## CHAPTER VII.

### DEFINITIONS AND DESCRIPTIONS OF PERPETUAL MOTION, FROM ENCYCLOPÆDIAS AND DICTIONARIES.

GREAT similarity in style and matter will be observed in each of these articles, and the paucity of information they generally afford is evidence how little has hitherto been known respecting what had been done and written on the subject. All speak in the most vague and general terms of the amount of attention devoted to its pursuit,—all claim to demonstrate its impossibility, either on the authority of M. de la Hire, or on one or two examples. Well has M. 's Gravesande observed on the insufficiency of arguments against the possibility of a perpetual motion to meet all known, much less all possible, cases. A false argument, or a weak one, is worse than useless, for the opinionated are only thereby confirmed in erroneous theories.

1.—In the edition of Rees' Cyclopædia for 1819, we read :—

**Perpetual Motion**, in mechanics, a motion which is supplied and renewed from itself without any external cause ; or it is an uninterrupted communication of the same degree of motion from one part of matter to another, in a circle or other curve returning into itself, so that the same momentum still returns undiminished upon the first mover.

This celebrated problem of a perpetual motion consists in the inventing of a machine which has the principle of its motion within itself. M. de la Hire has demonstrated the impossibility of any such machine, and finds that it amounts to this, viz., to find a body which is both heavier and lighter at the same time ; or to find a body which is heavier than itself.

To find a perpetual motion, or to construct an engine, &c., which shall have such a motion, is a famous problem that has

employed the mathematicians of two thousand years; though none, perhaps, have prosecuted it with attention and earnestness equal to those of the present age.

Infinite are the schemes, designs, plans, engines, wheels, &c., to which this longed-for perpetual motion has given birth: it were as endless as impertinent to give a detail of them all.

In effect, there seems but little in nature to countenance all this assiduity and expectation: among all the laws of matter and motion, we know of none yet which seems to furnish any principle or foundation for such an effect.

Action and re-action are allowed to be ever equal, and a body which gives any quantity of motion to another always loses just so much of its own; but, under the present state of things, the resistance of the air, the friction of the parts of machines, &c., do necessarily retard every motion.

To keep the motion constant, therefore, either:

First, there must be a supply from some foreign cause, which in a perpetual motion is excluded;

Or, secondly, all resistance from the friction of the parts of matter must be removed, which necessarily implies a change in the nature of things.*

For, by the second law of nature, the changes made in the motions of bodies are always proportional to the impressed moving force, and are produced in the same direction with it; no motion, then, can be communicated to any engine, greater than that of the first force impressed.

But, on our earth, all motion is performed in a resisting medium, and must, therefore, of necessity be retarded; consequently, a considerable quantity of its motion will be spent on the medium.

Nor is there any engine or machine in which all friction can be avoided; there being in nature no such thing as exact smoothness or perfect congruity,—the manner of the cohesion of the parts of bodies, the small proportion the solid matter bears to the vacuities between them, and the nature of those constituent particles, not admitting it. This friction, therefore, will also in time sensibly diminish the impressed or communicated force; so that a perpetual motion

* So far, this is a mere repetition from Diderot and D'Alembert's French Encyclopædia, 1765, folio.

can never follow, unless the communicated force be so much greater than the generating force as to recompense the diminution made therein by all these causes: but *nil dat quod non habet;* and the generating force cannot communicate a greater degree of motion than it hath itself.

Or, thirdly and lastly, there must be some method of gaining a force equivalent to what is lost, by the artful disposition and combination of mechanic powers; to which last point, then, all endeavours are to be directed: but how, or by what means, such force should be gained, is still a mystery.

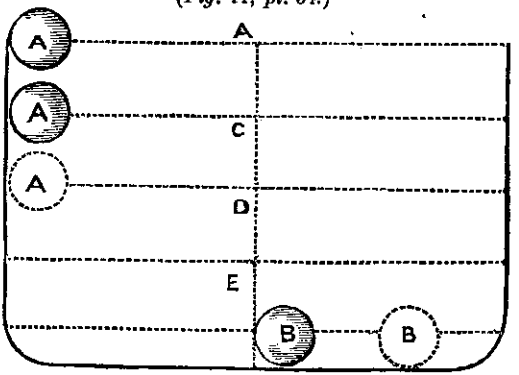
The multiplication of powers or forces, it is certain, avails nought; for what is gained in power is still lost in time, so that the quantity of motion still remains the same. This is an inviolable law of nature, by which nothing is left to art, but the choice of the several combinations that may produce the same effect.

