PERPETUUM MOBILE;

OR,

SEARCH FOR SELF-MOTIVE POWER.

CHAPTER I.

EARLY OPINIONS RESPECTING THE POSSIBILITY OF, AND PROJECTS FOR OBTAINING, PERPETUAL MOTION.

JOHN WILKINS, an ingenious and learned Bishop of Chester, was born near Daventry, in Northamptonshire, in 1614, and died 1672. He was well versed in mechanical science, and his writings display an extensive acquaintance with a variety of ancient authorities on every matter on which he discourses. He is the most exact writer of the seventeenth century on the subject of Perpetual Motion, examining it thoroughly, with admirable acuteness as well as candour. His celebrated work, entitled "Mathematical Magic," is divided into two books, the second quaintly designated "Dædalus," after that ancient inventor. Among the works he has briefly quoted in marginal notes, we may mention more at large—"A Treatise on Continuall Motions, by JOANNES TAISNIERUS, a public Professor of Rome, Ferraria, and other Vniuersities in Italie" —no date, but afterwards printed with other works, 1579,

quarto. Also "A Dialogue concerning Perpetual Motion, by THOMAS TYMME, Mynister," London, 1612, quarto. He does not, however, allude to another of the same period, "De Inventione Æterni Motoris, by JAMES ZABARELLA, Teacher of Logic at Padua," where he died 1589; his book was published at Francfort, 1618. The ninth, thirteenth, fourteenth, and fifteenth chapters of Bishop Wilkins' work, second book, here follow:—

CHAP. IX.—*Of a Perpetual Motion—The seeming facility and real difficulty of any such contrivance—The several ways whereby it hath been attempted, particularly by Chymistry.*

It is the chief inconvenience of all the automata beforementioned,* that they need a frequent repair of new strength, the causes whence their motion does proceed being subject to fail, and come to a period; and therefore it would be worth our enquiry to examine whether or no there may be made any such artificial contrivance, which might have the principle of moving from itself, so that the present motion should constantly be the cause of that which succeeds.

This is that great secret in Art which, like the Philosopher's Stone in Nature, hath been the business and study of many more refined wits, for divers ages together; and it may well be questioned whether either of them as yet hath ever been found out; though if this have, yet, like the other, it is not plainly treated of by any author.

Not but there are sundry discourses concerning this subject, but they are rather *conjectures* than *experiments*. And though many inventions in this kind may at first view bear a great shew of probability, yet they will fail, being brought to trial, and will not answer in practice what they promised in speculation. Any one who hath been versed in these experiments must needs acknowledge that he hath been often deceived in his strongest confidence; when the imagination hath contrived the whole frame of such an instrument, and conceives that the event must infallibly answer its hopes, yet then does it strangely deceive in the proof, and discovers to us some defect which we did not before take notice of.

* Various mills, chariots, clocks, &c., &c.

Hence it is, that you shall scarce talk with any one who hath never so little smattering in these arts, but he will instantly promise such a motion, as being but an easy atchievement, till further trial and experience hath taught him the difficulty of it. There being no enquiry that does more entice with the *probability* and deceive with the *subtilty*.

I shall briefly recite the several ways whereby this hath been attempted, or seems most likely to be effected, thereby to contract and facilitate the enquiries of those who are addicted to these kind of experiments; for when they know the defects of other inventions, they may the more easily avoid the same or the like in their own.

The ways whereby this hath been attempted may be generally reduced to these three kinds:—

1. By Chymical Extractions.
2. By Magnetical Virtues.
3. By the Natural Affection of Gravity.

1. The discovery of this hath been attempted by Chymistry. Paracelsus and his followers have bragged, that by their separations and extractions, they can make a little world which shall have the same perpetual motions with this microcosm, with the representation of all meteors, thunder, snow, rain, the courses of the sea in its ebbs and flows, and the like. But these miraculous promises would require as great a faith to believe them, as a power to perform them; and tho' they often talk of such great matters,—

> At nusquam totos inter qui talia curant,
> Apparet ullus, qui re miracula tanta
> Comprobet—

yet we can never see them confirmed by any real experiment; and then, besides, every particular author in that art hath such a distinct language of his own (all of them being so full of allegories and affected obscurities), that 'tis very hard for any one (unless he be thoroughly versed amongst them) to find out what they mean, much more to try it.

One of these ways (as I find it set down) is this:—Mix five ounces of ☿ with an equal weight of ☽; grind them together with ten ounces of sublimate; dissolve them in a cellar upon some marble for the space of four days, till they become like oil olive; *Etten. Mathem. Recreat., prob.* 118.

distil this with fire of chaff, or driving fire, and it will sublime into a dry substance; and so, by repeating of these dissolvings and distillings, there will be at length produced divers small attoms, which, being put into a glass well luted, and kept dry, will have a perpetual motion.

I cannot say any thing from experience against this; but methinks it does not seem very probable, because things that are forced up to such a vigorousness and activity as these ingredients seem to be by their frequent sublimings and distillings, are not likely to be of any duration. The more any thing is stretched beyond its usual nature, the less does it last; violence and perpetuity being no companions. And then, besides, suppose it true, yet such a motion could not well be applied to any use, which will needs take much from the delight of it.

Celebrated in an epigram by Hugo Grotius, l. 1.

Amongst the chymical experiments to this purpose, may be reckoned up that famous motion invented by Cornelius Dreble, and made for King James; wherein was represented the constant revolutions of the sun and moon, and that without the help either of springs or weights. Marcellus Vranckhein, speaking of the means whereby it was performed, he calls it *Scintillula animæ magneticæ mundi, seu astralis et insensibilis spiritus;* being that grand secret, for the discovery of which, those dictators of philosophy, Democritus, Pythagoras, Plato, did travel unto the Gymnosophists and Indian Priests. The author himself, in his discourse upon it, does not at all reveal the way how it was performed. But there is one Thomas Tymme, who was a familiar acquaintance of his, and did often pry into his works (as he professes himself), who affirms it to be done thus: By extracting a fiery spirit out of the mineral matter, joining the same with his proper air, which included in the axletree (of the first moving wheel), being hollow, carrieth the other wheels, making a continual rotation, except issue or vent be given in this hollow axletree, whereby the imprisoned spirit may get forth.

Epist. ad Ernestum de Lamp. Vitæ.

Epist. ad Jacobum Regem.

Philosoph. Dialogue, confer. 2, c. 3.

What strange things may be done by such extractions, I know not, and therefore dare not condemn this relation as impossible; but methinks it sounds rather like a chymical

dream, than a philosophical truth. It seems this imprisoned spirit is now set at liberty, or else is grown weary, for the instrument (as I have heard) hath stood still for many years. It is here considerable that any force is weakest near the center of a wheel; and therefore, though such a spirit might of itself have an agitation, yet 'tis not easily conceivable how it should have strength enough to carry the wheels about with it. And then, the absurdity of the author's citing this, would make one mistrust his mistake. He urges it as a strong argument against Copernicus; as if, because Dreble did thus contrive in an engine the revolution of the heavens and the immoveableness of the earth, therefore it must needs follow that 'tis the heavens which are moved, and not the earth. If his relation were no truer than his consequence, it had not been worth the citing.

CHAP. XIII.—*Concerning several attempts of contriving a Perpetual Motion, by Magnetical Virtues.*

The second way whereby the making of a perpetual motion hath been attempted, is by Magnetical Virtues, which are not without some strong probabilities of proving effectual to this purpose; especially when we consider that the heavenly revolutions (being as the first pattern imitated and aimed at in these attempts) are all of them performed by the help of these qualities. This great orb of earth, and all the other planets, being but as so many magnetical globes, endowed with such various and continual motions as may be most agreeable to the purposes for which they were intended. And, therefore, most of the authors who treat concerning this invention, do agree that the likeliest way to effect it, is by these kind of qualities.

