

(25)

Question:- In a simple screw-jack the pitch of the thread is 6mm and length of handle is 30cm. If the  $\eta$  of the jack is 45% then find effort required to lift the load of 8.6 kN.

Given data

$$p = 6 \text{ mm} = 0.6 \text{ cm}$$

Century = 100

$$L = 30 \text{ cm}$$

$$\eta = 45\% = 0.45 \Rightarrow \eta = 45\%$$

$$W = 8.6 \text{ kN}$$

$$= \frac{45}{100} = 0.45$$

To find out:-

$$P = ? \text{ (N)}$$

Solve:-

$$\textcircled{I} \text{ M.A.} = \frac{W}{P} = \frac{8.6 \text{ kN}}{P}$$

$$\boxed{\frac{W}{P} = \frac{8.6}{P}} \text{ --- } \textcircled{I}$$

$$\textcircled{II} \text{ V.R.} = \frac{2\pi L}{p} = \frac{2\pi \times 30}{0.6} = 100\pi$$

$$\textcircled{III} \quad \eta = \frac{\text{M.A.}}{\text{V.R.}} \times 100$$

$$\downarrow \quad \nearrow W$$

$$0.45 = \frac{\left(\frac{8.6}{P}\right)}{\text{V.R.}}$$

$$0.45 = \frac{8.6}{P} \quad (\text{V.R.} = 100\pi)$$

$$P = \frac{8.6 \times 10^3}{45\pi}$$

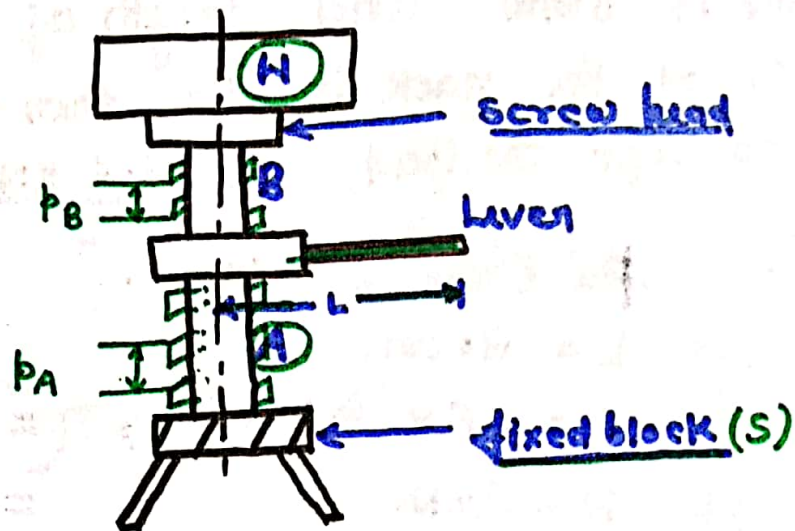
$$P = 60.80 \text{ N}$$

$$P = 60 \times 10^{-3} \text{ kN}$$

$$[P = 0.06 \text{ kN}]$$



## Differential Screw-Jack:-



→ Distance Moved by effort =  $2\pi L$

→ Distance Moved by load =  $p_A - p_B$

$$\therefore V \cdot R = \frac{2\pi L}{(p_A - p_B)} //$$

For ideal Machine,

$$\eta = 100\%$$

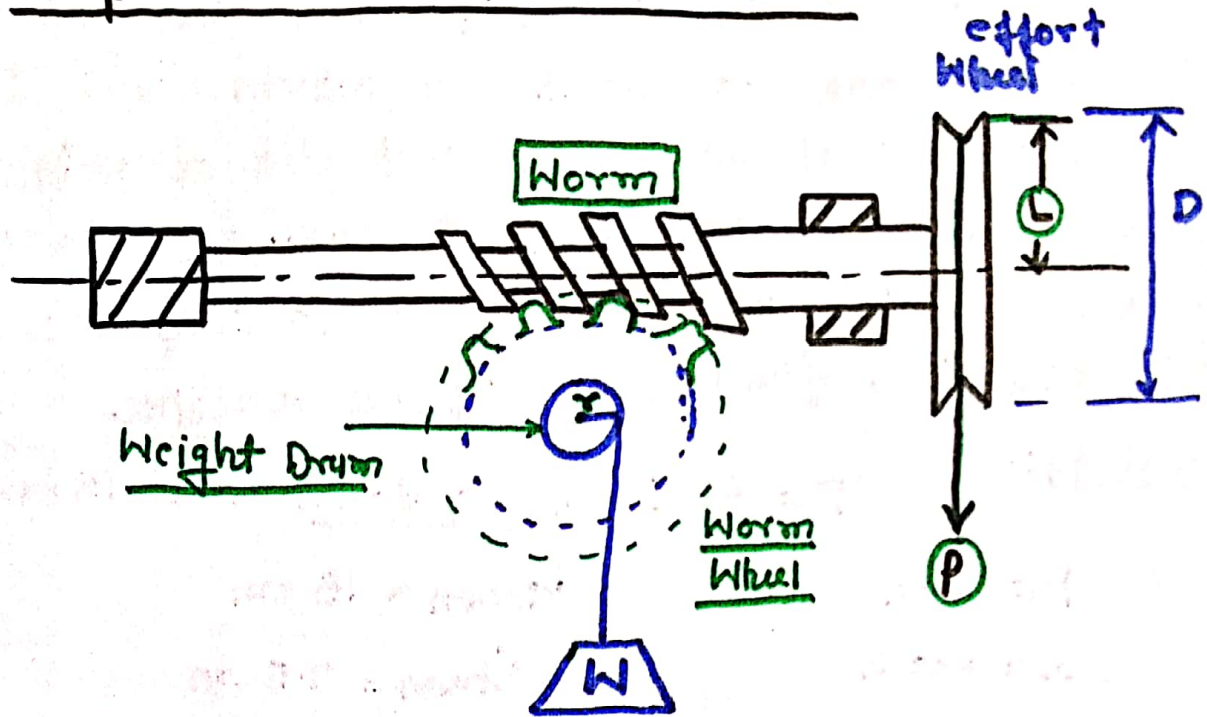
$$\eta = \frac{M \cdot A}{V \cdot R}$$

$$1 = \frac{M \cdot A}{V \cdot R}$$

$$\therefore \left[ \underline{M \cdot A = V \cdot R} = \frac{(2\pi L)}{(p_A - p_B)} \right] //$$



