Given: Power Screw

$d = 25mm$
$p = 5mm$
$F = 6kN$
$\mu_c = 0.05$ for collar
$\mu_t = 0.08$ for threads
d_c = friction diameter of the collar = 40 mm

Find: Overall efficiency and torque required to raise the load.

Solution: Find mean diameter.

$$d_m = d - \frac{p}{2} = 25mm - 2.5mm = 22.5mm$$

$$l = p = 5mm$$

$$T = \frac{F d_m}{2}\left(\frac{l + \pi \mu_t d_m}{\pi d_m + \mu_t l}\right) + \frac{F \mu_c d_c}{2}$$

$$= 8 \times 10^{-3} kN \cdot m + 9.6 \times 10^{-3} kN \cdot m$$

$$\boxed{T = 17.6 N \cdot m}$$

If the friction is equal to zero,

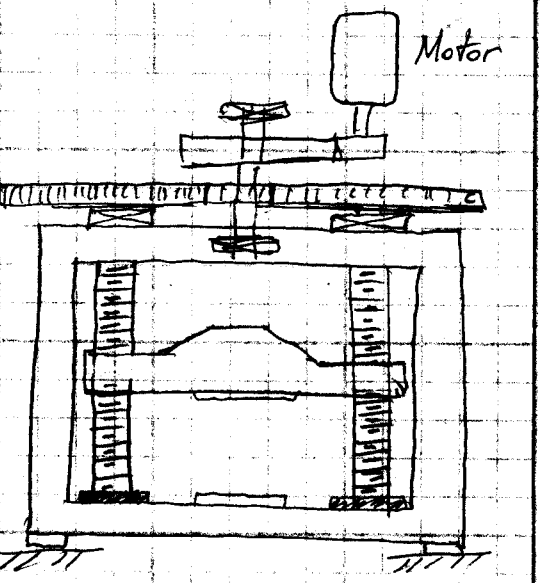
$$T_0 = \frac{Fl}{2\pi} = \frac{(6kN)(0.005m)}{6.7}$$

$$= 4.77 N \cdot m$$

$$\Rightarrow e = \frac{4.77 N \cdot m}{17.6 N \cdot m} = 27.1\%$$

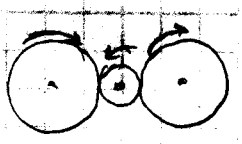
$$\boxed{e = 27.1\%}$$

Given: The machine shown in the figure can be used for a tension test but not for a compression test.



Find: (a) Why, (b) Do both screws have the same hand?

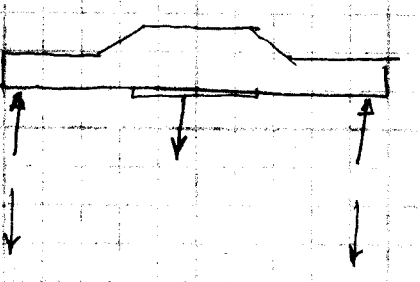
Solution:



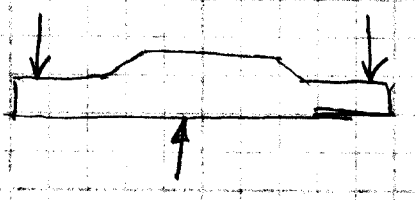
Direction of Rotation for Gears

Note that both power screws must have the same hand.

For a tension test, No load goes through the frame.



For a compression test, load goes through the frame decreasing the load seen by the specimen.



Given: Rated loaded of the press is 5,000 lb. The twin screws have ACME threads, a diameter of 3 in, and a pitch of ½ in. $\mu_t = 0.05$, $\mu_c = 0.06$, $d_c = 5$ in. Efficiency of the gears is 95% and the speed rate is 75:1. A slip clutch on the motor prevents overloading, and the full motor speed is 1720 rev/min.

Find: (a) How fast does the press head move?

(b) What should be the horsepower rating of the motor?

Solution: The rotational speed of the power screws are

$$n = \frac{1720 \text{ rev/min}}{75} = 22.93 \text{ rev/min}$$

The press moves at ½ in/rev.

$$\Rightarrow V = (p)(n) = \left(\frac{1}{2} \text{ in/rev}\right)\left(22.93 \frac{\text{rev}}{\text{min}}\right)$$

$$\boxed{V = 11.5 \text{ in/min}}$$

The mean thread diameter is given by

$$d_m = d - \frac{p}{2} = 3in - 1/2/2 = 2.75\,in$$

The torque at the rated load is given by

$$T = \frac{F d_m}{2}\left(\frac{l + \pi \mu_t d_m}{\pi d_m + \mu_t l}\right) + \frac{F \mu_t d_c}{2}$$

$$= 739\,in\text{-}lb + 750\,in\text{-}lb$$

$$= 1,489.\,in\text{-}lb$$

The torque produced by the motor is

$$T_m = \frac{1,489}{75(0.95)} = 20.9\,in\text{-}lb$$

$$T = 63,000\frac{P}{N}$$

$$\Rightarrow P = \frac{T * N}{63,000} = \frac{(20.9\,in.lb)(1720)}{63,000}$$

$$\boxed{P = 0.57\,hp}$$