CHAPTER VI.

PAPERS FROM EARLY SCIENTIFIC AND OTHER JOURNALS.

THE "Gentleman's Magazine" and "Annual Registers" afford several interesting communications; some from each were necessarily transferred to Chapter II. We have here, also, the "Monthly Magazine" of 1806-19; "Annals of Philosophy," 1820; and "Royal Institution," 1802.

The following are from the "Gentleman's Magazine:"—

I.—Two "Schemes for the Discovery of the Longitude."

Two persons—one at Exeter, the other at Dublin—conceive they have made some discoveries towards finding out the important secret of the longitude.

The Irish gentleman declares he has made several trials with good success, after a plain, easy, intelligent way, by machines of his own invention, which have given him an entire confidence of the truth of their operation; but not having opportunity to try the experiment at sea in different kinds of weather, wherein he has not the least doubt of success, he invites the assistance of some publick-spirited gentleman to fit out a ship two or three months for that purpose; on which consideration he will communicate the secret, and assign over half the reward.

The Exonian (who, by the way, signs himself "The Farmer," because he had wrote something formerly under that name) is more explicit, and gives the following account of his scheme:—

Discovery of a Perpetual Motion, whereby the Longitude may be mechanically found.

Before I proceed to this simple, yet most useful, discovery, I shall premise a few necessary things, viz.:—

1. That the difference of time is the difference of longitude,

because every 15 degrees to the eastward of any meridian is an hour sooner, and every 15 degrees to the westward is an hour later, in time, than at the said meridian; since 24 times 15 degrees compose the 360 degrees of the earth's circumference.

2. Hence it must follow, that if any vessel revolve round the globe westward, a day will be gain'd when that revolution is perform'd; and if she make her revolution eastward, a day must be lost, since by how much she departs from her meridian to the eastward, by just so much she loses; because every 15 degrees that way is one hour earlier in time; the 360 degrees in this eastern circuit must be 24 hours earlier, and consequently that time must be lost by a well-regulated perpetual motion, and the contrary.

3. It is generally allow'd, that the perpetual motion being found, this would discover the longitude; which I also grant, but with this provision, that it is so nicely regulated as to keep time exactly with or without an equation-table; that is to say, equal time to correspond with the sun.

4. Yet, as I prefer such a perpetual motion as will keep pace with apparent time, or, in other words, with the sun's shadow on a dial, or a true meridian line, being discover'd stands in no need of any equation-table at all; so I shall evidently make it appear that such a motion is found, in a proper sense for our purpose. So that what has hitherto been thought impossible by the generality of mankind shall no longer be a secret. And,

5. It must be granted, when duly consider'd, that there are many movements which, in the sense foregoing, may be call'd perpetual; yet, hitherto, there never came under my observation any of them that could be depended on in the case before us, except that one which I shall discover.

6. I will instance in two particulars, that are easily framed, tho' not very common.

First, There are some spring clocks and watches, so contriv'd by art as to lose no time in winding, by having a spring fixed to stand free from the work, except at such times as they are to be wound up; but then, by pulling a string fasten'd to it for that end, this spring presses sufficiently on a tooth in the main wheel to keep the movement going, so that no time is lost in winding. And this, I say, in a proper sense to the purpose, may be call'd perpetual; yet none of them

can be so sufficiently adjusted as to keep time to exactness, therefore not to be depended on in this case.

Secondly, Our long pendulum clocks, which are by the same contrivance kept going while wound, may be said, in the same sense, to be perpetual in their motion; yet even these, tho' nearer the truth than the other, are not to be depended on in a matter of so great moment. Nor, indeed, is there any equation-table extant that is just, even Flamstead's correct table being about 15 minutes erroneous at one time of the year, tho' it is right in October, when his greatest difference comes to 16 min. 2 sec.

Having thus premised, my next business shall be to demonstrate a perpetual motion, that comes so near the truth as not to vary from apparent time (tho' that is very unequal) 3 min. in a whole year, tho' daily proved by a dial well set, or by a just meridian line; which I take to be the greatest discovery hitherto so publickly made manifest.

But in order thereto, and to carry instruction with me to a mean capacity, I must have recourse to the method whereby so wonder-working a machine was first framed, by the late most ingenious Joseph Williamson, watch-maker, in London, whose name there is famous, and his works greatly admired.

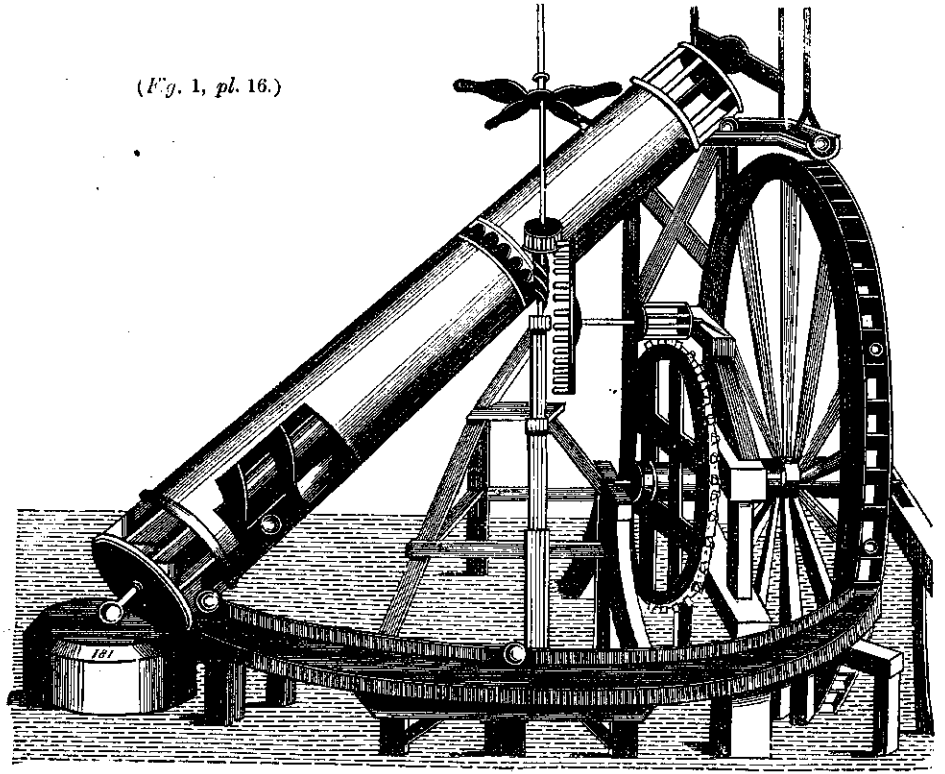
[He then explains how this horologist, from "his thirst after the knowledge of equation," spent seven years in forming correct tables.]

From this true equation-table, this excellent workman formed an elliptical wheel, that revolved once a year, and so fixed it to the day of the month, that it had such influence on the pendulum, by shortening and lengthening it, that his clocks, thus framed, would keep time to admiration with the sun, and therefore he called them his sun-clocks. This is the perpetual motion I commend to the world, for it loses no time at all in winding.

[This last expression shows how much it partook of a real perpetual motion. He goes on to state the praise bestowed on the invention in "a speech made to the Royal Society by Sir Isaac Newton." After this, follow observations on its uses, the mode of fixing it on board ship, with several necessary precautions.]

And so curious is the invention, that the spring which keeps the work going while the clock is wound up is also fixed to a plate that always by its force slides back again to

(*Fig.* 1, *pl.* 16.)



close the holes that receive the key for that end, when the tooth of the main wheel has, in its course, slipt from it.

* * * * * *

I subscribe,

THE FARMER.

P.S.—Nothing hitherto found can be so regularly adjusted to the time as a long pendulum movement. All springs are fallible, and short pendulums too. But those of about 33 inches long, that beat true seconds, are next to infallibility, being kept in perpetual motion, as I here manifest they may be.*

II.—Raising water:—Fig. 1, Col. Kranach's machine for constant motion, with a power to raise water. Fig. 2, Mr. Gervas's engine for raising water.

EXPLANATION.

Fig. 1 represents an artificial machine for constant motion; the inventor is Col. Kranach, who, in a book printed at Hamburgh, asserts that when once put in motion for any of the following works, it will continue its operation both night and day without any other help or assistance except that of a small quantity of standing water: that by it large and heavy weights may be drawn up, to 2,000 weight; that in 24 hours it will fling out 2,400 barrels of water, and is therefore highly necessary for the draining of land overflown by inundations; that it will be of great use in mines to draw up the water and ore 24 fathoms deep; that it may be employed instead of wind or water mills, for all manner of uses; and that this machine may be put either in a quick or slow motion.

