

(L 1.)

A B is a flat bar or ruler, having a longitudinal passage cut through it from n to m. A small fixed cylinder c, is made to enter this passage without having any motion through it. C D is a bar which is allowed to slide easily between the two small clips p and q; and it also carries an upright arm E F, from some part of which at any distance from the bar C D there rises another small cylinder a, which also enters the longitudinal passage n m of the bar A B, but on the opposite side to the first mentioned cylinder c, and so that they do not come in contact with each other when the bars are in motion.

If the bar A B be made to move so that its end A shall take the direction of the right angle A G parallel to the bar C D, the point a, will in the same time traverse the right line a b.

It will be seen thus, that by the direct or alternate rectilinear motion of the point A, we may communicate to the bar C D a motion of the same kind, with a velocity of any required ratio, or even inversely, by arranging the cylinder a in the arm E F, in a suitable manner.

SECTION II.

To convert a given direct and equable rectilinear motion, or the velocity of which varies by a given law, into alternate rectilinear motion of velocity similar to that of the moving power, either equable or variable by a given law; and in the same or in different directions.

THE given rectilinear motion will be converted into circular, by the methods shewn in Section III.; and the examples of Section VII, may then be taken as examples of the required conversion.

Having considered a fall of water as an uniform rectilinear motion, if we imagine a vessel which is alternately filled with the water, and emptied of it by means of a syphon, a float enclosed in the vessel will rise and fall alternately. This mover may be seen in a work entitled "Utilissimo trattato dell' Aque correnti, &c." dal Cavalier Carlo Fontana. Rome 1696.

An application of it as a mover, has been made by Messrs. Bossu and Solage, in a model of a corn mill deposited in the Repository of Machines: but in this instance, instead of using a syphon to empty the vessel, the valves of supply and exit are opened by the motion of the float-rods. We are not aware of the reasons which determined those distinguished machinists to convert the alternate rectilinear movement of the float-rod into an alternate circular motion; and thence to a direct circular motion, rather than avoid the use of an useless intermediate movement, which so materially lessens the power of the engine*.

The steam engine, in which steam may also be considered as a power constantly acting in a rectilinear direction, and producing the alternate movement of the piston. Hydraulic pumps, such as are some of those used in the Hungarian mines, in which a column of water acts on a similar principle, and produces the same effect as steam in the steam engine. Those in which the sudden expansion of air by a rapid combustion, is used as a first mover. All these machines should be classed in this division of our work, although not perhaps in a direct manner. But as the changing the direct rectilinear motion of the moving power into the alternate rectilinear motion of the piston, frequently involves considerable complexity of means, we consider such instances rather as particular machines, than those simple elementary transformations which it is our immediate business to describe; and therefore we have deemed it sufficient to mention them.

The alternated movements exhibited in all bodies which are exposed to considerable changes of temperature, and more particularly the metals, may be ranked among the most powerful first movers. It frequently counteracts the intention of the mechanical artist, and requires the exertion of all his patience and

* The motion of a float is used in the boilers of steam engines, or in reservoirs, to maintain the level of the water within certain limits.—L'Architecture Hydraulique of M. De Prony, vol. 2, contains the description of a method of regulating the velocity of steam engines by means of a float furnished with a syphon, invented by M. De Bettancourt.

A description of an instrument invented by M. Solomani, for the purpose of preserving a given temperature in a receiver of water by means of an aréometer, which acts as the float, may be seen in L'art du distillateur des eaux-de-vie et des esprits, par M. Le Normand.

ability: his ingenuity when thus excited, however, devises the means not merely of extrication from the difficulties of the subject, but even in many cases converts them to his advantage. Remarkable instances may be traced in the contrivances adopted to neutralize the action of this mover in many of our horological machines; and the inconceivable precision obtained in the admeasurement of trigonometrical bases, by means of the metallic rods of M. Borda *. Among the instruments whose action depends on this property of expansion by increased temperature, the thermometer of M. Brequet should be eminently distinguished. This alternate movement has been turned to useful account in regulating the draught of furnaces. A very elegant application of it has also been made by M. Molard, to the adjustment of two walls in one of the galleries of the Repository of Machines †.

(A 2.)

The oscillating column of M. Mannoury d'Ectot.

This machine resolves itself into two cylindrical tubes A and B, placed vertically, one immediately above the other; they are separated from each other by a small interval. The upper extremity of the tube A is closed by a plate, in which is a circular aperture *dd*, corresponding with a similar aperture in the tube B. C is a circular plate or diaphragm of smaller diameter than the aperture *dd*, and is placed a little below it. The action of the machine is thus:—The tube A being constantly supplied with water by a convenient reservoir, it will escape by the annular opening formed between the circular aperture *dd*, and the diaphragm C, and with the velocity proper to a column of water of uniform altitude. The annular aperture by which the water escapes increases the usual contraction of the spouting fluid, and forms a conical portion of water: the apex of which, by a due adjustment of its distance from the tube B, must be made to reach a little way within it.

A conical portion of the fluid will remain stationary upon the diaphragm.

* All the works on clock and watch-making contains examples of such arrangements.—Delambre. Base du system metrique.—Bulletin de la société d'encouragement, No. 48, June, 1808.

† Borgnis. Traité du mouvement des fardeaux.

The water rushes into the tube B, and if it be cylindrical will rise in it to a height equal to one third more than the altitude of the column in the tube A, but if it be conical the altitudes will increase with the convergency of the cone. When it has reached its maximum of elevation, it descends, passes into the stationary portion f, and causes the running portion of the fluid to diverge and to project a paraboloidic sheet, through the separating interval of the two tubes until the tube B is entirely empty. The jets of water recover their original action; the contraction of the spouting portion of the water again takes place; and the same process is recommenced. This alternate movement is found to take place in equal times.

The noble inventor expects to apply this alternate rectilinear motion of water to useful purposes as a mover, and to render the engine itself preferable to a great number of those generally used for the purpose of raising water. A work descriptive of this nobleman's ingenious inventions is expected shortly to make its appearance.

M. Carnot, in his report to the Institute of the 28th December, 1812, upon the different hydraulic machines presented by M. Mannoury, states the general problem proposed by that gentleman to be—"From a given fall of water to elevate a portion of it above the reservoir by means of a machine, all the parts of which are absolutely fixed; and which, consequently, does not comprehend or require either levers, wheels, pistons, valves, or any other moving parts of whatever description."

M. Carnot explains the entire novelty of this proposition, and gives an account of the principal methods which have been successfully adopted by the author for its accomplishment: speaking of the oscillating column he says—"Of these methods, this appears to us to possess the most novelty, because we are not acquainted with any facts which could have suggested the fundamental idea." He explains the phenomenæ by reference to the principles of the forces of activity of bodies in motion, and closes his report with a well-merited eulogium on the intelligence and learning of the noble author.