The 70-mm double thread screw of a 10 kN shop press shown in Fig. 2.2 has a square thread. The operator's force may be taken 180 N for each hand. The mean diameter of collar is 60 mm. Determine.

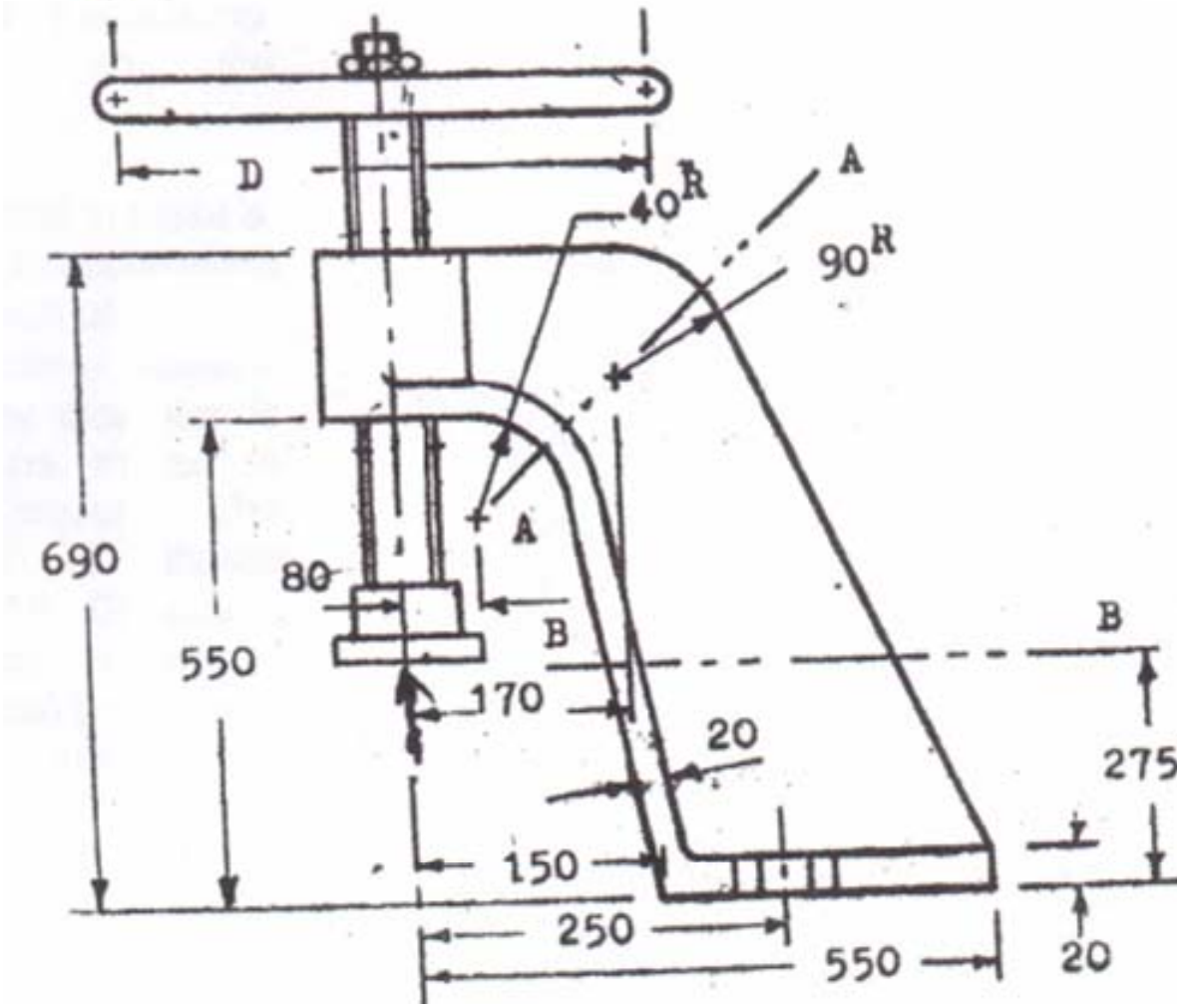
(a) the diameter D assuming that the coefficient of friction is 0.12 in the threads and 0.125 at the collar. The pitch is 12 mm

(b) the efficiency of the press

(c) the maximum normal and shear stresses in screw

(d) the bearing pressure in the threads

(e) the maximum normal stress in the frame at A-A making 45° to the horizontal and at section B-B.



