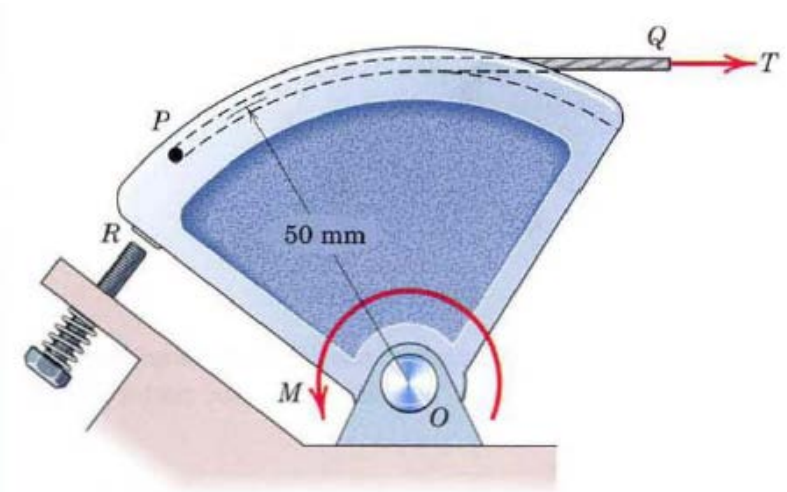
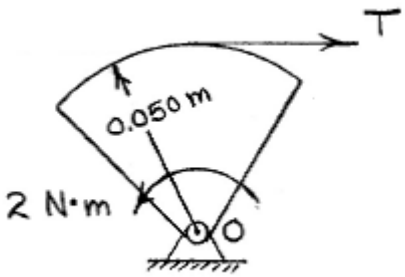
Problem 3

The throttle-control sector pivots freely at O. If an internal torsional spring exerts a return moment M = 2 N · m on the sector when in the position shown, for design purposes determine the necessary throttle-cable tension T so that the net moment about O is zero. Note that when T is zero, the sector rests against the idle -control adjustment screw at R.



Solution

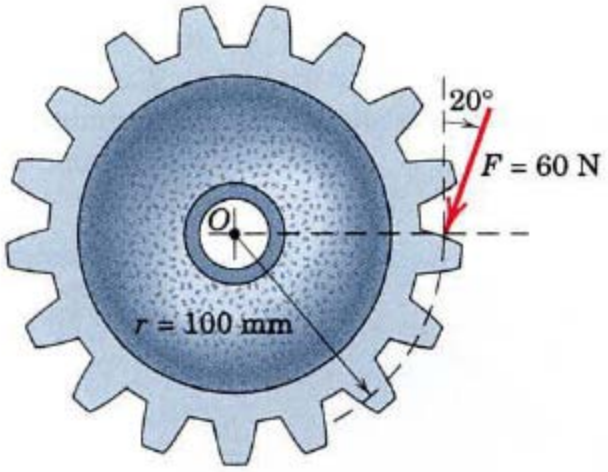


$$\curvearrowleft + \sum M_O = 2 - T(0.050) = 0$$

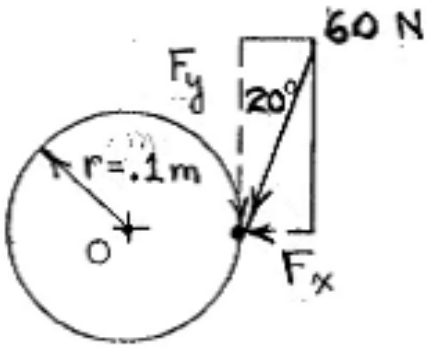
$$T = 40 \text{ N}$$

Problem 4

A force F of magnitude 40 N is applied to the gear. Determine the moment of F about point O.



