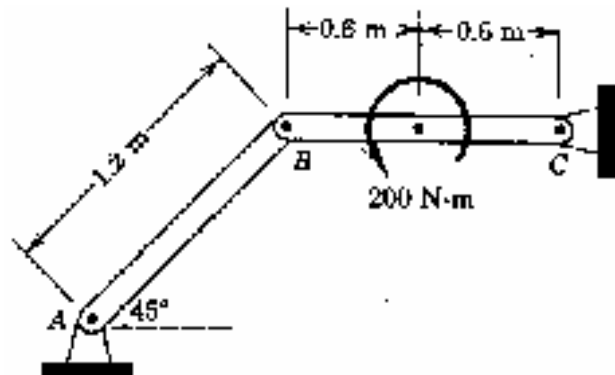
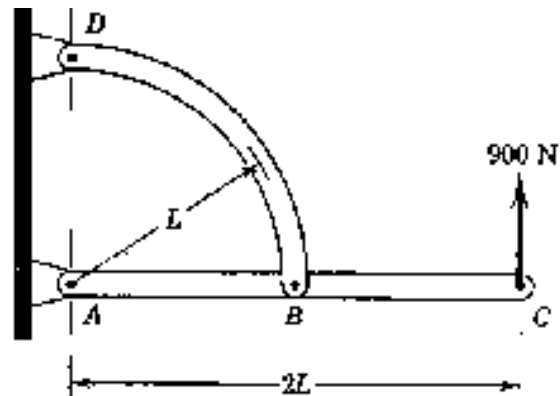


New Problem Sheet No. 4 (Frames)

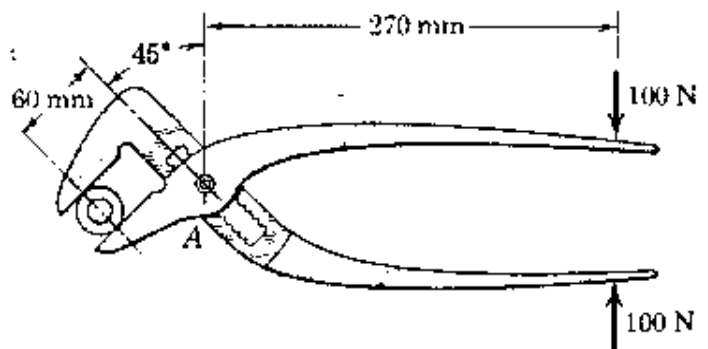
1. Determine the magnitude of the pin reaction at C.
Ans C = 236 N