The author protests that he had laboured for thirty years together before he brought this machine to perfection, and declares his readiness to oblige any gentleman with a small or large model thereof, and to inspect the building of it for use, at a reasonable gratification.

* Vol. 7, 1737, p. 67.

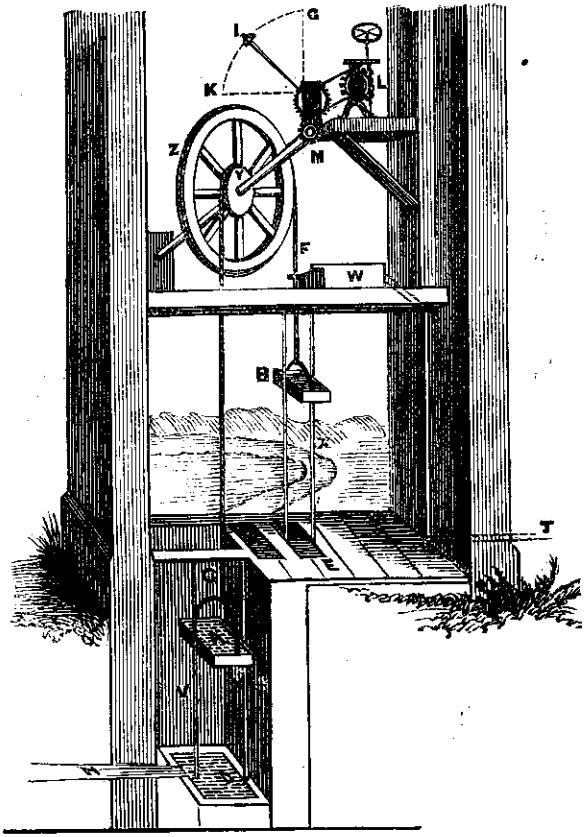
Fig. 2.—This is a representation of an engine for raising water, like that erected by Mr. Gervas, at Sir John Chester's, near Newport Pagnel.

A and B are two copper buckets of an unequal weight and size, suspended by chains, which alternately wind off and on the multiplying wheel Y Z; the part Y being smaller in diameter, and Z larger, in proportion to the different lift for which each is designed. The buckets being both filled with water from the spring, which affords a fall of ten feet, the larger bucket A, being heavier when full, though the lighter empty, descends the ten feet from C to D, and weighs up the lesser bucket, from E to F, perhaps 30 feet, where touching a trigger it discharges its water into a cistern W, whence it is conveyed for service by the pipe T; at the same time, the water by the like means is discharged (and runs away) from the larger bucket, which then being lighter is drawn up by the smaller (but at that time becomes the heavier) bucket, in order to be filled again at the spring. This work is continued day and night, without any other force, and has not been out of order since it was set up in 1725. The buckets are guided by two iron rods on each side, which run in grooves of the buckets, and the whole motion is kept steady by a jack fly L, which is turned by a spiral wheel at one end of the great axis M; and the other part of the regulator, being a quadrant with a moveable weight at I, is by a proper number of teeth on a communicating wheel suffered to go only in a fourth of a circle, from G to K, and serves as a balance, while the chains of the buckets are winding off and on the wheels.

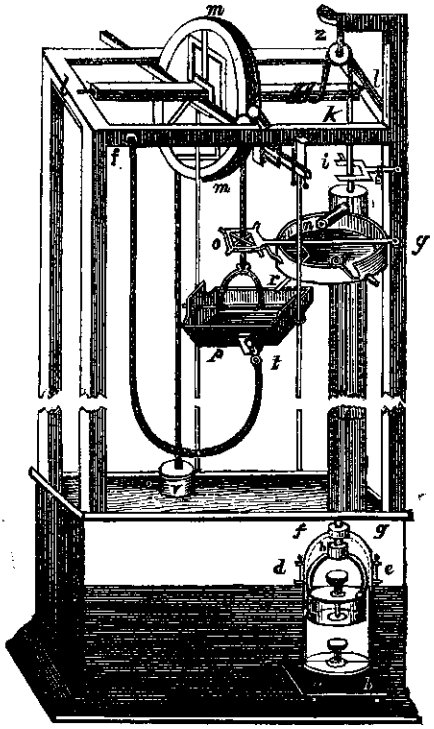
This engine carries up one bucket containing 5 gallons of water in 5 minutes, but then there is a waste of water ten gallons, which are the contents of the larger bucket; but Dr. Desaguliers observes, that it is not the hundredth part of what is spent by a water wheel to raise an equal quantity of water to the same height. The desirable improvement of this engine is to prevent the great waste of water,—and we are informed that can be effected in some degree by Thomas Yeoman, of Northampton.

But the reason of exhibiting this engine, together with that of the German engine (Fig. 1) is from a suggestion, that a round weight might by some means be made to run in and out of a scale or bucket, and so raise up water with very little

(*Fig.* 2, *pl.* 16.)



(*Fig.* 1, *pl.* 18)



or no waste. We promise, as an encouragement to the attempt, five pounds for the person who first compleats such a work, or produces a model for the like effect.

This, it is apprehended, will be much easier performed than the great operations mentioned by Col. Kranach. However, that person who can come at such a secret will not want five pounds, or a hundred times larger.*

III.—In the Gentleman's Magazine is described a "Self-moving Machine."

A full account of the same machine, with an engraving, as here given, will be found in "Le Journal des Sçavans, 1678 [re-printed Paris, 1724], 4to, page 79, entitled "Le mouvement perpétuel purement artificiel inventé et executé par le P. STANISLAS SOLSKI, Jesuite Poonois." The Magazine article proceeds:—

DESCRIPTION.—Fig. 1, a self-moving machine, invented by a Polish Jesuit. It consists of a pump, whose body *a b f g* is a palm and two fingers' breadth in diameter, and four palms in height; the head *d e f g* is a palm in height; the cylinder *a b d e* of the body of the pump is two palms and a half in height, of which the piston *c c* fills up one palm; the other palm and a half must hold at least five cans of water, each containing three quarts.

The wooden pipe from *f g* to the horizontal pipe *n n* is about thirty-two palms in vertical height.

The author observes that if the diameter of the mouth of the pipe *h n* be equal to that of the cavity of the pump, and the diameter of the iron rod *h k* be of such size as that the pipe *f g n* shall contain only seventeen cans of water, the machine will be the easier work'd, as the water being forced thro' a passage less strait meets with less resistance.

The diameter of the hole *f g* must be equal to half the diameter *d e* of the body of the pump, whence it will be four times straiter than the body of the pump, because circles are to one another as the squares of their diameters.

The machine works in the following manner:—The piston

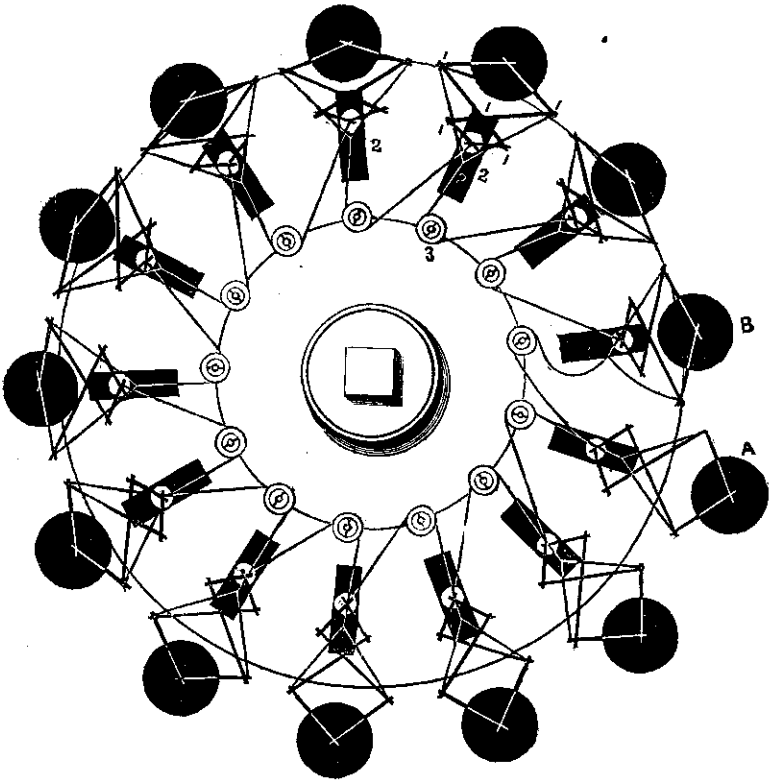
* Vol. 17, 1747, p. 459.

c c being at the bottom of the pump, the suckers, both of the pump and of the piston, shut by their own weight, whence by the descent of the bucket *p*, the wheel *m m*, six feet in diameter, is turned, by which means the chain *k z*, by passing round the axis *l l* of the wheel, raises the iron rod *k h*, and the piston *c c*, at which instant the sucker of the pump opens, and gives passage to the water, which is forced into the body of the pump by the weight of the external air. The counterpoise *v* descends, and so turns the wheel *m m*, round which goes the cord *m m o*, which, descending on the other side, raises the bucket.