Although it is allowed that, by the resolutions of force, there is a gain or increase of the absolute quantity of force, as the two forces in the sides of the parallelogram taken together exceed the force in the diagonal which is resolved into them, yet you cannot proceed resolving motion *in infinitum* by any machine whatsoever; but those you have resolved must be again compounded, in order to make a continual movement, and the gain obtained by the resolution will be lost again by the composition. In like manner, if you suppose two bodies to be perfectly elastic, and that the lesser body strikes the other at rest, there will be an increase of the absolute quantity of force, because the striking body will be reflected; but if you suppose them both to turn round any centre, after the stroke, so as to meet again, this increase of force will be lost, and their motion will be reduced to its first quantity. Such a gain, therefore, of force, as must be afterwards lost in the actions of the bodies, can never produce a perpetual movement. There are various ways, besides these, by which absolute force may be gained; but since there is always an equal gain in opposite directions, and no increase obtained in the same direction, in the circle of actions necessary to make a perpetual movement this gain must be presently lost, and not serve for the necessary expense of force employed in overcoming friction and the resistance of the medium. We may observe, therefore, that, though it could be shewn that in an infinite number of bodies, or in an

infinite machine, there could be a gain of force for ever, and a motion continued to infinity, it does not follow that a perpetual movement can be made. That which was proposed by M. Leibnitz, in August, 1690, in the "Leipsic Acts," as a consequence of the common estimation of the forces of bodies in motion, is of this kind, and, for this and other reasons, ought to be rejected.

The possibility of a perpetual motion has been urged from the following specious argument:—Let the height A B be

(*Fig.* 11, *pl.* 34.)




divided into four equal parts, A C, C D, D E, E B. Suppose the body A to acquire, by the descent A C, a velocity as 1, and this motion, by any contrivance, to be transmitted to an equal body B; then let the body A, by an equal descent C D, acquire another degree of motion as 1, to be transmitted likewise to the same body B, which in this manner is supposed to acquire a motion as 2, that is sufficient to carry it upwards from B to A; and because there yet remain the motions which A acquires by the descents D E and E B, that may be sufficient to keep an engine in motion, while B and A ascend and descend by turns, it is hence concluded that a sufficient gain of force may be obtained in this manner, so as to produce a perpetual movement. But it should be considered that two equal successive impulses, acting upon the same body, will not produce a motion in it double of that which would be generated by the first impulse; because the

second impulse has necessarily a less effect upon the body which is already in motion than the first impulse which acted upon it while at rest. In like manner, if there is a third and fourth impulse, the third will have less effect than the second, and the fourth less than the third. Hence it appears that a motion as 2, in the preceding case, cannot be produced in B by the two successive impulses transmitted from A, each of which is as 1.—Maclaurin's View, &c., book ii., c. 3. (See Orffyreus's Wheel.)*

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In the same Cyclopædia appears the following account of Orffyreus's celebrated Wheel :—

Orffyreus's Wheel, in mechanics, is a machine so called from its inventor, which he imagined to be a perpetual motion. This machine, according to the account given of it by M.'s Gravesande, in his "Œuvres Philosophiques," published by Allamand, Amst., 1774, consisted of a large circular wheel, or rather drum, twelve feet in diameter and fourteen inches in depth, and very light, as it was formed of an assemblage of deals, the intervals between which were covered with waxed cloth, in order to conceal the interior parts of it. The two extremities of an iron axis, on which it turned, rested on two supports. On giving the wheel a slight impulse in either direction, its motion was gradually accelerated; so that after two or three revolutions it acquired so great a velocity as to make twenty-five or twenty-six turns in a minute. This rapid motion it actually preserved during the space of two months, in the chamber of the Landgrave of Hesse, the door of which was kept locked, and sealed with the Landgrave's own seal. At the end of that time it was stopped, to prevent the wear of the materials. The professor, who had been an eye-witness to these circumstances, examined all the external parts of it, and was convinced that there could not be any communication between it and any neighbouring room. Orffyreus, however, was so incensed, that he broke the machine in pieces, and wrote on the wall, that it was the impertinent curiosity of Professor 's Gravesande which made him take this step. The Prince

* The Cyclopædia; or, Universal Dictionary of Arts, Sciences, and Literature. By Abraham Rees, D.D., F.R.S., &c. Vol. 25. 1819. The first part of this article has incorporated in it that on "Motion, Perpetual," in Hutton's Math. Dict., 4to., 1795.

of Hesse, who had seen the interior parts of this wheel, being asked by 's Gravesande, whether, after it had been in motion some time, there had been any change observable in it, or whether it contained any pieces that indicated fraud or deception, answered both questions in the negative, and declared that the machine was of a very simple construction.*

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2.—In the "Encyclopædia Britannica," we read, under the head "Perpetual Movement," that—

Many have attempted to find a perpetual movement, but without success; and there is reason to think, from the principles of mechanics, that such a movement is impossible; for though in many cases of bodies acting upon one another, there is a gain of absolute motion, yet the gain is always equal in opposite directions, so that the quantity of direct motion is never increased.