$d_o = 70$ mm double thread $L = 2P$

$W = 10$ KN square thread $\sec\alpha = 1$

$F_{handle} = 180$ N $d_{mc} = 60$ mm $P = 12$ mm

determine:- a) $D = ??$ $\mu = 0.12$ $\mu_c = 0.125$

$$d_i = d_o - P = 70 - 12 = 58 \text{ mm}$$

$$d_m = \frac{d_i + d_o}{2} = \frac{58+70}{2} = 64 \text{ mm}$$

$$L = 2P = 2 * 12 = 24$$

$$T = W\frac{d_m}{2}\left[\frac{\pi\mu d_m + L}{\pi d_m - \mu L}\right] + \frac{\mu_c W d_{mc}}{2} = F_{handle} * D$$

$$10 * 10^3 * \frac{64}{2}\left[\frac{\pi * 0.12 * 64 + 24}{\pi * 64 - 0.12 * 24}\right] + \frac{0.125 * 10^4 * 60}{2} = 180\,D$$

$$77710.3 + 37500 = 180\,D$$

$$\therefore D = 640.06 \text{ mm}$$

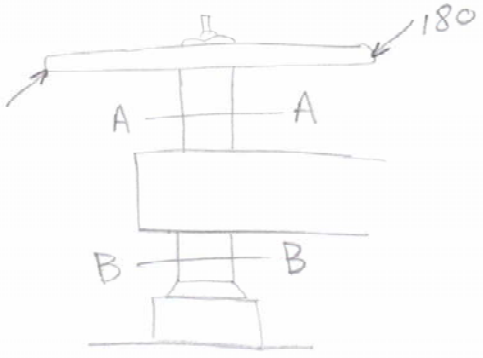
b) $\eta = ??$ $\eta = \frac{T_o}{T}$

$$T_o = \frac{WL}{2\pi} = \frac{10 * 10^3 * 24}{2\pi} = 38197.2$$

$$\eta = \frac{T_o}{T} = \frac{38197.2}{115210.3} = 0.3315 = 33.15\%$$

c) σ_{max} , $\tau_{max} = ??$

sec A–A



$$\tau = \frac{Tr}{J} = \frac{115210.3 * \frac{58}{2}}{\frac{\pi}{32}(58)^4} = 3 \text{ MPa}$$

$$\sigma_{max} = \frac{\sigma}{2} + \sqrt{\left(\frac{\sigma}{2}\right)^2 + \tau^2}$$

$$= 0 + \sqrt{(0)^2 + 3^2} = 3 \text{ MPa}$$

$$\tau_{max} = \sqrt{\left(\frac{\sigma}{2}\right)^2 + \tau^2} = \sqrt{(0)^2 + 3^2} = 3 \text{ MPa}$$

Sec B – B

$$\sigma_c = \frac{F}{A} = \frac{W}{\frac{\pi}{4}(d_i)^2} = \frac{10 * 10^3}{\frac{\pi}{4}(58)^2} = 3.785 \text{ MPa}$$

$$\tau = \frac{T_c r}{J} = \frac{37500 * 58/2}{\frac{\pi}{32}(58)^4}$$

$$= 0.979 \text{ MPa}$$

$$T_c = \frac{\mu_c W d_{mc}}{2}$$

$$= \frac{0.125 * 10^4 * 60}{2}$$

$$= 37500 \text{ N.mm}$$

$$\sigma_{max} = \frac{3.785}{2} + \sqrt{\left(\frac{3.785}{2}\right)^2 + (0.979)^2}$$

$$= 4.023 \text{ MPa}$$

$$\tau_{max} = \sqrt{\left(\frac{3.785}{2}\right)^2 + (0.979)^2} = 2.13 \text{ MPa}$$

$\sigma_{max} = 4.023$ MPa at Sec B – B

$\tau_{max} = 3$ MPa at sec A – A

d) bearing stress in threads

H (from drawing) = 690 – 550

H = 140 mm

$$\sigma_{br} = \frac{2W}{\pi d_m H}$$

$$= \frac{2 * 10 * 10^3}{\pi * 64 * 140} = 0.71 \text{ MPa}$$