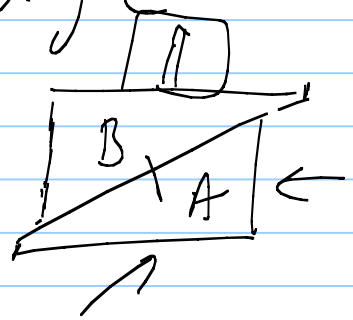
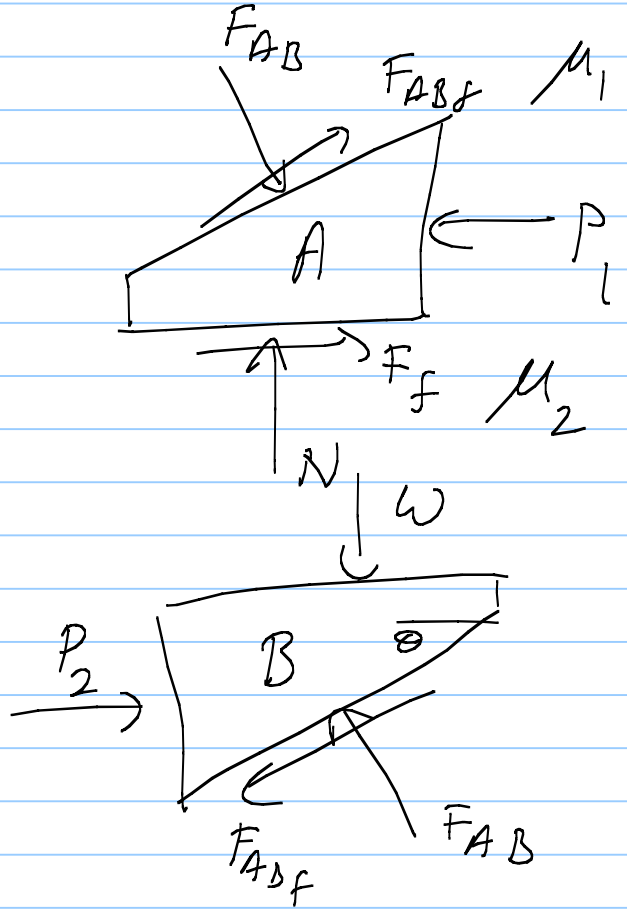
EGR180 7/16

Note Title 7/16/2009

Wedge





$F_{AB} \cdot \mu_1$

$$\sum F_{y_B} = -W - F_{AB_f} \sin\theta + F_{AB} \cos\theta = 0$$

$$F_{AB} = \frac{W}{\cos\theta - \mu_1 \sin\theta}$$

$$\sum F_{x_B} = P_2 - F_{AB_f} \cos\theta - F_{AB} \sin\theta = 0$$

$$P_2 = F_{AB} \left[\sin\theta + \mu_1 \cos\theta \right]$$

$$N = W$$

$$\sum F_{x_A} = -P_1 + F_{AB_f}\cos\theta + F_{AB}\sin\theta + F_f = 0$$

$$F_f = \mu_2 W$$

$$P_1 = \frac{W}{\cos\theta - \mu_1 \sin\theta}\left[\mu_1 \cos\theta + \sin\theta\right] + \mu_2 W$$

$$\mu_1 = \mu_2 = 0.4, \quad W = 2000\ \text{lbs}, \quad \theta = 8^\circ$$

$$P_1 = \frac{2000}{\cos(8) - .4\sin(8)}\left[\sin(8) + .4\cos(8)\right] + .4(2000)$$

