CHAPTER III.

PATENTS OF THE SEVENTEENTH AND EIGHTEENTH CENTURIES, WITH CONTEMPORARY SCIENTIFIC NOTICES ON THEM AND THE SUBJECT GENERALLY.

The very fact of patenting inventions, ostensibly to go on gravitating without coming to a stand-still, so long as their materials endure, offers fair presumptive evidence of the unfaltering faith of their designers. And the tone of early scientific journals is by no means decidedly averse to offering encouragement to these workers in the dark. We cannot extend these remarks to recent patentees and journalists;—the former generally deceive both themselves and others, and the latter now repudiate such productions.

The following patents belong to the seventeenth century:—

1630.—David Ramseye [No. 50], esquire, and one of the Groomes of the Privie Chamber. Among other claims to a patent for "his great paines, industry, and chardge" in finding out the same, he names—"To make any sort of mills to goe on standing waters by continuall mocion, without the helpe of winde, waite, or horse." But no description is given or was then required.

1635.—William Barton [No. 79], gentleman, "by his own invention, labour and expense, hath gained the 'skill of making of engines, which being put in order, will cause and maintain their own motions, with continuance and without any borrowed force of man, horse, wind, river, or brooke, whereby many several kinds of excellent rare works may be performed to the great good and benefit of the commonwealth, the like cause and means of which continuance of motion hath not been heretofore brought to perfection.'"

This patent, granted in the reign of Charles I., for the term of 14 years, is in the usual form to secure the right to the patentee and the payment by him of the annual rent of "tenn pounds" into the Exchequer "att the Feast of the Annunciacion of the Blessed Virgin Marie, att Saint Michaell the Archangell," beyond which, and the above title, nothing is known of the invention itself.

1662.—RALPH WAYNE [No. 135], gentleman, "hath, through his great charge, labour, and industry, attained the knowledge of 'an engine which, with the perpetual motion of it selfe, without the help or strength of any person or creature, will not only drain great levels of vast quantities of water, but also mines of fifty fathoms deep or more.'"

This patent, granted in the reign of Charles II., like the former gives only the title, and requires the yearly payment of four pounds per annum, for 14 years.

Here follow patents of the eighteenth century:—

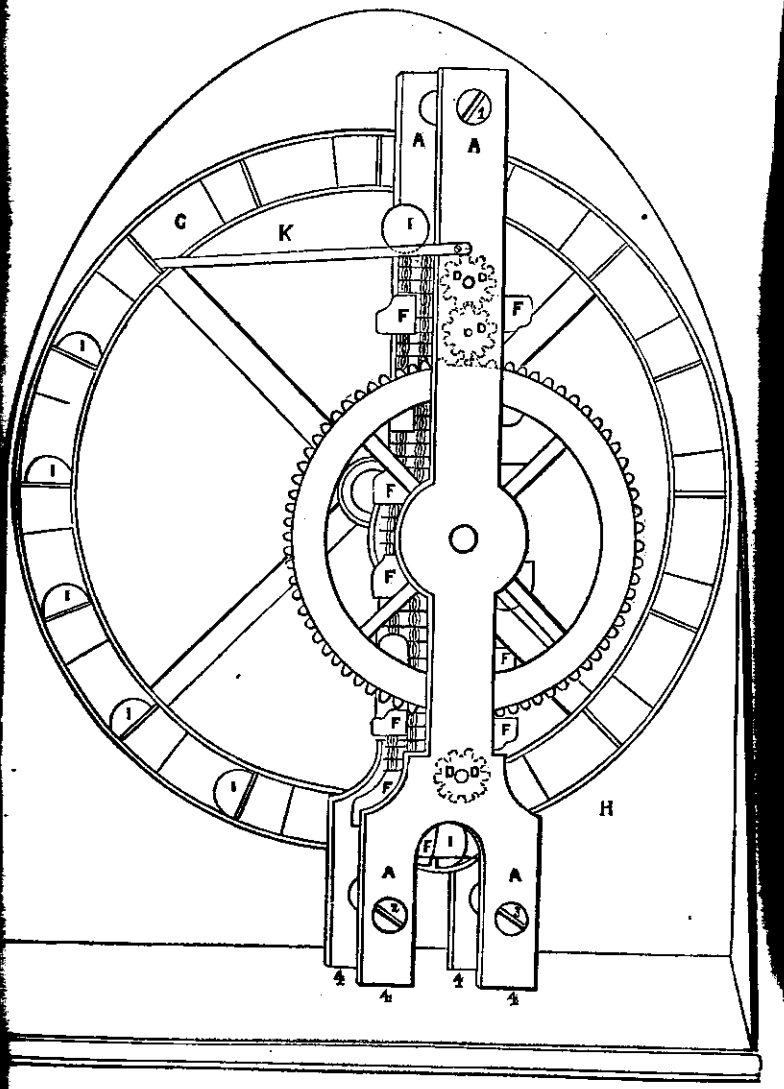
1779.—JOHN DIETRICK MÜLLER [No. 1228], of St. James', Westminster, gentleman. "A machine or engine constructed on self-moving principles." It is "a double wheel, consisting of two frames, fixed on and at right angles to an axis, moving on and supported by two pivots or gudgeons." Each wheel has two or more oval apertures, and boxes and weights made to fit and slide in them, and are to operate on "teeth or trundles," like "a man acting in the wheel of a crane, and thus the powers which are generated in any machine depend upon the exact formation and relative position of these oval holes," &c. &c. &c.

1782.—HILDEBRAND MORLEY [No. 1324], of Clement's Inn, Middlesex, gentleman. "New-invented wheel, engine, or machine, whereby to give or communicate to mills, clocks, timepieces, or other instruments or engines requiring the same properties, a constant and perpetual force and motion."