2. Determine the magnitude of the pin reaction at A for the frame loaded by the 900-N force.

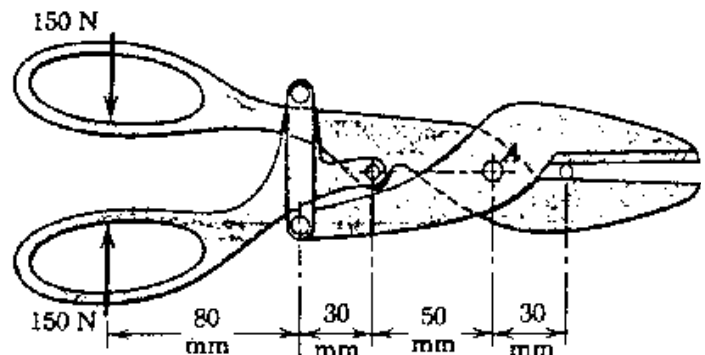


3. Compute the force supported by the pin at A for the slip-joint pliers under a grip of 100 N.
Ans. 525 N

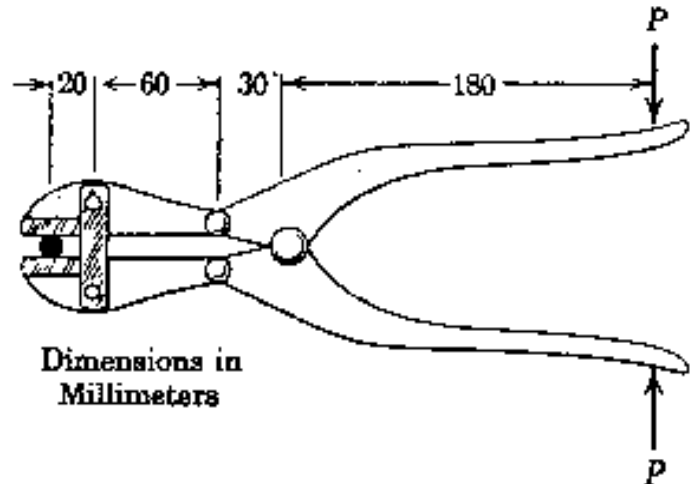


4. Compound-lever snips, shown in the figure, are often used in place of regular tinnerns' snips when large cutting forces are required. For the gripping force of 150 N, what is the cutting force P at a distance of 30 mm along the blade from the pin at A.

Ans. P = 1467 N

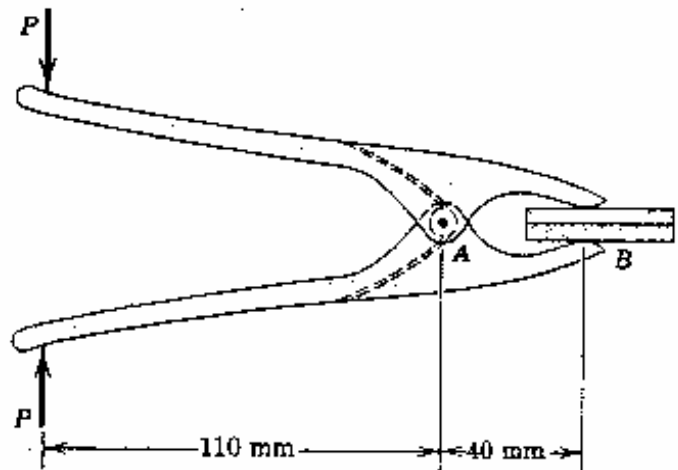


5. The A small bolt cutter operated by hand for cutting small bolts and rods is shown in the sketch. For a hand grip $P = 150 \text{ N}$, determine the force Q developed by each jaw on the rod to be cut.



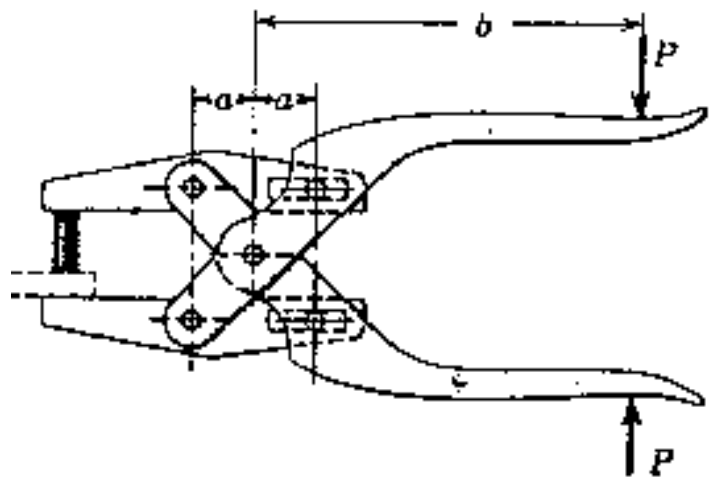
6. In the spring clamp shown, an internal spring is coiled around the pin A and the spring ends bear against the inner surfaces of the handle halves in order to provide the desired clamping force. In the position shown, a force of magnitude $P = 25 \text{ N}$ is required to release the clamp. Determine the compressive force at B if $P = 0$.