# ☼ Simple Worm and Worm Wheel:-



Let; No. of teeth on worm wheel =  $T$   
 Radius of drum =  $r$

Length of handle (or) radius of wheel =  $L$

Weight hanging on weight drum =  $W$

Effort on wheel (or) handle =  $P$

→ Distance moved by effort ( $D$ ) =  $2\pi L$

∴ One rotation of worm passed travel One tooth of worm wheel.

$$\therefore \text{Distance moved by Weight} = (d) = \left( \frac{1 \times 2\pi r}{T} \right)$$

$$\Rightarrow VR = \frac{D}{d} = \frac{2\pi L}{\frac{2\pi r}{T}} = \frac{LT}{r}$$

For ideal Machine  
 $\eta = 100\%$

$$\eta = \frac{m \cdot A}{v \cdot R} \Rightarrow 1 = \frac{m \cdot A}{v \cdot R}$$

$$M \cdot A = v \cdot R = \frac{2\pi L}{T}$$

$$M \cdot A = v \cdot R = \frac{LT}{r}$$

Question:- In a single threaded worm and worm wheel, there are 60 teeth on worm wheel. If dia. of effort wheel is 30 cm and dia. of weight drum is 15 cm, then find the V.R. 600 N weight is used to lift by it with effort of 20 N on this machine, find the  $\eta$  of the machine.

Given data:-

$$T = 60 ; \quad \underline{2L = 30 \text{ cm}} \Rightarrow L = 15 \text{ cm}$$

$$P = 20 \text{ N}$$

$$D_{\text{Drum}} = 15 \text{ cm}$$

$$W = 600 \text{ N}$$

$$r_{\text{drum}} = 7.5 \text{ cm}$$

To find out:- ① V.R. ✓  
②  $\eta$  %

$$\textcircled{i} \quad V.R. = \frac{LT}{r} = \frac{15 \times 60}{7.5} = 120$$

$$\textcircled{ii} \quad \left\{ M.A. = \frac{W}{P} = \frac{600}{20} = 30 \right\}$$

$$\textcircled{iii} \quad \eta = \frac{M.A.}{V.R.} \times 100$$

$$= \frac{30}{120} \times 100$$

$$\left\{ \eta = 25\% \right\} //$$