Gilbert de Magnet. Cabœus Philos. Magnet., l. 4, c. 20.

It was the opinion of Pet. Peregrinus, and there is an example pretended for it in Bettinus (apiar. 9, progym. 5, pro. 11) that a magnetical globe, or terella, being rightly placed upon its poles, would of itself have a constant rotation, like the diurnal motion of the earth. But this is commonly exploded as being against all experience.

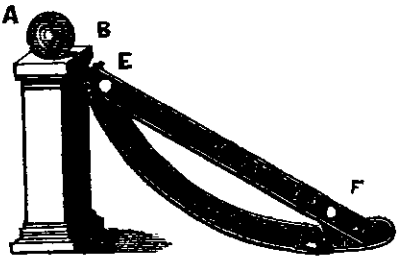
Athanas. Kircher de Arte Magnet., l. 1, par. 2, prop. 13. Item., l. 2, p. 4.

Others think it possible so to contrive several pieces of steel and loadstone that, by their continual attraction and

expulsion of one another, they may cause a perpetual revolution of a wheel. Of this opinion were [a] Taisner, [b] Pet. Peregrinus, and [c] Cardan, out of Antonius de Fantis. But D. Gilbert, who was more especially versed in magnetical experiments, concludes it to be a vain and groundless fancy.

[a] *Tract. de motu continuo.*
[b] *De Rota perpetui motus, par. 2, c. 2.*
[c] *De Variet. rerum, l. 9, c. 48.*
De Magnet., l. 2, c. 25.

But amongst all these kinds of inventions, that is most likely, wherein a loadstone is so disposed that it shall draw unto it on a reclined plane a bullet of steel, which steel, as it ascends near to the loadstone, may be contrived to fall down through some hole in the plane, and so to return unto the place from whence at first it began to move; and, being there, the loadstone will again attract it upwards till coming to this hole, it will fall down again; and so the motion shall be perpetual, as may be more easily conceivable by this figure:—



Suppose the loadstone to be represented at A B, which, though it have not strength enough to attract the bullet C directly from the ground, yet may do it by the help of the plane E F. Now, when the bullet is come to the top of this plane, its own gravity (which is supposed to exceed the strength of the loadstone) will make it fall into that hole at E; and the force it receives in this fall will carry it with such a violence unto the other end of this arch, that it will open the passage which is there made for it, and by its return will again shut it; so that the bullet (as at the first) is in the same place whence it was attracted, and, consequently, must move perpetually.

But however this invention may seem to be of such strong probability, yet there are sundry particulars which may prove it insufficient: for—

1. This bullet of steel must first be touched, and have its several poles, or else there can be little or no attraction of it. Suppose C in the steel to be answerable unto A in the stone, and to B; in the attraction C D must always be directed answerable to A B, and so the motion will be more difficult; by reason there can be no rotation or turning round of the bullet, but it must slide up with the line C D, answerable to the axis A B.

2. In its fall from E to G, which is *motus elementaris*, and proceeds from its gravity, there must needs be a rotation of it; and so 'tis odds but it happens wrong in the rise, the poles in the bullet being not in the same direction to those in the magnet; and if in this reflux it should so fall out, that D should be directed towards B, there should be rather a flight than an attraction, since those two ends do repel, and not draw one another.

3. If the loadstone A B have so much strength, that it can attract the bullet in F, when it is not turned round, but does only slide upon the plane, whereas its own gravity would move it downwards; then it is evident the sphere of its activity and strength would be so increased when it approaches much nearer, that it would not need the assistance of the plane, but would draw it immediately to itself without that help; and so the bullet would not fall down through the hole, but cleave to the stone, and, consequently, cease its motion: for, if the loadstone be of force enough to draw the bullet on the plane, at the distance F B, then must the strength of it be sufficient to attract it immediately unto itself, when it is so much nearer as E B. And if the gravity of the bullet be supposed so much to exceed the strength of the magnet, that it cannot draw it directly when it is so near, then will it not be able to attract the bullet up the plane, when it is so much further off.

So that none of all these magnetical experiments, which have been as yet discovered, are sufficient for the effecting of a perpetual motion, though these kind of qualities seem most conducible unto it; and perhaps, hereafter, it may be contrived from them.

CHAP. XIV.—*The seeming probability of effecting a Continual Motion by Solid Weights in a Hollow Wheel or Sphere.*

The third way whereby the making of a perpetual motion hath been attempted is by the Natural Affection of Gravity; when the heaviness of several bodies is so contrived, that the same motion which they give in their descent, may be able to carry them up again.

But (against the possibility of any such invention) it is thus objected by Cardan:—All sublunary bodies have a direct motion either of ascent or descent; which, because it does not refer to some term, therefore cannot be perpetual, but must needs cease when it is arrived at the place unto which it naturally tends.

Subtil., l. 17. De Var. Rerum, l. 9, c. 48.

I answer, though this may prove that there is no natural motion of any particular heavy body which is perpetual, yet it doth not hinder, but that it is possible from them to contrive such an artificial revolution as shall constantly be the cause of itself.

Those bodies which may be serviceable to this purpose are distinguishable into two kinds:—

1. Solid and consistent; as weights of metal, or the like.
2. Fluid or sliding; as water, sand, &c.

Both these ways have been attempted by many, though with very little or no success. Other men's conjectures in this kind you may see set down by divers authors. It would be too tedious to repeat them over, or set forth their draughts.

D. Flud. Tract. 2, par. 7, l. 2, c. 4 ♁ 7.

I shall only mention two new ones, which (if I am not over-partial) seem altogether as probable as any of these kinds that have been yet invented; and, till experience had discovered their defect and insufficiency, I did certainly conclude them to be infallible.

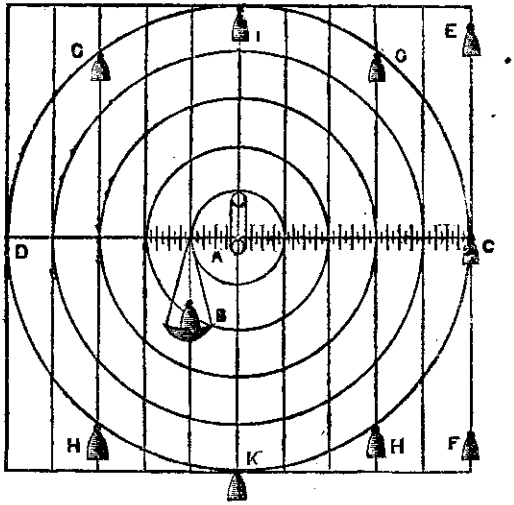
The first of these contrivances was by solid weights being placed in some hollow wheel or sphere, unto which they should give a perpetual revolution; for, as the philosopher hath largely proved, only a circular motion can properly be perpetual.

Arist. Phys., l. 8, c. 12.

But, for the better conceiving of this invention, it is requisite that we rightly understand some principles in Trochilicks, or the art of wheel instruments; as, chiefly, the relation betwixt the parts of a wheel and those of a ballance; the several proportions in the semi-

Arist. Mechan., c. 2. De ration. libræ ad circulu.

diameter of a wheel being answerable to the sides in a ballance, where the weight is multiplied according to its distance from the center.

