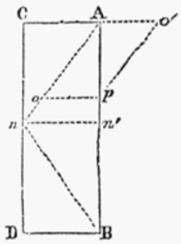
$r^2 R = w$. But when the pressure coincides with the axis, we have $\pi r^2 R = w$; hence, the strength in the two cases will be as 5 to 16.

Flexure of Columns and Posts.

It is evident that if a column be perfectly cylindrical, and the direction of the weight coincide exactly with the axis, flexure cannot take place; but if the weight be sufficient the fibres will yield by crushing. Flexure therefore must result from some obliquity in the line of direction of the force.

FIG. 12.



Let us take the most unfavorable case that would probably occur in practice, as it is that which gives the greatest diameter and is consequently the most safe.

Let A be the point of application of the weight, $A B$ its line of direction, $C D$ the position of the neutral axis at the instant

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The whole expression therefore becomes $\frac{R}{r} \int y x^2 dx = -\frac{R}{r}\left(\frac{\pi r^4}{2} + \frac{\pi r^4}{8}\right) = -\frac{5}{8}\pi R r^3$ and $\frac{\frac{R}{r} \int y x^2 dx}{\frac{R}{r} \int y x dx} = \frac{-\frac{5}{8}\pi R r^3}{-\frac{1}{2}\pi R r} = \frac{5}{4} r$.

Hence, the line through the centre of gravity, perpendicular to the base, passes at a distance of $\frac{1}{4} r$ from the centre; the centre of gravity will be found in this line, and also in the line drawn from A to the middle point of $B C$; hence, it will be at their intersection, and its height above the base can be found by the proportion $2r : \frac{R}{2} :: \frac{5}{4} r : \frac{5}{16} R$.