Ans. $B = 68.8 \text{ N}$

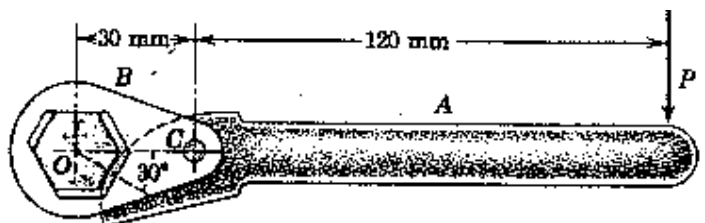


7. For the paper punch shown find the punching force Q corresponding to a hand grip P .

Ans. $Q = P(b/a)$



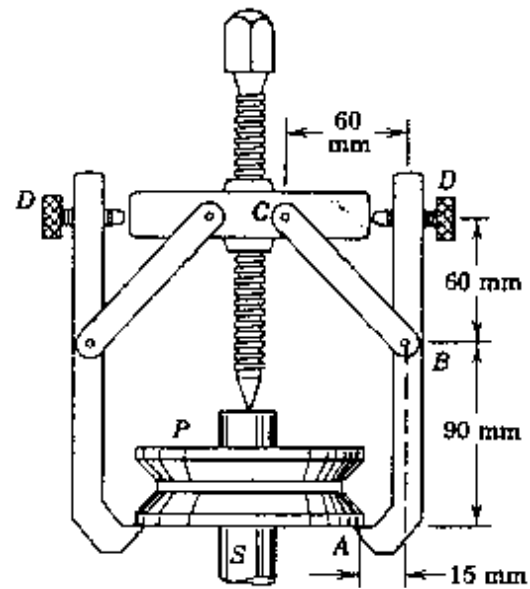
8. The special box wrench with head B swiveled at C to the handle A will accommodate a range of sizes of hexagonal bolt heads. For the nominal size shown where the center O of the bolt and the pin C are in line with the handle, compute the magnitude of the force supported by the pin at C if $P = 160 \text{ N}$. Assume the surface of the bolt head to be smooth.



Ans. $C = 1367 \text{ N}$

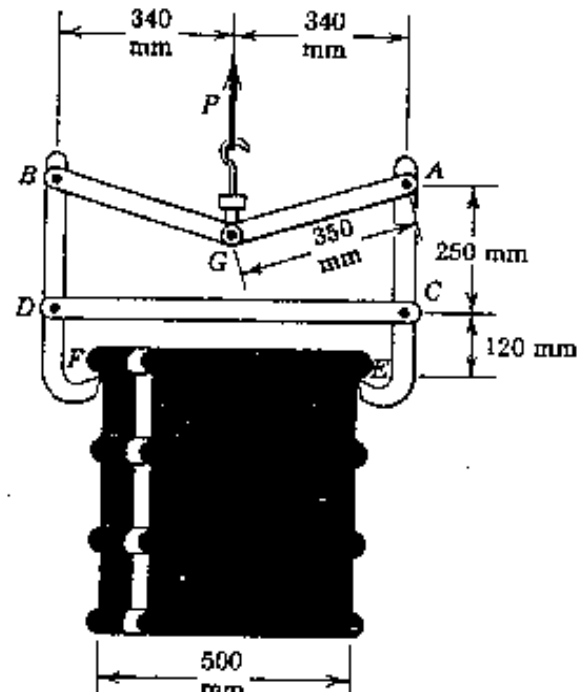
9. The figure shows a wheel puller which is removing a v-belt pulley P from its tight-fitting shaft S by tightening the central screw. If the pulley starts to slide off the shaft when the compression in the screw has reached 1.2 kN, calculate the magnitude of the force supported by each jaw at A. The adjusting screws D support horizontal force and keep the side arms parallel with the central screw.