To make a perpetual movement, it appears necessary that a certain system of bodies, of a determined number and quantity, should move in a certain space for ever, and in a certain way and manner; and for this there must be a series of actions returning in a circle, otherwise the movement will not be perpetual; so that any action by which the absolute quantity of force is increased, of which there are several sorts, must have its corresponding counter-action, by which the gain is destroyed and the quantity of force restored to its first state.

Thus, by these actions, there will never be any gain of direct force to overcome the friction and resistance of the medium, so that every motion being diminished by these resistances, they must at length languish and cease.†

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3.—In Chambers's "Cyclopædia," 1738, Perpetual Motion, in mechanics, is defined—

A motion which is supplied and renewed from itself, &c., &c., &c. (See Motion.)

Infinite are the schemes, designs, &c., &c., &c. Nor does

* Rees' Cyclopædia, vol. 26, 1819.
This may have been copied from Hutton's Math. Dict., 4to., 1795.

† Encyclopædia Britannica, 18 vols., 4to., 1797.
The above is copied verbatim into the English Encyclopædia, 10 vols., 4to., 1802; art. "Movement, Perpetual."

any of them deserve particular mention, since they have all equally proved abortive. * * * *

In effect, there seems but little in nature to countenance all this assiduity, &c., &c., &c. (See Nature.)

Action and re-action are allowed to be ever equal, &c., &c. (See Resistance.)

Also see Matter and Friction; Communication and Percussion; Medium.

The multiplication of powers or forces, it is certain, avails nought; for what is gained in power is still lost in time, so that the quantity of motion still remains the same.

All mechanics cannot make a little power equal or superior to a larger; and wherever a less power is found in equilibrio with a larger, *v. gr.* 25 pounds with 100, it is a kind of deception of the sense: the equilibrium is not strictly between 100 and 25, but between 100 pounds and 25 moving, or disposed to move, four times as fast as the 100.

To consider the weights, 100 and 25, as fixed and immoveable, the 25 may seem, somehow, raised beyond themselves, which is one of the sham-miracles of mechanics, that has deceived millions, but which is easily dissipated by considering the four degrees of velocity which are to be given to the 25 pounds, and which require a force equal to the excess of 100 above 25 pounds.

A power of 10 pounds moved with ten times the velocity of the 100 pounds, would have equalled them in the like manner, and the same may be said of all the possible products equal to 100. But, in fine, there must still be 100 pounds of power on each side, what way soever they be taken, whether in the matter or the velocity.

This is an inviolable law of nature, by which nothing is left to art, but the choice of the several combinations that may produce the same effect. (See Laws of Nature.)*

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4.—In Stone's "Mathematical Dictionary," we read of Perpetual Motion, that—

By this term ought to be meant an uninterrupted communication of the same degree of motion from one part of

* Cyclopædia; or, an Universal Dictionary of Arts and Sciences. By E. Chambers, F.R.S. 2 vols., folio, 1738. Vol. 2; art. "Motion, Perpetual," and "Machine."

matter to another, in a circle (or such-like curve returning into itself), so that the same quantity of matter shall return perpetually undiminished upon the first mover: and perhaps, if men had rightly understood that this is the true meaning of a perpetual motion, abundance of expence, both of money and reputation, might have been saved by the vain pretenders to this piece of impossible mechanism.

1. When a wheel, or other machine, once set in motion, will, without additional actions on it, continue to move with the same, or a greater, velocity with which it first moved, as long as the matter of which it consists remains the same; such a motion, by mechanics, is called perpetual.

2. But since bodies have not in themselves power to move themselves, and therefore have not power to increase or diminish a motion given them; if they are not acted on by other bodies, they will continue so to move, and with the same velocity: but all revolving bodies suffer friction with those by which they are suspended; and the velocities of those bodies are therefore continually lessen'd by the action of friction. Therefore, a wheel, or other machine, set in motion without additional actions on it, will not continue to move with the same velocity, tho' the matter of which it consists remains the same; but, on the contrary, this velocity will be continually diminished.

3. Moreover, since, by numberless experiments, the most polish'd or burnish'd bodies sliding over one another, lose all the motion which hath been given them, and in a short time; therefore every wheel, or any other such machine, will, in a short time, lose its motion.

4. Hence it appears, that the perpetual motion is not to be expected by a single wheel.

5. And if any contrivance causes one part of a wheel to preponderate another; whatsoever is gained by the descent of that preponderating part will be lost in its ascent; and then the wheel thus loaded, as soon as the friction hath destroyed the motion given it, will for awhile vibrate like other pedulous bodies, and then at last stand still. Consequently, no perpetual motion by wheel-work.*

* A New Mathematical Dictionary. By E. Stone, F.R.S. Second edition, 1 vol., 8vo., 1743.