In proportion as the counterpoise *v* descends, and the bucket *p* is raised, the axis of the great wheel is freed from the twistings of the cord, and so the piston by its own weight, and that of the iron rod, falls down to the bottom of the body of the pump, and by that means the sucker of the pump shuts, and the five cans of water mount up thro' the piston by its sucker, which opens above. The same operation is readily performed again, in order to carry that water into the pipe *f g n n i*, whence it is discharged thro' the horizontal pipe *n n* into the basin, which holds at least thirty-two pounds of water. This water falls into the bucket *p*, thro' the pipe *q r*, whose clap opens, being raised by two cross sticks, which are fastened to the cord, and lift up the bar *o y*.

The bucket *p* contains four cans and a half of water; it is two palms in length, ten at the opening, and six inches in depth, where the two long faces uniting form an angle of 120 degrees: being thus filled, it descends apace, and the bar *n o* being depressed, the clap falls and closes the pipe *q r*, and as it descends 30 feet, and as the great wheel is 10 feet in diameter, it makes an entire revolution, and thus the axis *l l* twisting up the chain *k z*, the rod *k b* raises anew the piston *c*, and carries again at least four cans and a half of water into the basin *n q*, thro' the horizontal pipe *n n*.

The bucket, when descended almost to the surface of the water of the well, is raised again by the cord *s t*, which is too short to reach the water, and being for the present discharged of its weight, the piston descends to the bottom of the body of the pump, by its own weight and that of the rod *h k*, and the cross sticks *o* of the cord of the bucket coming under the bar *o y*, raises it together with the clap, that the water of the basin *n q* may fall again, thro' the pipe


2
2
3
B
A

q r, into the bucket *p*, causing it to descend anew, and so maintain a perpetual motion.

There are several other small pieces in this machine, the use of which is easily comprehended.*

IV.—A new plain draught of a Self-moving Wheel, tho' not perpetual; with a description of its parts, and manner of operating; submitted to the inspection and amusement of the curious.

Directions to make a Self moving Wheel.

Let there be a well-turned board, of at least two feet diameter.

At Fig. 1, six pins for the chequers to turn upon.

At Fig. 2, let in brass grooves into the board for the receiving of rollers, which must be fastened to the bottom points of the small chequers.

At Fig. 3, place pullies.

At the points of the small chequers fasten chains that pass round the pullies, and are made fast to both points of the next large chequer; the chains must be all of an equal length.

Make very substantial brass chequers, with good joints to play free without wriggling, and of as large a size as the circumference of the wheel will admit, and fix weights at the points of the said chequers.

Remarks upon the manner of Operating.

Observe, that one pound, placed at the zenith of the larg chequer, is correctly equal to two pounds placed at the nadir of the small chequer; and that this power (if occasion be) may easily be either increased or diminished at pleasure, by only fastening the chains farther off or nigher to the weights: therefore, it is self-evident that the weights above the horizon cannot want full power for the drawing in of all the weights below it; more especially those particular weights that arrive gradually to the mounting side of the wheel, as is shewn hereafter. And this is done by reason of the chains being all in a diagonal position, therefore the weights below the

* Vol. 21, 1751, p. 391.

horizon cannot be otherwise drawn in by such slant lines, than into a gradual, regular, elliptical form, as they appear in the plate. But to prevent the said weights from being either too much or too little drawn in, this diagonal position of the chains may, by means of the pullies, be made to slant more or less, so as to answer to the right elliptical form of drawing in the weights as shall be requisite; and thus, by this elliptical form of the weights, the power of gravity must needs give the wheel some considerable share of movement, so as to cause the weight B, &c., to descend below the horizon, where they will run out to the same length, as you see the weight A does, to the very great and constant supply of power to the descending side of the wheel.

As to the mounting side of the wheel, by the manner of chaining the chequers to each other, they become partly as it were all of one piece, so that the weights above the horizon can no way press down their chequers, without communicating their drawing-in power to, and being always felt, in a certain measure, by every weight of the wheel, in the elliptical manner above mentioned, with respect to the diagonal position of the chains. Moreover, whatever number of weights shall descend below the horizon on the one hand, the like number of weights must ascend above it on the other, where they, in conjunction, will press down their chequers with ample force, for the gradual drawing-in of those extended weights which are their next followers, reducing them into the same less extended form as they themselves were in just before they were carried above the horizon. After the same gradual manner, by the power of the weights above, will all the extended weights be thus gradually reduced, drawn in, and carried round, when, at the same time, the elliptical form of the wheel, by the constant supply of weights running out at the descending side, will at all times be kept up, like as at the first setting off of the wheel, for the continuance of the movement.

By all which it appears that there are two different and distinct acting powers in this wheel, both which, by the freeness of the joints and other parts, in a workman-like manner, cannot but act with that puissance as to leave no room to reflect upon friction in any respect whatever.

Therefore, if, upon due inspection, no objection shall appear against either of the said powers, is not here a discovery of a

new power in a short, easy, obvious manner, capable of any improvement in proportion to the size of the wheel, so as to be applicable to ten thousand different uses, both great and small?

Suppose we compare this wheel with the Marquis of Worcester's great wheel (see vol. 18,* pp. 9, 61, 107), some time since shewn in the Tower of London, there will appear the following most material differences:—His wheel was contrived with loose, running weights, forty in number, of fifty pounds each; which, at the nadir, bore the same distance from the centre as the weights at the descending side, upon which account, no such contrivance can possibly ever answer the design to keep moving, as is easily demonstrable; whereas, in this wheel, the weights at the nadir will at all times be considerably nigher the center than the weights of the descending side, the consequence of which wants no explaining. And should one of these wheels be made up for any large use, and, by mistakes in the workman, it be so made as not to answer fully to the purpose, as mentioned above, still the same would be of exceeding great service by being applied to co-operate with the powers of a fire engine, for the raising of double the quantity of water they now raise, which is the same thing as the saving of half the quantity of coals that are now consumed.†

*** As a considerable wager is depending whether a model, upon these principles, can be made to operate, any artist, who imagines that he can make such a one, at a moderate price, may send his terms in writing to E. Cave, at St. John's Gate.

The Self-moving Wheel shewn to be defective by a Mechanical Demonstration.

Mr. Urban,— * * * What I have here sent you is an attempt to prove that the wheel with weights, described in your last magazine, tho' put in motion by the hand, will not continue and preserve that motion any better than a common plain wheel would. * * * *

In the following demonstration, I suppose, and take for

* Where a copy is given of the Marquis's Century of Inventions, with original remarks on each.

† Vol. 21, 1751, p. 448.

granted, that Mr. A. B., by his self-moving, tho' not perpetual, wheel, as he terms it, means such a wheel as, by the action of gravity alone, would continue in a regular uniform motion round its axis, till some of the parts of it are decayed or out of order. I suppose, too, since he says nothing to the contrary, the weights are all exactly equal. And I suppose and allow that such weights, fitted to the wheel in the manner he directs, would, by the action of gravity, so form themselves as to be constantly farther distant from the center of motion on the descending side than on the ascending. It must be allowed, too, that any weight so fixed (or, to speak more properly, the center of gravity of it) would, in every entire revolution of the wheel, describe a curve line returning into itself again, and that all the other weights would successively describe the same curve—perhaps not of a regular elliptical form, as Mr. A. B. imagines, but quite irregular in its shape. However this be, it matters not, so long as a line passing perpendicularly thro' the center of motion, and produced both ways till it touches the curve in two points (which points we shall call the zenith and the nadir, and suppose to be marked with the letters Z and N), divides it into two unequal parts, whereof that through which the weights descend is the largest and most distant from the center of motion, as, from what has been already granted, must be the case here.

