To this ball let a spring D be attached, which is also attached to the disk at p and let the ball be free to move radially along the rod B. When the ball is at any distance r ft. from the centre of rotation O, the centrifugal force C acting on it is $C = \frac{w}{g} r \omega^2$ where w is the weight of the ball and ω is the angular velocity in radians per second corresponding to n.

Now let S denote the spring pull per foot of extension and let the spring have no extension when the ball is at O, thus for this position of the weight the extension of the spring will be r ft. Then the pull exerted by the spring will be $s^1 \times r$ pds., and as there must be equilibrium between the pull of the spring and the centrifugal force we have $s^1 r = \frac{w}{g} r \omega^2$ or $s^1 = \frac{w}{g} \omega^2$. We shall find it convenient to use S to denote the force required to change the length of the spring

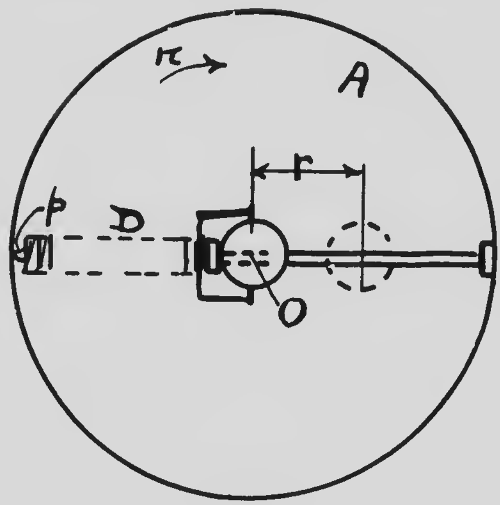

Fig. 38.

one inch so that $s^1 = 12S$. And if r be also measured in inches then we get by supplying the constants $Sr = .0000284\, w r n^2$ for the inch unit. Suppose now we wish to have n constant for all values of r, *i.e.*, an *isochronous* arrangement, we would then make $S = .0000284\, w n^2$, or if we take $w = 25$ lbs., $n = 200$ revs. per min. $S = 28.4$ lbs. *i. e.*, if to this ball we attach a spring so designed that a force of 28.4 pounds will change its length by one inch, and if further the spring be so connected with the ball that the extension of the former is always equal to the radius of rotation of the latter, then the arrangement is isochronous, or the ball will remain at any radius from the centre so long as the speed is 200 r. p. m. It will be evident, however, that the least external force would send the ball to the extreme end of its travel, or it is not stable.