5.—In a "Dictionary of Mechanical Science," we are informed that—

Perpetual Motion is that which possesses in itself the principle of motion; and consequently, since every body in nature, when in motion, once begun, would be perpetual, but for the operation of some external causes—such are those of friction, resistance, &c.; and since it is also a known principle in mechanics that no absolute power can be gained by any combination of machinery, except there being at the same time an equal gain in an opposite direction; but that, on the contrary, there must necessarily be some lost from the above causes, it follows that a perpetual motion can never take place from any purely mechanical combination; yet this is a problem which has engaged the attention of many ingenious men, from the earliest period to the present time, though it has but seldom been attempted by men of science, since the true laws of mechanics have been so well established.

An idea of a mechanical contrivance to work without intermission, till its parts are destroyed by friction [is given in an engraving of a water-wheel working a pump to supply itself]. It was supposed that the water which had fallen upon the wheel into the reservoir would be raised by means of the pump, fall through the horizontal pipe, and so produce a continued rotatory motion. Experience has, however, proved its inutility. The machine cannot furnish power enough to perpetuate its motion.*

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6.—Another popular Scientific Dictionary states that—

Perpetual Motion is that which possesses within itself the principle of motion, and that of sufficient force to overcome the friction of its parts. In nature there are numerous perpetual motions, such as the revolution of the heavenly bodies, the tides, organic and inorganic changes, vital functions, &c. Artificial or mechanical perpetual motion has never yet been attained, though the subject has occupied the attention of the ingenious for many ages, the nearest approach to it being, perhaps, the dry electrical pile of De Luc.†

* Dictionary of Mechanical Science. 4to., pp. 1066. Fisher and Co. The Preface and Introduction are by "A. J. Wyke House, Middlesex, June, 1827."

† The Dictionary of Arts, Sciences, and Manufactures. By G. Francis, F.L.S. 8vo. 1842.

7.—Perpetual Motion, in Ogilvie's excellent "Imperial Dictionary," is defined as—

That which generates a power of continuing itself for ever or indefinitely, by means of mechanism or some application of the force of gravity, not yet discovered. The celebrated problem of a perpetual motion consists in the inventing of a machine which shall have the principle of its motion within itself, and numberless schemes have been proposed for its solution; but unless friction and the resistance of the air, which necessarily retard, and finally stop, the motions of machines, could be removed, a perpetual motion must be impossible from any pure mechanical combination. The problem, when strictly investigated, amounts to this—namely, to find a body which is both heavier and lighter at the same time, or to find a body which is heavier than itself. In speaking of the perpetual motion, it is to be understood that from among the forces by which motion may be produced we are to exclude not only air and water, but other agents—as heat, atmospheric changes, &c. The only admissible agents are the inertia of matter and its attractive forces, which may all be considered of the same kind as gravitation. The planets in their orbits, and in their rotations on their axes, furnish instances of perpetual motion.*

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8.—In the "Dictionary of Science and Literature," by Professor Brande and Dr. Cauvin, appears the following:—

Perpetual Motion, in mechanics, a machine which, when set in motion, would continue to move for ever, or at least until destroyed by the friction of the parts, without the aid of any exterior cause. The discovery of the perpetual motion has always been a celebrated problem in mechanics, on which many ingenious, though in general ill-instructed, persons have consumed their time; but all the labour bestowed on it has proved abortive. In fact, its impossibility has been so fully demonstrated from the known laws of matter, that it is rather an insult than a praise to say of any one that he has occupied himself with the research. Nevertheless,

* The Imperial Dictionary, English, Technological, and Scientific. Edited by John Ogilvie, LL.D. Glasgow, 1854. Royal 8vo.

the pursuit of the chimera has been the cause of many useful inventions.

In speaking of the perpetual motion, it is to be understood that from among the forces by which motion may be produced we are to exclude not only air and water, but other natural agents—as heat, atmospheric changes, &c. The only admissible agents are the inertia of matter and its attractive forces, which may all be considered of the same kind as gravitation.

It is an admitted principle in philosophy, that action and re-action are equal; that when motion is communicated from one body to another, the first loses just as much as is gained by the second. But every moving body is continually retarded by two passive forces, the resistance of the air and friction. In order, therefore, that motion may be continual without diminution, one of two things is necessary,—either that it be maintained by an extra force (in which case it would cease to be what we understand by a perpetual motion); or that the resistance of the air and friction be annihilated, which is physically impossible. The motion cannot be perpetuated till these retarding forces are compensated, and they can only be compensated by an exterior force; for the force communicated to any body cannot be greater that the generating force, and this is only sufficient to continue the same quality of motion when there is no resistance. To find the perpetual motion is, therefore, a proposition equivalent to this,—to find a force (either an attractive force like that of gravitation or magnetism, or an elastic force, that of a spring, for example) greater than itself.

But it may be argued that by some arrangement or combination of mechanical powers a force may be gained equal to that which is lost in overcoming friction and atmospheric resistance. This notion at first mention appears plausible, and is, in fact, that by which most speculators have been led astray. It is, however, entirely erroneous; for by no multiplication of forces or powers by mechanical agents, can the quantity of motion be increased. Whatever is gained in power is lost in time; the quantity of motion transmitted by the machine remains unaltered.*

* The entire of the foregoing, ending at this paragraph, appears also in Appleton's Dictionary of Machines, Mechanics, Engine Work, and Engineering. New York, 1858. 2 vols., royal 8vo.

