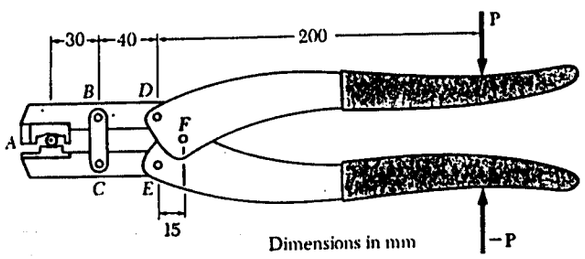
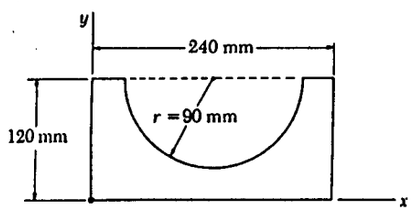
1. (5% × 4 = 20%) Please explain the following keywords as completely as possible:
   (a) Moment of inertia of areas.
   (b) Principle of virtual work.
   (c) Conservative forces.
   (d) Potential energy of a particle under the action of conservative forces.

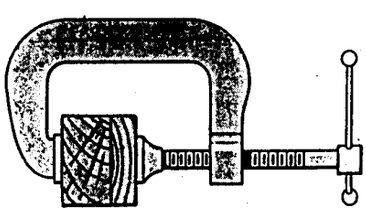
2. (10%) The tool shown is used to crimp terminals onto electric wires. Knowing that a worker will apply forces of magnitude P = 135 N to the handles, determine the magnitude of the crimping forces which will be exerted on the terminal.



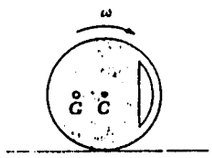
3. (10%) Determine the moment of inertia of the area shown with respect to the x axis.



4. (20%) A clamp is used to hold two pieces of wood together as shown. The clamp has a double square thread of mean diameter equal to 10 mm and with a pitch of 2 mm. The coefficient of friction between threads is $\mu_s = 0.30$. If a maximum torque of 40 N·m is applied in tightening the clamp, determine (a) the force exerted on the pieces of wood, (b) the torque required to loosen the clamp.



5. The mass center G of a 5-kg wheel of radius R=180 mm is located at a distance r=60 mm from its geometric center C. The centroidal radius of gyration of the wheel is $\bar{k}$=90 mm. As the wheel rolls without sliding, its angular velocity is obsered to vary. Knowing that ω= 8 rad/s in the position shown, determine (a) the angular velocity of the wheel when the mass center G is directly above the geometric certer C, (b) the reaction at the horizontal surface at the same instant. (20%)



6. The 8-kg rod AB is attached by pins to two 5-kg uniform disks as shown. The assembly rolls without sliding on a horizontal surface. If the assembly is released from rest when θ= 60°, determine (a) the angular velocity of the disks when θ= 180°, (b) the force exerted by the surface on each disk at that instant. (20%)