25.3: Pulley

A pulley is a grooved wheel mounted in a frame. Pulleys may be connected to other pulleys to form compound pulley systems that have a large mechanical advantage. One may use such pulley arrangements to allow just one or two men to lift a large, heavy object such as a piano or safe. (Figure $25.3.1$)

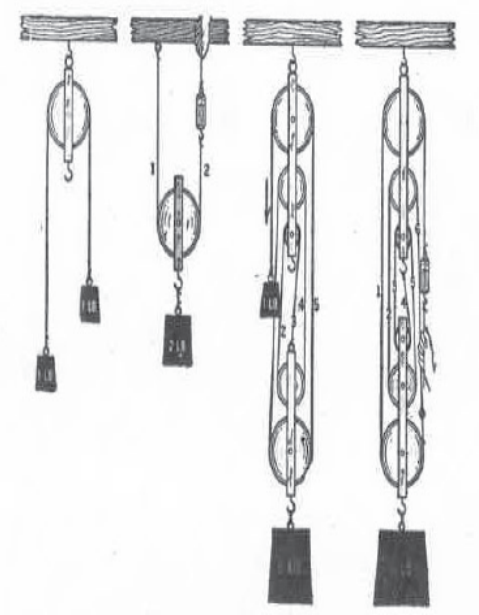

Figure $25.3.1$: Systems of pulleys. These systems have a mechanical advantage of (left to right): 1, 2, 5, and 6 , so that each example requires only 1lb of effort to lift $1, 2, 5$, and 6 pounds, respectively. Note that the leftmost arrangement only changes the direction of the applied effort force, by allowing us to pull downward to lift the weight upward; it does not provide any mechanical advantage. (Ref. [17])

The mechanical advantage of a set of pulleys is equal to the number of strands N_R holding up the resistive force:

$$M.A. = N_R \tag{25.3.1}$$

Therefore one can gain a larger mechanical advantage (and thus lift a heavier weight) by using more pulleys.