Although the perpetual motion has been demonstrated again and again to be impossible on any known principle of mechanics, projectors have not thereby been deterred from the pursuit. In 1775, the Academy of Sciences at Paris resolved not to consider or admit into their Memoirs any future proposal for the discovery of the perpetual motion; yet such appears to be the seductive nature of the subject that innumerable schemes, designs, and projects for accomplishing it have since been, and even to the present time continue to be, put forward; and there are very recent instances of men of no common attainments and reputation, and well versed, moreover, in the principles of mechanical science, who have been deceived by the ingenious frauds of charlatans and impostors into a belief of its actual discovery. Montucla, "Hist. des Math.," tome iii., p. 813; "Repertory of Arts,"* vols. vii. and xiv.; "London Journal of Arts,"† May, 1827; Airy, "Trans. of the Cambridge Phil. Soc.," vol. iii., part 2;‡ Poppe, "Wunder der Mechanik," 1832; and various papers in the earlier volumes of the "Mémoires de l'Académie des Sciences," and the "Philosophical Transactions.") §

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9.—The American Encyclopædia defines Perpetual Motion as—

A motion which is supplied and renewed from itself, without the intervention of external causes. The problem of a perpetual motion consists in the inventing of a machine which has the principle of its motion within itself; and numberless schemes have been proposed for its solution. The difficulty is, that the resistance of the air, the friction of the parts of the machine, &c., necessarily retard, and finally stop, the motions of machines, and therefore seem to render perpetual

* The "Repertory," vol. 7, refers to the Patent of Conradus Shiviers, 1790 (but should be Schwiers—see his Patent, Chapter III.), and vol. 14 to Motion from the Rising and Falling of the Tide.

† The article in the "London Journal," very flippantly written, affects to criticise the Patent of Sir William Congreve, 1827. (See Chapter XI.)

‡ Airy's paper relates to the Pendulum, and in no way to Perpetual Motion.

§ A Dictionary of Science, Literature, and Art. By W. T. Brande, F.R.S., &c., and Joseph Cauvin, M.D., &c. London, 1852. 8vo.

motion an impossibility. Attempts have recently been made to produce a *perpetuum mobile* by means of galvanism: a metallic bar being placed between two dry galvanic columns, is alternately attracted by each column.*

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10.—The following is a translation of an article from a French Encyclopædia of 1765, printed in Switzerland, and has been embodied in most of our modern Encyclopædias:—

Perpetual Motion is a movement which is maintained and renewed from itself, without any external cause. Or it is an uninterrupted communication of the same degree of motion which passes from one part of matter to another. In order to find perpetual motion, a machine must be constructed having such a movement. This has been the famous problem which has exercised the minds of mathematicians for 2,000 years.

We have an infinite number of designs, figures, plans, machines, and wheels, &c., which are the fruits of the efforts made to resolve this problem. It would be useless here to give the details of any of these projects, which are scarce worth mentioning, for they have all failed. It is now more an insult than praise to say of any one that they are searching for perpetual motion. The inutility of the efforts that have been made to find it, gives a very unfavourable idea of those who occupy themselves in this research. Indeed, it appears that we dare scarcely hope to find it. Amongst the properties of matter and motion, we know of none that has the principle of such an effect.

It is agreed that the action and re-action must be equal, that one body that gives motion to another body must lose as much motion as it communicates. The resistance of the air and friction must necessarily retard that motion: thus, in order that motion may continue always, it will be necessary that it should be supplied from an exterior cause,—this would then no longer be what is required as perpetual motion; or that all resistance should be annihilated,—which is physically impossible.†

* Encyclopædia Americana, vol. 10. Philadelphia, 1854.

† Encyclopédie, ou Dictionnaire raisonné des Sciences, des Arts, et des Métiers. Par Diderot et D'Alembert. Neufchastel, 1765. Folio.

[The article concludes, referring to "Matiére et Frottemen." And under the word "Mouvement," perpetual motion is treated as "Le célébre problème;" and allusion is made to M. de la Hire's estimate of its impossibility, as it requires to find a body at the same time light and heavy; or, a body which will outweigh itself.]

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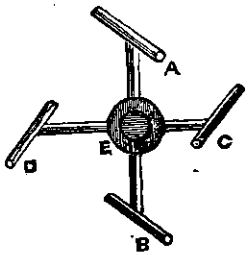
11.—In the "Encyclopédie Méthodique" will be found two articles—one, "L'Examen du Mouvement Perpétuel," which, with the [illegible] is extracted from Montucla's "Mathematical [illegible]," the second, by M. Decremps, of which we now offer an abridged translation, is as follows:—

Perpetual Motion, as proved, is but a step of the ladder of ambition to the mechanic. We will give, by way of recreation or amusement, an idea of a perpetuated movement, produced by magnetic attraction.