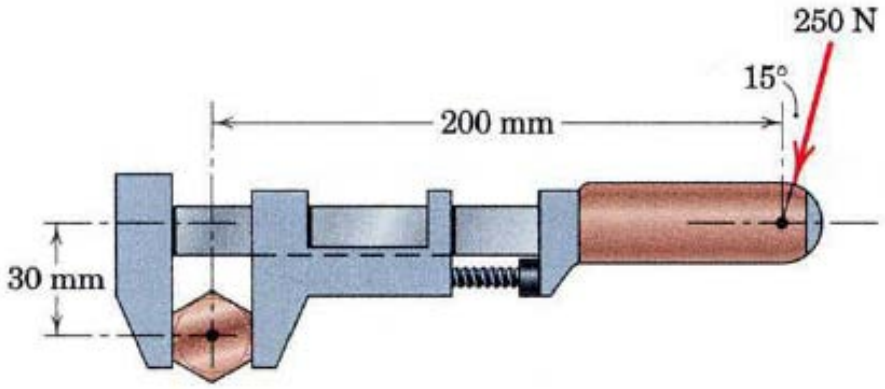
Solution



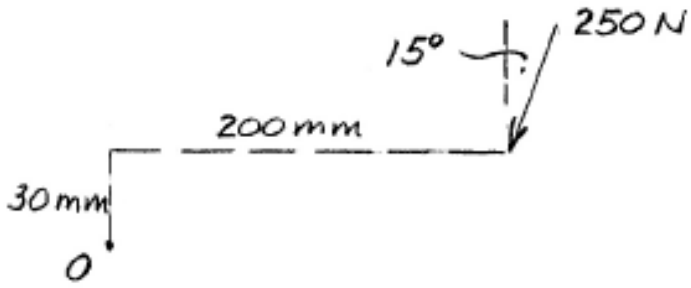
$$+\circlearrowleft M_o = r F_y$$
$$= (0.1)(60 \cos 20°)$$
$$= 5.64 \text{ N·m}$$

Problem 5

Calculate the moment of the 250·N force on the handle of the monkey wrench about the center of the bolt.



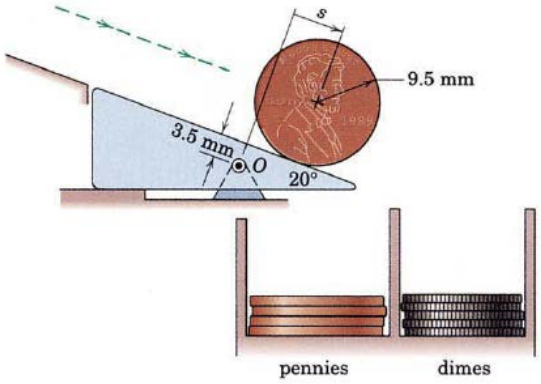
Solution



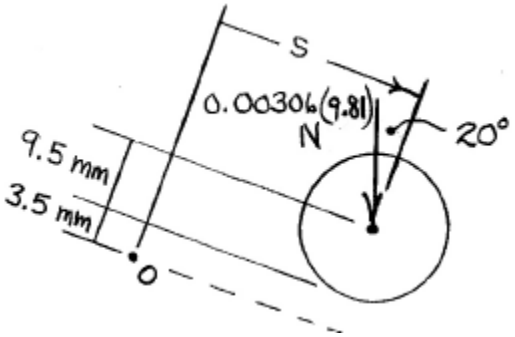
$$\circlearrowleft M_O = 250\cos 15°(0.200) - 250\sin 15°(0.030)$$
$$= 48.30 - 1.941 = \underline{46.4\ N\cdot m}$$

Problem 6

A portion of a mechanical coin sorter works as follows: Pennies and dimes roll down the 200 incline, the last triangular portion of which pivots freely about a horizontal axis through O. Dimes are light enough (2.28 grams each) so that the triangular portion remains stationary, and the dimes roll into the right collection column. Pennies, on the other hand, are heavy enough (3.06 grams each) so that the triangular portion pivots clockwise , and the pennies roll into the left collection column. Determine the moment about O of the weight of the penny in terms of the slant distance *s* in millimeter s .



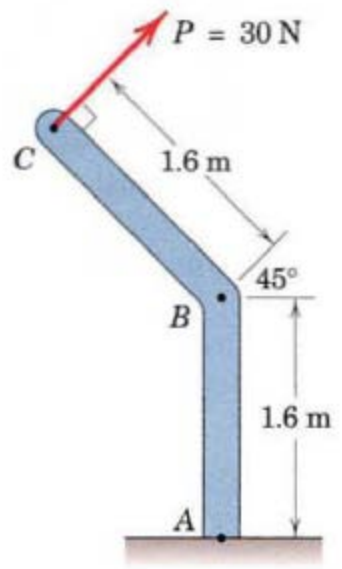
Solution



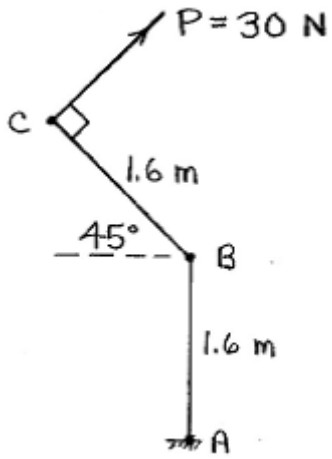
$$\curvearrowleft M_O = 0.00306(9.81)\left[s\cos 20^\circ + (9.5+3.5)\sin 20^\circ\right]$$
$$= 0.1335 + 0.0282s \ \text{N·mm} \quad (s \text{ in mm})$$

Problem 7

The 30·N force P is applied perpendicular to the portion BC of the bent bar. Determine the moment of P about point B and about point A.