"My said invented wheel, engine, or machine, whereby

to give or communicate to mills, clocks, timepieces, or other instruments or engines requiring the same properties, a constant and perpetual force and motion, has a framework of wood, iron, or other metal to which the machinery is fixt and supported. It consists of a wheel which is divided on the rim or outward edge into any number of divisions in the manner of a water wheel, so that each division be sufficient to contain a round ball, which balls are made of wood, or hollow balls made of tin, copper, iron, or other metal, or of glass. These balls, as the wheel moves round, fall off on an inclined plane or spout, from whence they acquire sufficient velocity or force to enter through a passage a tall square tube filled either with quicksilver, water, or other fluids, which is there supported by the pressure of the outward air. As soon as those balls enter the aforesaid tube they will rise upwards therein, being lighter than the fluids, and through a certain number of new contrived valves which support the fluids alternately in the tube. When the balls are arrived at the top or broad head of the aforesaid tube, they are conducted to a wheel with a certain number of teeth, on which are placed lifters to lift the balls out of the said fluids. This said wheel is drove by another wheel with the same number of teeth and diameter, to which is joined a pulley, over which passes a cord, chain, catgut, silken thread, or any other line or twist, which, being joined at both ends, is passt over another pulley fixt to the axle of the great wheel, which great wheel, when loaded with the aforesaid balls, turns round the aforesaid two other wheels, by which means the balls are lifted out of and from the fluids, and fall on an inclined plane or spout, which lead to the great wheel. At the lower end of this inclined plane or spout is fixt a small wheel, which is put into motion by spokes fixt on the rim or outward edge of the great wheel, which turns the balls separately on itself to continue the motion."

1786.—Thomas Mead [No. 1543], of Sandwich, Kent, carpenter. "An automaton or machine upon a self-moving principle, which when in motion, will acquire and preserve velocity and force sufficient to work every kind of mill, crane, pump, and all other engines and machines in general, and give motion to any sort of carriage or vessel." This invention con-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... "a square frame of wood boarded close on the under ... square posts of wood fixed into the bottom frame and top ... boarded top and bottom, in which box moves a circular ... board, carrying the flies, wheel work, &c." And a complicated affair it is, to be sure. However, the patentee says, "When this machinery is to be put in motion, the bottom frame, tube, and box, are to be filled with water, mercury, or some other fluid." How it was intended to work is doubtful; that it never did do duty is certain.

1790.—Conradus Schwiers [No. 1745], of Hoxton, Middlesex, Doctor in Divinity. "A machine on a self-moving principle, or perpetual motion."

"Now know ye, that in obedience of the said letters patent, and the proviso therein contained, I, the said Conradus Schwiers, do hereby declare my said new invented self-moving principle, or perpetual motion, is made and performed in manner following, that is to say:—

"Two stiles or uprights marked in the plan (see opposite page) hereunto annexed, A, A, &c., and fastened together by the screws 1, 2, 3, and to the base at 4, 4, 4, 4, between which stiles or uprights run the wheel C, and the pinion D, and the two double pinions D, D, &c., over which double pinions runs the double chain E, E, &c., to which chain are fixed the bucketts F, F, &c. The chain is made with joints on each side and bars running across, equal in number to the cogs of the wheel C. Upon the same axle with the wheel C, on the farther side of the inner stile A, runs the wheel G, whose diameter is full double that of the wheel C; and the pivot of the wheel G runs in the back H as the other pivot of the same axle runs in the front stile A. The wheel G is divided near the periphery into receptacles in number equal to the buckets on the chain, which receptacles are supplied with metal balls I, I, &c. from the buckets F, F, &c. *by means of the gutter K, which balls by* their weight forcing round the wheel G, and thereby lifting up the buckets F, F, &c. on one side as they go down on the other side, discharge themselves again at the gutter L, where they are taken up by the buckets F, F, &c., and discharged again at the gutter K, and are so repeated in a constant succession as often as any receptacle is vacant in the wheel G at

the gutter K for their reception, and by that means the perpetual revolution is obtained, the upper ball being at the same time discharged from one bucket when the lower ball is taken up by another."*

1790.—JOHN HAYWOOD [No. 1750], of Long Acre, Middlesex, draftsman and mechanic. "A machine for working mills and engines without the aid of fire, water, or wind, or in aid of all or any of those or any other powers."

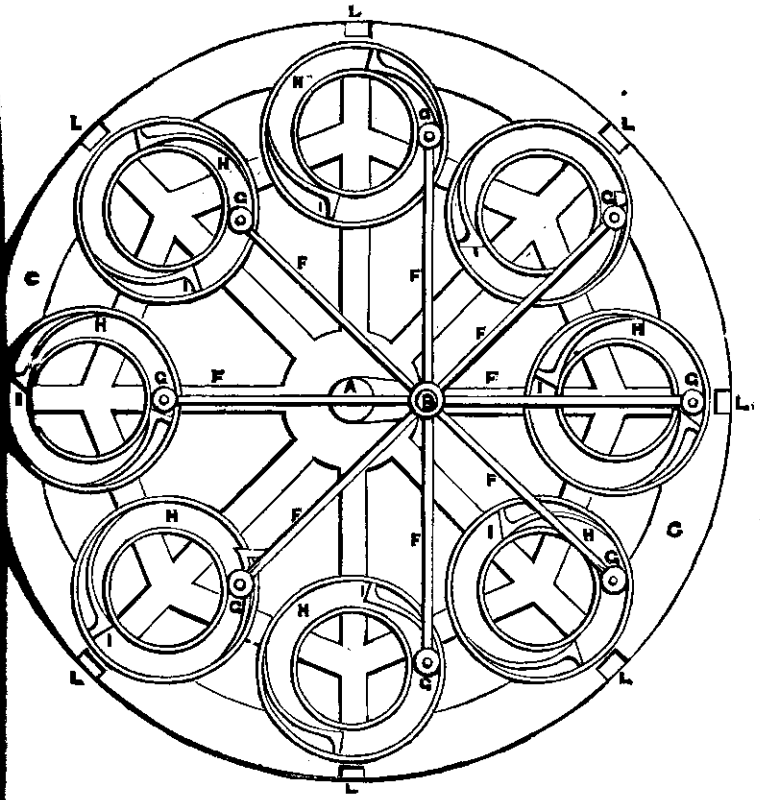
"The machine acts on a rotative principle, or, in other words, has a revolving circular or circulating motion round an axis, center, or centers. It may be made or constructed of any materials or matter whatsoever, so it be of sufficient strength to sustain the power of action when applied to any mill, engine, or machine to which action or motion can or may be communicated by a wheel. The size or dimensions of this machine are by no means confined, but may be varied or altered as circumstances may require.

