; but if it remove ever so little from K, remaining at the same time in the line DH, the problem cannot be resolved. This affinity might have been determined *à priori*: for it is, as we have seen, a general principle, that a problem is converted into a porism when one or when two of the conditions of it necessarily involve in them some one of the rest. Suppose, then, that two of the conditions are exactly in that state which determines the third; then while they remain fixed or given, should that third one vary or differ ever so little from the state required by the other two, a contradiction will ensue: therefore if, in the hypothesis of a problem, the conditions be so related to one another as to render it indeterminate, a porism is produced; but if, of the conditions thus related to one another, some one be supposed to vary, while the others continue the same, an absurdity follows, and the problem becomes impossible. Wherever, therefore, any problem admits both of an indeterminate and an impossible case, it is certain, that these cases are nearly related to one another, and that some of the conditions by which they are produced are common to both." It is supposed above, that *two* of the conditions of a problem involve in them a third; and wherever that happens, the conclusion which has been deduced will invariably take place. But a porism may in some cases be so simple as to arise from the mere coincidence of *one* condition with another, though in no case whatever any inconsistency can take place between them. There are, however, comparatively few porisms so simple in their origin, or that arise from problems where the conditions are but little complicated; for it usually happens that a problem which can become indefinite may also become impossible; and if so, the connection already explained never fails to take place.

Plate CCCCXIII

Another species of impossibility may frequently arise from the porismatic case of a problem which will affect in some measure the application of geometry to astronomy, or any of the sciences depending on experiment or observation. For when a problem is to be resolved by help of data furnished by experiment or observation, the first thing to be considered is, whether the data so obtained be sufficient for determining the thing sought; and in this a very erroneous judgment may be formed, if we rest satisfied with a general view of the subject; for tho' the problem may in general be resolved from the data with which we are provided, yet these data may be so related to one another in the case under consideration, that the problem will become indeterminate, and instead of one solution will admit of an indefinite number. This we have already found to be the case in the foregoing propositions. Such cases may not indeed occur in any of the practical applications of geometry; but there is one of the same kind which has actually occurred in astronomy. Sir Isaac Newton, in his *Principia*, has considered a small part of the orbit of a comet as a straight line described with an uniform motion. From this hypothesis, by means of four observations made at proper intervals of time, the determination of the path of the comet is reduced to this geometrical problem: Four straight lines being given in position, it is required to draw a fifth line across them, so as to be cut by them into three parts, having given ratios to one another. Now this problem had been constructed by Dr Wallis and Sir Christopher Wren, and also in three different ways by Sir Isaac himself in different parts of his works; yet none of these geometers observed that there was a particular situation of the lines in which the problem admitted of innumerable solutions: and this happens to be the very case in which the problem is applicable to the determination of the comet's path, as was first discovered by the Abbé Boscovich, who was led to it by finding, that in this way he could never determine the path of a comet with any degree of certainty.

Besides the geometrical there is also an algebraical analysis belonging to porisms; which, however, does not belong to this place, because we give this account of them merely as an article of ancient geometry; and the ancients never employed algebra in their investigations. Mr Playfair, professor of mathematics in the university of Edinburgh, has written a paper on the origin and geometrical investigation of porisms, which is published in the third volume of the Transactions of the Royal Society of Edinburgh, from which this account of the subject

subject is taken. He has there promised a second part to his paper, in which the algebraical investigation of porisms is to be considered. This will no doubt throw considerable light upon the subject, as we may readily judge from that gentleman's known abilities, and from the specimen he has already given us in the first part.

PORK, the flesh of swine killed for the purposes of food. See SUS.

