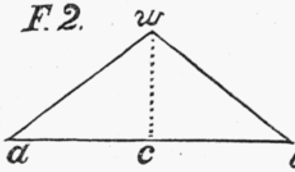
of the structure and its load. The braces *aw* and *bw*, in supporting the weight *w*, [Fig. 2,] act in the directions of their lengths with a certain force, which bears the same relation to $\frac{1}{2}w$ as *wa* or *wb* bears to *wc*, and their action at each of the points *a* and *b*, is the same as would be that of a perpendicular force equal to $\frac{1}{2}w$, and a horizontal force outward equal to $\frac{1}{2}\frac{ac}{wc}w$. Therefore the abutments must be calculated to withstand this horizontal force, or some sort of connection or ligature must be provided between *a* and *b*, capable of withstanding it, in which case the action upon each abutment is simply a vertical pressure equal to $\frac{1}{2}w$, omitting the weight of the structure.

F. 2.



This horizontal action is called the horizontal thrust, and if the abutments be relied on to sustain it, they will require to be better and more strongly built than when they only sustain the weight.

This thrust always has place when a weight is sustained by any means except by a continuous series of solid bodies extending from it directly downward to the earth. Hence the necessity, in all cases of indirect sustension of weights, of having, at least, 2 pieces or parts, either inclining in opposite directions, or having unequal inclinations, that their horizontal actions may neutralize one another; otherwise the body would move in the direction of the greater horizontal thrust.

The horizontal thrust has place even in the case of a simple beam, being exerted by the upper part, and counteracted by the lower.

In the case of suspension bridges, the horizontal action of the chains is inward, and a counteracting outward thrust is exerted by that portion of the earth between the points of attachment; or it may be met and opposed by a rigid body extending from one point of suspension to the other.