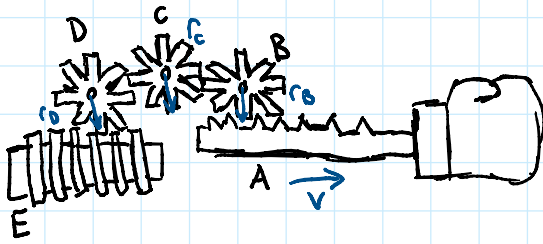


20-R-KM-DK-7 Intermediate

Gear System

Inspiration: None



An engineer tries to be really funny and creates a prank punching machine. She wants to ensure the fist won't actually hurt anyone. She calculates that it will be perfectly safe as long as the boxing glove has a maximum velocity of $v = 1 \text{ m/s}$. What should the angular velocity of the worm gear (gear E) be to achieve this? For every 10 revolutions of gear E, gear D rotates once. Gears B, C, and D have radii $r_B = 3 \text{ cm}$, $r_C = 5 \text{ cm}$, and $r_D = 6 \text{ cm}$ respectively.

$$v_A = v_B \quad v_B = \omega_B r_B \quad 1 \text{ m/s} = \omega_B (0.03 \text{ m}) \quad \omega_B = 33.\overline{3} \text{ rad/s}$$

$$\omega_C r_C = \omega_B r_B \quad \omega_C = (33.\overline{3}) \frac{3 \text{ cm}}{5 \text{ cm}} = 20 \text{ rad/s}$$

$$\omega_D r_D = \omega_C r_C \quad \omega_D = (20) \frac{5}{6} = 16.\overline{6} \text{ rad/s}$$

For every 10 revs of E, D rotates 1 rev $\Rightarrow 10 \times$ faster

$$\omega_E = \omega_D \times 10 = \boxed{166.\overline{6} \text{ rad/s}}$$