"References to the drawings of the machine hereunto annexed:—Fig. 1 is the section of the machine. A, A, B, a cranked or double center, fixed to the stand or frame D by the bolts E. C, C, the wheel which turns or revolves round that part of the cranked center mark A. F, levers which turn or revolve round the cranked center B. G, G, rollers or weights which revolve in the circular guides or grooves by means of the leavers F. H, H, circular grooves or guides which are affixed to the inner sides of the wheel. N.B.—The distance from A to B is the radius in all cases to determine the space between the center of the guide or groove H and the center of the roller or weight G. The distance of the two concentric circles which form the guides or grooves H must be equal to the diameter of the roller or weight G. I, I, springs which stop the rollers or weights G from returning when at the horizontal diameter of the wheel. K, weights, which may be increased or diminished at pleasure. L, ledges which connect the sides of the wheel together. N.B.—By fixing cogs or teeth on the rim of the wheel, so as to connect it with any

* Copied from the original specification. The same also occurs in The Repertory of Arts and Manufactures, first series, vol. 7, 8vo., 1797, Art. XXIII., p. 165.

..., machine, or engine to which motion can be given by a ...eel, the power of this machine may be communicated."

(*Fig.* 1.)



1794.—Thomas Mead [No. 1979], of Sculcoates, York, engineer. "Certain methods of exerting, putting, and continuing in motion pneumatic chemical or pneumato-chemical apparatus." This is an arrangement of pipes, cylinders, stop-cocks, and "a hollow fire grate," of which it would be folly

to quote the description; indeed, the patentee himself complacently states—"it was not for any particular apparatus for which the letters patent were granted!"

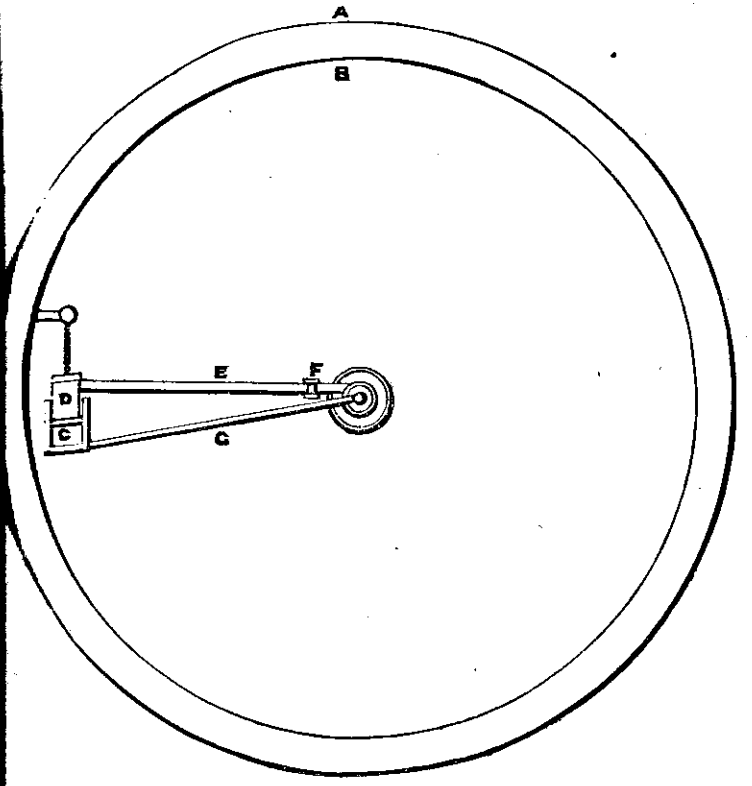
1797.—RICHARD VARLEY [No. 2181], of Damside, Lancashire, merchant. "A new perpetual moving power."

"My invention consists of a method of applying the weight of the atmosphere upon a wheel in any other fluid, and by that means destroying its spring or reaction, the manner of doing which I describe as follows, agreeable to the drawing (Fig. 6) annexed:—

"A is a circular vessel, made of copper or any other substance, capable of containing water, and covered with a top part so as to be perfectly air tight. B is a wheel placed in the inside of the vessel, with its axle perpendicular, the uppermost part of which comes thro' the top of the vessel, and is made to work air-tight; the lower end runs in a step within the vessel, and no part of the wheel is to touch the vessel but its axis. C is a cylinder placed firmly upon the wheel. D is the piston, suspended by a chain to a strong spring fixed on the wheel. This spring is to be made of such strength as that when the whole weight of the atmosphere is upon the piston the air will only move it about one inch down. E is the tube leading from the axle, which is hollow from the top to the level of the wheel, so as to admit the external air by this tube to the piston D, which piston is a circular vessel, made air-tight, and exactly fits the cylinder. There is a joint in the tube E at F, which is made air-tight by leathers, so that when the piston descends the tube may give way to it. G is a small tube leading from the bottom of the cylinder to the center of the axle, and from thence brought out at the end of it, and by which the air is extracted from the cylinder by means of an air pump, and a vacuum formed in it. On the top part, or any other convenient place of the vessel, are fixed two cylinders or tubes, of a proportional size to the cylinders on the wheel, one of which is a condensing cylinder, by means of a screw and piston, and by which the water in the vessel may be compressed; the other has its piston suspended at the bottom, and the top part of the cylinder being filled with air, as the other piston is

screwed down this rises, and condenses the air in the cylinder, the spring of which keeps the water in the vessel pressed to all parts alike; and when the air is extracted from the cylinder

(*Fig.* 6.)