Mr. Wilson shows in his cabinet, at York, a compass arranged on a pivot, in the midst of a circle of iron hooks, constantly turning round by the influence of the magnetised iron hooks, each attracting the needle in its turn. It was considered a trick, really effected by concealed clockwork.

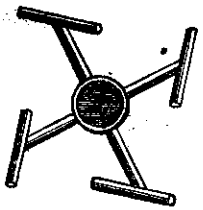
Mr. Wilson showed another experiment, consisting of two cross[illegible] of wood on a pivot, placed vertically, each having at its [illegible] inclined cases, or sheaths, containing balls of lead (see Fig. 4, plate 4). He says it is as simple as ingenious: it is attached by string. The balls A and B are in equilibrium, because they [illegible] at an equal distance from the [illegible] line passing through the ce[illegible] by the construction of the [illegible] ball D, being, on the co[illegible] ther from the centre than [illegible] C, ought to overweigh th[illegible] and overcome the equili[illegible] and to the point B, and cause the machine to make a q[illegible] turn, and so on until worn out.

(*Fig.* 4.)



To prove the falsity of the experiment, we see that the Ball D (Fig. 5), being farther from the centre than the ball C, tends to carry it round; but the ball B, which at the same moment is farther from the centre than the ball A, tends to reverse the motion. These opposite efforts must then stop the machine. Mr. Wilson admitted this statement, and said the arms were magnetised, and the stand contained a hidden magnet, and was so artfully contrived as to be capable of easily deceiving.*

(*Fig.* 5.)



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12.—The following is from Zedler's "Great Universal Lexicon of all Knowledge and Art," Leipsic and Halle, 1741:—

Perpetual Motion, in mechanics, is the name given to the extraordinary movement of a machine possessing within itself its own power of motion, and so it would deserve to be called if it would last as long as the materials used in its construction. But, as a necessary consequence, it must act independent of outward power, and possess within itself the power of movement. Many persons have, from ancient times to the present day, sought to obtain this object, with great trouble and at much expence. Gaspar Schottus has described many rare examples in his "Technica Curiosa," lib. x., P. i., p. 732. But there is a larger collection of these examples by Francisco Tertio de Lanis, in his "Magisterio Naturæ et Artis," tom. i., lib. viii., c. 2 and 3; also L. C. Sturm, in "Mathesi," P. ii., p. 366. For, although the search seemed to be given up, and the pursuit was much ridiculed by Bonajustus Lorini, in his work, lib. v., c. 19, who considers it an enquiry beneath the attention of any learned mathematician, and that the finding of it would be less a mental

* Dictionnaire Encyclopédique des Amusemens des Sciences Mathématiques et Physiques. Part — of the Encyclopédie Méthodique. Paris, 1792. 4to.

investigation than an accidental discovery, besides that the loss of power by friction alone would exclude obtaining an exact calculation, many other circumstances concur to increase the difficulty. The complicated construction of most machinery conceals the truth as regards defects; it depends on a mere matter of chance to discover it. Simon Stevinus, in his "Element. Static.," lib. i., prop. 19, p. 448, gives a demonstration of the balance, in which he clearly proves that this movement is quite impossible. After him, we have Leibnitz, who has examined plans, and shows that machines of this kind must cease movement; and says, whoever wishes to follow this pursuit must be thoroughly versed in mechanics, so as to be prepared for, and provided against, every obstruction as it occurs.

In 1730, Schlüter, an eminent engineer, received an offer of 30,000 roubles from the King if he, or any other, would find out perpetual motion; but, in consequence of his decease, his son renewed the offer, but without avail. In 1712, Herr Orffyreus, celebrated in mathematics and mechanics, made a great sensation, having, after ten years' study and industry, perfected a perpetual motion; the first model of it was 2½ Leipsic yards in diameter and 4 inches deep; it raised some pounds. He then exhibited it at Court, before the nobility and people of high standing, and some celebrated mathematicians and mechanics. He showed it in several places, and was much censured for its smallness, his critics declaring that a larger one would not go. He, therefore, constructed a large machine in 1713, which was nearly 5 Leipsic yards high and 6 inches thick, revolving at the rate of fifty revolutions per minute, and raised a weight of 40 pounds. This he exhibited openly before persons of all classes. He next went to Merseburg, where he constructed a third machine, 6 Leipsic yards high (and one schuh thick). No outward cause of motion was observable, although examined by various artizans and others capable of judging; it could be moved by the finger, and had a strong inward power of its own. Being much persecuted by censures, he challenged an open trial, which occurred October 31, 1715, before commissioners, a prince, duke, several members of the nobility and learned societies, all of whom signed a certificate to the effect that they had seen it turn both right and left, on the slightest impulse, soon

acquiring a regular, rapid movement. It was published, with two others, at Leipsic, 1715, entitled—"Advice to Students on the Orffyrean System; the happy discoverer of the Perpetual Motion." His opponents continued numerous and violent, one laying a large wager that no such power existed.

