Prob 7.43)

**Sun Gear:**

Let \( r_s \) = radius of sun gear (watch units)

\( P_N = \) normal force exerted on sun gear by the three planet gears

\( P_T = \) tangential force exerted on sun gear by the three planet gears

\( R_N = \) normal force exerted on planet gear by the outer ring

\( R_T = \) tangential force exerted on planet gear by the outer ring

**Top Planet Gear:**

**Summing Forces and Moments:**

\[ \Sigma M_o = M - 3P_T = I_s ds \]

\[ \Sigma M_p = R_T v_p - P_T v_p = I_p \omega_p \]

\( (\Sigma F_T)_{planer} = R_T + P_T = m_p a_T \)

**Kinematics:**

Note that the ring is stationary, so at point \( A \) on the planet gear, \( \alpha_T = 0 \).

Thus, \( a_p = v_p \omega_p \) and \( a_B = 2v_p \omega_p \)

Also, point \( B \) is where the sun gear and the planet gears come into contact. Because the center \( (O) \) of the sun gear is stationary, \( a_o = 0 \). This means that \( a_{B_T} = r_s ds \) which we can set equal to the above expression for \( a_{B_T} \).