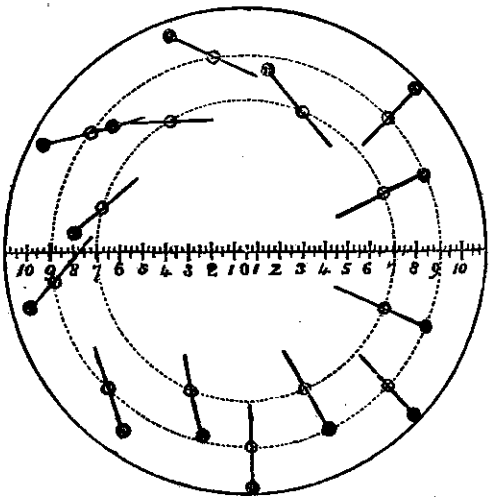


Thus, suppose the center to be at A, and the diameter of the wheel, D C, to be divided into equal parts (as is here expressed), it is evident, according to the former ground, that one pound at C will equiponderate to five pound at B, because there is such a proportion betwixt their several distances from the center. And it is not material whether or no these several weights be placed horizontally; for though B do hang lower than C, yet this does not at all concern the heaviness; or though the plummet C were placed much higher than it is at E, or lower at F, yet would it still retain the same weight which it had at C; because these plummets (as in the nature of all heavy bodies), do tend downwards by a strait line; so that their several gravities are to be measured by that part of the horizontal semidiameter which is directly either below or above them. Thus, when the plummet C shall be moved either to G or H, it will lose one-third of its former heaviness, and be equally ponderous as if it were placed in the ballance at number 3; and if we suppose it to be situated at

I or K, then the weight of it will lie wholly upon the center, and not at all conduce to the motion of the wheel on either side; so that the strait lines which pass through the divisions of the diameter may serve to measure the heaviness of any weight in its several situations.

These things thoroughly considered, it seems very possible and easie for a man to contrive the plummets of a wheel, that they may be always heavier in their fall, than in their ascent; and so, consequently, that they should give a perpetual motion to the wheel itself; since it is impossible for that to remain unmoved as long as one side in it is heavier than the other.

For the performance of this, the weights must be so ordered—1. That in their descent they may fall from the center, and in their ascent may rise nearer to it. 2. That the fall of each plummet may begin the motion of that which should succeed it, as in the following diagram:—



Where there are sixteen plummets, eight in the inward circle, and as many in the outward. (The inequality being to arise from their situation, it is therefore most convenient that the number of them be even.) The eight inward plummets are

supposed to be in themselves so much heavier than the other, that in the wheel they may be of equal weight with those above them, and then the fall of these will be of sufficient force to bring down the other. For example, if the outward be each of them four ounces, then the inward must be five; because the outward is distant from the center five of those parts whereof the inward is but four. Each pair of these weights should be joined together by a little string or chain, which must be fastened about the middle, betwixt the bullet and the center of that plummet which is to fall first, and at the top of the other.

When these bullets, in their descent, are at their farthest distance from the center of the wheel, then shall they be stopped, and rest on the pins placed to that purpose; and so, in their rising, there must be other pins to keep them in a convenient posture and distance from the center, lest, approaching too near unto it, they thereby become unfit to fall when they shall come to the top of the descending side.

This may be otherwise contrived with some different circumstances, but they will all redound to the same effect. By such an engine it seems very probable that a man may produce perpetual motion; the distance of the plummets from the center increasing with weight on one side, and their being tied to one another, causing a constant succession in their falling.

But now, upon experience, I have found this to be fallacious; and the reason may sufficiently appear by a calculation of the heaviness of each plummet, according to its several situation; which may easily be done by those perpendiculars that cut the diameter, (as was before explained, and is here expressed in five of the plummets on the descending side). From such a calculation it will be evident, that both the sides of this wheel will equiponderate; and so consequently, that the supposed inequality whence the motion should proceed, is but imaginary and groundless. On the descending side, the heaviness of each plummet may be measured according to these numbers, (supposing the diameter of the wheel to be divided into twenty parts, and each of those subdivided into four):—

THE OUTWARD PLUMMETS.		THE INWARD PLUMMETS.	
7.0 10.0 7.0	The sum 24.	1.0 7.2 7.2 3.0	The sum 19.

On the ascending side, the weights are to be reckoned according to these degrees:—

THE OUTWARD.		THE INWARD.	
1.3 7.2 9.0 5.3 0.0	The sum 24.	4.1 7.0 5.2 2.1	The sum 19.

The sum of which last numbers is equal with the former, and therefore both the sides of such a wheel in this situation will equiponderate.

If it be objected, that the plummet A should be contrived to pull down the other at B, and then the descending side will be heavier than the other; for answer to this, it is considerable—

1. That these bullets towards the top of the wheel, cannot descend till they come to a certain kind of inclination.

2. That any lower bullet hanging upon the other above it, to pull it down, must be conceived, as if the weight of it were in that point where its string touches the upper; at which point this bullet will be of less heaviness in respect of the wheel, than if it did rest in its own place; so that both the sides of it, in any kind of situation, may equiponderate.

CHAP. XV.—*Of composing a Perpetual Motion by Fluid Weights—Concerning Archimedes his Water Screw—The great probability of accomplishing this enquiry by the help of that, with the fallibleness of it upon experiment.*

That which I shall mention as the last way, for the trial of this experiment, is by contriving it in some Water Instrument; which may seem altogether as probable and easie as any of the rest; because that element, by reason of its fluid and subtle nature (whereby, of its own accord, it searches out the lower and more narrow passages), may be most pliable to the mind of the artificer. Now, the usual means for the ascent of water is either by suckers or forces, or something equivalent thereunto; neither of which may be conveniently applied unto such a work as this, because there is required unto each of them so much or more strength, as may be answerable to the full weight of the water that is to be drawn up; and then, besides, they move for the most part by fits and snatches, so that it is not easily conceivable, how they should conduce

unto such a motion, which, by reason of its perpetuity, must be regular and equal.

But, amongst all other ways to this purpose, that invention of Archimedes is incomparably the best, which is usually called *Cochlea*, or the Water Screw; being framed by the helical revolution of a cavity about a cylinder. We have not any discourse from the author himself concerning it, nor is it certain whether he ever writ anything to this purpose; but if he did, yet, as the injury of time hath deprived us of many other his excellent works, so likewise of this amongst the rest.

[Near five pages are occupied in describing the use of this screw, and the form and manner of making it; then follows:—]

The true inclination of the screw being found, together with the certain quantity of water which every helix does contain; it is further considerable, that the water by this instrument does ascend naturally of itself, without any violence or labour; and that the heaviness of it does lie chiefly upon the centers or axis of the cylinder, both its sides being of equal weight (saith Ubaldus); so that, it should seem, though we suppose each revolution to have an equal quantity of water, yet the screw will remain with any part upwards, according as it shall be set, without turning itself either way; and, therefore, the least strength being added to either of its sides should make it descend, according to that common maxim of Archimedes—any addition will make that which equiponderates with another to tend downwards.

Ubaldus de Cochlea, l. 3, prop. 4.

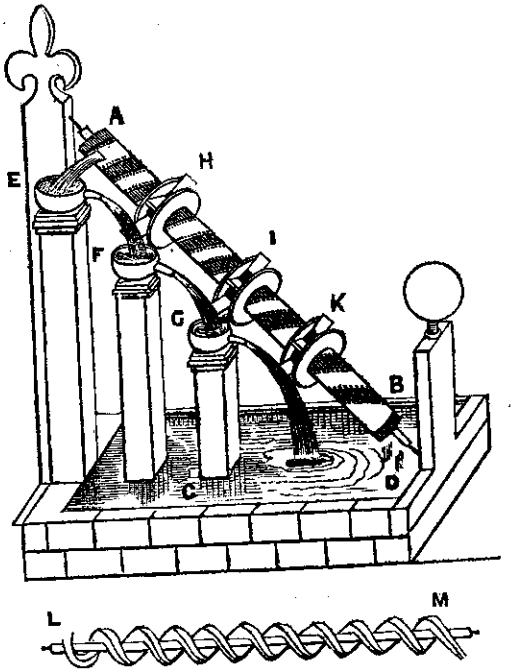
De Æquipond. Suppos. 3.