These things being premised, let us now examine what power gravity will supply any one single weight with, to continue the wheel in motion: let us call this weight W. Now, 'tis plain that W, in its passage from the zenith to the nadir, thro' the greatest and most distant part of the curve, will yet descend perpendicularly, or get nearer to the center of the earth only as much as comes to the length of the line Z N. In its further progress from the nadir to the zenith, from whence it first set out, tho' it be thro' a less and nearer part of the curve, it will, notwithstanding this, ascend perpendicularly, or recede from the earth's center the length of the same line N Z; and, therefore, since the weight W is obliged, in every entire revolution, to ascend perpendicularly thro' as large a space as it descends, it follows that the reaction of gravity upon it, whilst it is in the ascending part of the curve, will be exactly equal to the action of gravity whilst in the contrary part of it; whence 'tis plain that, upon the whole, this particular weight W will not be supply'd, by

gravity, with the least power to continue the wheel in motion, tho', by application of the hand, it was once set agoing. The same will hold true of every other weight fixed to the wheel; and therefore all the weights, be the number what it will, will have no power at all, upon the whole, to continue the wheel in motion; so that (if we abstract from what difference may be caus'd through friction—resistance) this wheel would continue moving no longer than any common plain wheel would that had the same velocity at first given to it by the hand. Q.E.D.

But to make this still plainer, instead of one, let us consider two opposite weights together, and examine wherein the material difference lies between the action of two equal weights so placed in this machine, and of two others fixed to the ends of any common lever, whose center of motion is at some distance from its middle point. Now, with respect to the lever, let the two equal weights fixed to it be called W and X. Let W be that which is farthest from the center of motion, and let the lever be placed in a horizontal situation. The reason why W will in this case preponderate, tho' the weights be equal, is because it can approach the center of the earth faster than it obliges X to recede from it; for W, in passing from its first position to its lowest point—that is, till the lever becomes vertical—will have got nearer to the center of the earth, just as much as comes to its own distance from the center of motion, and X, in the meanwhile, will have ascended thro' a space equal to its distance from the same; but the distance of X from the fulcrum, or center of motion, was, by supposition, less than that of W; and, therefore, since W in this case does in the same time descend further than it obliges X to ascend, it necessarily follows that it can and does descend faster, which is the reason of its preponderating and causing the lever to move.

But the case of two equal and opposite weights that are fixed to Mr. A. B.'s wheel is quite different; for, let the two weights be here, also, called W and X, 'tis plain that in the same time that W moves from Z to N, X must move from N to Z; in which time also X will have ascended just as much as W has descended, or will have receded from the center of the earth just as much as W has approached towards it: the recess of the one and the access of the other being equal to the same line Z N. And therefore, tho' the absolute velocities

of W and X may be, and are, very different (W in this case describing a larger part of the curve, whilst X describes a less), yet will their perpendicular velocities be the same; and, consequently, since the two weights are, by supposition, equal, W will not preponderate or cause X to move. The same may be said of every other pair of weights that are opposite, and therefore all the weights on the descending side will not preponderate or cause the wheel to move. Whence 'tis plain again that Mr. A. B.'s wheel with weights is no better disposed to be put or continue in motion, by the action of gravity upon it, than any common plain wheel is. Q.E.D.

Mr. Urban,—Now I am writing to you upon this subject, I shall beg leave to add a short general demonstration, to shew that it is utterly impossible for any wheel whatsoever, by means of weights affixed, to be so contrived, as, by the action of gravity alone, to be put and continued in motion round its axis, even so much as for one single revolution.

'Tis a well-known truth in mechanicks, that if gravity, acting on any body, can't move the center of gravity of that body, it can't move the body at all. Now, a wheel furnished with weights, in any manner whatsoever, may be considered as one complete body, the center of gravity of which can either be made to move, by the action of gravity upon the body, or it can not. If the line of direction of the center of gravity of this complex body passes directly thro' the center of motion, in this case, the center of gravity, and, consequently, the body itself, will not be moved at all by the action of gravity alone; but if the aforesaid line of direction passes on one side of the center of motion, in this case, as the center of gravity is not immediately sustained, it may therefore descend, and the wheel may move;* but this center of gravity, by the action of gravity on the body, will never be made to perform a whole revolution round the center of motion; it will only vibrate for some time in the

* I say that in this case it *may* descend, but not that it always *will* do so; for tho', in the wheel of the Marquis of Worcester, and of Mr. A. B., the line of direction of the center of gravity of the whole machine passes on one side of the center of motion, and at a considerable distance from it, yet in such machines, tho' turned by the hand, the center of gravity will not move at all, but is as much fixed as if it coincided with the center of motion.

manner of a pendulum, which vibrating motion, by unavoidable friction and resistance, will be soon destroyed, and the body, with its center of gravity, remain at rest without having performed so much as one single entire revolution. Q.E.D.

If the publishing of what has been here said gives such satisfaction to the publick as may prevent any future attempts of this kind, which have hitherto always proved fruitless, and frequently very expensive, and which, I am thoroughly persuaded, can never be successful, my end is answered; but if not, I shall at least have the satisfaction myself to think that it can do no harm in the world, which is more than can be truly said of many things that have lately appeared in print.

Twiford, Nov. 20, 1751. T. P.*

Mr. Urban,—Reading in your last Magazine, p. 501, Mr. T. P.'s attempt to prove the wheel with weights, described in your last October Magazine, p. 449, tho' put in motion by the hand, will not continue moving any longer than a common wheel would; when, at the same time, he allows that weights so fitted to a wheel, in the manner directed, would, by the action of gravity, so form themselves as to be constantly further distant from the center of the wheel on the descending side than on the ascending; he also allowing that weights so ordered would, in every revolution of the wheel, describe a curve line, returning into itself again, and that all the weights of the wheel will describe the same curve, and, by consequence, granting, though he does not mention it, that the weights at the bottom of the wheel, as well as all those at the mounting side, will be always nigher the center than the weights at the descending: these things being supposed must infallibly render the wheel constantly lapsided, which is all that is, or need be, required to continue its motion. Whatever may be in old objections, against old contrivances, is one thing, but to contrive to have the weights at the bottom of the wheel, as well as the weights at the mounting side, to be always nigher the center than the weights of the descending side, I take to be a quite new discovery, and is

* Vol. 21, 1751, p. 501.

more than can be said of any former contrivance whatever; but as to the consequences of this promising contrivance, I cannot see how it can be any further known, without making of the experiment.

I am, &c.,

Queen Street, Westminster. M. B.*

V.—Perpetual Motion proposed to be effected by Magnetism. —Alleged discovery by Hero Hicken, of Friezland.

MR. URBAN,—Ever since I became acquainted with the mechanical powers (which is now near seven years ago), the greatest part of my leisure time has been employed upon inventions for the good of the publick. Each branch of experimental philosophy has in turn engaged my attention; and I might also add, that each has in turn —— but modesty forbids me to proceed. Yet I must tell you, that if the attraction of the loadstone would have supported a weight at the distance of but ¾ of an inch (which a printed book affirms for a truth), gravity before this time had been useless in clockwork, and the longitude effectually discovered. I was extremely sorry, as you may very well suppose, that so useful a scheme should miscarry; and so much the more, as I was within less than an inch of it. But disappointments, Mr. Urban, we must expect to meet with, as my attempts upon perpetual motion have often experimentally taught me. For that, you must know, in spite of demonstration, has ever been my favorite pursuit, and many are the projects that I have successively been big with; some lasted a week, some a fortnight, but a month most commonly put an end to them all. But, however, I have at last succeeded. My present scheme had overcome every objection that either my own head, or my neighbour's, could possibly bring against it; and I was drawing out a plan of it to transmit to you, when the following article appeared in the "Gazetteer:"—

"A paragraph from Amsterdam, in the last 'Utrecht Gazette,' says, that at Doornum, in East Friezland, a mechanic, named Hero Hicken, has invented a machine, which, being

* Vol. 21, 1751, p. 610.

once set in motion, keeps going perpetually, till such time as the materials of which it is composed are fallen to decay, or the structure of the machine itself altered."

It is impossible for me to tell you, Mr. Urban, what a terrible damp this threw upon my spirits; in spight of all my philosophy, I was neither able to eat, drink, or sleep, for a considerable time after. For this was not only a full demonstration that my scheme was practicable, but also attended with this melancholy circumstance, that England would lose the honour of it.

As a month has now elapsed since I met with the above account, without any further confirmation of it, my uneasiness is greatly abated, and I now begin to flatter myself, that either M. Hicken's project has failed, or that the whole account is only one of those periodical paragraphs that appear once in about thirty years. But, as my situation does not permit me to make a strict enquiry into the truth of these matters, I freely resign that office to those of your readers who have leisure enough to examine the arcana of newsmongers, or money enough to take a tramp to Doornum.

I am, &c.,

ANDREW DOSWIL.

EXPLANATION OF THE MACHINE.

A B C D represents a frame of brass or wood for the machine E F to run in.

E and F are two brass wheels, similar and equal, fixed upon a moveable axis G.

