This result is independent of the particular points of the arms from which the weights depend, and in this lies the convenience of the machine as a Balance.

89. In the *Differential Axle* (fig. 18), two axles of different sizes run fixed together on the same axis, and the weight is supported on these by a pully, whose string is coiled round these axles in opposite directions. If P be raised by a complete turn of the machine, W descends through a space equal to half the quantity of string set free from the axles; that is, through half the difference of the circumferences of the axles; and, the circumferences being as the radii, we have Differential axle. Fig. 18.

$$P \times \text{radius of wheel} = W. \tfrac{1}{2}\,(\text{difference of radii of axles}).$$

In the common wheel and axle, the power and wheel being given, the mechanical advantage is increased by diminishing the radius of the axle, but this diminution is practically limited by regard to the strength of the axle. In the above machine, the mechanical advantage may be increased indefinitely, by making the axles more nearly of equal size, without too much weakening them.

If the axles were absolutely equal, the mechanical advantage would be infinite, and it is obvious that any weight would be here supported without a power at all.

90. In *Hunter's Screw* (fig. 19), the weight is supported on a smaller screw, which runs in a companion in the interior of a larger screw, the latter passing through a fixed block and being acted on by a power as usual. Hunter's Screw. Fig. 19.

When the power makes a complete revolution, and raises the large screw through the distance between its threads, the smaller screw at the same time descends *in* the large one through the distance between its own threads, and the weight therefore on the whole rises through the difference between the "distances of the threads" in the two screws. Hence,

$P \times$ circumference of $P = W \times$ difference between distances of contiguous threads in the two screws.