But now, because the weight of this instrument and the water in it does lean wholly upon the axis, hence is it (saith Ubaldus) that the grating and rubbing of these axes against the sockets wherein they are placed, will cause some ineptitude and resistency to that rotation of the cylinder; which would otherwise ensue upon the addition of the least weight to any one side; but (saith the same author) any power that is greater than this resistency which does arise from the axis, will serve for the turning of it round.

These things considered together, it will hence appear how a perpetual motion may seem easily contrivable. For, if there were but such a water-wheel made on this instrument, upon which the stream that is carried up may fall in its descent, it would turn the screw round, and by that means convey as

much water up as is required to move it; so that the motion must needs be continual, since the same weight which in its fall does turn the wheel is, by the turning of the wheel, carried up again.

Or, if the water, falling upon one wheel, would not be forcible enough for this effect, why then there might be two or three, or more, according as the length and elevation of the instrument will admit; by which means the weight of it may be so multiplied in the fall that it shall be equivalent to twice or thrice that quantity of water which ascends; as may be more plainly discerned by the following diagram:—



Where the figure L M, at the bottom, does represent a wooden cylinder with helical cavities cut in it, which at A B is sup-

posed to be covered over with tin plates, and three water-wheels upon it, H I K; the lower cistern, which contains the water, being C D. Now, this cylinder being turned round, all the water which from the cistern ascends through it, will fall into the vessel at E, and from that vessel being conveyed upon the water-wheel H, shall consequently give a circular motion to the whole screw. Or, if this alone should be too weak for the turning of it, then the same water which falls from the wheel H, being received into the other vessel F, may from thence again descend on the wheel I, by which means the force of it will be doubled. And if this be yet unsufficient, then may the water which falls on the second wheel I, be received into the other vessel G, and from thence again descend on the third wheel at K; and so for as many other wheels as the instrument is capable of. So that, besides the greater distance of these three streams from the center or axis by which they are made so much heavier, and besides that the fall of this outward water is forcible and violent, whereas the ascent of that within is natural,—besides all this, there is thrice as much water to turn the screw as is carried up by it.

There is another like contrivance to this purpose in Pet. Bettin., apiar. 6, pojym. 1, prop. 10, but with much less advantage than 'tis here proposed.

But, on the other side, if all the water falling upon one wheel would be able to turn it round, then half of it would serve with two wheels, and the rest may be so disposed of in the fall as to serve unto some other useful delightful ends.

When I first thought of this invention, I could scarce forbear, with Archimedes, to cry out εὕρηκα, εὕρηκα; it seeming so infallible a way for the effecting of a perpetual motion that nothing could be so much as probably objected against it; but, upon trial and experience, I find it altogether insufficient for any such purpose, and that for these two reasons:—

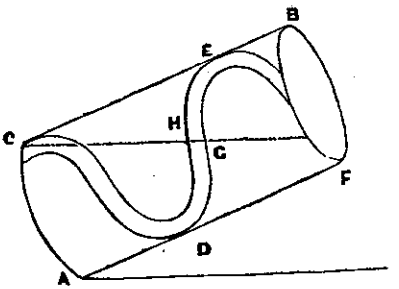
1. The water that ascends will not make any considerable stream in the fall.

2. This stream, tho' multiplied, will not be of force enough to turn about the screw.

1. The water ascends gently, and by intermissions; but it falls continually, and with force; each of the three vessels being supposed full at the first, that so the weight of the water in them might add the greater strength and swiftness to the streams that descend from them. Now, this swiftness of motion will cause so great a difference betwixt them that

one of these little streams may spend more water in the fall than a stream six times bigger in the ascent, tho' we should suppose both of them to be continuate; how much more, then, when as the ascending water is vented by fits and intermissions, every circumvolution voiding so much as is contained in one helix; and, in this particular, one that is not versed in these kind of experiments may be easily deceived.

But, secondly, tho' there were so great a disproportion, yet, notwithstanding, the force of these outward streams might well enough serve for the turning of the screw, if it were so that both its sides would equiponderate the water being in them (as Ubaldus hath affirmed). But now, upon farther examination, we shall find this assertion of his to be utterly against both reason and experience. And herein does consist the chief mistake of this contrivance; for the ascending side of the screw is made, by the water contained in it, so much heavier than the descending side, that these outward streams, thus applied, will not be of force enough to make them equiponderate, much less to move the whole, as may be more easily discern'd by this fig.:—



Where A B represents a screw covered over, C D E one helix or revolution of it, C D the ascending side, E D the descending side, the point D the middle; the horizontal line C F shewing 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 does cut the helix. Now, it is evident that this latter part, D G, is

nothing near so much, and consequently not so heavy as the other, D C; and thus is it in all the other revolutions, which, as they are either more or larger, so will the difficulty of this motion be increased. Whence it will appear that the outward streams which descend must be of so much force as to countervail all that weight whereby the ascending side in every one of these revolutions does exceed the other. And tho' this may be effected by making the water-wheels larger, yet then the motion will be so slow that the screw will not be able to supply the outward streams.

There is another contrivance to this purpose, mentioned by Kircher de Magnete, l. 2, p. 4, depending upon the heat of the sun and the force of winds; but it is liable to such abundance of exceptions that it is scarce worth the mentioning, and does by no means deserve the confidence of any ingenious artist.

Thus have I briefly explained the probabilities and defects of those subtle contrivances whereby the making of a perpetual motion hath been attempted. I would be loth to discourage the enquiry of any ingenious artificer by denying the possibility of effecting it with any of these mechanical helps; but yet (I conceive) if those principles which concern the slowness of the power in comparison to the greatness of the weight were rightly understood and thoroughly considered, they would make this experiment to seem, if not altogether impossible, yet much more difficult than otherwise, perhaps, it will appear. However, the enquiring after it cannot but deserve our endeavours, as being one of the most noble amongst all these mechanical subtilties. And, as it is in the fable of him who dug the vineyard for a hid treasure, tho' he did not find the money, yet he thereby made the ground more fruitful, so, tho' we do not attain to the effecting of this particular, yet our searching after it may discover so many other excellent subtilties as shall abundantly recompence the labour of our enquiry.

And then, besides, it may be another encouragement to consider the pleasure of such speculations, which do ravish and sublime the thoughts with more clear angelical contentments. Archimedes was generally so taken up in the delight of these mathematical studies of this familiar siren (as Plutarch stiles them) that he forgot

ἀπείρας καὶ συνεχὴς σειρῆνος. *Plutarch. Marcell. Joan. Tzetzes, Chil. 2. Hist. 35. Valer. Maxim. l. 8, c. 7.*

both his meat and drink, and other necessities of nature; nay, that he neglected the saving of his life, when that rude soldier, in the pride and haste of victory, would not give him leisure to finish his demonstration. What a ravishment was that, when, having found out the way to measure Hiero's crown, he leaped out of the bath, and (as if he were suddenly possess'd) ran naked up and down, crying εὕρηκα, εὕρηκα! It is storied of Thales that, in his joy and gratitude for one of these mathematical inventions, he went presently to the Temple, and there offered up a solemn sacrifice; and Pythagoras, upon the like occasion, is related to have sacrificed a hundred oxen; the justice of Providence having so contrived it, that the pleasure which there is in the success of such inventions should be proportioned to the great difficulty and labour of their enquiry.*

Of Continual Motion. By Joannes Taisnierus; prior to 1579.—In the library of the British Museum is an edition of "A very necessarie & profitable booke concerning Nauigation, compiled in Latin by Joannes Taisnierus, a public professor in Rome, Ferraria, and other universities in Italie of the Mathematicalles, named a Treatise of Continuall Motions; translated into English by Richard Eden." It is a black letter quarto tract, printed by Richard Jugge, without date, consisting of eighty-two pages. The first part is "Of the vertue of the Loadstone," and the second part is "Of continual motion by the said stone Magnes." It was reprinted 1579. In his introductory remarks, he observes, in allusion to continual motion, that it is—

The thing which to this day in manner from the beginning of the world, great philosophers with perpetual studie and great labour, have endeavoured to bring to effect, and desired end, hath neverthelesse hitherto remayned eyther unknown or hydde, not without great damage & hynderance of most expert mathematicians.