C, and the piston D is forced down by the external atmosphere into the cylinder, this pressure is continued, and the condensed air expands in proportion, and prevents any tendency to a vacuum being formed, which would cause a cohesion of all the parts. By this means the external air is suspended upon the

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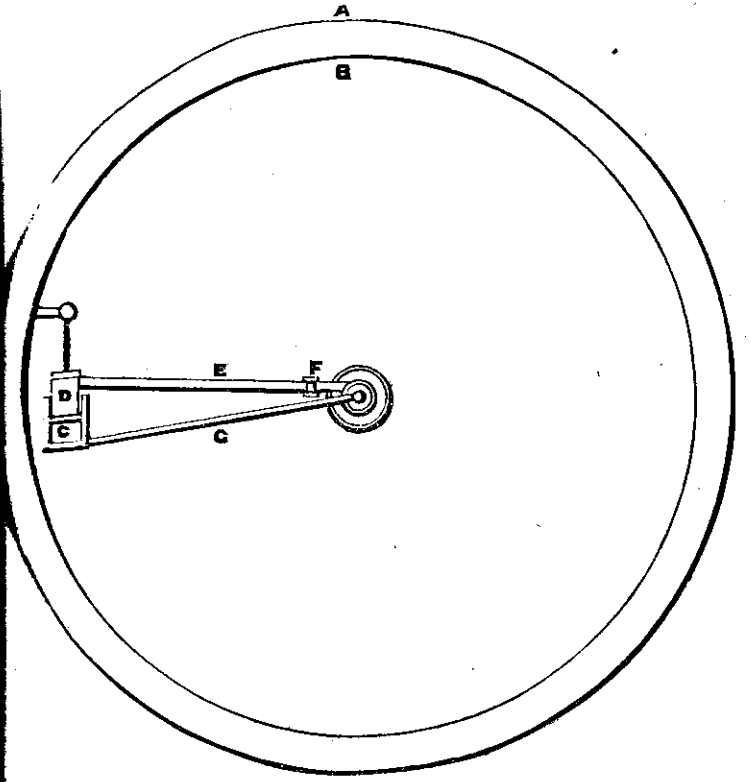
(*Fig.* 6.)



C, and the piston D is forced down by the external atmosphere into the cylinder, this pressure is continued, and the condensed air expands in proportion, and prevents any tendency to a vacuum being formed, which would cause a cohesion of all the parts. By this means the external air is suspended upon the

wheel by the chain, the same as a weight, and the spring of the atmosphere being taken from the cylinder, there is nothing to oppose this weight, there being no spring in water; and this power may be increased in proportion to the size and number of cylinders on the wheel and its diameter."*

The following strictures on Mr. Varley's machine for producing perpetual motion occur in the "Monthly Magazine:"—

On the 23rd May, 1797, letters patent were granted to Mr. Richard Varley, of Damside, Bolton-le-Moor, county of Lancaster, cotton manufacturer, for a machine for producing perpetual motion.

The ignorant and prejudiced part of mankind have in all ages attached a folly to the pursuit of various mysteries of nature and science; such as the ascertaining the longitude at sea, the variation of the magnetic needle, the transmutation of metals, the quadrature of the circle, the adhesion of metallic particles, the repulsion of atmospheric particles, the essential differences between bodies to the exclusion of their attributes, and perpetual motion. The last has been thought, in the general meaning of the term, to be the most chimerical, because all machines are composed of perishable substances.

Mr. Varley's discovery of a new perpetual power appears, however, to promise as much utility as steam, wind, water, or any other force requisite for working mechanical apparatus.

We present our readers beneath with the form of the opened superfices of his apparatus, with this peculiar advantage that it never diminishes its force, while the machine upon which it acts preserves its original form and solidity.

[Here follows a description, as given in foregoing specification.]

Thus, having described the machine, it appears that the principle of the discovery of the new power is effected by "converging the weight of the atmosphere on a wheel in any other fluid, and by that means destroying the repulsive quality, or re-action of the air."

* Copied from the original patent. A copy is published in The Repertory of Arts and Manufactures, 8vo, 1799, vol. 10, first series, p. 9.

The process Mr. Varley pursues in effecting his purpose is as follows:—The copper vessel is filled with water or any other fluid, with the other apparatus in it as before described. It is then closed with the cover, and by means of leather on the edges is made perfectly air-tight. In this condition, with the help of an air-pump, a vacuum is formed in the larger cylinder, over which cylinder is a spring that is acted upon by the condensed air conveyed into the piston through the tube F, and that produces the action of the wheel, because water has no spring.

It is found that upon every square inch of the earth's surface there exists a weight of nearly sixteen pounds of common air, and that a column of mercury, whose elevation will be thirty inches, and its base one cubic inch, will weigh fifteen pounds avoirdupoise, at the rate of eight ounces for every cubic inch of mercury. Since this atmospheric power can be condensed by various means, the formation therefore of the vacuum in the cylinder, and the pressure of the condensed air against it, of course produces the revolution of the wheel, which is the effect sought for.

The cylinders can be increased on the radii, or wheel-spokes, to any weight, as also may the condensed air. Consequently, if a toothed segment or cogged wheel of any description is fitted to it, it will receive the full action of the weight of the atmosphere as its impulsive power, and may be easily applied to any machine in the same manner as if it were acted upon by steam, wind, water, horses, weight, spring, or any description of muscular power necessary to produce motion.*

The following is an editorial Note to Correspondents in "Nicholson's Journal of Philosophy, &c." 4to. 1797. Vol. 1, p. 334:—

I should be glad to give a description and drawing of Mr. Varley's machine for producing perpetual motion, as requested by Mr. Notlem, of Wisbech, if an attentive perusal of the specification enrolled in Chancery had shewn me anything tending to improve the theory or practice of mechanics. The description in the periodical work he mentions is not sufficiently clear to shew the whole of what the writer

* The Monthly Magazine for 1797. Vol. 4 (July No.), p. 58.

meant to explain, and I found the original equally imperfect. Mr. Varley's notion, obscured by some extraneous and unimportant circumstances, appears to be, that if an exhausted cylinder be fixed to one part of the periphery of a wheel, and a piston fitted therein, the pressure of the atmosphere on this last, supposed also to be attached to the wheel by a spring and chain (parallel to a tangent), will tend to drive it into the vacuum, and, if prevented by the shortness of the chain, will draw the wheel round. It is obvious to any person acquainted with statics, that the pressures on his wheel must counterbalance each other, and cannot produce motion.