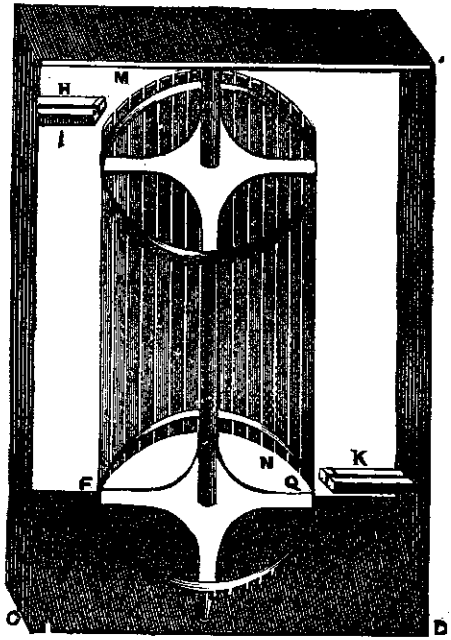
1, 2, 3, &c., are a number of artificial magnets, placed within the teeth of the wheel all round, and as near each other as is possible, provided they do not touch; their north poles at E, and their south poles at F.

H and I are two similar and equal magnets fixed in the brass plate A C, very near each other, but not touching.

K and L two more fixed in the brass plate B D.

Now, as the north pole of one magnet repels the north pole of another magnet, and attracts the south; and inversely the south pole of one magnet repels the south pole of another, and attracts the north; so the south pole, I, attracts all the north ones at E; and the north pole, H, repels all

the north ones at M. In like manner, K attracts at N, and L repels at O, and by this means the whole machine E F moves perpetually round.



N.B.—As the success of the machine depends a good deal on the nearness of the poles, the twentieth part of an inch is the thickness I would recommend for the magnets; the proportion of every other part is as the artist pleases. The magnets are to be put, not flat, but edgeway to the wheel; and to prevent anything affecting their virtue after they are touched, a brass ring to slide over the whole will be most convenient.*

* Vol. 33, 1763, p. 439.

VI.—Under the title of "A new-invented Machine for Raising Water," appears a letter—

To the Society for the Encouragement of Arts, Manufactures, and Commerce, the following proposal is with great deference submitted, by their most obedient humble servant,

RICHARD BLACKWELL.

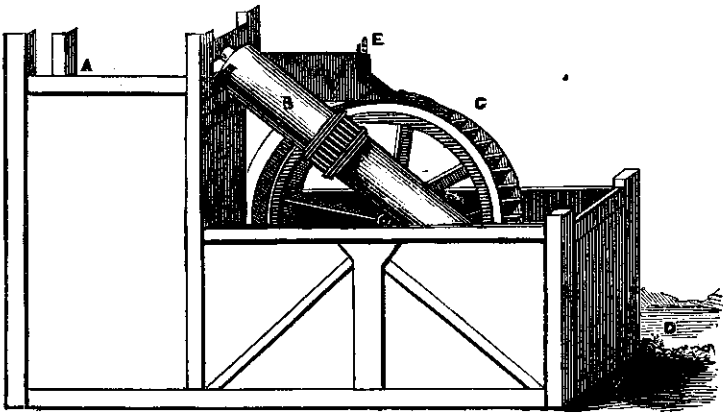
MR. URBAN,—Having read your Magazine for July last, wherein you have obliged the public with a print of that curious engine* for raising water in Kew Gardens, erected by the ingenious Mr. Smeaton, it put me in mind of what I have often thought of—viz., that (upon the principle of Archimedes' water-screw) a machine might be contrived to raise water perpetually, by means of an over-shot wheel applied to the said screw, agreeable to the annexed drawing. On this principle I once undertook to construct a model of such a machine, but other employments not permitting me to finish it, I cannot ascertain the success; yet I conceive the water which may be raised by the revolution of the screw, when applied to the overshot wheel, will be more than sufficient to keep it in constant motion; and the surplus water may be applied to many useful purposes in life.

The great utility of such a machine is very obvious, especially among the seats of our nobility and gentry, many of whom are so unhappily situated that they have no convenience of water but at a continual expense of bringing it from some distant place; whereas, could they raise it to a sufficient height, they might constantly be supplied without any trouble. Add to this the great advantage this machine may yield in pleasure gardens, and the infinite service the reservoir of water would be in cases of fire.

If by experiment it should appear that the water raised by the screw is more than sufficient to supply the over-shot wheel, the whole may be employed to add more power to that wheel, which may then be applied to many useful purposes where mill-work is applicable.

* An Archimedes screw, erected in 1761. When worked by two horses, it supplies the lake and basins in the gardens with upwards of 3,600 hogsheads of water every twelve hours.

The whole is submitted to those gentlemen whose knowledge in hydrostaticks renders them proper judges of such matters.



A, the reservoir.

B, the Archimedean screw, by the revolution of which the reservoir is supplied with water.

C, the over-shot wheel, by the force of which the screw is kept in constant rotation.

D, a small rivulet, or spring, which supplies the well with water.

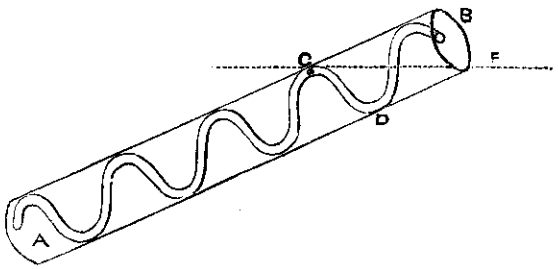
E, the bolt to regulate the flux of the water into the over-shot wheel.*

MR. URBAN,—The ingenious gentleman whose plan of a machine for raising water by a perpetual motion you inserted in your Magazine (see p. 448) was, I am afraid, too sanguine in his hopes of success. Were the slowness of the motion in this machine in proportion to the force with which it is expected to operate thoroughly considered, I imagine no practical trial need be made to convince us of the fallacy of its contrivance. First, then—

The water which is thrown up by the screw can never be able

* Vol. 33, 1763, p. 448.

to turn the wheel, both because of the smallness of its quantity and the slowness of its ascent through the screw, in proportion to its descent down the wheel ; for even supposing the screw to turn round twice (which is more than appears from the plan before us) whilst the wheel turns once, yet no more water can be thrown up by each revolution of the screw, than is contained in that part of its uppermost helix, which lies above an horizontal line drawn through the middle of the screw. (See the annexed diagram, A B.) Now, can twice this quantity of water be supposed to turn this wheel round—especially when the stream in which it falls, falls by fits, and is intermitted till the return of the mouth of the upper helix of the screw to the surface of the reservoir? But though we suppose even this to be possible, if the screw were suspended at its center of motion, yet we can scarcely allow it to be so, when the screw is far from being thus suspended, and consequently far from that equilibrium which is alone consistent with an easy and regular motion. That this must be the case in this machine will, I hope, be sufficiently demonstrated from the annexed diagram.



A B represents a screw covered over ; C D E one helix or revolution of it ; C D the side that is to ascend ; E D the descending side ; the point D the middle ; the horizontal line C F showing how much of the helix is filled with water, viz., of the ascending side, from C, the beginning of the helix, to D, the middle of it ; and, on the descending side, from D, the middle, to the point G, where the horizontal line cuts the helix. Now it is evident that this latter pa D G is nothing near so large, nor, consequently, so

heavy as the other (ascending) part D C. And thus it must be in all the other revolutions which, as they are either more in number or larger in diameter, so much must the difficulty increase: from whence it appears that the outward stream must be of force sufficient to overcome the difference of weight in the ascending side of the screw, which can scarcely be effected by any contrivance of this sort; for though the water-wheel might be made larger, yet the velocity of the motion which it could communicate to the screw would be inversely diminished.

Most of the arguments I here make use of are to be found in a book of Dr. Wilkins', wherein he also mentions a contrivance to multiply the same stream so as to apply it several times to the same screw;* but even with this addition it is impossible.

I send this letter with no other view than to prevent any persons making an experiment which must be attended with a disappointment so expensive; nor, indeed, could any one speak with another view against an artist who seems so ingenious and so modest. Your Magazine, Mr. Urban, bringing forth to public view these efforts of invention, must be an incentive to enquiries of this nature, which may be of the greatest service to society. I cannot, therefore, better conclude this letter than with the words of the author I above mentioned:—"However, the enquiry after it (the perpetual motion) cannot but deserve our endeavours, as being one of the most noble amongst all these mechanic subtelties. And, as in the fable of him who dug the vineyard for a hidden treasure, though he did not find the money, yet he thereby made the ground more fruitful; so, though we do not attain to the effecting this particular, yet our searching after it may discover so many excellent inventions as shall abundantly recompence the labour of the enquiry."

I am, Sir, &c.,

J. S.†

* See Chapter I.

