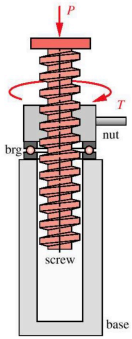
Ex1) Power Screw Jack



- **Assume square thread with**
  - **single-start thread,**
  - **the pitch $p = 0.2$ in,**
  - **the pitch diameter $d_p = 1.15$ in,**
  - **the collar diameter $d_c = 2$ in,**
  - **the lead screw friction $\mu = 0.15$,**
  - **the collar friction $\mu_B = 0.02$**
- **Determine torque T to lift up and lower down $P = 1000\ \ell b$ of load**

Square thread $\rightarrow$ $\alpha = 0^\circ$

Single start $\rightarrow$ $L = p = 0.2$

$$\tan\lambda = \frac{L}{\pi d_p} = \frac{0.2}{\pi \cdot 1.15} = 0.055$$

Lifting :

$$T_{up} = T + T_g$$

$$= \frac{P d_p}{2} \cdot \frac{\mu\cos\lambda + \sin\lambda}{\cos\lambda - \mu\sin\lambda} + \mu_g \frac{P d_c}{2}$$

$$= \frac{P}{2}\left(d_p \left(\frac{\mu + \tan\lambda}{1 - \mu\tan\lambda} \right) + \mu_g d_c \right)$$

$$= \frac{1000}{2}\left(1.15\ \frac{0.15 + 0.055}{1 - 0.15 \cdot 0.055} + 0.02 \times 2 \right)$$

$$= \boxed{139.07\ \ell b \cdot in}$$

Lowering :

$$T_{down} = T' + T_g$$

$$= \frac{1000}{2}\left(1.15\ \frac{0.15 - 0.055}{1 + 0.15 \cdot 0.055} + 0.02 \times 2 \right)$$

$$= \boxed{73.97\ \ell b \cdot in}$$