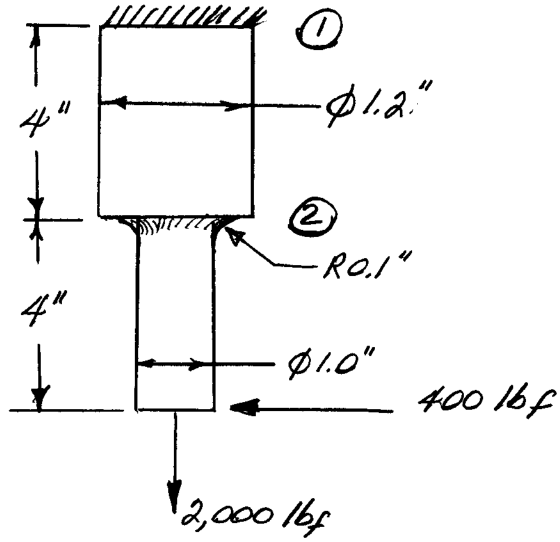
Given:



Find: Most critically stressed location.

Solution: Location 1 - Base

Bending stress $\equiv \sigma_b = \dfrac{Mc}{I}$

$$c = \frac{1.2"}{2} = 0.6"$$

$$I = \frac{\pi}{64} D^4 = \frac{\pi}{64}(1.2")^4 = 0.102 \text{ in}^4$$

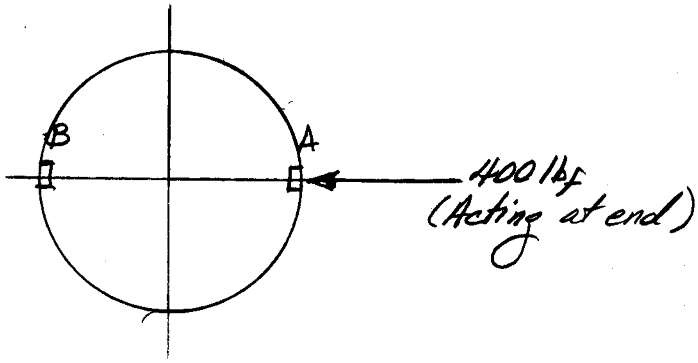
$$M = (400 \text{ lbf})(8 \text{ in}) = 3{,}200 \text{ lbf-in}$$

$$\sigma_b = 18{,}800 \text{ psi} = \underline{\underline{18.8 \text{ ksi}}}$$

Axial Stress $\equiv \sigma_a = \dfrac{P}{A}$

$$A = \frac{\pi}{4} D^2 = \frac{\pi}{4}(1.2)^2 = 1.13 \text{ in}^2$$

$$\sigma_a = \frac{2{,}000 \text{ lbf}}{1.13 \text{ in}^2} = 1{,}770. \text{ psi} = \underline{\underline{1.77 \text{ ksi}}}$$



Section at Location 1.

Normal stress at point $A \equiv \sigma_{nA} = \sigma_a + \sigma_b$

$= 1.77 + 18.8 = \underline{\underline{20.6\ ksi}}$

Normal stress at point $B \equiv \sigma_{nB} = \sigma_a - \sigma_b$

$= 1.77 - 18.8 = -17.0\ ksi$

Location 2 - Fillet

Bending stress $\equiv \sigma_b = \dfrac{K_t M c}{I}$

$M = (400\ lbf)(4\ in) = 1{,}600\ lbf\text{-}in$

$c = \dfrac{1.0"}{2} = 0.5\ in$

$I = \dfrac{\pi}{64} D^4 = \dfrac{\pi}{64}(1.0)^4 = 0.049\ in^4$

$\dfrac{r}{d} = \dfrac{0.1}{1.0} = 0.1\ ;\ \dfrac{D}{d} = \dfrac{1.2}{1.0} = 1.2$

from chart in class notes,

$K_t = 1.7$

$\Rightarrow \sigma_b = 27{,}800\ psi = \underline{\underline{27.8\ ksi}}$

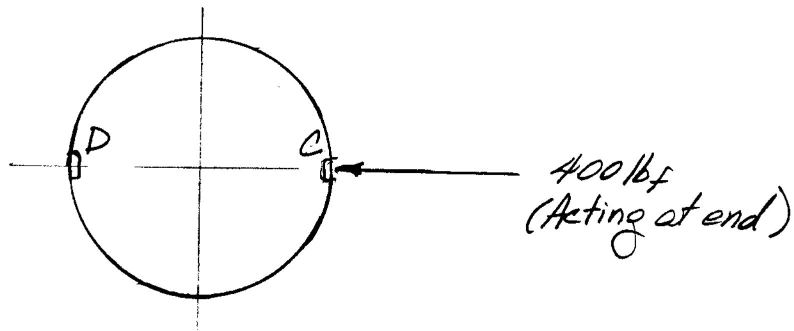
Axial stress $\equiv \sigma_a = \dfrac{K_t P}{A}$

$A = \frac{\pi}{4} D^2 = \frac{\pi}{4}(1)^2 = 0.785 \text{ in}^2$

from chart in class notes,

$K_t = 1.7$

$\sigma_a = 4{,}330.\ \text{psi} = \underline{\underline{4.33 \text{ ksi}}}$



Section at Location 2

Normal stress at point C

$\sigma_{nC} = \sigma_a + \sigma_b = 4.33 + 27.8 = 32.1 \text{ ksi}$

Normal stress at point D

$\sigma_{nD} = \sigma_a - \sigma_b = 4.33 - 27.8 = -23.5 \text{ ksi}$

The critical stress location is at point C at location 2 $\quad \sigma_{max} = 32.1 \text{ ksi}$