machine; and in compound machines the action is communicated by teeth or cogs, forming wheel and pinion work.

Rule. As the radius of the wheel is to the radius of the axle, so is the effect to the power.

Example. A weight of 50 lbs. is exerted on the periphery of a wheel whose radius is 10 feet. Required the weight raised at the extremity of a cord wound round the axle, the radius being 20 inches.

$$\frac{50 \text{ lbs.} \times 10 \text{ feet} \times 12 \text{ inches}}{20 \text{ inches.}} = 300 \text{ lbs., the weight.}$$

The Inclined Plane.

The inclined plane acts as a mechanical power by sustaining a portion of the weight to be raised, while the direction of the applied force is changed from the perpendicular to one more or less horizontal, and the weight moves upwards on it in a diagonal between them. Equilibrium is sustained when the power is to the weight as the perpendicular height of the inclined plane is to its inclined length or hypothenuse, when the power acts in a direction parallel to the inclination of the plane; but as the height is to the base when in a direction parallel to the base.

Rule. As the length of the plane is to its height, so is the weight to the power.

Example. Required the power necessary to raise 540 lbs. up an inclined plane 5 feet long and 2 feet high.

As 5 : 2 :: 540 : 216 lbs., the power.

The *length*, in the above rule, must represent that of the inclined surface, or of the base, accordingly as the power acts parallel to either of these surfaces.

The Wedge.

The wedge may be regarded as two inclined planes, united by a common base, acting on two weights or resistances at once, or on a fulcrum and a weight, between which it moves, generally, in practice, by the impulse of successive blows.

As in the inclined plane, equilibrium consists in the power being to the resistance as the back of the wedge is to its length, or to the length of its side, accordingly as the resistance acts perpendicularly to the central line of length or to that of the side.

Case 1. *When two bodies are forced from one another by means of a wedge, in a direction parallel to its back.*

Rule. As the length of the wedge is to half its back or head, so is the resistance to the power.

Example. The breadth of the back or head of the wedge being 3 inches, and the length of either of its inclined sides 10 inches, required the power necessary to separate two substances with a force of 150 lbs.

As 10 : $1\frac{1}{2}$ :: 150 : $22\frac{1}{2}$ lbs., the power.

Case 2. *When only one of the bodies is movable.*

Rule. As the length of the wedge is to its back or head, so is the resistance to the power.

Example. The breadth, length, and force, the same as in the last example.

As 10 : 3 :: 150 : 45 lbs., the power.

The Screw.

The screw is an inclined plane, and may be supposed to be generated by wrapping a triangle, or an inclined plane, round a cylinder. The base of the triangle is the circumference of the cylinder; its height, the distance between two consecutive cords or threads; and the hypothenuse forms the spiral cord or inclined plane.

Rule. To the square of the circumference of the screw, add the square of the distance between two threads, and extract the square root of the sum: this will give the length of the inclined plane. Its height is the distance between two consecutive cords or threads.

When a winch or lever is applied to turn the screw, the power of the screw is as the circle described by the handle of the winch, or lever, to the internal or distance between the spirals.

Case 1. *When the weight to be raised is given, to find the power.*

Rule. Multiply the weight by the distance between two threads of the screw, and divide the product by the circumference of the circle described by the lever. The quotient is the power.

Example. Required the power to be applied to the end of a lever three feet long, to raise a weight of five tons with a screw of $1\frac{1}{4}$ inch between the threads.

$$\frac{11200 \text{ lbs.} \times 1{\cdot}25}{36 \text{ inches} \times 2 \times 3{\cdot}1416} = 61{\cdot}9 \text{ lbs., the power.}$$

Case 2. *When the power is given, to find the weight it will raise.*

Rule. Multiply the power by the circumference of the circle described by the lever, and divide the product by the distance between two threads of the screw: the quotient will be the weight. The example is the converse of that in the former case."
—*Hazlett's Hand-Book.*

Shingles rendered Fire-proof.

Mr. John Mears says, in the Boston *Cultivator*, that he has prepared shingles in the following manner, and after an experience of eleven years, and using seven forges in his blacksmith's shop, he has never seen a shingle on fire, nor has a nail started. The shingles are prepared in the following manner;—"Having a large trough, I put into it a bushel of quicklime, half a bushel of refuse salt, and five or six pounds of potash, adding water to slack the lime and dissolve the vegetable alkali and the salt—well knowing that pieces of an old lime pit, a soap barrel, or a pork tub, were not the best kindling stuff, and having long since learned, while at the Vineyard Sound, that hot salt-water white wash endure far longer than that made with fresh water, absorbing moisture, striking into the wood and not peeling and washing off. I set the bundles of the shingles nearly to the bands, in the wash for two hours; then turned them end for end. When laid on the roof and walls, they were brushed over twice with the liquid, and were brushed over at intervals of two or three years after."