Mechanics and Engineering.

ELEMENTARY PAPERS FOR YOUNG MECHANICS.

V.—The Inclined Plane.

It is well known that the steeper a hill, the more difficult it is to push or pull a load up it, and that by lengthening out the slope, by means of a winding road, a mountain may be crossed which stands so high and so precipitous that it would be impossible to cross it by the shortest route.

These facts are illustrations of the mechanical principle involved in the "Inclined Plane."

The inclined plane is a flat surface inclined to the horizon, on which weights may be raised. The advantage of using it being that by a weight descending vertically a greater weight may be made to ascend the slope, or by the exertion of a force equal to a descending weight. the same result may be attained.

The contrivance does not increase the force, as a little consideration will make plain. In figure 5, the line ZY is the

inclined plane, and the XZ is the vertical line. It will be observed that the length of the line ZY is greater than the length of the line XZ, and ZY and XZ are virtually arms of a lever, so that the smaller weight moving a greater distance will overcome a heavier weight moving a shorter distance.

In figure 5, let W represent the weight to be raised the height XZ, by means of a weight P, which is connected to it by a cord passing over a pulley at A, above the point Z. When W is at Y. the foot of the incline, P is at Z, and when W reaches Z it will only have been raised a distance equal to XZ, while P will have fallen a distance equal to ZY. Leaving friction out of the count, W × XZ will be equal to P × ZY.

This explains why it is that the more gradual the slope, the less the power required to raise the weight, but the longer the distance through which that power must be exerted.

In our illustration the power is supposed to act on the weight in a direction parallel to the inclined plane, and if the weight be 720 pounds, and the inclined plane 24 feet and the vertical height 4 feet, then the power $P = 720 \times 4 \div 24 = 120$. That is, 120 lbs. descending vertically would draw 720 lbs. up the slope. The length of the base line XY is proportional to another element, viz., the pressure of the weight on the inclined plane.

As Z X Y is a right-angled triangle, the lengths of the lines may be readily determined when any two of them are known. as the square of ZY is equal to the sum of the squares of ZX and XY.

The three sides of the triangle are proportional as follows—The inclined plane—to the weight: The height—to the power: The base—to the pressure on the plane.

When the power is applied in any other direction, such as parallel to the base, or at some other angle, then the conditions are altered, and a difference in the proportion of the power to the weight arises.

When the power acts parallel to the base the sides of the triangle are proportioned as follows:—The base—to the weight: The height—to the power: The inclined plane—to the pressure on the plane.

The WEDGE is simply a double form of inclined plane, or two inclined planes with their bases joined.

The wedge is generally employed to separate bodies by force; the force being applied either by blows or by direct pressure on the back of the wedge, though sometimes it is applied to the point of the wedge by pulling.

The motion of the wedge when employed in separating two bodies must be in the direction from the point towards the back, and the power obtained is in direct proportion to the length of the wedge and inversely as the breadth.

That is, the smaller the angle at the point of the wedge, the less force will be required to be applied to the wedge to force it in.

The same principles which determine the proportions of an inclined plane apply to wedges, although it is usual that the inclined plane is fixed and stationary and the weight and force travel upon it, while a wedge is made to move.

In case of a direct steady pressure being applied to a wedge, it is required to find what weight may be lifted or what amount of resistance may be overcome. Rule—Multiply the power by the length of the wedge, and divide by the thickness; the quotient will be the weight.

The less power moving a greater distance overcomes a greater weight moving a less distance; which principle was found to be the foundation for rules regarding the lever, the inclined plane, and now, also, the wedge. All students of mechanics should endeavor to get this idea clearly fixed in their minds and act upon it in their daily work, as it will save them from many a mistake. It cannot be too strongly impressed upon their minds, that every *effect* must be the result of some adequate cause, and no machine or mechanical contrivance can *produce* or *increase* power.

The SCREW is another modification of the inclined plane, but we must reserve it for consideration in a distinct paper.

HOW TO USE EMERY WHEELS.

The following hints on how to use emery wheels are taken from the price list of the Hart Emery Wheel Company, Hamilton:—

Choose a Grinder proportioned to the Size of Wheels. (See our Price List of Grinders, pages 8 to 13.)

Always use Collars on Each Side of the Wheel. The diameter of the collar ought to be at least one-fourth that of the wheel.

Take as much care of the Grinder as you would of a Lathe, Planer or Drill.

See that the Wheels are True and Balanced before running them.

Keep the Wheels True. For large wheels a Diamond Tool is indispensable. The Emery Wheel Dresser will keep small wheels true, and will be found exceedingly useful to clean out particles of metal from the surface of any wheel. For further information about Dressers, see page 16.

Run the Wheels at the proper speed. Our price list and cards all contain a list of the proper number of revolutions of mandrel for all sizes of wheels. A rim speed of 5,000 to 5,500 feet per minute is by common consent decided to be the most effective.