It has always been easy to shew the fallacy of schemes for perpetual motion in the particular instances; but I have met with no clear enunciation of this project so general as to include every possible scheme, and evince its own absurdity. The difficulty of performing this seems to arise from a want of direct and concise demonstrations of the fundamental principles of the lever, and the equal pressure of fluids in all directions.

Mr. Nicholson, in consequence of Mr. Varley's and Dr. Schwiers' patents, wrote as follows:—

On the Mechanical Projects for affording a Perpetual Motion.

In consequence of the notice* taken of Mr. Varley's attempt to produce a perpetual motion, I have been requested by several correspondents to state how far the mechanical scheme for which Dr. Conrad Shiviers† took out a patent in the year 1790, for the same object, may be worthy of attention. I have, on that occasion, mentioned the difficulties which have prevented any clear general demonstration of the absurdity of this pursuit from being produced, though it has not been difficult to shew the fallacy of the individual plans. It does not, indeed, seem easy to enunciate the scheme itself. What, in universal terms, is the thing proposed to be done? Is it to cause a body to act in such a manner that the re-action shall be greater than the action itself, and by that means generate force by the accumulation of the surplus? Or, can

* Nicholson's Phil. Jour. 4to. Page 334.

† Read—Dr. Schwiers.

the motion communicated be greater than that lost by the agent? Since these positions are evidently contrary to the physical axioms called the laws of nature, and frictions and resistances would speedily destroy all motions of simple uniformity, it may be presumed that S' Gravesande, who thought that all the demonstrations of the absurdity of schemes for perpetual motion contained paralogism, would have stated the proposition under different terms. * But, without entering upon this apparently unprofitable disquisition, it may be useful, as well as entertaining, to make a few observations on the mechanical contrivances which depend on a mistaken deduction from the general theorem respecting the balance, among which that of Dr. Shiviers* must be classed.

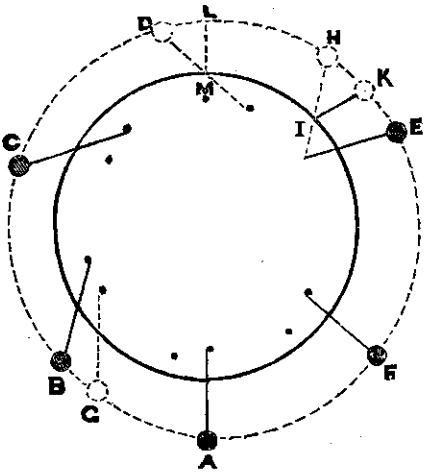
There is no doubt but numerous arrangements have been made, and still are laboured at by various individuals, to produce a machine which shall possess the power of moving itself perpetually, notwithstanding the inevitable loss by friction and resistance of the air. Little, however, of these abortive exertions has been entered upon record. The plans of Bishop Wilkins, the Marquis of Worcester, and M. Orfyreus, are all which at this time occur to my recollection.

There is no doubt but the celebrated Wilkins was a man of learning and ability. His essay towards a real character and a philosophical language is sufficient to render his name immortal. Twenty years before the appearance of that work, he published his "Mathematical Magic," namely, in the year 1648, containing 295 pages, small octavo, which, from the number of copies still in being, I suppose to have been a very popular treatise. It is in this work that I find, among other contrivances for the same purpose, a wheel carrying sixteen loaded arms, similar to that delineated in Fig. 4, plate 15, in which, however, for the sake of simplicity, I have drawn but six. Each lever, A B C D E F, is moveable through an angle of 45°, by a joint near the circumference of the wheel, and the inner end or tail of each is confined by two studs or pins, so that it must either lie in the direction of a radius, or else in the required position of obliquity. If the wheel be now supposed to move in the direction E F, it is evident that the levers A B C D, by hanging in the oblique

* Read—Dr. Schwiers.

position against the antecedent pins, will describe a less circle in their ascent than when, on the other side, they come to descend in the positions E F. Hence, it was expected that the descending weights, having the advantage of a longer lever, would always predominate. Dr. Wilkins, by referring the weights to an horizontal diameter, has shewn that in his machine they will not. A popular notion of this result may also be gathered from the figure, where there are three weights on the ascending, and only two on the descending side; the obliquity of position giving an advantage in point of number, equal to what the other side may possess in

(*Fig.* 4, *pl.* 15.)



intensity. Or, if this contrivance were to be strictly examined, on the supposition that the levers and weights were indefinitely numerous, the question would be determined by shewing that the circular arcs A K, H I, are in equilibrio with the arcs A G, G L.

The simplest method of examining any scheme of this kind with weights, consists in enquiring whether the perpendicular ascents and descents would be performed with equal masses in equal times. If so, there will be no preponder-

ance, and, consequently, no motion. This is clearly the case with the contrivance before us.

The Marquis of Worcester, who will ever be remembered as the inventor of the steam engine, has described a perpetual motion in the fifty-sixth No.* of his "Century of Inventions," published in the year 1655, and since reprinted in 1767 by the Foulis's at Glasgow. His words were as follow :—

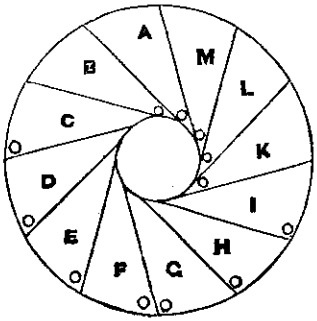
"To provide and make, that all the weights of the descending side of a wheel shall be perpetually further from the centre than those of the mounting side, and yet equal in number and heft to the one side as the other. A most incredible thing if not seen, but tried before the late King (of blessed memory) in the Tower by my directions, two extraordinary ambassadors accompanying his Majesty, and the Duke of Richmond and Duke Hamilton, with most of the Court, attending him. The wheel was fourteen feet over, and forty weights of fifty pounds a-piece. Sir William Balfour, then Lieutenant of the Tower, can justify it with several others. They all saw, that no sooner these great weights passed the diameter line of the lower side, but they hung a foot further from the centre; nor no sooner passed the diameter line of the upper side, but they hung a foot nearer. Be pleased to judge the consequence."