In 1716, Christian Wagner, a great mathematician, in Leipsic, published—"The now fully discovered Perpetual Motion," in which he shows that, through the experiments of Orffyreus, he has made his own discoveries. He constructed a copper machine, which turned right and left with amazing rapidity, lifting a weight of 70 pounds; and this he exhibited in Leipsic.

One of Orffyreus's opponents, J. G. Borlach, of Dresden, wrote, in 1716, "Advice against Perpetual Motion."

Jacob A. Mahn, who was first a confectioner and then a clockmaker, professed to have been anticipated in the invention by Orffyreus, being himself short of means, and published his complaint in the newspapers of 1717. This, and other like representations, have not damaged Orffyreus's reputation of being the happy possessor of the secret of this wonderful discovery.

We next hear of Orffyreus being at Cassel, where he filled the office of Councillor of Commerce. He there constructed another machine, and then put forth the following advertisement:—"Fresh news of the curious and well-confirmed perpetual motion trial of Herr Orffyreus, which he now exhibits in a newly-built machine at Weissen-stein, near Cassel. From November, 1717, until the present year, 1718, it has moved perpetually during eight weeks. It is under the lock and seal of the Landgrave of Hesse Cassel. All who doubt are invited to inspect it. And, moreover, a wager of 10,000 reichs-thaler is offered for any one to accept." The diameter of this wheel was 12 schuhe, and 2½ schuhe thick; the axle-tree was 6 schuhe long, and 8 zoll (inches) thick. It was made of oak; it turned either way, commencing by a slow movement, which went on increasing. It had power to raise a large heavy box, full of stones; and this power was so evident as to dissipate all doubts of its genuineness. The Landgrave signed a certificate, speaking of the merits of the invention in unqualified terms of commendation. It was expected it could be employed for various practical operations, as mill-work and raising water; particularly by

...ce Charles (the Landgrave), who was well versed in both ...thematics and mechanics, and had given much time and ...ention to the study of perpetual motion. Orffyreus, on his ...rt, required a special protection, which the Landgrave ...fused; this became a cause of dispute, the particulars of ...hich appear in Bresslauer's "History of Nature and Medi...ine."

Gärtner, of Poland, made an Archimedean screw, and a machine working by means of balls or weights, a full account of which is given in the "Séjour de Paris." He went to Paris and produced another machine, also worked by balls; but of these inventions we have only his own account. On his return to Germany, he made a whet-stone or grind-stone, worked by a perpetual movement, turning right or left, quick or slow, and moveable from place to place. The King of Poland invited him to his Court, and enquired whether the power could be applied to carry on great works, of which Gärtner expressed his opinion of its inapplicability on so large a scale. Gärtner* has published numerous learned papers on this subject, many of which will be found in Bresslauer's work, already named.†

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13.—In the "Allgemeine Encyclopädie, von M. H. E. Meier," of 1842, is an article by Hankel, on Perpetual Motion. He classes this motion as—

First, Physical; and, secondly, Mechanical. To the first belong the barometer and the magnet; and to the second (generally understood), a machine which not only has a self-moving power of its own, but is capable of renewing and keeping up its own motion without any outward help; or, again, one part of a machine following another in a rotation in a circle, so that the part carried round should return to its first position without having lost any of its pristine power. Kaspar Schottus's "Technica Curiosa" refers to several machines, and we find many more described by Franziskus

* In Meier's Encyclopædia, of 1842, is a statement of the discovery ...rtner's plan being a deception.

† H. Zedler's Great Universal Lexicon. Leipsic and Halle, 1741.

de Lanis, in his "Magisterium Naturæ et Artis." In numbers of the "Journal des Savans" for 1678, 1686, 1700, 1726, and 1745, are accounts of many machines which are said to have succeeded in attaining and retaining perpetual motion. But Papinus appears to have written most favourably* on this subject in the "Phil. Trans.," xv. and xvi., and "Acta Erud.," 1688 and 1689. We have also, on this matter, Desaguliers, in "Phil. Trans.," xxxi.; C. L. Sturm, in "Math.," part ii., p. 366; Bonajustus Lorini, in "Festungsbau," lib. v., c. 19; Simon Stevinus, in "Element. Static.," lib. i., prop. 19; Parent, in "Mém. de l'Acad.," Paris, 1700, p. 159. La Hire, in "Mém. de l'Acad.," x., p. 426, expresses himself quite against it; which feeling may be earlier traced in the correspondence of Corn. Drebbel von Peiresc to his friend Camden ("G. Camdeni Epistolæ," Londini, 1691, pp. 333, 387), and also in Kepler ("Epistol.," 1718, p. 393). Chr. Wolff, in his "Math. Lexic.," Leipsic, 1716, is favourable to the possibility of a perpetual motion. Diez describes, in 1722, a machine he constructed on the system of Orffyreus's plan, but treats of the incompleteness of that and all others that had appeared. The Academy of Paris, in 1775, passed a resolution not to consider any plans intended for perpetual motion; at the same time appeared a paper from Carnot ("Principes fondamentaux de l'équilibre et du mouvement," Par., 1803, sec. 281). T. Young ("Lec. on Nat. Phil.," tom. i., p. 91), and others, although they have written against it—but persons, mostly of uncultivated minds—still hope to find out this movement.

