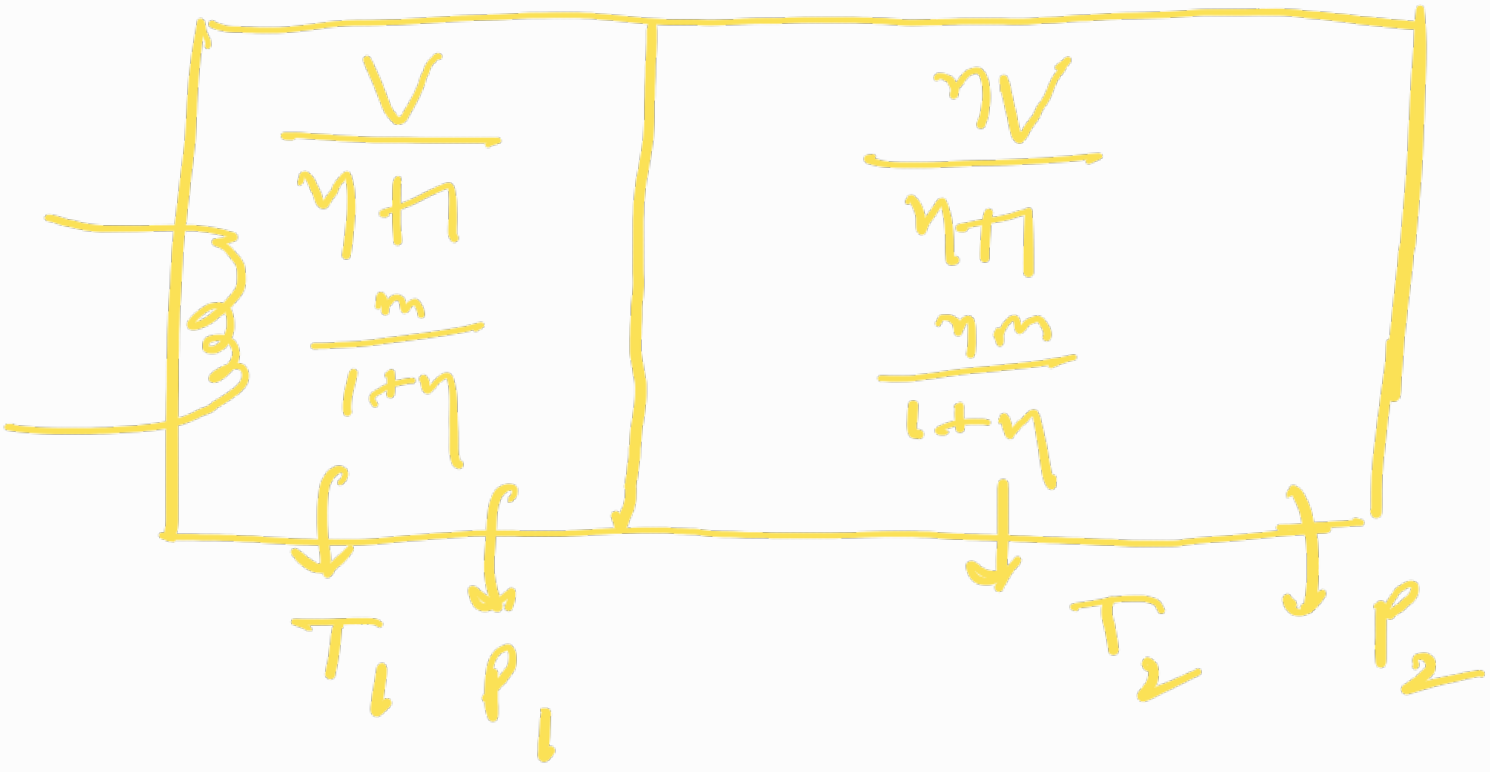


$$\frac{P_1 V}{1+\eta} = \frac{m}{1+\eta M} R T_1$$

$$\frac{P_2 \eta V}{1+\eta} = \frac{\eta m}{1+\eta M} R T_2$$

$$P_1 = \frac{mRT_1}{MV} \qquad P_2 = \frac{mRT_2}{MV}$$

$$\Delta P = \frac{mR}{MV}(T_1 - T_2)$$

$$P - H(T_1 - T_2)$$

$$= \frac{m}{(\eta n)} C_V \frac{dT_1}{dt}$$

$$H(T_1 - T_2) = \left(\frac{\eta m}{\eta n}\right) C_V \frac{dT_2}{dt}$$

$$P - 2H(T_1 - T_2)$$

$$= \frac{mC_V}{\eta n}\left[\frac{dT_1}{dt} - \frac{d(\eta T_2)}{dt}\right]$$

$$= \frac{m C_V}{\eta n}\left[\frac{dT_1}{dt} - \eta \frac{dT_2}{dt}\right]$$

After very long time,

$$\frac{dT_1'}{dt} = \frac{dT_2}{dt}$$

$$P - 2H(\Delta T)$$

$$= \frac{nC_V}{\eta_{th}} \left(\frac{dT_1'}{dt}\right)(1-\eta)$$

$$C_V \frac{dT_1'}{dt} = C_V \frac{dT_2}{dt} = \frac{H\Delta T(\eta_{th})}{\eta_m}$$

$$P - 2H(\Delta T)$$

$$= \frac{\eta_1(1-\eta)}{(1+\eta)} \frac{H(\Delta T)(1+\eta)}{\eta_m}$$

$$H(\Delta T)\left[2 + \frac{1-\eta}{\eta}\right]$$

$$= P$$

$$H(\Delta T)\left(\frac{\eta_{th}}{\eta}\right) = P$$

$$\frac{H\,\Delta P\,MV}{nR}\left(\frac{\eta_{th}}{\eta}\right) = P_{max}$$

Why after long time

$$\frac{dT_1}{dt} = \frac{dT_2}{dt} \; ??$$

We see from above that $P_2 - P_1 = \Delta P$

$$= \frac{n}{M}\frac{R}{V}(\Delta T).$$

When (ΔP) is max,

$$\frac{d(\Delta P)}{dt} = 0.$$ Hence,

$$\frac{d(\Delta T)}{dt} = 0 \;\&\; \frac{dT_1}{dt} = \frac{dT_2}{dt}$$

This is very important.