† Vol. 33, 1763, p. 554.

heavy as the other (ascending) part D C. And thus it must be in all the other revolutions which, as they are either more in number or larger in diameter, so much must the difficulty increase: from whence it appears that the outward stream must be of force sufficient to overcome the difference of weight in the ascending side of the screw, which can scarcely be effected by any contrivance of this sort; for though the water-wheel might be made larger, yet the velocity of the motion which it could communicate to the screw would be inversely diminished.

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I am, Sir, &c.,

J. S.†

* See Chapter I.

† Vol. 33, 1763, p. 554.

VII.—Alleged discovery by William Ashman.

Horsley, Gloucestershire, Nov. 12, 1800.

MR. URBAN,—I beg you to announce that Mr. William Ashman, hatter, of this place, has this day been with me and asserted that he has discovered the perpetual motion, *i.e.*, that he has invented, and actually possesses, a self-moving machine, which, when once set going, will continue so till worn out. He also says it is applicable to the greatest objects and most useful purposes. I have thought it my duty to communicate his assertion to Sir Joseph Banks.

T. D. FOSBROOKE.*

VIII.—Perpetual Motion by Galvanic agency.

The perpetual motion, so long sought for in vain, is now sought through the medium of galvanism. A French physician has in his cabinet two galvanic piles, 16 inches high, which alternately attract a pretty heavy beam. The continual oscillation of the beam gives motion to a pendulum, which has never stopped for the last three years. The physician is now endeavouring to give to this movement an isochronism which may render it more useful.†

IX.—An ancient attempt at Perpetual Motion.

MR. URBAN,—In the curious preface of the learned Dr. Dee, prefixed to his Euclid, is the following remarkable passage in the article "Trochilike." If any of your ingenious correspondents can furnish an explanation of so odd a piece of mechanism, it will afford much satisfaction to

A CONSTANT READER.

"By wheels, strange works and incredible are done, as will hereafter appear. A wonderful example of further possibility and present commodity was seen in my time, in a certain instrument, which by the inventor and artificer (before) was sold for twenty talents of gold, and then had (by

* Vol. 70, part 2, 1800, p. 1128.

† The "Abstract of Foreign Occurrences," in the "Gentleman's Magazine," vol. 87, part 2, 1817, p. 170. The same in vol. 88, part 1, p. 63.

misfortune) received some injury and hurt. And one Janellus of Cremona did mend the same, and presented it unto the Emperor Charles the Fift. Hieronymus Cardanus can be my witnesse, that therein was one wheel which moved, and that in such rate, that, in 7000 years, only his own period should be finished. A thing almost incredible: but how farre I keep me within my bounds, very many men (yet alive) can tel."

Quere. Does not the doctor intimate this machine to be very ancient by the mode of fixing the price? Talents have not, I believe, been used in reckoning by any moderns. I desire likewise to be informed whether he refers to the verbal or written testimony of Cardan? If the latter, in what part of his works is an account of the same wonderful automaton to be found?*

X.—Dr. Kenrick and J. D. Muller make application for Patents.

Dr. Kenrick† and Mr. John Dietrick Muller waited on the Attorney-General: the first with reference from the Court of Chancery on a petition for a patent for the exclusive benefit of a discovery of a mechanical principle, of self-motion, for the construction of machines which acquire a constant supply of power from the action of gravity on themselves only; the latter, on a like reference, for the invention of a machine or engine constructed on self-moving principles. The Attorney-General, on hearing the merits, was pleased to make his report in favour of both parties.‡

XI.—A Magnetic Scheme suggested.

Mr. Urban,—How frequently do we find ourselves in the situation of the author in the farce of the "Critic," who having been discovered in a plagiarism, is driven to his shifts

* Vol. 47, 1777, p. 441.

† Probably the invention alluded to, but not described, in his lecture (Chapter III.); and elsewhere called "The Rotator."

‡ The "Historical Chronicle," in the "Gentleman's Magazine," vol. 49, 1779, p. 269.

for an excuse, and at length observes, "that all he has to say about it is, that Shakspeare and he had the same ideas, but that Shakspeare used them first" (or words to that effect). In some such light does a rude idea of mine stand just now. About two years ago, or not quite so long, I mentioned to a philosophical friend, who had frequently turned his attention towards the construction of a machine that would afford the long sought for desideration of perpetual motion, my opinion as to what I conceived must be selected as the first principle of any such action. I considered that whatever the power may be which shall keep up an action of that kind, would be found only in nature; and that, however art may assist towards the attainment of the end, it would, nevertheless, be found to be but secondary. I told him the power which I conceived was the one required; and he (on my writing to ask if he remembered the conversation) replies, that he perfectly recollects it; and that the magnet was that to which I alluded. Now, Mr. Urban, I am very far indeed from wishing to claim anything like discovery; but I can only say, that the gentleman in whose behalf the interest of Parliament is about to be sought, "has had the same idea (so far as the magnet is concerned) with me, but has used it first." Mine being, however, but a theory, as I never have attempted to construct the machine I had in my mind, I should justly merit both scorn and ridicule, could I have for a moment the effrontery of putting my hypothesis in competition with the tried apparatus of the gentleman in question. Nevertheless, I may venture to give them on paper, as they may, perhaps, assist in a small degree towards exciting the attention of more philosophical men than myself. I am well aware of the mechanical difficulties that will present themselves, but still do think they may be overcome. The power of the magnet we know to be both attractive and repellent; and as this power exists independent of human agency, I have always looked upon it as the most likely to supply the wants we are anxious to remove. I therefore suppose that a wheel, simple in its construction and like to a water-wheel, might be made to move on a diamond or agate pivot, having its weather boards (I know not if that be the technical term for the parts which dip into the stream or not) armed with iron; the magnet then to be applied nearly vertical and wheel put in motion, when it appeared to me that the attractive power

acting on the extremities of the wheel, on one side of each of the boards and in an opposite power to the other, would continue to propel the wheel with a rotatory motion: the first impetus of course must be given by hand. Rude and untried as my plan is, I cannot but think it practicable, and trust that you will oblige me by giving it a place in your publication, as through such a channel of scientific information it may, perhaps, assist some to form new ideas, or to induce others to correct the erroneous one (if it be such) of

Yours, &c.,

ALPHABETICUS.*

XII.—Spence's Motion by Magnetism.

John Spence, an ingenious individual, residing at Linlithgow, in Scotland, has applied the magnetic power to the production of a perpetual motion. This person was in early life apprenticed to a shoemaker, but the natural bent of his genius for mechanics overcame every obstacle; he got to be keeper of a steam-engine in a spinning factory at Glasgow, and after two years' study in this school, retired to his native place to pursue the shoemaking for bread; and wheels, levers, &c., for the gratification of his own taste. The perpetual motion was an object worthy of such a devotee, and we find that he has invented a piece of mechanism which is doubly curious, from its own powers, and from the extraordinary difficulties in whose despite it has been accomplished. It is not easy to convey an idea of it without plates. A wooden beam, poised by the centre, has a piece of steel attached to one end of it, which is alternately drawn up by a piece of magnet placed above it, and down by another placed below it: as the end of the beam approaches the magnet, either above or below, the machine interjects a non-conducting substance, which suspends the attraction of the magnet approached, and allows the other to exert its powers. Thus the end of the beam continually ascends and descends betwixt the two magnets, without ever coming into contact with either; the attractive power of each being suspended precisely at the moment of nearest approach. And as the magnetic attraction is a permanently operating power, there appears to be no

* Vol. 88, part 1, 1818, p. 391.

limit to the continuance of the motion, but the endurance of the materials of the machine. The first machine made by Mr. Spence is very rude, and fashioned by his own hands, but he intends applying the principle to the motion of a time-piece. We trust this ingenious man will meet the encouragement he deserves—if not as the reward of his talents and perseverance, at least for the benefit of the community, for it is from such sources that great national improvements are often derived.*

XIII.—A Wheel moved by Magnetic influence.

The piece of mechanism consists of only one small horizontal wheel, not exceeding 3-4ths of an inch in diameter, through the centre of which, on the plane of the wheel, passes a small magnetic bar, projecting about 3-4ths of an inch beyond the circumference of the wheel on the one side, and about 3-8ths of an inch on the other side. These projections are called the north and south poles. The axis of the wheel is of course perpendicular. Its operative power is magnetism; its motion (probably owing to the friction inseparable from the long-continued action of the axis in its sockets) is somewhat irregular; but on the whole it is a curiosity highly deserving attention. Owing to a sudden shock, its motion was stopped entirely the other day, but we have learned that it has been restored. About two years ago it was stopped by some unknown cause, but after a short pause recovered its motion of itself, without any additional impulse, and continued its revolutions without intermission. In a room at Mr. Swan's, in Coppergate, which was excessively warm, and crowded with company, its action ceased altogether, after first becoming irregular and sickly. Query.—Might not this simple fact lead to some important issue on the question of the variation of the compass? This we only know, that the magnetic influence was deadened by excessive heat, and resuscitated by more moderate atmosphere.—*Yorkshire Gazette.*†

* Vol. 88, part 2, 1818, p. 156.

