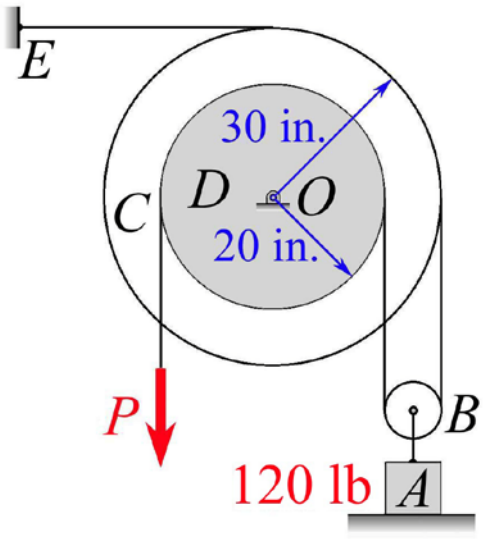
MEEG 2003 Quiz #9.m28

Two drums C and D are rigidly fastened together and are free to rotate about the bearing at O as shown. The value of μ_s is 0.11 between the belt and the smaller drum D and 0.20 between the belt and the larger drum C. Determine the minimum magnitude $P_{\min}$ of the applied vertical force needed to lift the 120-lb block A up from the ground.



Hint. Consider the cases: *(a)* slipping between belt and drum D is assumed to impend, *(b)* slipping between belt and drum C is assumed to impend.

FBD for block A and pulley at B: ① $T_B = 60$ lb ①

Case *(a)*: Slipping between belt and drum D is assumed to impend. $P = 60e^{0.11\pi} = 84.77$ $P = 84.8$ lb ②

Case *(b)*: Slipping between belt and drum C is assumed to impend. $60 = T_E\, e^{0.20(\pi/2)}$ $T_E = 43.824$ lb ②

FBD for both drums and $\Sigma M_O = 0$: ② $P = 84.3$ lb ①

Conclusion: Choose the smaller of the two P's as answer.

$P = 84.3$ lb ①