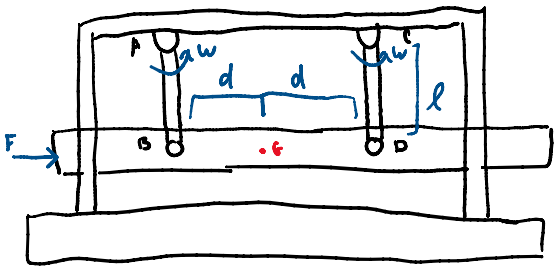
20-R-KIN-DK-13

July 22, 2020 9:46 AM

20-R-KIN-DK-13 Beginner Translation (RBK)

Inspiration: F17-5 Hibbeler



A group of engineering peasants have constructed a stationary battering ram in attempts to siege the castle of Santa Ono. Determine the tension developed in the linkages AB and CD as well as the angular acceleration if the ***400 kg*** log is subject to a horizontal force of ***300 N*** and both linkages have an angular velocity of ***omega = 6 rad/s***. Assume the mass of the linkages are negligible.
Links AB and CD have a length ***l = 1.2 m*** and are an equal distance ***d = 1.5 m*** away from the center of gravity of the log.

$\sum F_x = 300 = m_{log} a_x$ $\quad \sum F_y = F_{AB} + F_{CD} - F_g = m_{log} a_y$ $\quad \sum M_G = 0 = F_{CD}(1.5) - F_{AB}(1.5)$

$F_{AB} = F_{CD}$

$\vec{a}_B = \vec{a}_A + \vec{\alpha} \times \vec{r}_{B/A} - \omega^2 \vec{r}_{B/A}$

$= 0 + \alpha \hat{k} \times -1.2\hat{j} - 36(-1.2\hat{j})$

$= 1.2\alpha \hat{i} + 43.2\hat{j}$

Rigid body this entire log undergoes this acceleration

$a_x = 1.2\alpha \quad a_y = 43.2$

$300 = 400(1.2)\alpha$ $\quad \alpha = \frac{5}{8}\ rad/s^2$

$2F_{AB} - (400)(9.81) = 400(43.2)$

$F_{CD} = 10602\ N$

$F_{AB} = 10602\ N$