Desaguliers, in his "Course of Experimental Philosophy," vol. 1, page 185, has quoted this passage, and given a sketch of a pretended self-moving wheel, similar to Fig. 5, plate 15, as resembling the contrivance mentioned by the Marquis of Worcester. The description of this last engineer agrees, however, somewhat better with the contrivance Fig. 4. It must, of course, be a mistake in terms, when he says the weight receded from the centre at the lower diameter, and approached towards it at the upper: the contrary being in fact necessary to afford any hope of success; and accordingly in the quotation it is so stated. I am, therefore, disposed to think that Fig. 5 represents the wheel of Orfyreus at Hesse Cassel, much talked of about the year 1720, and which probably was made to revolve, during the time of exhibition, by some concealed apparatus. It consists of a number of cells or partitions, distinguished by the letters of the alphabet, which are made between the interior and exterior surfaces of two concentric

* 1663 is the date of the first printed edition, and 1659 date of the MS.

cylinders. The partitions being placed obliquely with respect to the radius, a cylindrical or spherical weight placed on each,

(*Fig. 5, pl. 15.*)



it is seen from the figure, that these weights will lie against the inner surface of the large cylinder whenever the outer end of the bottom partition of any cell is lowest; and, on the contrary, when that extremity is highest, the weight will rest on the surface of the interior cylinder. Let the wheel be made to revolve in the direction A B C; the weights in C D E F G H I being close to the external circle, and the weights K L M A B close to the inner, for the reasons last mentioned. As the cell B descends, its weight will likewise run out, at the same time that the weight in the cell I will run in, in consequence of its partition being elevated. By the continuation of this process, since all the weights on the descending side pass down at a greater distance from the centre, while those of the ascending side rise for a considerable part of their ascent at a less distance from the same point, it is concluded that the wheel will continue to maintain its motion. On this, however, it is to be remarked, that the perpendicular ascent and descent are alike, both in measure and in time of performance; and that the familiar examination, even to those who know little of such subjects, is sufficient to show that the preponderance is not quite so palpable as at first it appears. For the weights G and F, H and E, I and D are evidently in equilibrio, because at the same horizontal distance from the centre; and if the favourable supposition that

the weight B hath already run out be admitted, it will then remain a question whether these two exterior weights, B and C, can preponderate over the four inner weights, K L M A. The more accurate examination of this particular contrivance will lead to the following theorem:—In two concentric circles, if tangents be drawn at the extreme points of a diameter of the smaller, and continued till they intersect the larger, the common centre of gravity of the arc of the greater circle included between the tangents, and of the half periphery of the smaller circle on the opposite side of the diameter, will be the common centre of the circles. If, therefore, the balls were indefinitely numerous and small, the supposed effective parts of the wheel (Fig. 5) would be in equilibrio, as well as the parts beneath the horizontal tangent of the inner circle.

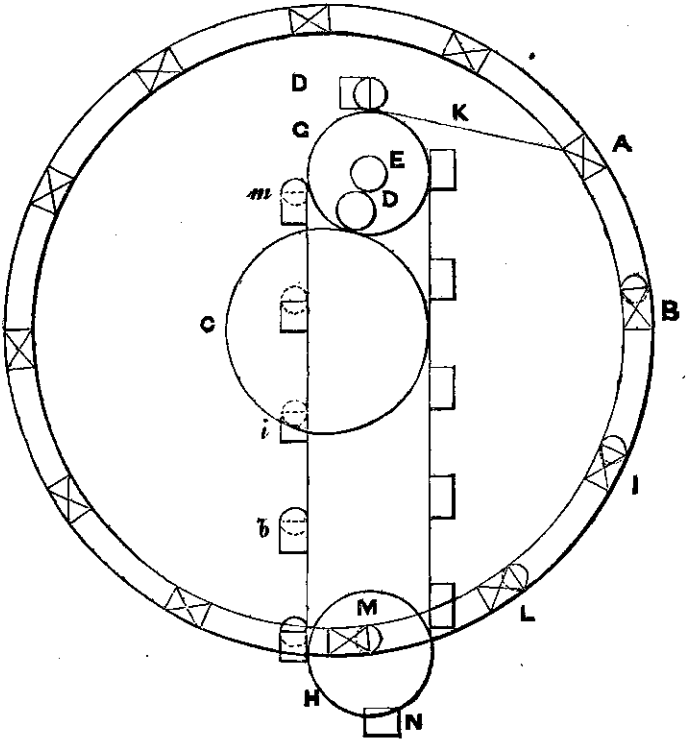
Fig. 6 represents the contrivance of Dr. Shiviers,* which, in a periodical publication, in other particulars respectable, has been said to continue in motion for weeks and even months together. There is not the smallest probability that it should continue in motion for half a minute, or nearly as long as a simple wheel would retain part of its first impulse. The external circle denotes a wheel carrying a number of buckets, A B I L, &c. C represents a toothed wheel, on the same axis, which drives a pinion D; and this last drives another pinion E upon the axis of a lanthorn, or wheel intended to work a chain-pump with the same number of buckets as in the larger wheel A B I. The lanthorn G is made of such a size as to receive the buckets *a b i l* with a due velocity. K represents a gutter, through which a metallic ball, contained in the bucket *m*, may run and lodge itself in the bucket A of the wheel. Each of the buckets of the wheel, B I L M, which are below the gutter, is supplied with a metallic ball, and so likewise are the ascending buckets, *a b i l m*, of the chain-pump. As the pump supplies the wheel, it is again supplied at M, where the balls fall into its ascending buckets. Now, it is presumed that the balls in the wheel, I suppose on account of their distance from the centre of motion, will descend with more than sufficient force to raise those on the chain, and, consequently, that the motion will be perpetual.

