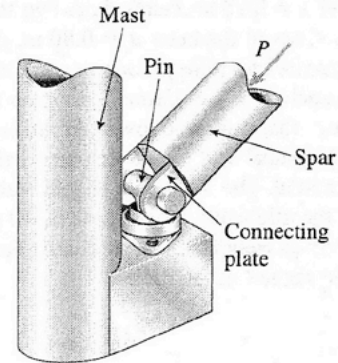


## Quiz # 1

**Problem 1.0** A ship's spar is attached at the base of a mast by a pin connection (see figure). The spar is a steel tube of outer diameter  $d_2 = 80$  mm and inner diameter  $d_1 = 70$  mm. The steel pin has diameter  $d = 25$  mm, and the two plates connecting the spar to the pin have thickness  $t = 12$  mm.

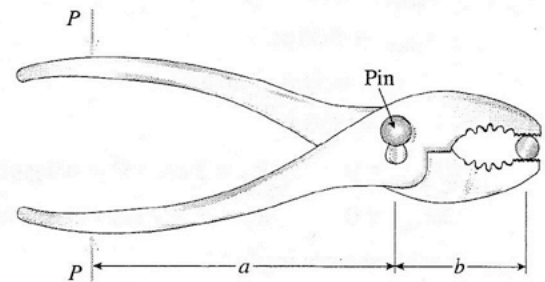
The allowable stresses are as follows: compressive stress in the spar, 70 MPa; shear stress in the pin, 45 MPa; and bearing stress between the pin and the connecting plates, 110 MPa.

Determine the allowable compressive force  $P_{\text{allow}}$  in the spar.



**Problem 2.0** What is the maximum possible value of the clamping force  $C$  in the jaws of the pliers shown in the figure if  $a = 3.75$  in.,  $b = 1.60$  in., and the ultimate shear stress in the 0.20-in. diameter pin is 50 ksi?

What is the maximum permissible value of the applied load  $P$  if a factor of safety of 3.0 with respect to failure of the pin is to be maintained?



**Problem 3.0** Two flat bars loaded in tension by forces  $P$  are spliced using two rectangular splice plates and two  $\frac{1}{2}$ -in. diameter rivets (see figure). The bars have width  $b = 1.0$  in. (except at the splice, where the bars are wider) and thickness  $t = 0.4$  in. The bars are made of steel having an ultimate stress in tension equal to 60 ksi. The ultimate stresses in shear and bearing for the rivet steel are 25 ksi and 80 ksi, respectively.

Determine the allowable load  $P_{\text{allow}}$  if a safety factor of 2.5 is desired with respect to the ultimate load that can be carried. (Consider tension in the bars, shear in the rivets, and bearing between the rivets and the bars. Disregard friction between the plates.)

