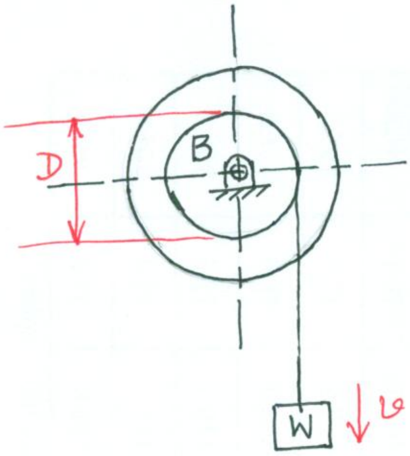
#1416/P.419



$W_B = 200$ lb

$D = 2$ ft

$W = 32.2$ lb

Neglect friction and mass of cable

$v_{OW} = 0$, $S = 20$ ft, $t = 4$ sec.

(a) Tension in cable, $T = ?$

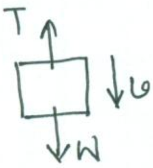
(b) Radius of gyration of B, $\bar{k}_B = ?$

Sol^n

$$S = v_{OW} t + \frac{1}{2} a t^2$$

$$\Rightarrow 20 = 0 \times 4 + \frac{1}{2} \times a \times 4^2$$

$$\therefore a = 2.5 \text{ fps}^2$$



From the freebody of the weight W, taking $\Sigma F_y = 0 \downarrow +$

$$W - T = \frac{W}{g} \cdot a$$

$$\Rightarrow 32.2 - T = \frac{32.2}{32.2} \times 2.5$$

$$\therefore T = \boxed{29.7 \text{ lb}} \text{ Ans.}$$

Change in kinetic energy of the whole system,

$$\Delta KE = \Delta KE_B + \Delta KE_W$$

$$= \frac{1}{2} \bar{I}_B \left(\omega_B^2 - \omega_{OB}^2\right) + \frac{1}{2} \frac{W}{g} \cdot \left(v_W^2 - v_{OW}^2\right)$$

$$= \frac{1}{2} \times \frac{200}{32.2} \times \bar{k}_B^2 \times 10^2 + \frac{1}{2} \times \frac{32.2}{32.2} \times 10^2$$

$$= 310.56 \, \bar{k}_B^2 + 50$$

$v_W = at = 2.5 \times 4 = 10$ fps

$\omega_B = \frac{v_W}{r} = \frac{10}{1} = 10$ rad/s.

$\omega_{OB} = \frac{v_{OW}}{r} = \frac{0}{1} = 0$

$\bar{I}_B = m_B \bar{k}_B^2 = \frac{W_B}{g} \bar{k}_B^2$

$= \frac{200}{32.2} \bar{k}_B^2$

Net work done by the system, $U_{net} = W.S = 32.2 \times 20 = 644$ lb

$$U_{net} = \Delta KE$$

$$\Rightarrow 644 = 310.56 \, \bar{k}_B^2 + 50$$

$$\therefore \bar{k}_B = \boxed{1.38 \text{ ft}} \text{ Ans.}$$

Note: For an explanation of U_{net} see example 278/ alternative sol^n/pp.398-399