* Mathematical Magick, in two books, by Bishop Wilkins. 8vo. 1707. Fifth edition. Book ii., called Dædalus; or, Mechanical Motions.

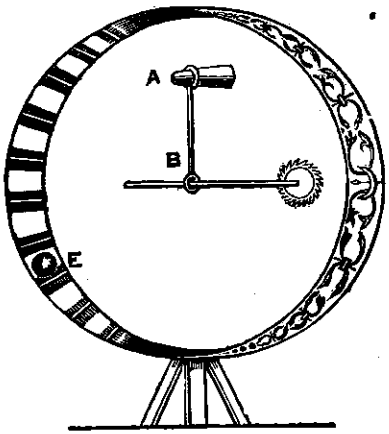
Referring now to the second part, we read :—

From the begynnyng of the worlde, in manner all naturall philosophers & mathematitians, with great expences and labour, have attempted to fynde out a continuall motion or moovyng: yet unto this day have few or none atteyned to the true ende of their desyre. They have attempted to doo this with divers instrumentes & wheeles, & with quicksylver, not knowyng the vertue of this stone. Neyther can continual motion be founde by anye other meanes, then by the stone Magnes, in this maner. Make a holowe case of sylver, after the fashion of a concave glasse, outwardly laboured with curious art of gravyng, not onely for ornament, but also for lyghtnesse; the lyghter that it is, so much the more eassyer shal it be mooved, neyther must it be so pearced through, that such as are ignorant of the hyd secrete, may easyly perceyve it.

[" The fourme of the stone" is here engraved.]

It must have on the inner syde certayne litle nayles & denticles or smal teeth of iron of one equal weyght, to be fastened on the border or margent, so that the one be no further distant from the other, then is the thycknesse of a beane or chicke pease. The sayd wheele also must be in all partes of equall weyght, then fasten the exiltree in the myddest, upon the whiche the wheele may turne, the exiltree remaynyng utterly immoveable. To the whiche exiltree agayne shal be joyned a pynne of sylver, fastened to the same, & placed betweene the two cases in the hyghest parte, whereon place the stone Magnes. Beyng thus prepared let it be fyrste brought to a rounde fourme, then (as is sayd) let the poles be founde: then the poles untouched, the two contrarye sydes lying betweene the poles, must be fyled & pullyshed, & the stone brought in maner to the fourme of an egge, & somewhat narower in those two sydes, lest the lower parte thereof shoulde occupie the inferior place, that it may touche the walles of the case lyke a litle wheele. This done, place the stone upon the pynne, as a stone is fastened in a ryng, with such art, that the north pole may a litle enclyne toward the denticles, to the ende that the vertue thereof woorke not directly his impression, but with a certayne inclination geve his influence upon the denticles of iron. Every denticle therefore shall come to the north pole, & when by force of the wheele it shall somewhat passe that pole, it shall come to the

south part, whiche shall dryve it backe agayne; whom then agayne the pole artike shall drawe as appeareth. And that the wheele may the sooner doo his office within the cases, inclose therein a litle calculus (that is) a litle rounde stone or



pellet of copper or sylver, of suche quantitie, that it may commodiously be receyved within any of the denticles: then when the wheeles shal be raysed up, the pellet or rounde weyght shal fal on the contrary parte. And whereas the motion of the wheele downwarde to the lowest part, is perpetuall, & the fall of the pellet, opposite or contrary, ever receyved within any two of the denticles, the motion shall be perpetuall, because the weyght of the wheele & pellet ever enclyneth to the centre of the earth, & lowest place. Therefore when it shal permit the denticles to rest about the stone, then shall it well serve to the purpose. The myddle places within the denticles ought so artificially to be made belowe, that they may aptly receive the fallyng pellet or plommet, as the fygure above declareth. And briefly to have wrytten thus much of continuall motion may suffice.

Description of the Engraving—A, the stone; B, the silver pinne; E, calculus, a little rounde stone or small weyght.

PERPETUAL MOTION.—In the "Theatrum Machinarum Generale," by JACOB LEUPOLD, published at Leipsic, 1724, folio, appears an article, of which the following is a free and abridged translation:—

The so-called machine to produce perpetual motion consists of a proper adjustment of weights. Such a machine is one that without external power would have a continual movement of its own, as long as its materials last. The search after this movement has become so general in the present day (prior to 1724), that the humblest mechanics enthusiastically express certainty of their ability, had they time and money, to produce something of the kind to surprise the world. However, is there any subject after which so many thousands have longed, spent their money, industry, and time, as this same perpetual motion? Dr. Becher has eight dissimilar inventions, all of which have interested the scientific world, one of the number being perpetual motion. Although the discovery of making gold would be the most honourable and praiseworthy thing in the world, yet not even that has been so sought after as perpetual motion; because the one requires a high knowledge of chemistry, and the other merely requiring that a certain weight at a distance from the axletree, should fall and rise without losing its power; and it is here so many inventors have been deceived, from wanting proper mechanical knowledge. The machines most hopeful are those given in Figures 10 and 11.

[For engravings and full account, see Appendix A.]

The action of the foregoing plans, in each, tends to find the centre of gravity, and therefore after many trials were all found to cease movement.

It still remains to find out this wonderful and undiscovered thing, which to the present time remains impossible both mathematically and mechanically, so far as we yet know. Great weight only increases friction, but there was a wheel or machine that did not weigh above forty pounds, and was nine feet diameter, which promised better results, yet failed like others, and so dissipated all hope of succeeding.

Notwithstanding we hold that perpetual motion is not an impossibility, as has been shown to all the world by Coun-

cillor Orffyreus, and attested by the princely word of the Landgrave of Hesse Cassel, a prince himself well grounded in the science of mechanics, and who so minutely scrutinised and observed this wonderful motion, which was with him on trial during two months; all of which time he kept the machine in a sealed chamber.

To all the seekers after perpetual motion the following remarks will be found most valuable:—

1. That they must endeavour to construct one of the simplest of machines; for the more material and workmanship, the less chance of durability. And if not found in such simple arrangement, it will be hid for ever.

2. That it must be tried by experiment and not only on paper, for the friction and action can only be estimated by trial.