The hog is the only domestic animal that we know of no use to man when alive, and therefore seems properly designed for food. Besides, as loathsome and ugly to every human eye, it is killed without reluctance. The Pythagoreans, whether to preserve health, or on account of compassion, generally forbade the use of animal food; and yet it is alleged that Pythagoras reserved the use of hog's flesh for himself. The Jews, the Egyptians, &c. and other inhabitants of warm countries, and all the Mahometans at present, reject the use of pork. It is difficult to find a satisfactory reason for this, or for the precept given to the Jews respecting it, tho' unquestionably there was some good one for it. The Greeks gave great commendations to this food; and Galen, though indeed that is suspected to be from a particular fondness, is everywhere full of it. The Romans considered it as one of their delicacies; and if some of the inhabitants of the northern climates have taken an aversion to it, that probably arose from the uncultivated state of their country not being able to rear it. Pork is of a very tender structure; increased perhaps from a peculiarity in its œconomy, viz. taking on fat more readily than any other animal. Pork is a white meat even in its adult state, and then gives out a jelly in very great quantity. On account of its little perspirability and tenderness it is very nutritious, and was given for that intention to the *athletæ*. With regard to its alkalescency, no proper experiments have yet been made; but as it is of a gelatinous and succulent nature, it is probably less so than many others. Upon the whole, it appears to be a very valuable nutriment; and the reason is not very obvious why it was in some countries forbid. It is said that this animal is apt to be diseased; but why were not inconveniences felt on that account in Greece? Again, it has been alleged, that as Palestine would not rear these animals, and as the Jews had learned the use of them in Egypt, it was necessary they should have a precept to avoid them. But the Egyptians themselves did not use this meat; and this religious precept, indeed, as well as many others, seems to have been borrowed from them. Possibly, as pork is not very perspirable, it might increase the leprosy, which was said to be epidemic in Palestine; though this is far from being certain.

Cullen's Mat. Med.

PORLOCK, in the county of Somerset in England, is a small sea-port town six miles west from Minehead. This whole parish, including hamlets, contains about 110 houses, and nearly 600 inhabitants. The situation of the town is very romantic, being nearly surrounded on all sides, except toward the sea, by steep and lofty hills, intersected by deep vales and hollow glens. Some of the hills are beautifully wooded, and contain numbers of wild deer. The valleys are very deep and picturesque; the sides being steep, scarred with wild rocks, and patched with woods and forest shrubs. Some of them are well cultivated and studd with villages or single farms and cottages, although agriculture here is very imperfectly understood. Most of the roads and fields are so steep, that no carriages of any kind can be used; all the crops are therefore carried in with crooks on horses, and the manure in wooden pots called *dossels*. Many of the poor are employed in spinning yarn for the Dunster manufactory. W. Long. 3. 32. N. Lat. 51. 14.

PORO. See CALAURIA.

PORPESSE, in ichthyology. See DELPHINUS.

PORPHYRIUS, a famous Platonic philosopher, was born at Tyre in 233, in the reign of Alexander Severus. He was the disciple of Longinus, and became the ornament of his school at Athens; from thence he went to Rome, and attended Plotinus, with whom he lived six years. After Plotinus's death he taught philosophy at Rome with great applause; and became well skilled in polite literature, geography, astronomy, and music. He lived till the end of the third century, and died in the reign of Dioclesian. There are still extant his book on the Categories of Aristotle; a Treatise on Abstinence from Flesh; and several other pieces in Greek. He also composed a large treatise against the Christian religion, which is lost. That work was answered by Methodius bishop of Tyre, and also by Eusebius, Apollinarius, St Augustin, St Jerome, St Cyril, and Theodoret. The emperor Theodosius the Great caused Porphyrius's book to be burned in 338. Those of his works that are still extant were printed at Cambridge in 1655, 8vo, with a Latin version.

"Porphyrius (says Dr Enfield) was, it must be owned, a writer of deep erudition; and had his judgment and integrity been equal to his learning, he would have deserved a distinguished place among the ancients. But neither the splendor of his diction, nor the variety of his reading, can atone for the credulity or the dishonesty which filled the narrative parts of his works with so many extravagant tales, or interest the judicious reader in the abstruse subtelties and mystical flights of his philosophical writings."

PORPHYRY, a genus of stones belonging to the order of saxa. It is found of several different colours, as green, deep-red, purple, black, dark-brown, and grey. Under the name of *porphyry*, Mr Kirwan and M. de Saussure include those stones which contain either felt-spar, schoerl, quartz, or mica, with other species of crystallized stone on a siliceous or calcareous ground. There are a great many different kinds. M. Ferber describes 20 varieties under four species, but in general it is considered with relation to its ground, which is met with of the colours already mentioned. When the ground is of jasper, the porphyry is commonly very hard; the red generally contains felt-spar in small white dots or specks; and frequently, together with these, black spots of schoerl. The green is often magnetic, and is either a jasper or schoerl, with spots of quartz. Sometimes a porphyry of one colour contains a fragment of another of a different colour. Those that have chert for their ground are fusible *per se*. The calcareous porphyry consists of quartz, felt-spar, and mica, in separate grains, united by a calcareous cement; and, lastly, the micaceous porphyry consists of a greenish grey micaceous ground, in which red felt-spar and greenish soap-rock are inserted.

The porphyry of the ancients is a most elegant mass of an extremely firm and compact structure, remarkably heavy, and of a fine strong purple, variegated more or less