Work done in Twisting a Wire or Rod:

Let a wire or rod of length l and radius r be fixed at the upper end. At the lower end of the wire, a couple is applied so that a twist of an angle θ is produced at this end.

If C be the couple per unit twist

of the wire, then the couple, to twist the wire through an angle θ, will be $C\theta$. Now, the work done in twisting the wire further through a small angle $d\theta$, is given by

$$dW = C\theta \cdot d\theta.$$

Hence, the total work done in twisting the wire through the angle θ is

$$W = \int_0^\theta C\theta \cdot d\theta = \frac{1}{2} C\theta^2 = \frac{n\pi r^4 \theta^2}{4l}$$

$$\left[\because C = \frac{n\pi r^4}{2l}\right]$$

The energy spent in doing this work, is stored up in the wire and is known as Strain energy.

Determination of Modulus of Rigidity Statically: Statical methods are based on a direct application of the expression for the twisting couple $\left(= \frac{n\pi r^4 \theta}{2l}\right)$.

There are two types of apparatus employed for the determination of modulus of rigidity for the material of a rod or wire.

Paper-I

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