3. That unless grounded in the fundamental principles of mechanics, no one should attempt the project, as he will only lose time and money. The thousands who fail of success yet learn something of mechanics, and that one pound cannot move more than one pound, but always arrives at an equilibrium.*

PERPETUAL SYPHON AND MILL.—Leupold, in his "Theatrum Machinarum Generale," on Hydraulics, describes:—

The water-wheel of a mill operated by a syphon. The inventor has here endeavoured to gain perpetual motion by constructing a syphon which at A has more water than at B, consequently more weight; to lessen the waste of water at A, he makes the syphon smaller at its aperture; so that the weight of A and B are equalised. Water, however, is weighed not by its quantity but its height, hence this plan did not succeed in this, and many other instances; and it has been tried to the ruin of many. Modifications of the principle on which this syphon is constructed have been found, on experiment, equally false. In the work of Sinclari's "De Arte magna et nova gravitatis et levitatis," the subject of perpetual motion by means of mercury is very skilfully handled. But all these plans have circumstances attending them causing

* Vol. 1, par. 58.

their failure.—*From the first chapter of the first division on Hydraulics.*

[See Appendix B, for full account and engraving.]

PERPETUAL PUMP.—In continuance of the same subject, but employing other means, Leupold describes:—

A machine with a water-snake (Archimedean screw) whereby perpetual motion was attempted.

There was a wheel made connected with a screw, and the water was to fall from the screw on the wheel. Several hands were occupied with great industry and earnestness on it for some years. A full description of this plan is to be found in Bettinus and in Peter Schotte's "Mechanica Hydraulica-Pneumatica;" but Bettinus, and especially Kircherus, have written to prove the impossibility of the method here proposed.

[For engraving and full description from Leupold's work, see Appendix C.]

Our next early authority on the subject under consideration is derived from "A History of Manual Arts, 1661," to the following effect:—

[After alluding to "Archimedes of Syracuse, the greatest mathematician and the rarest engineer that was in his time," who invented "a sphear and an artificial heaven, wherein he did represent the rotations and revolutions of the planets," and of which Claudian gives a poetic description—"that this machin did move of itself; it was an automaton, a self-moving device;" and further, "that these motions were driven and acted by certain spirits pent within;" also of another device of "a silver heaven sent by the Emperour Ferdinand for a present to Soliman the Grand Signior," with twelve men, and a book "that shewed the use of it, and how to order and keep it in perpetual motion,"—an account is next given of Cornelius van Drebble, a Dutchman, of Alcmar, engineer to King James, in England:—]

He presented the king with a rare instrument of perpetual motion, without the means of steel, springs, or weights; it was made in the form of a globe, in the hollow whereof were wheels of brass moving about, with two pointers on each side thereof, to proportion and shew forth the times of dayes, moneths, and years, like a perpetual almanack. (Page 19.)

At page 22 is an account of Fanellus Turrianus, a citizen of Cremona, who "did recreate the Emperour Charles the Fift (when he had resigned up his empire, and retired to a monastique life in Spain) with ingenious and rare devices;"— among others—

He framed a mill of iron that turned itself, of such subtile work & smalness, that a monk could easily hide it in his sleeve; yet would it daylie grinde so much wheat as would abundantly serve 8 persons for their day's allowance.*

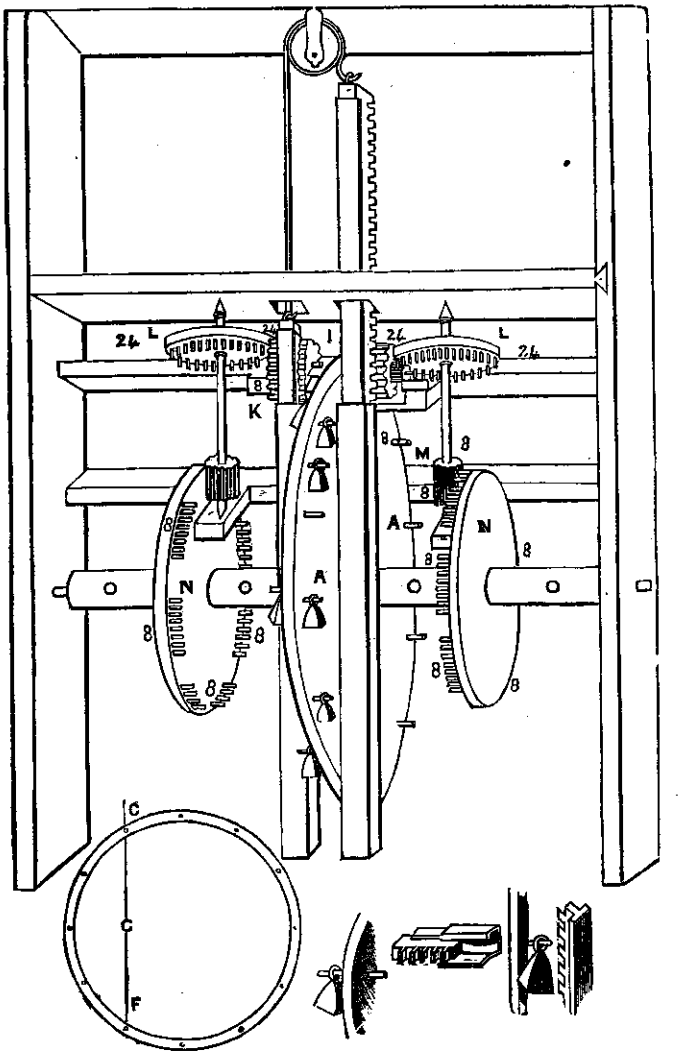
The next two articles we shall quote will be given in the original Latin version; the first from a folio edition of ROBERT FLUDD'S works, 1618, as follows:—

De instrumento haud spernendo, quo quidam Helvetius motum perpetuum invenisse pro certo credebat. Estque speciei primæ rotarum differentiæ.

A. rota principalis. B. C. pondera unius lateris. D. E. F. pondera alterius lateris. G. baculus portator. H. sustinens baculum. I. rotula elevans. K. ejus pecten. L. corona. M. pecten corona. N. interfracta. O. arbor. P. orbiculus. Q. chorda. R. pondus 4 librarum.

Rota principalis hoc modo fit, scilicet, ut in 12. partes æquales dividatur in uno ac altero latere, & affigantur cuique lateri clavi 6. eâdem distantiâ ab invicem dispositi, sic tamen, ut quivis clavus stet in medio duorum aliorum ex altero latere rotæ, et non unus juxta alium: Appensis jam ponderibus 6. (quorum in quovis latere sunt 3. omnia tamen 6. in una parte rotæ citra centrum) reperitur hæc rota onerata pondere 15.

* Humane Industry; or, a History of most Manual Arts. 12mo. London, 1661. Pp. 14 to 23.


24
L
K
I
M
A
N
C
F

librarum, quia pondus C. in recta linea habet lb. quatuor. D. E. circa 7. lb. B. F. autem 4. quæ simul aggregatæ efficiunt 15. lb. quemadmodum ex regulis prima primi cap. et prima ac secunda secundi cap. lib. primi patet.

Movetur jam rota, ita ut infimum pondus appropinquet clavo baculi portantis, qui positus juxta B. & F. recipit hoc pondus per uncum suum, ubi illi adhærenti portatur in altum, & rota inferiùs evacuata perget; interim appropinquat clavus proximus, qui sequitur B. & in eodem loco, ubi jam est B. recipit pondus sibi apportatum a baculo: Et ita semper oneratur rota in superiori & exoneratur in inferiori parte, quia semper, dum duodecima pars rotæ volvitur, baculum ascendere, et dum alia duodecima pars vertitur, iterùm eundem descendere necesse est. Elevatur autem baculus per rotulum L. quæ rotula ter vertendo attingit omnem altitudinem baculi, ipsum ad clavum usque desideratum elevans: Vertitur autem ejusmodi rotula per pectinem suum K. à corona L. quæ et ipsa per suum pectinem M. à rota interfracta N. semel volvitur, à quavis duodecima parte rotæ interfractæ O. semper dentes habentæ in duodecima sua parte superficiei, et hoc sexies habet enim alias intermedias vacuas ejusdem speciei ad relinquendum baculum, qui sponte sua cadere, et per casum suum rotulam Q. et coronam M. reverti cogit; Ne autem cadat cum impetu, suspensus est ad chordam Q. alteri baculo adhærentem, per orbiculum P. quia tantum, quantum unus baculus cadit, alter ascendit.

