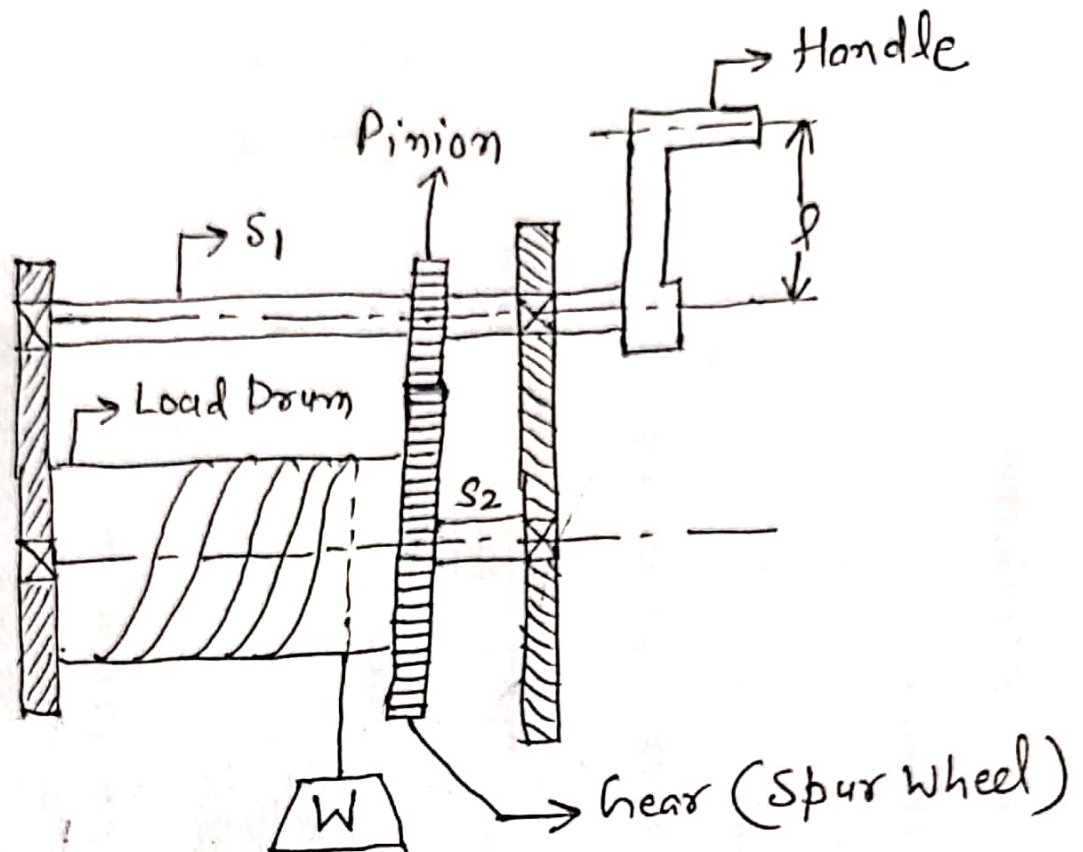


# Single Purchase Winch Crab

①



- It consists of two parallel spindles  $S_1$  &  $S_2$ . Two toothed wheel one smaller and other larger are mounted on spindle  $S_1$  and  $S_2$  respectively. (Figure)
- \* Smaller wheel is known as pinion.
  - \* Larger wheel is known as gear.
  - ⇒ Spindle  $S_2$  carries a load drum attached to gear. A string is wound round the load drum at the end of which load W is suspended.
  - ⇒ A handle is attached to spindle  $S_1$ . Effort ( $P$ ) is applied at this handle.

Let,  $T_1 =$  No. of teeth on pinion. (2)

$T_2 =$  No. of teeth on gear or spur

$d =$  diameter of load drum.

$l =$  length of handle.

$W =$  Load lifted

$P =$  Effort Applied.

For one revolution of handle,  
distance moved by effort =  $\underline{2\pi l}$

No. of revolution made by pinion = 1

No. of revolutions made by spur =  $\frac{T_1}{T_2}$

\* As load drum is attached to spur, so

distance moved by load =  $\frac{T_1}{T_2} \times \pi d$ .

Now, Velocity Ratio =  $\frac{\text{distance moved by effort}}{\text{distance moved by load}}$

$$\text{or } V.R. = \frac{2\pi l}{\frac{T_1}{T_2} \times \pi d} = \frac{2l}{d} \times \frac{T_2}{T_1}$$

$$\boxed{M.A. = \frac{W}{P}}$$

$$\text{Efficiency, } \boxed{\eta = \frac{M.A.}{V.R.}}$$

Problem: - In a single purchase winch (3)  
crab, number of teeth on pinion  
is 30 and that on spur wheel is  
300. The diameter of load drum is  
40cm. If length of handle is 35cm

Find: i) Velocity Ratio

ii) Efficiency of crab if an effort of  
50N can lift a load of 800N.

Solution: - Given,  $T_1 = 30$ ,  $T_2 = 300$

$$d = \underline{40\text{cm}}, \quad l = \underline{35\text{cm}}$$

$$\underline{P = 50\text{N}}, \quad \underline{W = 800\text{N}}$$

$$M.A. = \frac{W}{P} = \frac{800}{50} = \underline{16}$$

$$\text{Velocity Ratio, } V.R = \frac{2l}{d} \times \frac{T_2}{T_1}$$

$$= \frac{2 \times 35}{40} \times \frac{300}{30}$$

$$= \underline{17.5} \quad \underline{\text{Ans}}$$

$$\text{Efficiency, } \eta = \frac{MA}{VR} = \frac{16}{17.5} \times 100$$

$$\boxed{\eta = 91.42\%}$$