Solution

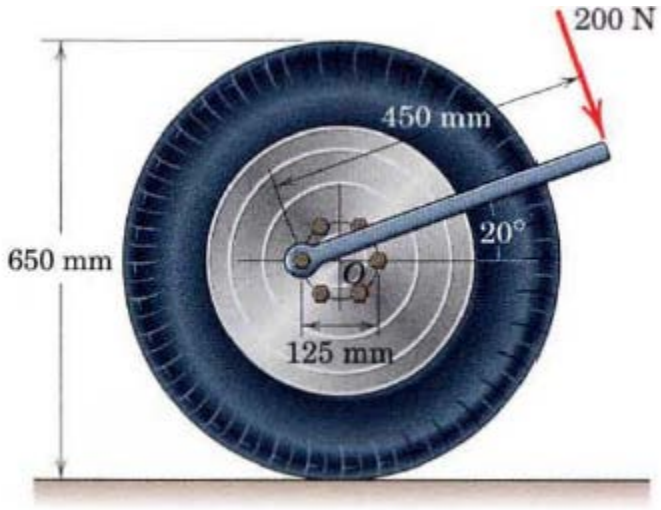


$+\circlearrowleft M_B = 30(1.6) = 48 \ \text{N·m}$

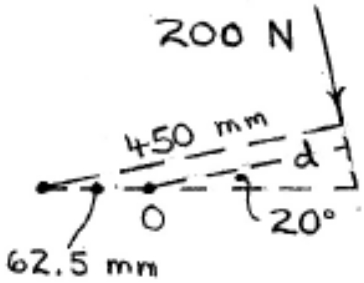
$+\circlearrowleft M_A = 30\cos 45°\,(1.6 + 1.6\sin 45°) + 30\sin 45°\,(1.6\cos 45°) = \underline{81.9 \ \text{N·m}}$

Problem 8

A force of 200 N is applied to the end of the wrench to tighten a flange bolt which holds the wheel to the axle. Determine the moment AI produced by this force about the center O of the wheel for the position of the wrench shown.



Solution

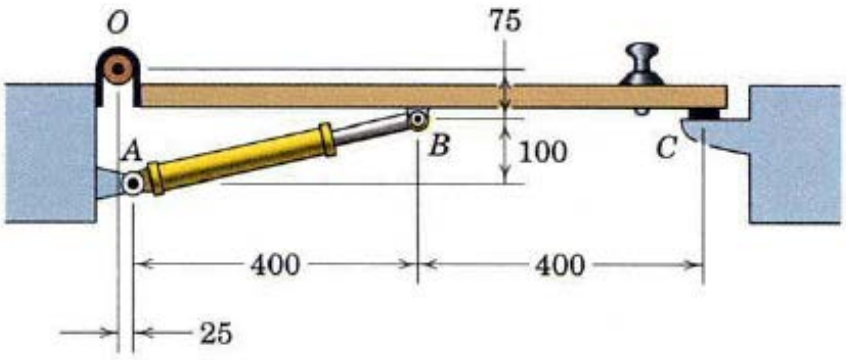


$$d = 450 - 62.5 \cos 20^\circ$$
$$= 391 \text{ mm}$$

$$+\circlearrowleft M = Fd = 200(0.391)$$
$$= \underline{78.3 \text{ N·m}}$$

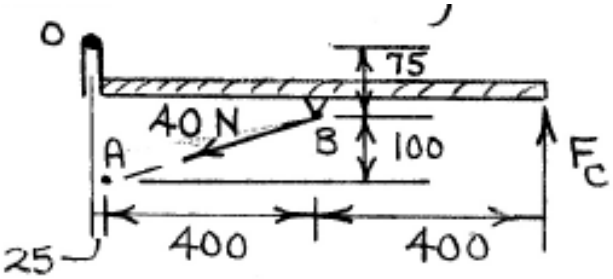
Problem 9

The force exerted by the plunger of cylinder AB on the door is 40 N directed along the line AB, and this force tends to keep the door closed. Compute the moment of this force about the hinge O. What force F_c normal to the plane of the door must the door stop at C exert on the door so that the combined moment about O of the two forces is zero?



Dimensions in millimeters

Solution



$$AB = \sqrt{400^2 + 100^2}$$

$$= 412 \text{ mm}$$

$$+\circlearrowright M_O = \left(\frac{400}{412} \cdot 40\right)(75) + \left(\frac{100}{412} \cdot 40\right)(425)$$

$$= 7030 \text{ N·mm} \quad \text{or} \quad \underline{7.03 \text{ N·m}}$$

$$+\circlearrowright \Sigma M_O = 0 : -F_C(825) + 7030 = 0$$

$$\underline{F_C = 8.53 \text{ N}}$$