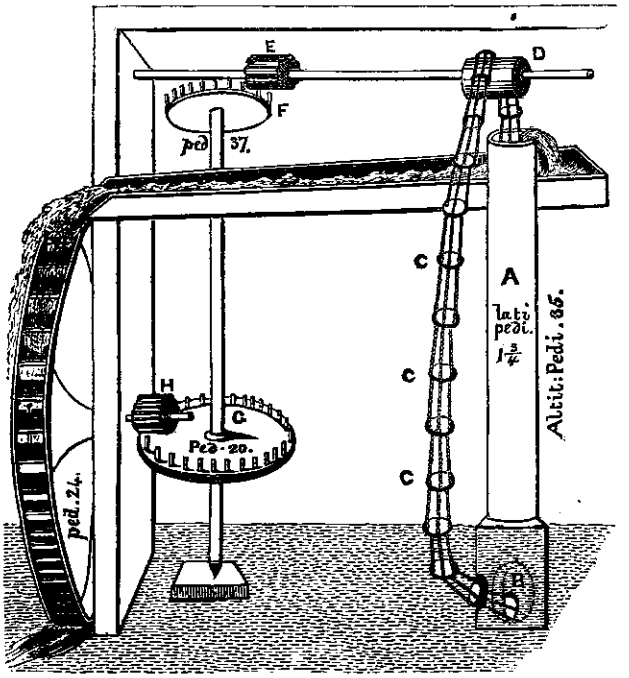
Rota interfracta affixa est arbori aut axi rotæ principalis, et ejus vi circumvolvitur. Quod autem similia instrumenta posita sunt ex alio rotæ principalis latere, eò fit, quod semper et continuo loboratur onerando et exonerando rotam, quia quando ex uno latere pondus aufertur, in alio appenditur. Et sic semper rota habet 5, pondera pendentia, et unum semper inascendente baculo.

Sed, quamvis hæc viri Helvetici theoria sit satis ingeniosa aud probabilis quod 5. pondera inhærentia rotæ unum pondus facilè trahere et elevare deberent; Attamen, quia vis non est proportionata ad tempus, nihil hîc efficitur, quia ascendens pondus pertransire debet per pondera 5. aut per spatium tot partium, quarum unicâ ipsum movetur, unicum pondus ascendens tantum perdurat, quantum cætera quinque ratione longi transitus. Ergo seipsum superare nequit.

Hanc Ingeniatoris Helvetici inventionem ejúsque errorem

hoc loco descripsimus, ut hujus scientiæ curiosi majori diligentia proportionum cognitionem perscutentur, easque sedulò observent.

De alia bona inventione ad aquas facilè elevandas, quo quidam Italus se motum perpetuum invenisse jactitare ausus est.



INSTRUMENTI DESCRIPTIO.

LITERARUM EXPLICATIO.

A. haustrum seu pompa.

B. rotula affixa in haustrifundo, super quam pistella, sive rotunda ex corio conflata leviter circumvolvuntur, ut facilius sursum tendant; repleturque uncis ferreis.

C. C. C. pistella seu rotunda ex corio, quorum ope aqua extollitur in pompa.

D. rotula per quam dicta rotunda in altum elevantur.
E. pecten movens rotulam D. et B.
F. est rota à rota inferiori G. circumducta, cujus dentibus pecten E. circulariter agit.
H. pecten movens rotam G.

INSTRUMENTI HUJUS USUS.

Numeratur hoc instrumentum inter rotas primæ differentiæ, quod valdè est necessarium in multis usibus, quia minimo labore magnam aquæ quantitatem sursum propter rotarum multitudinem ferre non est dubium.

Longitudo autem haustri A. est 35. pedum, ejus verò latitudo pedis 1. cum ½ secundum proportionem, cujus concavitates rotundæ exactè fieri debent, ut non perdant aliquid aquæ ab iis attractæ in suis ascensionibus; Pompæ igitur concavitas erit bene rotunda.

Rota magna aquaria habebit pedes 24. in altitudine: Illa verò G. pedes 20.

Italus ille, sua contemplatione deceptus putabat se tantum aquæ per pompam elevaturum, ut rotam aquariam perpetuò movere cogeret, quia majorem vim requiri dicebat in fine hujus instrumenti, quàm in principio, sed, quia malè capiebat ponderum proportiones, igitur in sua praxi erat deceptus.*

The second Latin authority we have to offer is BETTINO, as follows:—

Motum aquæ per machinas perpetuum molitionibus longe facillimis attentare.

Motus ille graunium circa terræ centrum perpetuus indicatus in 7 & 8 propositionibus, etiam si fieri posset, esset tamen inutilis humanæ, ac ciuilis vitæ necessitatibus. In hac decima propositione motum aquæ perpetuum attentamus per machinas; qui motus si fieret, maximo esset usui, et quæstusa compendia ex eo in vitam humanam redundarent. Ut igitur aliquid circa famosissiman hanc materiam nos etiam ex nostro

* Tractatus Secundus De Naturæ Simia seu Technica macrocosmi historia in partes undecim divisa. Roberto Fludd alias de Fluctibus Armigero et in Medicina Doctore Oxoniensi. In Nobili Oppenheimio. Folio. 1618. Pp. 456 and 462.

sensu prodamus, aio (quod attinet ad theoricam quandam constructionem ex ingenii geometrici, ac scientifici inventione, prodeunté) plures machinas aquaticas construi posse, aut ab antiquis ingeniosissimè constructas facillimo negotio ita posse accomodari, ut, fortasse, nisi quid obstet exparte materiæ (à quæ mathematica inventio abstrahit, nec culpam subit physicæ imperfectionis) machinæ illæ semper eádem aquæ quantitate in orbem ascendente, ac descendente, perpetuo quodam motu agitentur.

Exemplum exhibiamus in mirissima illa machina cochleæ Archimedeæ per lineas spirales aquã haurientis, et (ut in sequenti propositione demonstrabimus) deuectione pondus impositum euehentis. Moveatur rota A B C, et cochleæ G D pes G è subiecto lacu G E aquam attollat per spiralem, ac volutam circa cilindrum G D. Cum aqua peruenerit ad D, atque effundetur, excipiatur canali, seu tubo D F, qui tubus versus rotam A B C deuexus deferat aquam, atq; effundat in rotam cuius aquæ decidentis vis supplebit vices potentiæ moventis rotam: ac dum rota ab aqua movetur movetur et cochlea, et cochlea aquam haurit, atq; attollit, aqua sublata revertitur, ac refunditur in rotam, é rota excipitur in lacum. Atq; hoc aquæ circulo machina cochleæ, quæ impetum accepit à motrice potentia an non iam per se solo aquæ circumitu ciebitur, motuq; rotabitur perpetuo dum aqua é lacu non defecerit?

Pariarte, atq; invéto machina Ctesibii, cuius fabricam, et simulacrũ habes apud Vitruuium, et aliæ aliquæ antiquorum, si fiat ut aquæ quam attolunt, refundatur in rotam, qua machinam moveat, an non poterunt motus perpetui exempla præbere? Sed nos exemplum nostrum exhibuimus in cochlea tum ob alia, tum præcipue ob duo, quæ mox apponam, quibus singulariter in hac machina facilior fit constructio, et usus ad motum perpetuum, quám in alia ulla; prætereaq; reiici videtur oppositiones præcipuæ, quæ obstare possunt molientibus inventa pro motu aquæ per machinas perpetuo.

