

The mechanical advantage can therefore be indefinitely increased by making the distance between the threads more nearly the same in each screw. In the common screw, the advantage is increased by diminishing the distance between the threads, but the diminution is practically limited by regard to the strength of the thread.

If each screw had the same distance of threads, the advantage would be infinite, and it is obvious that any weight would be supported without a power at all, the outer screw rising just as much as the inner screw descends *within* it, so that the weight would be stationary.

P. or V.V.

In every machine,

what is gained in power

is lost in time,

Work done and efficiency,

91. When a power P is supporting a weight W on any machine, if the machine be set in motion, it will continue to move uniformly so long as its geometrical relations with the power and weight are unaltered; and if s, S be the spaces gone through by the power and weight in any time (that is, their *virtual velocities*) we have $P \times s = W \times S$. Hence a given force acting through a given space for any time will lift the same weight only through a given space, whatever be the machine through which it acts; and if the weight lifted be increased, in the same proportion will the space through which it is lifted be diminished. Also when a given power lifts a weight through a given space, the greater the weight, the greater in the same proportion is the space through which the power must act, and (the motion being uniform) the longer is the time employed. Hence the principle of virtual velocities is sometimes stated in the form, that "in every machine what is gained in power is lost in time."

92. Hence also this product $P \times s$ or $W \times S$ may be considered the *work done* by the machine, and is sometimes termed its *duty*; while with reference to the power, the names of *mechanical efficiency* and *laboring force* have been given.

In this sense, although *advantage* may be gained by a machine, no *efficiency* is gained or (*theoretically*) lost, but it remains the same as if the power were applied directly without the intervention of the machine.