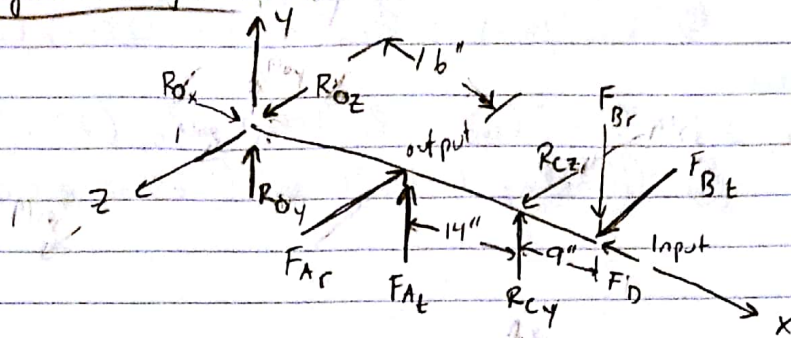


Design Project



- ① Given : Input Power of 0.75 hp ; $F_D = 2000 \text{ lb}$
constant speed of 600 rpm

$$d_A = 20 \text{ in} , \theta_A = 20^\circ$$

$$d_B = 8 \text{ in} , \theta_B = 20^\circ$$

Find : F_A

$$① F_{Ax} = F_A \sin \theta_A , ③ F_{Bx} = F_B \sin \theta_B$$

$$② F_{Ay} = F_A \cos \theta_A , ④ F_{By} = F_B \cos \theta_B$$

$$⑤ P = Tw \Rightarrow T = \frac{P}{\omega} = \frac{(0.75 \text{ hp})(550 \text{ lb}\cdot\text{ft/s})}{600 \text{ rpm} \cdot \frac{2\pi \text{ rad}}{60 \text{ s}}}$$

$$1 \text{ hp} = 550 \text{ lb}\cdot\text{ft/s}$$

$$1 \text{ rpm} = \frac{2\pi \text{ rad}}{60 \text{ sec}}$$

$$T = 6.565141403 \text{ lb}\cdot\text{ft}$$

$$T \cdot \frac{12 \text{ in}}{1 \text{ ft}} = 78.78169683 \text{ lb}\cdot\text{in}$$

$$⑥ \sum F_y = 0 = R_{Ay} + F_{Ay} + R_{By} - F_{Bx} \Rightarrow R_{Ay} + F_A \cos \theta_A + R_{By} = F_B \sin \theta_B \quad (13)$$

$$⑦ \sum F_z = 0 = R_{Dz} - F_{Ax} + R_{Cz} + F_{Bx} \Rightarrow R_{Dz} - F_A \sin \theta_A + R_{Cz} = -F_B \cos \theta_B \quad (14)$$

$$⑧ \sum F_x = 0 = -F_D + R_{Dx} \Rightarrow R_{Dx} = F_D = 2 \text{ kip}$$

x-y plane :

$$⑨ \sum M_O = 0 = F_{Ay}(16 \text{ in}) + R_{By}(30 \text{ in}) - F_{Bx}(39 \text{ in})$$

x-z plane :

$$⑩ \sum M_O = 0 = -F_{Ax}(16 \text{ in}) + R_{Cz}(30 \text{ in}) + F_{Bx}(39 \text{ in})$$

$$⑪ F_A \cos \theta_A (16 \text{ in}) + R_{By} (30 \text{ in}) - F_B \sin \theta_B (39 \text{ in}) = 0$$

$$⑫ -F_A \sin \theta_A (16 \text{ in}) + R_{Cz} (30 \text{ in}) + F_B \cos \theta_B (39 \text{ in}) = 0$$

$$F_{Bx} = \frac{T}{r_B} = \frac{2T}{d_B} = 19.69542421 \text{ lb}$$

$$F_B = \frac{F_{Bx}}{\cos \theta_B} = 20.95943266 \text{ lb}$$