† Vol. 91 (July to December, 1821), part 2, p. 628.

In the "Annual Register," for 1774, is a "Description of the curious Time-piece in Mr. Cox's Museum:"—

Among other great works now introduced at Mr. Cox's Museum is an immense barometer, of so extraordinary a construction that by it the long sought for, and in all likelihood the only perpetual motion that ever will be discovered is obtained. The constant revolution of the wheels moving in vertical, horizontal, and other directions, is not only physically produced, but the indication of time from an union of the philosophic with the mechanic principles is effected. Upon the dial, besides a minute and an hour hand, is another hand dividing the minute into 60 equal parts. These hands are motionless till affixed to the primary motion, so that the motion of the time-piece (as Mr. Cox in his descriptive inventory judiciously expresses it) is originated, continued, and perfected, by the philosophic principle through which it is (solely) actuated.

The encouragement Mr. Cox has, for many years, given to men of genius, and the perseverance with which he has pursued the great line of utility, have not only given birth to productions that have astonished all Europe, as well as the eastern world, but have at last produced the wonderful machine above described. Several of the most eminent philosophers and mathematicians in this kingdom, who have examined it attentively, are of opinion that it will lead to farther improvements both in philosophy and mechanics; and we hear that Mr. Cox intends to devote a part of every week to the gratification of such gentlemen in the scientific world as wish to be acquainted either with the construction or the mode of operation, the principles of action or the masterly execution of so capital a performance. This article is, we are informed, one of the prizes, and the work of many years, during which time numberless ineffectual and expensive trials were made, which perhaps would have damped any ardour but Mr. Cox's, and probably prevented the world from ever being benefited by so valuable a discovery.

"I have seen and examined (says Mr. James Ferguson, in a letter dated Bolt-court, Fleet-street, Jan. 28) the above-described clock, which is kept constantly going, by the rising and falling of the quicksilver in a most extraordinary barometer; and there is no danger of its ever failing to go;

for there is always such a quantity of moving power accumulated as would keep the clock going for a year, even if the barometer should be taken quite away from it. And, indeed, on examining the whole contrivance and construction, I must with truth say that it is the most ingenious piece of mechanism I ever saw in my life."

For a further account of this extraordinary machine, see Mr. Cox's descriptive inventory of his museum.*

Alleged discovery in France, by M. Dodemant:—

A machine, capable of being set in motion, and producing a powerful effect, without either the intervention of any combustible, the action of any current of water or of air, or the exertion of animal strength, but possessing within itself the inexhaustible principle of motion, would doubtless prove of great utility to mankind. Such is that of which M. Dodemant, professor of mathematics at Lyons, announces himself the inventor. At his request, the prefect has directed two persons—M. Carron, chief engineer of the department, and M. Moller, professor of natural philosophy—to examine this machine.†

The following, referring to Geiser's imposition and Zamboni's Column, is extracted from an article headed "The most important inventions and discoveries of our times," which in a note we are informed is "from the German of M. Poppe, of Tubingen:"—

Many able mechanicians have been endeavouring to discover a *perpetuum mobile;* but many, who thought themselves on the point of succeeding, found their hopes deceived, and the phantom they had pursued eluded their grasp. The clock of M. Geiser, an admirable piece of mechanism, seemed to have solved this great problem in an ingenious and simple manner; but it deceived only for a time, not only the author of this essay, but many of the most excellent mathematicians; for in this clock springs were concealed in the most artful manner, which were wound up at certain times, to aid the apparent power, which was not able alone to keep the machine in

* The Annual Register, vol. 17, 1774, p. 248.

† The Monthly Magazine, vol. 22, part 2, 1806, p. 67.

motion. Above a year ago, the author of this article discovered this trick, with several other lovers of the arts, who had joined with him to examine the machine; and he soon after made his discovery public.

The column of Zamboni, and the clock connected with it, by that artist, at Verona, which have now gone, without interruption, for above four years, as well as that of Ramis, at Munich (called the electric pendulum clock), are therefore, perhaps, the best *perpetuum mobile* that we yet have. By this name we of course understand a machine which is able constantly to renew the cause of its motion by its own mechanism, and whose moving principle preserves its action without interruption, and without any new impulse, till it is stopped either by the wear of the machine or by violence. The invention of a machine possessed of this property is indeed very difficult, but not impossible, as Kastner Langsdorff and other mathematicians have demonstrated.*

An imposition exposed in a letter from Mr. Thomas Gill, Chairman of the Committee of Mechanics in the Society for the Encouragement of Arts, &c. &c., of London, to Prof. Thomson, on a pretended Patent Self-moving Engine:—

No. 125, Strand, London, Oct. 4, 1820.

SIR,—My attention has lately been directed to a gross imposition upon the public in a pretended self-moving engine, which is now exhibiting in this metropolis, and which I think it highly proper to expose, and thereby, as far as lies in my power, prevent the delusion from being continued.

It is announced in the following handbill:—

"The newly-discovered patent self-existing engine for propelling ships at sea, carriages on the road, and all kinds of machinery, without the aid of horse, steam, water, or other power now in use. To be seen at work every day, Sundays excepted, from ten in the morning till six at night, at 32, Burlington Arcade, Piccadilly. Admittance, Two Shillings.

"N.B.—Gentlemen intending to have their machinery driven by the above power are desired to apply as above. If by letter, post-paid.

* The New Monthly Magazine, vol. 12, part 2 (July to December, 1819), p. 162.

I found the machine to consist of a light brass wheel, about two feet in diameter, turning upon an horizontal axis, which is supported at each end in square blocks upon the tops of two brass columns, which are affixed to a mahogany table mounted upon a thick pillar of the same wood, with feet and rolling castors, so that it may be moved about, and thereby show that it has no communication through the floor of the room it is exhibited in. The thickness of the table is about an inch and a half, and the pillar is about 6 inches in diameter. Around the periphery of the wheel are fixed at equal distances, by screws, a number of small cylindrical rods or bars of metal, which are placed parallel to the axis of the wheel; and at one end of the frame surrounding the wheel (and which frame is besides supported on two other brass columns) is a brass pillar, which has an arm or bracket, on which is fixed, near the periphery of the wheel, a ball, which the inventor pretends is formed of a new combination of metals, the composition of which, he says, possesses a new species of attraction, which is not magnetism, for the metal bars on the periphery of the wheel so as to draw each of them in succession continually towards it; but as this attraction takes place equally above and below the ball, he says that he cuts it off below by means of a plate of a different composition of metals, which is placed beneath the ball, and thus he pretends that the wheel is continually turned round by this new attempt at reviving the long since exploded doctrine of attraction and repulsion, and with considerable force, and says that he has in the country a machine of two horses' power. On being asked if he had any pieces of the compound metals with him besides those on the machine, he said he had not, and would not suffer any person to possess them, lest they should take them to pieces, and thereby discover their composition. On being questioned as to his patent, he said that in fact he had none, having merely entered a *caveat* to prevent any persons from taking out a patent for a similar machine without his being informed thereof. So much, then, for his pretended patent; and I verily believe that his new-invented power rests on no better a foundation, and that, in fact, his wheel is turned by spring mounted on a barrel, as usual in spring clocks and other pieces of mechanism, and which is concealed either in the substance of the table itself or in the thick

pillar which supports it, the barrel having a ring of teeth around it, working in a pinion affixed upon the lower end of an upright axis concealed in one of the brass columns that support the horizontal axis of the wheel, and having at its upper end another pinion which works into a small toothed contrate wheel fixed on the end of the horizontal axis, but also concealed in the brass block on the top of the column, and in another pillar which is screwed upon the top of the block, and is quite large enough to contain it, and thus gives motion to the wheel; and, indeed, the artifice is but very clumsily concealed. I should have added that the brass pillar last mentioned supports an upright axis having a pinion at its lower end, which is driven by a contrate wheel on the horizontal axis of the wheel, and which upright axis has at the top of it a fly with wings to regulate the motion of the machine, as in other spring movements.

