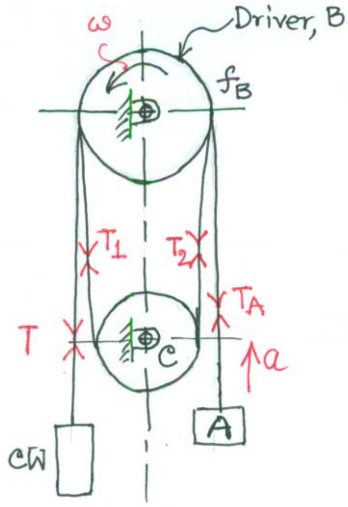
1142/P.328



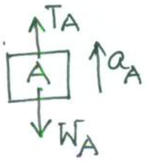
$W_A = 5000$ lb CW = ?

$a_A = 3\,fps^2$ Neglect inertia effects.

$f_B = 0{\cdot}1$

Note: Here min^m CW is asked for. If CW is less than this min^m, body A will drop down, irrespective of whether sheave B rotates ↷ or ↶. In other words, for min^m CW, body A will be in a ~~sta~~ impending state to drop down. It indicates $T_A > T_1$

Sol^n

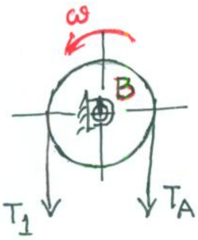


From the freebody of A

$$\Sigma F = m a \uparrow +ve$$

$$\Rightarrow T_A - W_A = \frac{W_A}{g}\cdot a_A$$

$$\therefore T_A = 5000 + \frac{5000}{32{\cdot}2}\times 3 = 5465{\cdot}84 \text{ lb}$$



From body B, since $T_A > T_1$

$$T_A = T_1 e^{f_B\theta}$$

$$\therefore T_1 = \frac{T_A}{e^{f_B\theta}} = \frac{5465{\cdot}84}{e^{0{\cdot}1\times\pi}} = 3992{\cdot}26 \text{ lb}$$

$$= T_2$$

[∵ Sheave C is frictionless]

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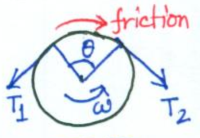
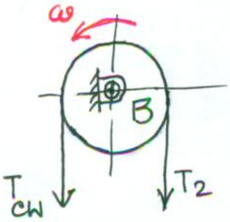


$T_1 > T_2$

$T_1 = T_2 e^{f\theta}$

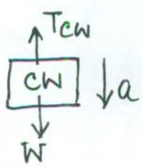


$T_2 > T_{cw}$

Again from body B

$$T_2 = T_{cw}\, e^{f_B\theta}$$

$$\therefore T_{cw} = \frac{T_2}{e^{f_B\theta}} = \frac{3992{\cdot}26}{e^{0{\cdot}1\pi}} = 2915{\cdot}95 \text{ lb}$$



From freebody of counter weight,

$$\Sigma F = m a \downarrow +ve$$

$$\Rightarrow W - T_{cw} = \frac{W}{g}\cdot a \;\Rightarrow\; W\left(1 - \frac{a}{g}\right) = T_w$$

$$\therefore W = 2915{\cdot}95 \Big/ \left(1 - \frac{3}{32{\cdot}2}\right) = \boxed{3214{\cdot}9 \text{ lb}}$$