Primò enim si fingas, atq; opponas requiri maiorem uim motricem in rota, quám sit aquæ uis, ac quantitas in rotam decidentis, ut cochlea pondus aquæ possit attollere, etiam si augeatur vis aquæ dum sublata in machinam deinde in natæ gravitatis nisu, ac pōdere maiori præcipi dantur revoluta in rotam machinæ motricem. Respondeo primò singulare esse in cochlea ut minor vis ad eius motionem proportione requira-

tur, quàm, in alia ulla machina, duas præcipuè ob causas. Prima est quia euectio illa per spiralem circa cylindrum, vel conum, est aliqua, & minus violenta, quám sublatio aquæ perpendiculariter ascendentis, vel per vim ejectæ, ut in Ctesibiana machina, et in aliis quibusdam fit. Secunda causa facilitatis ad motum in cochleà est à modo peculiari, atq; admirando euectionis ponderum per spiralem, dùm cochlea obliqua circumuoluitur; ea enim euectio ita fit, ut pondera ipsa suam euectionem inuent. Nam fit quidam motus mixtus ex continenti quodam decensu simul, atq; ascensu gravium, quæ gravia dum motu proprio descensum affectant, decurrunt sponte per spiralem, atq; ipsa spiralis ex circumuolutionè cochleæ pondera decurrentia sensim, atq; oblique, ac quasi furtiuè paullatim attollit. plura inferius in sequenti proposit. 11 et in schol. 1 ad eam propositionem dicemus circa miriss hunc motum spiralem, &c.

Minor vis requiritur ad motum cochlea, quàm aliarum machiniarum.

Respondeo 2, quod ad aquæ quantitatem, ac vim, cóchlea habet etiam hoc eximiũ, ac peculiare, ut in ipsa machina (hoc est circa cylindrum, vel conum) possint multiplicari volutæ, siue tubi spirales ita, ut non unica tantum sit spiralis (quod hactenus in usu fuit circa cylindricas cochleas) sed ternæ, quaternæ, ac plures spirales circumpositæ maiorem aquæ copiam pro numero spiralium hauriant, et attollant. Qua de re inferius in schol. 2 proposit. sequentis undecimæ. Nunc tantúm ad rem indico quemadmodum aquæ copia possit augeri, ut aquare, ac superare possit uim potentiæ rotam A B C moventis.

Notandum est universé circa hunc aquæ circulum per aptas machinas ad motũ perpetuum, canales, ac tubos machinarum, per quos aqua influet sic aptandos, et cum omni cautione muniendos, ut nihil aquę inter fluẽtis, aut defluentis possit furtim effluere, atq; effundi. Nam exea aquæ effusione imminueretur non solum quantitas, sed et uis aquæ necessaria ad machinam movendam, et ad motum perpetuandum.

Nota cautionem.

Si tamen, ut in nostra figurà, aqua, post defluxum in rotam diffluat in lacum, nihil aquæ peribit, &c. etiam si apertè decidant. Eadem enim aquæ quantitas semper refunditur in lacum.

Vide ad motum perpetuum adhuc maiora adiumenta propos. 14 inferius in hoc progym. [Apiar. IV., progym. I., prop. X.]

Horaria dioptrica, & catoptrica. Machinæ perpetuo motu diu, noctuq; solis cursum sequentes, ac per horas dimentientes.

1. Pertinent ad paradoxa gnomonica horologia dioptrica, velut scaphia, in quibus aquâ infusis umbra gnomonis per aquam refracta horas indicat. Reuise nos initio Apiarii nostri astronomici, ubi modum apposuimus metendi organicè * quantitatem anguli refractorii per scaphia. Nihil nos hîc de iis dioptricis horariis, quia nihil habent in nouitate utilitatis, immo solúm addunt plures difficultates fabricæ, ac usui horariorum in scaphiis usitatorum.

Horaria dioptrica, in quibus horæ per refractionem, &c.

2. Sunt et horaria catoptrica, in quibus et horariæ lineæ ïnuersæ, et specillum loco verticis gnomonici reflectit radium solis ad horas indicandas. De quibus vide opusculum doctissimum erudissimi P. Athanasii Kircheri è nostra Societate, qui unus è tribus fuit cęsoribus, et adprobatoribus Romæ meorum Apiariorum. Novitas in iis catoptricis horariis ingeniosa, et in eo præcipue utilis est quòd horas indicet intracubicula, et conclavia in umbra, ne oculorum aciem præstringat solis fulgor, &c. Nos in sequenti capite aliquem usum catoptricum nō catoptricorum horariorum dabimus, quem apud alios non vidimus.

Horaria catoptrica, in quibus horæ per reflexionem.

3. Machinas horarias aliqui machinati sūt, in quibus vel rotularum supra aquam libratarum mobilis index, vel globulus in aqua mobilis diu, noctuq; perpetua, lentissimaq; rotatione motum solis sequuntur. Hæ machinæ non tam ad mathematicum quám ad physicum philosophum pertinent, et extra nostrum institutum sunt, qui mathematica inventa geometricis demonstrationibus confirmata profitemur; ob admirandam tamen novitatem digna sunt ea horaria, quæ inter nostra paradoxa reponantur accipe verba, et iconem unius è prædictis machinæ, ut iacent apud R. Sylvestrum Petra sanctam nostra societatis, in expolitissimo opere de symbolis heroicis lib. 4 in fine capitis 5. Scio magnetis lapidis effecta prorsus admiranda esse, atq; ex illius virtute prodire semper aliquid novi. Sic Leodu nuper in Collegio Anglorū nostræ Societatis P. Frâciscus Linus Magister matheseos excogitavit felicissime orbem, qui intra phialam (velut B C A) in circunfusæ aquæ centro (sicut in circunfuso aëre tellus) hæret secreto suæ molis libramento (ut ad D). Sed conuersionem

Mira horaria machina cū motu perpetuo.

cæli tamen ab ortu in occasum arcanâ vi, et veluti quodam amore consectatur, spatioq; vigintiquatuor horarum omnino circumagitur.

Pisciculus intereà indicis loco est (ceu in G) et quasi nandi peritus, ac libratus pondere suo prætereuntes horas veluti admirãs designat rostro, easq; oculis de fixis intuetur. Motâ phialâ, si aquæ impetus detur, mox iter sua sponte orbis releget; penitusq; ratio temporis constabit, postquam tranquillitas redierit.

Indicem quoq; in phialâ constituas, et indicabit perinde horas. Sed et solem finge in eodem orbe, verum solem in ortu, meridie, occasu sequetur, atq; adeo è sede sua excussas requiret illicò, et repetet stationem syderi consentaneam. Tantum plus nimis adproper abit, quia nescit amor tarditatem: nihilominus dum aliquoties transiliet, resilietq; demum ob inebit locum, ex cuo citra errorem solis comes denuò ibit.

Vitreus orbis A C B sustinetur, ut vides, lector, ab aquâ peluis C E F B.

Egent tamen etiam hæ machinæ, quemadmodum et authomata horaria ex ponderibus, vel ex chalybe contorto, subinde aliqua restauratione, quia deniq; nullum à mortalibus inventum est immortale, ac verà perpetuum.* [Apiar. IX., progym. V., prop. XI.]

* Apiaria Universæ Philosophiæ Mathematicæ in quibus Paradoxa. By Mario Bettino Bononiensi e Soc. Jesu. Bononiæ, 1645. Folio.