$$= 1945.5 \text{ lbs}$$

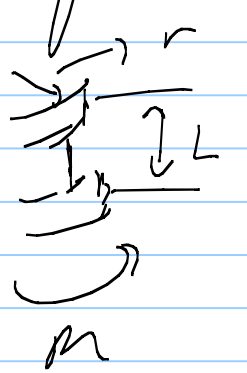
$$P_2 = 1145.5 \text{ lbs}$$

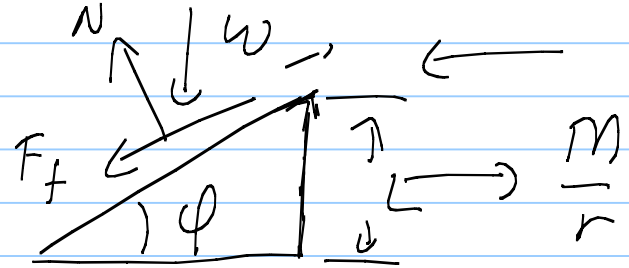
$$\mu_1 = \mu_2 = 0.2$$

$$P_1 = 1100.8 \text{ lbs}$$

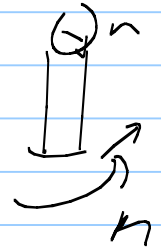
$$P_2 = 700.8 \text{ lbs}$$

Square Threaded Screw





M



$P = \frac{M}{r}$

$\tan\varphi = \frac{L}{2\pi r}$

$$\sum F_y = -W + N\cos\varphi - F_f \sin\varphi = 0 \qquad F_f = \mu N$$

$$N = \frac{W}{\cos\varphi - \mu\sin\varphi}$$

$$\sum F_x = \frac{m}{r} - N\sin\varphi - F_g\cos\varphi = 0$$

$$\frac{m}{r} = \frac{\omega}{\cos\varphi - \mu\sin\varphi}\left[\sin\varphi + \mu\cos\varphi\right]$$

$$m = \omega r\left[\frac{\mu + \tan\varphi}{1 - \mu\tan\varphi}\right]$$

$$= \omega r\left[\frac{\mu + L/2\pi r}{1 - \mu L/2\pi r}\right] \text{ tightening}$$

$$M = Wr\left[\frac{\mu - L/2\pi r}{1 + \mu L/2\pi r}\right] \quad \text{lowering}$$

$\mu = 0.4$, $W = 2000$ lbs, $r = 0.5''$, $L = 0.25''$

$$M = 2000(.5)\left[\frac{0.4 + \frac{.25}{2\pi(.5)}}{1 - \frac{(.4)(.25)}{2\pi(.5)}}\right] = 495.3 \text{ in-lbs}$$

$$= 41.3 \text{ ft-lbs}$$

$$M = 2000(.5)\left[\frac{.4 - .25/2\pi(.5)}{1 + .4(.25)/2\pi(.5)}\right] = 310.5 \text{ in-lbs}$$

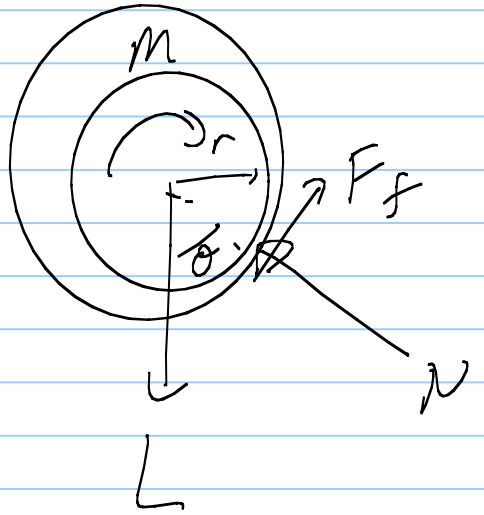
$$= 25.9 \text{ ft-lbs}$$

$\mu = 0.2$, $L = 0.6$

$$M = 2000(.5)\left[\frac{.2 + .6/\pi}{1 - \frac{(.2)(.6)}{\pi}}\right] = 33.9 \text{ ft-lbs}$$

$$M = 2000(.5)\left[\frac{.2 - .6/\pi}{1 + \frac{(.2)(.6)}{\pi}}\right] = 0.7 \text{ ft-lbs}$$

