

that is produced by the mere addition of a similar load of work, or that it does the more work the slower it goes.

We have supposed the machine to be in its state of permanent uniform motion. If we consider it only in the beginning of its motion, the result is still more in favour of slow motion: for, at the first action of the moving power, the inertia of the machine itself consumes part of it, and it acquires its permanent speed by degrees; during which, the resistances arising from the work, friction, &c. increase, till they exactly balance the pressure of the water; and after this the machine accelerates no more. Now the greater the power and the resistance arising from the work are, in proportion to the inertia of the machine, the sooner will all arrive at its state of permanent velocity.

There is another circumstance which impairs the performance of an overshot wheel moving with a great velocity, *viz.* the effects of the centrifugal force on the water in the buckets. Our mill-wrights know well enough, that too great velocity will throw the water out of the buckets; but few, if any, know exactly the diminution of power produced by this cause. The following very simple construction will determine this: Let AOB (Fig. 10.) be an overshot wheel, of which AB is the upright diameter, and C is the centre. Make CF the length of a pendulum, which will make two vibrations during one turn of the wheel. Draw FE to the elbow of any of the buckets. The water in this bucket, instead of having its surface horizontal, as NO, will have it in the direction n O perpendicular to FE very nearly.

For the time of falling along half of FC is to that of two vibrations of this pendulum, or to the time of a revolution of the wheel as the radius of a circle is to its circumference: and it is well known, that the time of moving along half of AC, by the uniform action of the centrifugal force, is to that of a revolution as the radius of a circle to its circumference. Therefore the time of describing $\frac{1}{2}$ of