In 1712, a certain Orffyreus, named Bessler, of Saxony, after ten years hard striving, professed to have found perpetual motion, being then in Gera. He made a second larger machine at Draschwitz, in 1713. A third still larger wheel was made in Merseburg: it lifted 70 lbs. from the court-yard up to the roof of the house he occupied. A fourth and larger wheel was erected by him at the desire of Landgrave Karl von Hessen-Cassel, at his castle of Weissen-stein, where it was in a sealed room, and found in eight weeks to be in the same good movement. He was strenuously opposed by the mechanic Gärtner, of Dresden, and Barloch, who declared his discovery to be an imposition. Gärtner finished a machine,

* See Chapter IV. for Papin's real sentiments.

or wheel, with weights, intended to perpetually move a clock, artfully constructed and beautifully worked: it stood on a raised stand or pedestal, under which, after some months, was discovered a hidden clockwork, by which the wheel was turned. It was made under the patronage of King Augustus II. of Poland.

None of the foreign inventors have as yet found out a machine that without some outward help will continue in motion. These machines are all complicated, instead of adopting the most simple construction, and their inventors seem not properly to understand the principles of the lever. Descriptions of such machines will be found in a dissertation of Diez, also in one by Neumann (Lubeck, 1767).*

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14.—Dr. Binder, in his "Conversations Lexicon," published at Regensburg, 1848, says:—

What is understood by perpetual motion is a self-moving machine, unaided by any outward appliance. Such motion is impossible, acted on as it must be by friction and other counteracting causes. The necessary loss of power must be apparent, because of the impulsive power being derived at the expense of any surplus power that might appear to be gained, for the operation cannot be greater than the cause. It has been a study and paradox for many ages. There are the clocks of Cox, La Paute, and others; the celebrated Merseburge machine, Castelli's wheel, the wonderful weight-moving machine of Conrad Schwiers.† There was also Geisser's wheel, but of which, in 1832, after his death, appeared a description in Poppe's "Wunder der Mechanik," showing it contained concealed clockwork.

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15.—The following short article, in Latin, is derived from Hoffmann's Lexicon of 1698:—

Perpetui Motus specimen, exhibetur ab Athanasio Kirchero, in hydraulica machina, seu clepsydra, quæ, ubi effluxit inversa, iterum fluit obversa, cœlum aquarum aspergine irrorans, uti-

* M. H. F. Meier's Allgemeine Encyklopädie. Leipsic, 1842. Fol.

† See his Patent in Chapter III., date 1790.

docet in "Descript. Musæi Kircheriani," Georg. de Sepibus, p. 3. Idem aliô quoque instrumentô utcunque eum adumbrat. In eo namque motu rarefactionis & condensationis, ex metu vacui sublata aut depressa aqua, quæ in exteriore canali detinetur; cum desuper levigato corpore innatante, per annexam chordam, quæ circa cylindrum convoluta, suberis levissimi innatantis super aquam pondere in exteriore circulo per axim indice instructam vel horas vel humidum & siccum demonstrat. Sic ex quibusdam puteis, qui ad diversa anni tempora aquâ plus minusve repletur, fieri potest thermometrum, quod continuô motu quatuor distinguat; quinimô ad certa distincta spatia sonô campanulæ graduum aut anni mutatum tempus sonorô strepitu accidisse commoveat; sicque in sphæra vitrea caloris & frigoris gradus distinguantur. (Vide Georg. de Sepibus in "Musæo Kircheriano," p. 53, & suprà Mobile Perpetuum.)*

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There is a large amount of repetition in this chapter, and which it has been difficult to avoid increasing. Sufficient has been quoted to satisfy an impartial reader how unsatisfactorily these great channels of information have supplied matter on this one subject. The French Encyclopædias are the most defective; but the German "Conversations Lexicons" are comprehensive, and afford the greatest number of authorities; still, of these we have been obliged to omit an edition of 1836; and also Dr. Wolff, 1843; I. Meyer, 1850; and (Brockhaus) 1853 and 1856; in consequence of their striking resemblance to each other.

* Lexicon Universale. By Joh. Jacobi Hofmannus. Lugduni, Batavorum, 1698. Folio.