Perpetual Motion—A Science Classic

Physics

"The Fallibleness of it upon Experiment"

MATHEMATICAL MAGICK, or The VVonders that may be performed by Mechanicall Geometry. In two Books. Concerning Mechanicall Povvers, Motions. Being one of the most easie, pleasant, usefull, (and yet most neglected) part of Mathematicks. Not before treated of in this language. By I. W. M. A. [John Wilkins, M. A., 14th Bishop of Chester, first Secretary of the Royal Society.] London, 1648.

THAT which I shall mention as the last way, for the triall of this experiment, is by contriving it in some water instrument; which may seem altogether as probable and safe as any of the rest, because that element by reason of its fluid and subtle nature (whereby of its own acord it searhes out the lower and more narrow passages) may be most pliable to the mind of the artificer. Now the usuall 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 bee regular and equall.

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 helicall revolution of a cavity about a Cylinder. We have not any discourse from the Authour himself concerning it, nor is it certain whether he ever writ any thing to this purpose. But if he did, yet as the injury of time hath deprived us of many other his excellent workes, so likewise of this, amongst the rest . . .

The nature and manner of making this, is more largely handled by *Vitruvius.*

The figure of it is after this manner.

When you see there is a Cylinder *AA,* and a spirall cavity or pipe twining about it, according to equall revolutions *BB.* The axis and centers of

"Thus have I briefly explained the probabilities and defects of those subtle contrivances, whereby the making of a perpetuall motion hath been attempted. I would be loath to discourage the enquiry of any ingenuous artificer, by denying the possibility of effecting it with any of these Mechanicall helps; But yet (I conceive) if those principles which concern the slownesse of the power in comparison to the greatnesse of the weight, were rightly understood, and thoroughly considered, they would make this experiment to seem (if not altogether impossible, yet) much more difficult then otherwise perhaps it will appear. However, the inquiring after it, cannot but deserve our endeavours, as being one of the most noble amongst al these Mechanical subtilties. And (as it is in the fable of him who dugge the Vineyard, for a hid treasure, though he did not finde the money, yet hee thereby made the ground more fruitfull, so) though we doe not attaine to the effecting of this particular, yet our searching after it may discover so many other excellent subtilties, as shall abundantly recompense the labour of our enquiry.

And then besides, it may be another encouragement to consider the pleasure of such speculations, which doe ravish and sublime the thoughts with more cleare angelicall contentments. . . . The justice of providence having so contrived it, that the pleasure which there is in the successe of such inventions, should be proportioned to the great difficulty and labour of their inquiry."—Wilkins

its motions are at the points *CD,* upon which being turned, it will so happen that the same part of the pipe which was now lowermost, will presently become higher, so that the water does ascend by descending; ascending in comparison to the whole instrument, and descending in respect of its severall parts. This being one of the strangest wonders amongst those many, wherein these Mathematicall arts doe abound, that a heavy body should rise by falling down, and the farther it passes by its own naturall motion of descent, by so much higher still shall it ascend; which though it seems so evidently to contradict all reason and Philosophy; yet in this instrument it may be manifested both by demonstration and sense.

This pipe or cavity for the matter of it, cannot easily be made of metall, by reason of its often turnings; but for triall, there might bee such a cavity, cut in a column of wood, and afterwards covered over with tinne plate.

For the form and manner of making this screw, *Vitruvius* does prescribe these two rules:

1. That there must be an equality observed betwixt the breadth of the pipe, and the distance of its severall circumvolutions,

2. That there must be such a proportion betwixt the length of the instrument, and its elevation, as is answerable to the *Pythagoricall Trigon.* If the Hypotenusall, or Screw be 5, the perpendicular or elevation must be 3, and the basis 4.

However (with his leave) neither of these proportions are generally necessary, but should be varied according to other circumstances. As for the breadth of the pipe in respect of its revolutions, it is left at liberty, and may bee contrived according to the quantity of water which it should contain. The chief thing to be considered is the obliquity or closenesse of these circumvolutions. For the nearer they are unto one another, the higher may the instrument be erected; there being no other guide for its true elevation but this . . .

If you would know the just quantity of water which every revolution does contain and carry, according to any inclination of the cylinder, this may be easily found by ascribing on it an *Ellipsis,* parallel to the Horizon; which *Ellipsis* will shew how much of the revolution is empty, and how much full.

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 it self 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 equall weight (saith *Vbaldus;*) So that (it should seem) though we suppose each revolution to have an equall 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 maxime of *Archimedes;* any addition will make that which equiponderates with another, to tend downwards.
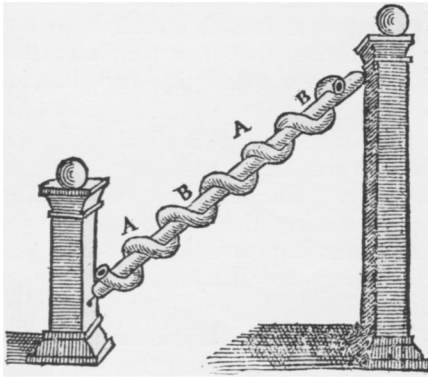
But now, because the weight of this instrument, and the water in it does leane wholly upon the axis, hence is it (saith *Vbaldus*) that the grating and rubbing of these axes against the sockets wherein they are placed, will cause some ineptitude and resistency to that rotation of the cylinder, which would otherwise ensue upon the addition of the least weight to any one side; But (saith the same Authour) 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 continuall, 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 bee 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 this following Diagram.

Where the figure *L M*, at the bottome does represent a wooden cylinder with helicall cavities cut in it, which at *A B*, is supposed 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 be-

ing turned round, all the water which from the cistern ascends through it, will fall into the vessell at *E*, and from that vessell being conveyed upon the water-wheel *H*, shall consequently give a circular motion to the whole Screw: Or if this alone should bee too weak for the turning of it, then the same water which falls from wheel *H*, being received into the other vessell *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 insufficient, then may the water which falls on the second wheel *I*, be received into the other vessell *G*, and from thence again descend on the third wheel at *K*: and so for as many other wheeles, 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 naturall; Besides all this, there is thrice as much water to turn the Screw, as is carried up by it.

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 usefull delightfull ends.

When I first thought of this invention, I could scarce forbear with *Archimedes* to cry out *"Eureka, eureka"*; It seeming so infallible a way for the effecting of a perpetuall motion, that nothing could bee so much as probably objected against it: But upon triall and experience I finde 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 (though multiplied)

will not bee of force enough to turn about the Screw.

1. The water ascends gently and by intermissions, but it falls continuately and with force; each of the three vessels being supposed full at the first, that so the weight of the water in them might adde the greater strength and swiftness to the streams that descend from them; Now this swiftnesse of motion will cause so great a difference betwixt them, that one of these little streams may spend more water in the fall, then a stream six times bigger in the ascent, though 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 onely so much as is contained in one *Helix?* And in this particular, one that is not versed in these kinds of experiments, may bee easily deceived.

But secondly, though there were so great a disproportion, yet notwithstanding the force of these outward streams, migh 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 *Vbaldus* 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 then 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.