Inclined plane.

71. *The Inclined Plane.*

This is a plane fixed at a certain angle (called its *inclination*) to the horizon, and on it a heavy particle is supported by a force applied and the reaction of the plane. Since the plane is smooth, its reaction is exerted in a normal direction; also the weight of the particle acts vertically: therefore if a vertical plane be drawn through the particle and the normal to the inclined plane, since the plane thus drawn contains the directions of those two forces acting on the particle, the third force or *Power* must also act in this plane.

Fig. 11.

Let the figure represent this plane; AB, the section of the inclined plane; AC, horizontal.

The angle BAC is the inclination, α (suppose).

Let P, the power, act at an angle θ to AB, and let

R be the reaction of the plane exerted perpendicularly to AB.

W the weight of the particle acting vertically downwards.

The particle is then kept at rest by the three forces P, R, W.

Taking the resolved parts of these along AB, that of P is $P\cos\theta$; of R is 0; of W is $W\cos(90°-\alpha) = W\sin\alpha$.

Hence by the "vanishing of the Resultant,"

$$P\cos\theta - W\sin\alpha = 0,$$

which gives the mechanical advantage $\left(\frac{W}{P}\right) = \left(\frac{\cos\theta}{\sin\alpha}\right)$.

Cor. 1. For a given inclination, the mechanical advantage is greatest when $\cos\theta$ is greatest; that is, when $\theta = 0$, and the force acts parallel to the plane.

For a force acting at a given angle to planes of different inclinations, the mechanical advantage increases as the inclination diminishes.