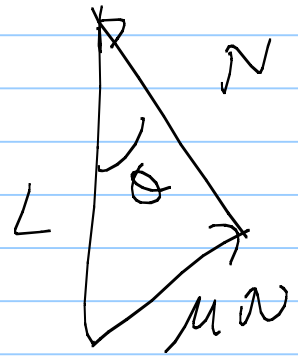
Journal Bearing



$$\sum m_0 = -m + rF_f = 0$$

$$F_f = \mu N$$

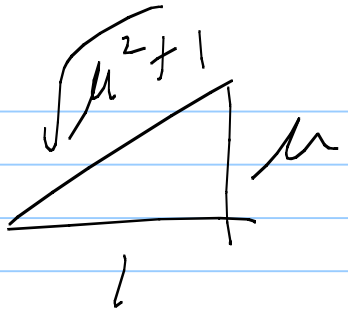
$$m = \underline{\mu r N}$$



$$\mu = \tan(\theta)$$

$$\mu N = L \sin(\theta)$$

$$M = rL\sin\theta = \mu r L\cos\theta$$



$$\boxed{M = \frac{\mu r L}{\sqrt{1+\mu^2}}}$$

$L = 1000$ lbs

$r = 0.25''$

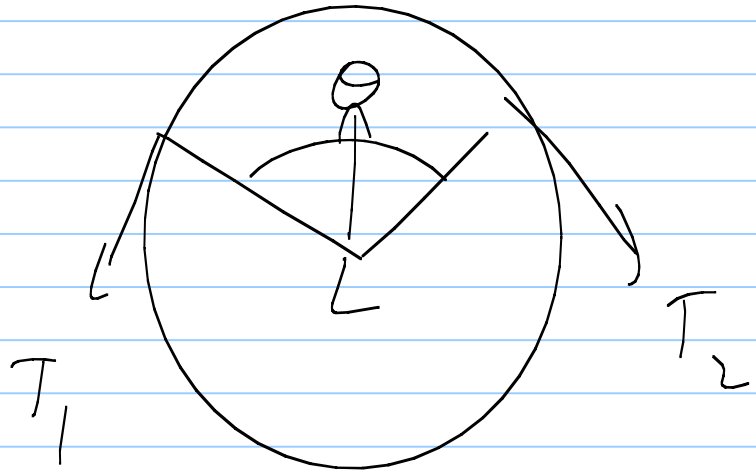
$\mu = 0.1$

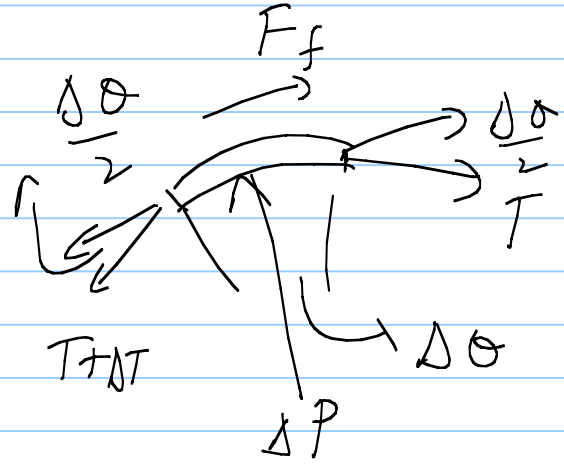
$$M = \frac{(0.1)(0.25)(1000)}{\sqrt{1.01}} = 24.9 \text{ in-lbs}$$

25.0 in-lbs

$$\theta = \tan^{-1}(.1) = 5.7^\circ$$

Flat Belt





$$\Delta P - (T+\Delta T)\sin\left(\frac{\Delta\theta}{2}\right) - T\sin\left(\frac{\Delta\theta}{2}\right) = 0$$

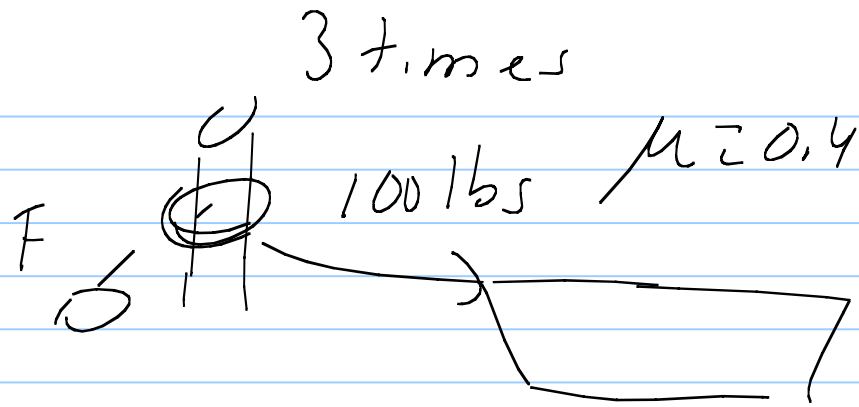
$$F_f = \mu \Delta P$$

$$(T+\Delta T)\cos\left(\frac{\Delta\theta}{2}\right) - T\cos\left(\frac{\Delta\theta}{2}\right) - F_f = 0$$

$$\Delta P = T\Delta\theta$$

$$\Delta T = F_f = \mu \Delta P = \mu T \Delta\theta$$

$$\frac{dT}{d\theta} = \mu T \Rightarrow T_2 = T_1 e^{\mu\theta}$$



$$T_1 = T_2 e^{-\mu\theta}$$

$$= 100\, e^{-(.4)(6\pi)}$$

$$= 0.053 \text{ lbs}$$