The deception in this contrivance has much less seduction than in the two foregoing, because it is more easily referred

* Should be Dr. Schwiers. The patent bears date 1790 [No. 1745].

to the simple lever. This, like the others, exhibits no prospect of success, when tried by the simple consideration of

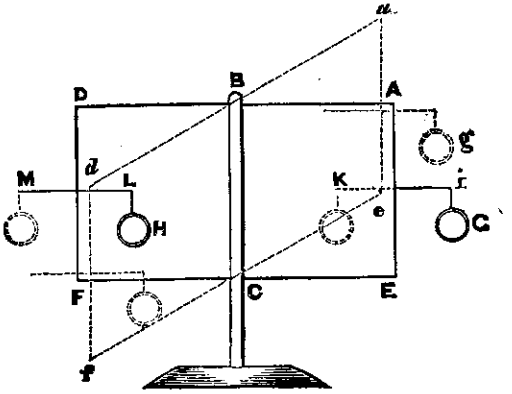
(*Fig. 6, pl. 15.*)



the equality of the ascent and descent in the whole time of the rotation of a single ball. It may also be shewn, from the principles of wheel-work, which are familiar to artisans, that whatever is gained by the excess of the diameter of the great wheel beyond that of the wheel C, is again lost by the excess of the lanthorn A beyond the pinion E.

The fundamental proposition of the simple lever or balance, that equal bodies at an equal distance from the fulcrum will equiponderate, but that at unequal distances the most remote will descend, has in these and numberless other instances led mechanical workmen and speculators to pursue this fruitless enquiry with labour and expense often ill-afforded, and with a degree of anxiety and infatuation which can hardly be conceived by those who have never suffered the pain of hope long deferred. For this reason chiefly, it has appeared desirable and useful to treat the subject in a familiar way, without descending to those expressions of contempt, which ignorance, harmless to all but itself, is surely not entitled to. If such reasoners were well convinced that the power of a machine is to be estimated by the excess of motion referred to the perpendicular, without any regard to the apparent centre of the machine, and that in machines very little compounded it is possible to produce effects directly contrary to the rule which is true of the simple lever, they would probably renounce many flattering projects, grounded only on the supposition of its universality. Desaguliers contrived an apparatus in which two equal weights may be placed at any distance whatever from the centre of motion, and still con-

Compound Balance. (*Fig.* 3, *pl.* 15.)

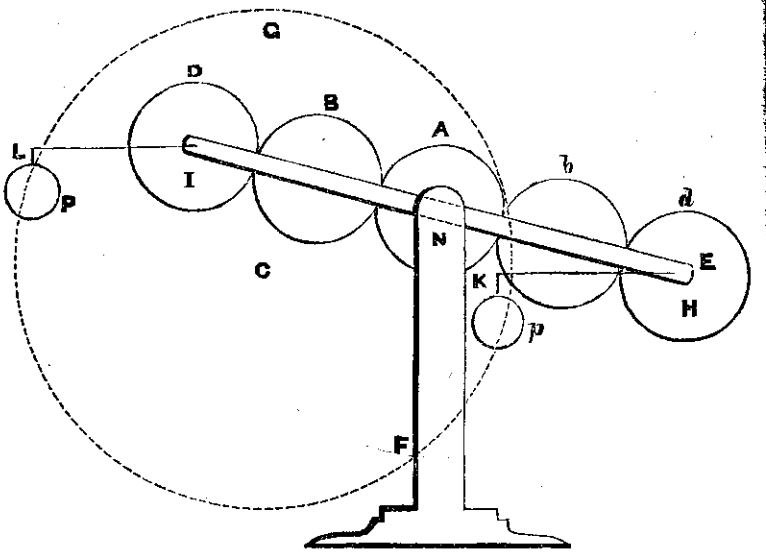


tinue in equilibrio. Fig. 3 represents this instrument. A D denotes a balance with equal arms, and E F another of the

same dimensions. These move on the centres B and C, and are connected by the inflexible rods A E and D F; the motion being left free by means of joints at the corners. Across the rods A D, E F, are fixed two bars, I K, L M. Now, it is unnecessary to shew that the weight G will describe exactly the same line or circular arc, when the levers are moved into the position *a d f e*, or any other position, as it would have described in case it had been suspended at A, or K, or E; and that it is of no consequence in this respect at what part of the line A E or I K it be fixed. The same observations are true of the weight H on the other side. And accordingly it is found that these equal weights may be suspended anywhere on the lines I K and L M without altering their equilibrium.

By this contrivance it is most evidently proved, to those who are totally unacquainted with the theory, that weights do not preponderate in compound engines, on account of their distance from the centre. Several other contrivances may be made to the same effect. The following combination of

(*Fig.* 2, *pl.* 15.)



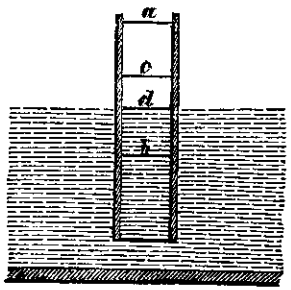
wheel-work presented itself to me as one which would most probably be mistaken for a perpetual motion. (Fig. 2, plate 15.) The five circles represent the same number of wheels, of equal diameter and number of teeth, acting together. The middle wheel A is fixed between two upright pillars, so that it cannot revolve. The other four wheels are pinned in a frame H I, in which they can revolve, and through which the axis of A likewise passes. From the extremity of the axis of D, and also of *d*, proceed the horizontal levers H K and I L, which are equal, and point in the same direction parallel to the plane of the wheels. At the extremity of these arms hang the equal weights P and *p*. Let it now be imagined that the end I of the frame is depressed, the wheel B will turn round by the re-action of the fixed wheel A in the same direction as H I, and it will make one revolution in the same time relative to the frame, or two with regard to absolute space, by reason of its being carried round. The action of B upon D will produce a rotation relative to the frame in the opposite direction during the same time. Instead, therefore, of two revolutions, like the wheel B, this wheel D, with regard to absolute space, will not revolve at all, and in every position of the apparatus the arm I L will continue horizontal, and point the same way. For similar reasons, the arm H K will retain its position. Consequently, it is seen that the descending weight will move at a great horizontal distance from the centre N, while the ascending weight rises very near that centre. But there will not on this account be a perpetual motion: for the action of the levers H K and I L upon the frame H I, by means of the toothed wheels, will in the detail be found precisely alike, and in the general consideration of the motions of P and *p*, the opposite motions in the circle E F G will be accurately the same.

