

Mech. adv. Hence the mechanical advantage $\left(\frac{W}{P}\right)$ is equal to the ratio of the radii of the wheel and axle.

Cor.—Any number of wheels and axles may run on the same axis, and the condition of equilibrium will be that the sum of the products of each power into the radius of its wheel is equal to the corresponding sum for the weights and radii of the axles, the powers being all supposed to turn in the same direction and the weights all in the opposite.

Pullies.

64. *The Pullies.*

A pulley is a wheel running freely on an axis, which, passing through its centre, is fixed in a block by which the pulley is suspended and to which a weight may be attached. The circumference of the pulley is grooved to admit of a string passing over or under it. The pulley is said to be *fixed* or *moveable* according as its block is so.

Single fixed Pulley.

Let P , Q be the forces, applied at the ends of the string passing over the pulley. The whole system being smooth, the tension of the string is the same throughout (§ 10), and, therefore,

$$P = Q.$$

No mechanical advantage is gained or lost.

Single moveable Pulley.
Fig. 6.

65. *Single moveable pulley supported by a string passing under it, the free portions of the string being parallel, and a weight attached to the block.*

Let P be the force applied to the string on one side of the pulley; then, the whole system being smooth, the tension of the string is the same throughout, and P is therefore also the force applied to the string on the other side. There are then two parallel forces, each equal to P , supporting a weight W which acts vertically. Hence the strings must be vertical, and

$$W = 2P.$$