is one third of the velocity acquired by falling from the surface, in which case it will raise 8/27ths of the water ex­pended to the same height, which is double of the perfor­mance of a mill acted on by the impulse of water.

But this is a very imperfect account of the operation. When the machine (constructed exactly as we have de­scribed) moves round, the water which issues descends in the vertical trunk, and then, moving along the horizontal arms, partakes of this circular motion. This excites a cen­trifugal force, which is exerted against the ends of the arms by the intervention of the fluid. The whole fluid is subjected to this pressure (increasing for every section across the arm in the proportion of its distance from the axis), and every particle is pressed with the accumulated centrifugal forces of all the sections that are nearer to the axis. Every section therefore sustains an actual pressure proportional to the square of its distance from the axis. This increases the velocity of efflux, and this increases the velocity of revolution ; and this mutual co-operation would seem to terminate in an infinite velocity of both motions. But, on the other hand, this circular motion must be given anew to every particle of water as it enters the horizontal arm. This can be done only by the motion already in the arm, and at its expense. Thus there must be a velocity which cannot be overpassed even by an unloaded machine. But it is also plain, that by making the horizontal arm very capacious, the motion of the water from the axis to the jet may be made very slow, and much of this diminution of circular motion prevented. Accordingly, Euler has re­commended a form by which this is done in the most emi­nent degree. His machine consists of a hollow conoidal ring, of which fig. 12 is a section. The part AH*ha* is a sort of funnel-basin, which receives the water from the spout F, not in the direction pointing towards the axis, but in the direction, and with the precise velocity, of its motion. This pre­vents any retardation by dragging forward the water. The water then passes down between the outer conoid AC*ca* and the inner conoid HG*gh* along spiral channels formed by parti­tions soldered to both conoids. The curves of these chan­nels are determined by a theory which aims at the annihi­lation of all unnecessary and improper motions of the water, but which is too abstruse to find a place here. The water thus conducted arrives at the bottom *CGcg.* On the outer circumference of this bottom is arranged a num­ber of spouts (one for each channel), which are all directed one way in tangents to the circumference.

Adopting the common theory of the re-action of fluids, this should be a very powerful machine, and should raise 8/27ths of the water expended. But if we admit the re­action to be equal to the force of the issuing fluid (and we do not see how this can be refused), the machine must he nearly twice as powerful. We therefore repeat our won­der that it has not been brought into use. But it appears that no trial has been made even of a model ; so that we have no experiments to encourage an engineer to repeat the trial Even the late author Professor Segner has not related any thing of this kind in his *Exercitationes Hydrau­licos,* where he particularly describes the machine. Such remissness has probably proceeded from fixing the atten­tion on Euler’s improved construction. It is plain that this must be a most cumbrous mass, even in a small size re­quiring a prodigious vessel, and carrying an unwieldy load. If we examine the theory which recommends this construc­tion, we find that the advantages, though real and sensible, bear but a small proportion to the whole performance of the simple machine as invented by Dr Barker. It is there­fore to be regretted that engineers have not attempted to realize the first project. We beg leave to recommend it,

with a further argument taken from an addition made to it by M. Mathon de la Cour, in Rozier’s *Journal de Physique,* January and August 1775. This gentleman brings down a large pipe FEH (fig. 13) from a reservoir, bends it upward at H, and introduces it into two ho­rizontal arms DA, DB, which have an upright spindle DK, carrying a millstone in the style of Dr Barker’s mill. The ingenious mechanician will have no difficulty of contriving a method of joining these pipes, so as to permit a free circular motion without losing much water. The operation of the machine in this form is evident. The water, pressed by the column FG, flows out at the holes A and B, and the unbalanced pressure on the opposite sides of the arms forces them round. The compendiousness and other advantages of this construction are more striking, allowing us to make use of the greatest fall without any increase of the size of the machine. It undoubtedly enables us to employ a stream of water too scanty to be employed in any other form. The author gives the dimensions of an engine which he had seen at Bourg Argental. AB is 92 inches, and its diameter 3 inches ; the diameter of each orifice is 11/6; FG is 21 feet; the pipe D was fitted into C by grind­ing, and the internal diameter of D is 2 inches.

When the machine was performing no work, or was un­loaded, and emitted water by one hole only, it made 115 turns in a minute ; thus giving a velocity of forty-six feet per second for the hole. This is a curious fact ; for the water would issue from this hole at rest with the velocity of 371/6. This great velocity (which was much less than the velocity with which the water actually quitted the pipe) was undoubtedly produced by the prodigious centrifugal force, which was nearly seventeen times the weight of the water in the orifice.

The empty machine weighed eighty pounds, and its weight was half supported by the upper pressure of the water, so that the friction of the pivots was much dimi­nished. It is a pity that the author has given no account of any work done by the machine. Indeed it was only working ventilators for a large hall. His theory by no means embraces all its principles, nor is it well founded.

We think that the free motion round the neck of the feeding pipe, without any loss of water or any considerable friction, may be obtained in the following manner. AB (fig. 14) represents a portion of the revolving horizontal pipe, and CE*ec* part of the feeding pipe. The neck of the first is turned truly cylindrical, so as to turn easily, but without shake, in the collar Ce of the feeding pipe, and each has a shoulder which may support the other. That the friction of this joint may not be great, and the pipes destroy each other by wearing, the horizontal pipe has an iron spindle EF, fixed exactly in the axis of the joint, and rest­ing with its pivot F in a step of hard steel, fixed to the iron bar GH, which goes across the feeding pipe, and is firmly supported in it. This pipe is made bell-shaped, widening below. A collar or hose of thin leather is fitted to the inside of this pipe, and is represented (in section) by LKM*mkl*. It is kept in its place by means of a metal or wooden ring Nn, thin at the upper edge, and taper-shaped. This is drawn in above the leather, and stretch­ing it, causes it to apply to the side of the pipe all around. There can be no leakage at this joint, because the water will press the leather to the smooth metal pipe ; nor can there be any sensible friction, because the water gets at the edge of the leather, and the whole unbalanced pressure