It has always been considered as essential to a perpetual motion, that it should be derived from some energy which is not supposed to vary in its intensity. Such are the inertia, the gravity or magnetism of bodies. For an occasional or periodical variation of intensity in any force is evidently productive of motion, which requires only to be accumulated or applied, and the apparatus for applying it cannot be considered as a machine for perpetual motion. Neither, in strictness, can any machine whose motion is derived from the rotation of the earth, and the consequent change of seasons

and rotation of events, be so considered, because it does not generate, but only communicates. The perpetual flow of rivers; the vicissitudes of the tides; the constant, periodical and variable winds; the expansions and contractions of air, mercury, or other fluids, by daily or other changes of temperature; the differences of expansions in metals, by the same change; the rise and fall of the mercury in the barometer; the hygrometric changes in the remains of organized beings, and every other mutation which continually happens around us, may be applied to give motion to mills, clocks, and other engines, which may be contrived to endure as long as the apparatus retains its figure.*

1801.—***Specification of the Patent granted to Joseph Gaston John Baptiste, Count de Thiville [2472], of Piccadilly, in the County of Middlesex, for "Certain new methods of giving an independent moving power to all machines, by means of hydraulic engines; and also of constructing and employing separately several of their parts, such as wheels, pistons, and apparatus for reducing friction, upon new principles."—Dated February 5,*** 1801.

To all to whom these presents shall come, &c. Now know ye, that in compliance with the said proviso, I, the said Joseph Gaston John Baptiste, Count de Thiville, do hereby declare, that my said invention consists in the application of certain hydrostatical principles not at all or but little known till now, which contrary to the laws of statics in solid bodies, give to incompressible fluids the property of rising almost spontaneously above the place from which they have fallen. Without accounting for the causes, I will confine myself to effects founded on experiments, and give some specimens of these principles, and of the consequences resulting therefrom. Let Fig. 1 be an empty tube, and stopped at bottom or top



(*Fig.* 1, *pl.* 14.)

* A Journal of Natural Philosophy, Chemistry, and the Arts. By William Nicholson. Vol. 1. 4to. 1797. Page 375.

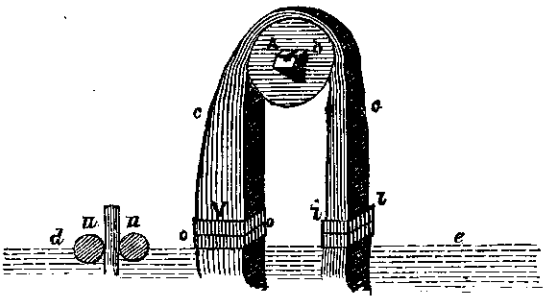
air-tight. If it be immersed into water and suddenly opened, the fluid will rise to *a*, fall to *b*, rise again to *c*, and so on till it fix itself at *d*, which is the level of the fluid.

[He then proceeds to describe Fig. 2 as "a vertical section of a chest fastened in a large reservoir or pond." Four other figures are given to illustrate this plan on the preceding principle of giving motion to machinery. That he had not reduced his plans to practice, appears from the following:—]

At what height, in what quantity, and at what expence of power can the water be raised, are likewise liable to great variations, and can only be ascertained by experiments on large scales, and in open water.

[Some "Observations by the Patentee" are added, on "Friction in Fluids," on "Resistance of Fluids," and]

PERPETUAL MOTION.—Without prejudging anything upon the principles I have introduced in my specification,—which principles I consider as a theorem from which every one may draw the corollaries,—I will confine myself within the limits I have prescribed, and propose the following problem:—



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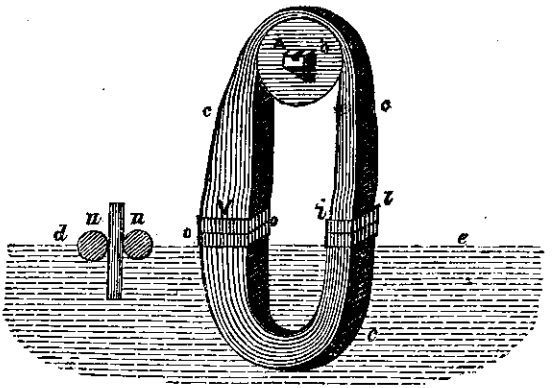

(*Fig.* 13, *pl.* 14.)

Let A (Fig. 13) be a wheel or cylinder turning on its gudgeon *b*; *c c c* is an assemblage of sheets of any material

or stuff; these sheets pass between thin plates or wires fastened in a fixed box, *i i;* at *o o* they pass freely between small cylinders or rollers, turning in another fixed box, V. Instead of being so separated, they may be pressed close to each other by passing between two rollers, *u u*. Thus, the apparatus being so disposed, and the level of the water being as at *d e*, I say the phenomenon of spontaneous ascent of fluids in capillary tubes or spaces, ought to take place between the sheets at *i i;* and it ought not to do so at *o o*, or at *u u*, by their being too close to or distant from each other. That being established, I represent by Y the power acquired by the ascent of the fluid at *i i;* I represent by Z the mechanical resistance occasioned by the rubbing of the sheets against the cylinders at *o o*, or by their pressure at *u u*. Now, I ask how, and at what point, the laws which preside over the phenomena of nature at *i i*, and those which regulate the mechanical effect at *o o* or *u u*, coincide so as to determine a constant ratio between the power and the resistance; and finally, what is the ratio between Y and Z.

It is obvious that if Z is greater than or equal to Y, the machine will remain immovable. If, on the contrary, Y is greater than Z, the machine once put in motion will never stop.*

* The Repertory of Arts and Manufactures. 8vo. 1801. Vol. 14, p. 289.