Ans. $A = 0.626 \text{ kN}$



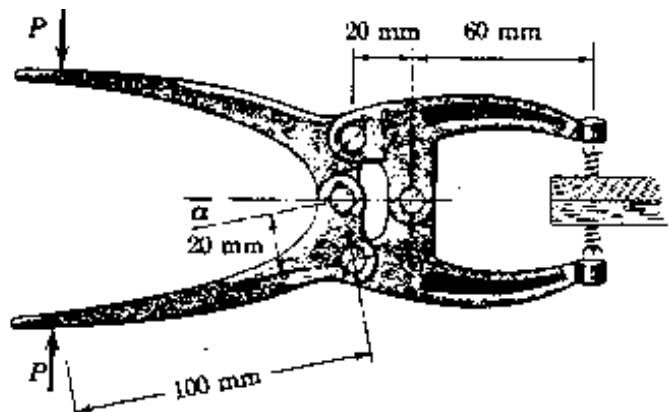
10. A lifting device for transporting 135-kg steel drums is shown. Calculate the magnitude of the force exerted on the drum at E and F.

Ans. $E = F = 5.19 \text{ N}$



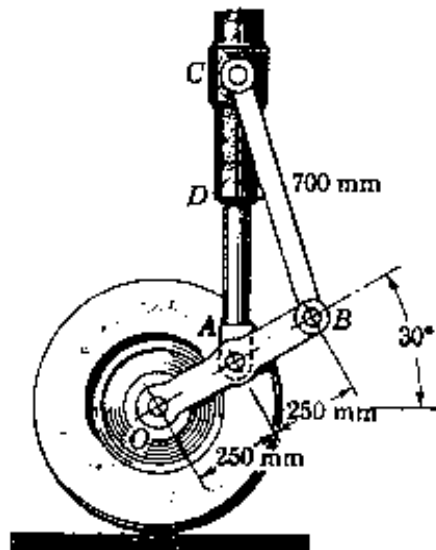
11. The toggle pliers are used for a variety of clamping purposes. For the handle position given by $\alpha = 10^\circ$ and for a handle grip of $P = 150 \text{ N}$, Calculate the clamping force C produced.

Ans. C = 1368 N



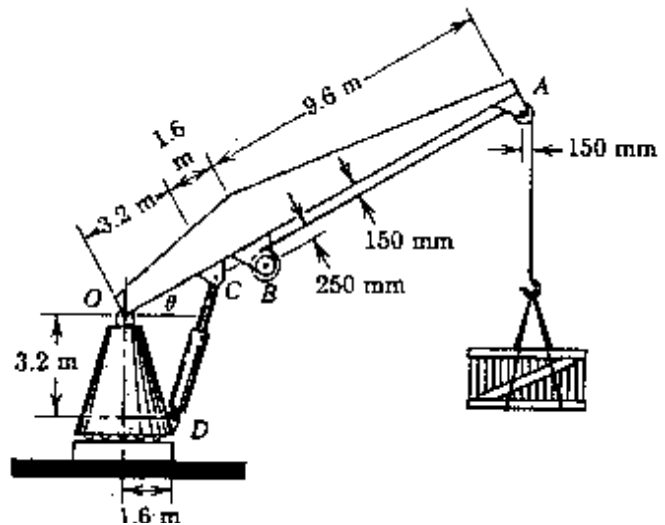
12. The aircraft landing gear consists of a spring- and hydraulically-loaded piston and cylinder D and the two pivoted links OB and OC. If the gear is moving along the runway at a constant speed with the wheel supporting a stabilized constant load of 24 kN, calculate the total force that the pin at A supports.

Ans. 44.7 kN



13. The shipboard crane is supporting a load of 4 Mg in the position shown where $\theta = 30^\circ$. The hoisting drum B is operated by a high-torque electric motor. Calculate the added compression P in the hydraulic cylinder and the magnitude R of the additional force supported by the pin at O, both due to the effect of the 4-Mg load.

Ans. $P = 211 \text{ kN}$, $R = 173.7 \text{ kN}$



14. The hoisting mechanism for the dump truck is shown in the enlarged view. Determine the compression P in the hydraulic cylinder BE and the magnitude of the force supported by the pin at A for the particular position shown, where BA is perpendicular to OAE and link DC is perpendicular to AC. The dump and its load together have a mass of 9 Mg with center of mass at G. All dimension for the indicated geometry are given on the figure.

Ans. $P = 119.0 \text{ kN}$, $A = 64.5 \text{ kN}$

