

Energy of Motion and of Position. 23

the weight is made to turn a system of wheels, each wheel will have its bearings that will cause more or less friction. The meshing of the cogs between one wheel and another will be an additional source of friction, and to this must be added the resistance offered by the air to the motion of the wheels. We have already seen that the arrest of motion is followed by a corresponding production of heat. In comparing the effective work done, then, in winding up the weight that drives the machine with that which it will perform in running down, we must deduct all the energy that passes into heat caused by the friction of the bearings, the cogs, and the resistance of the air. This, added to the effective work performed, will be equal to that expended in raising the weight. It will thus be seen that by no possible means can power be gained by machinery, but machinery enables us to utilize power in many convenient and highly advantageous ways that would be impossible without its use.

It was an old notion that power could be gained by machinery, and many men have spent years of time as well as fortunes in pursuing this will-o'-the-wisp, which, if true, would enable us to construct a machine that would propel itself. From their standpoint an animal or a man seemed to be a realization of a perpetual motion. They did not