less able to support the weight, and a collapse must result.

If \( w \) be less than the above proportion indicates, it will be unable to withstand the upward tendency of the point \( c \), due to the thrust of \( bc \) and \( dc \) (or, to the preponderance of the vertical thrust of \( bc \), over that of \( dc \)), the point \( c \) will rise, the upward tendency becoming greater and greater, and the result will be a collapse, as before. The same reasoning, and the same inference, apply to any other angular point, as at \( c \). It is, therefore, only in theory that such a thing as an equilibrated erect arch, can exist. The arch is here considered as a geometrical line without breadth or thickness.

It is this property of instability, in the Erect Arch, that the diagonals in the Arch Truss, [Figs. 5 and 11] are designed to obviate, and to enable the arch to retain its form and stability under a variable load.

**LXXI.** Still, in theory, an arch may be in equilibrio with any given distribution of load, whenever the points \( a, b, c, \) etc., are so situated that the sides of the triangle \( bcm \), for instance, formed by a vertical with lines respectively coinciding or parallel with the two segments meeting at \( c \), are proportional to the 3 forces acting at \( c \), as above stated, and so at the other angular points of the figure.

To construct an equilibrated arch adapted to a given distribution of load, consisting of determinate weights at given horizontal intervals between the extremities of the arch, we may proceed as follows:

Draw a horizontal line representing the chord \( ak \), and upon the vertical \( Cf \), erected from its centre, take \( Cf \) equal to the required versed sine, or depth of the