This barefaced imposition reminds me of another which was practised upon the public several years since, and was detected, and very properly exposed, by my friend Mr. J. T. Hawkins, which put an end to the trick: this consisted of what was said to be a self-moving pendulum, and beneath the bottle of it a ball was placed, out of which, as the exhibitor pretended, an elastic fluid was continually proceeding, which gave an impulse to the ball as it passed over it. Mr. Hawkins, however, found that the impulse was, in fact, given to the pendulum at its upper end; and that the axis on which it hung communicated with another pendulum which was kept in motion by a weight or other maintaining power; for in like manner the real cause of the wheel's motion in this new imposition is concealed, and the attention of the spectator is directed to another pretended first mover, and which is besides attended with the additional advantage of affording him matter for wonder, which constitutes the chief pleasure of the multitude, and contributes greatly to the profit of the exhibition.

I am, Sir, your most obedient servant,

THOMAS GILL.*

* Annals of Philosophy. By Thomas Thomson, M.D. 8vo. Vol. 16, 1820, p. 373.

Mr. G., Editor of the Technical Repository, referred to in Chapter VIII. of the present work.

In the notice given of "Lectures delivered in the Theatre of the Royal Institution," the following occurs, in mentioning "Dr. Young's Lectures on Mechanics:"—

The doctrines of rotatory power and preponderance were considered after those of equilibrium; the apparatus intended for illustrating the effects of rotatory power was not completed; but an experiment was made, in a subsequent lecture, in confirmation of the propositions respecting the most advantageous disposition of power in machines. Six equal weights were attached to as many threads, and each pair of threads was passed in opposite directions round the different portions of three pullies. The first pulley was so formed that its larger portion was to its smaller as 3 to 2; the second was in the ratio of 5 to 2, and the third as 4 to 1; and the three weights, of which the threads were coiled round the smaller part of each pulley, being suffered to rise at the same instant, the middle weight rose evidently much faster than either of the others. Dr. Young, however, remarked that the greatest velocity would not in all cases be practically desirable, on account of the injury that the machinery would sustain from the shock in stopping it. A model of a wheel with moveable weights, for producing perpetual motion, was employed for showing the fallacy of all projects of this kind, and it was observed that a general demonstration of its insufficiency might be deduced from the properties of the centre of gravity.*

In "Œuvres Philosophiques" of M.'s Gravesande, we find his letter to Sir Isaac Newton, already given (Chapter II.), and the following—

Remarks touching Perpetual Motion.

About eight months ago, by order of His Serene Highness the Landgrave of Hesse, I was called upon to examine the effects of a machine at Cassel, which the inventor (Orffyreus) professed to be a perpetual motion. He carefully hid its interior, requiring a certain sum when the

* Journals of the Royal Institution of Great Britain, vol. 1, 8vo., 1802, p. 105.

machine should have been first fully examined and recognised by mathematicians to be, what in mechanics is called a perpetual motion. I was so forcibly struck by what I saw and what I heard of it, as to be unable to call it in question. I was obliged to look on the machine as one of the most beautiful inventions in mechanics that I had ever known, and had only to consider the truth of the effects before me. I wrote to Mr. Newton all I had observed about it, which having been printed, fault has been found with what I advance, saying:—"that I do not believe perpetual motion to be a contradiction;"—"that the demonstrations given on its impossibility do not appear to me as applicable to all machines;"—and, lastly, "that I find it probable that the machine at Cassel may be a perpetual motion." All the difficulty turns on the first of these remarks; if that were proved, the remaining ones would not embarrass me much; and has, no doubt, been found too bold to venture on without proof. In this I quite agree, and I should not have committed the fault had my letter been written for the public. I was so little inclined to advance a proposition without proof, that I have never yet declared what I thought on perpetual motion, foreseeing the judgment that all mathematicians must pass on any one who should turn aside from the generally received opinions. What I considered I owed to truth, after having seen the machine at Cassel, induced me to give Mr. Newton my opinion on it, and at the same time to say what I thought of the proofs of the impossibility of perpetual motion. I must now justify myself before the public.

We must, however, first establish the state of the question. As no foreign agent must be employed, it will be seen that a clock, in whatever way wound up, would not be perpetual motion. It may be what mathematicians have taught under the term of collision, on the power of which they are divided in opinion. All agree that the force of collision is proportionate to the mass. We must admit the possibility of perpetual motion in all machines which would have the principle of their movement in the collision of bodies. The impossibility of perpetual motion has not been shown in all possible cases, affected by collision. And the laws of nature are not yet well enough known to allow our drawing a conclusion that perpetual motion is contrary to these laws.

As it is possible for a body to rise quicker than it descends, on this I found my proof of the possibility of perpetual motion.

Conceive a body falling from one foot high, losing all its movement by the shock; suppose it to fall four times similarly, it would have fallen from the height of four feet, and the four shocks would be equal to the force that the gravity communicated to the body during the four moments of its fall. But it is known that the body could mount in two of these moments to the height of four feet; consequently, the force of two of these four shocks suffices to make it rise, and the two other shocks may be employed to move a machine: so the movement would be continued perpetually by the falls reiterated of the same body, which at each revolution would gain the force of two shocks. The gain of the force would be greater at each revolution, if the number of shocks were increased in the descent. Thus, there is in nature an augmentation of strength, which is sufficient to support the opinion that perpetual motion is not a contradiction—nay, that it is even possible.

This possibility will appear still clearer, if attention is paid to the property of springs, that they rebound with the same force that bound them. This matter was disputed between MM. Leibnitz and Papin, in the "Actes de Leipsic," respecting whether the force of a body was proportionate to its speed; if admitted, Leibnitz considered perpetual motion would be the consequence; Papin admitted the validity of the consequence, but doubted the proposition.

The only means of replying to the arguments brought forward on the possibility of perpetual motion, is to deny with M. Leibnitz the principle on which they are founded.

I should not be able to persuade myself that it is a contradiction to construct a machine which would have in itself the principle of the augmentation of power, in consequence of the laws of nature. These laws are so little known to us, and there is little appearance that they will ever be discovered sufficiently for us to arrive at such a conclusion. To me it seems, that these laws, on the contrary, ought to make us look upon such a machine as very possible, although it may never be accomplished by human art.

The question of the possibility or impossibility of perpetual motion, then, seems to me of little consequence; but it is

desirable that the strong persuasion that mathematicians have regarding its impossibility should not prevent their paying serious attention to such a machine as the astonishing wheel of Cassel; a wheel having the principle of movement internal, and which is moved by the slightest effort, turning either way without any necessity to reverse the moving power; lastly, after making some millions of surprisingly rapid turns, continues its motion until stopped by a strong effort of the arm. It appears to me that such a machine merits some praise, even should it not satisfy all its inventor's representations. If it is perpetual motion, he deserves the recompense he asks; and if not, the public may here discover a beautiful invention.*

[For full details, see Appendix F.]

The resolution of the Royal Academy of Sciences in Paris not to entertain communications relating to Perpetual Motion, was passed in 1775. They say:—

This year the Academy has passed the resolution not to examine any solution of problems on the following subjects:—

The duplication of the cube, the trisection of the angle, the quadrature of the circle, or any machine announced as showing perpetual motion.

We believe ourselves bound to account for the motives which have led to this determination.

* * * * *

The construction of a perpetual motion is absolutely impossible. If even friction and resistance from the middle did not eventually destroy the effect of the first motive power, that power cannot produce an effect equal to its cause; if, then, it is desired that the effect of a complete power should act continually, the effect must be infinitely small in a given time. If the friction and resistance be subtracted, the first motion given to a body will always continue; but it will not act in regard to other bodies, and the only perpetual motion possible in this hypothesis

* Œuvres Philosophiques et Mathematiques de Mr. G. J. 's Gravesande. Amsterdam, 1774. 2 vols., 4to. (Vol. 1, p. 305.)

(which could not exist in nature) would be absolutely useless in carrying out the object proposed by the constructors of these perpetual motion machines. The drawback to these researches is their being exceedingly expensive, and has ruined more than one family; often mechanics, who could have rendered great services to the public, have wasted their means, time, and genius.

Such are the principal motives that have dictated the determination of the Academy. In stating that they will not occupy themselves any longer with these subjects, they only declare their opinion of the complete uselessness of the labour of those who so occupy themselves. It has often been said, that in seeking to solve chimerical problems, many useful truths have been found; an opinion which originated in a time when the proper method of discovering the truth was unknown, which in the present day is well known. It is more than probable that the right manner of discovering these truths is to search for them. But the quadrature of the circle is the only rejected problem of the Academy which could give rise to any useful research; and, if a geometrician should find it out, the determination of the Academy would only enhance his merit, as it would show the opinion that geometricians have of the difficulty, not to say insolubility, of the problem.*

* Histoire de l'Académie Royale des Sciences, 1775. Paris, 1778. 4to. Pp. 61-66.