The Mechanics of Textile Processes

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Ex. A weight of 16 lbs. is hung 15 in. from the fulcrum F, Fig. 137. What upward pressure must be exerted at a point 7 in. from F?

First find the result by experiment as shown in Fig. 137. Then check by calculation.

$W \times x = P \times y$

$16 \times 15 = P \times 7$

$P = (16 \times 15) \div 7 = 34.28$ lbs.

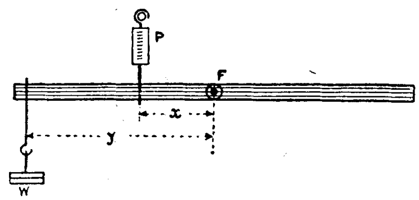

Fig. 137.

Ex. A weight of 23 lbs. is hung 6½ in. from the fulcrum F in Fig 138. What will be the indications on a spring P which supports the arm 15 in. from F?

As in the previous examples we have

$W \times x = P \times y$

$23 \times 6\frac{1}{2} = P \times 15$

$P = (23 \times 6\frac{1}{2}) \div 15 = 9.96$ lbs.

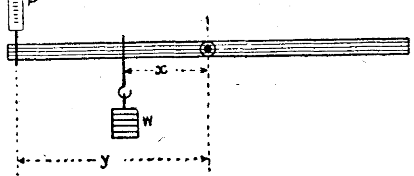

Fig. 138.

Ex. A safety valve is 3 in. dia. The center of the valve is 5 in. from the fulcrum. Find weight to be placed 20 in. from the fulcrum so that the valve will blow off when the steam pressure is 50 lbs. per sq. in. in the boiler, Fig. 139.

Area of valve = 7.0686 sq. in.

$P = 7.0686 \times 50 = 353.43$ lbs., total pressure.

$P \times y = W \times x$

$(P \times y) \div x = W$

$(353.43 \times 3) \div 20 = 53$ lbs., weight at W

Weight to be hung at W = 53 lbs.

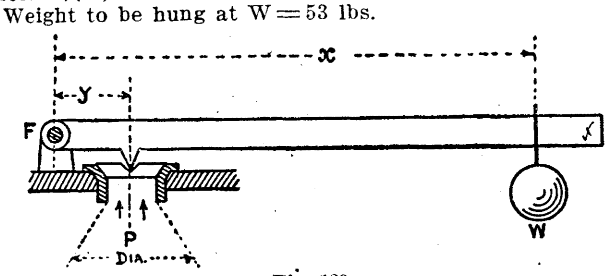

Fig. 139.

Ex. Four calender rollers of a lap end are weighted as shown in Fig. 140. The top lever FW is 14 in. long, FP is 3 in. The bottom lever FW is 60 in. long, FP is 6 in. What pressure is exerted at P, and what is the pressure on the cotton as it passes between each pair of rollers if the top roller weighs 60 lbs., the second roller 65 lbs., and the third roller 72 lbs.? The weight on the bottom lever is 12 lbs. Both sides of the machine are provided with levers and weights.

In the bottom lever the pressure P is found as follows:—

$P = (W \times x) \div y$

$P \times y = W \times x$

$P = (12 \times 60) \div 6 = 120$ lbs.

$P = 120$ lbs.

In the top lever the weight W is the same as the pressure P on the bottom lever, so that—

$(W \times x) \div y = P$

$(W \times x) = (P \times y)$

$P = (120 \times 14) \div 3 = 560$ lbs.

$560 \times 2 = 1120$ lbs., total pressure.

Pressure on top roller is 1120 lbs.

Pressure between top rollers $= 1120 + 60 = 1180$ lbs.

Pressure between second rollers $= 1180 + 65 = 1245$ lbs.

Pressure between bottom rollers $= 1245 + 72 = 1317$ lbs.

Ex. The calender rollers of the lap end of an opener are weighted as shown in Fig. 141. The lever is 72 in. long and the pressure is applied 3 in. from the fulcrum. If a weight of 22 lb. is placed 66 in. from the fulcrum, what pressure is put on the cotton between each pair of rollers if the top roller weighs 70 lbs., the second roller 78 lbs., and the third roller 82 lbs.? Separate levers act on each end of the top roller.

$x = 66$ in. $y = 3$ in. $W = 22$ lbs.

$Wx = Py$

$Wx \div y = P$

$P = (22 \times 66) \div 3 = 484$ lbs.

$484 \times 2 = 968$ lbs., otal pressure.

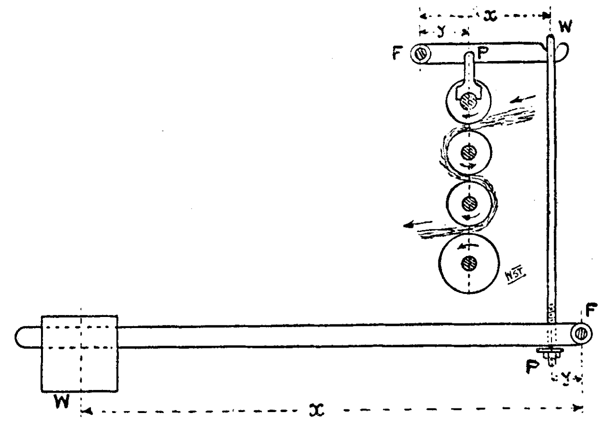

Fig. 140.

CENTER OF GRAVITY

Every particle of a body is acted upon by the force of gravity, and the sum of these forces over the whole body gives it the quality of weight. Some parts of a body may be heavier than other parts, and such parts will be pulled downwards with greater force than the rest. The center of gravity is therefore that point in a body where the resultant of

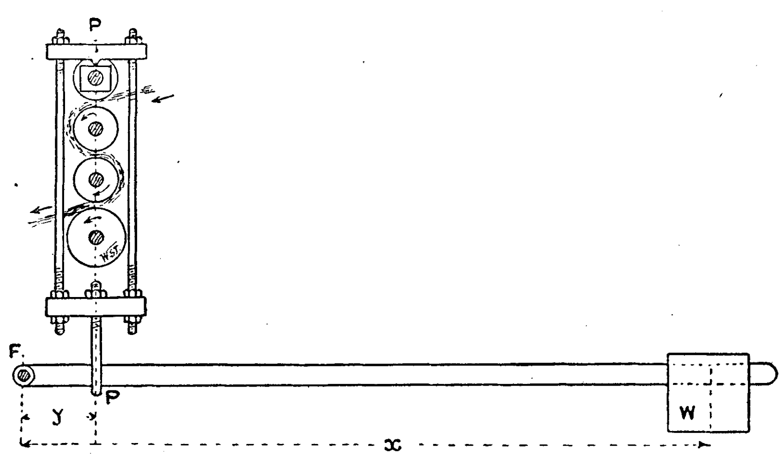

Fig. 141.

the force of gravity acts. In other words, when a body is acted upon by gravity alone, the center of gravity is the point upon which the body will balance; if supported at that point, the body will be in equilibrium.

Inspection alone in many cases is sufficient to inform us as to the position of the center of gravity. A thin symmetrical plate of uniform material will have its center of gravity in the center as, for instance, a square plate, a circular or a uniform rod of any section will have its center of gravity at its middle point.