4.9 Lenoir Cycle:

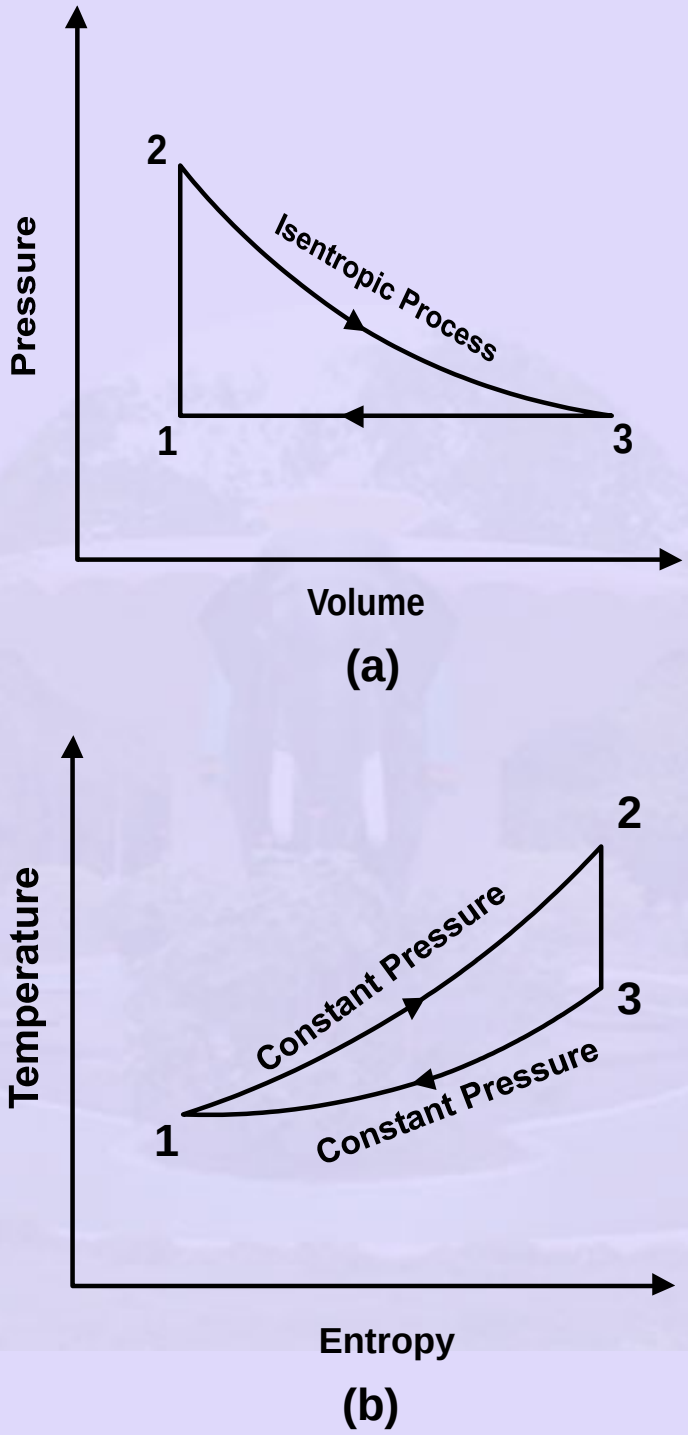

Fig.4.9. Lenoir cycle on p-v and T-s diagrams

The Lenoir cycle consists of the following processes:

- *Process 1-2: Constant volume heat addition*
- *Process 2-3: Reversible adiabatic expansion*
- *Process 3-4: Constant pressure heat rejection.*
- *No compression process.*

The thermal efficiency can be derived as follows:

$$\eta_{th} = \frac{\text{Heat added - Heat rejected}}{\text{Heat added}} = \frac{C_v\left(T_2 - T_1\right) - C_p\left(T_3 - T_1\right)}{C_v\left(T_2 - T_1\right)}$$

$$\eta_{th} = 1 - \gamma\left(\frac{T_3 - T_1}{T_2 - T_1}\right)$$

Let, $\frac{P_2}{P_1} = r_p$ = Pressure ratio

$T_2 = r_p T_1$

$$\frac{T_3}{T_2} = \left(\frac{P_3}{P_2}\right)^{\frac{\gamma - 1}{\gamma}} = \left(\frac{P_1}{P_2}\right)^{\frac{\gamma - 1}{\gamma}} = \left(\frac{1}{\alpha_1}\right)^{\frac{\gamma - 1}{\gamma}} = \left(r_p\right)^{\frac{1}{\gamma} - 1}$$

$$T_3 = T_2\left(r_p\right)^{\frac{1}{\gamma} - 1} = T_1\, r_p\left(r_p\right)^{\frac{1}{\gamma} - 1} = T_1\left(r_p\right)^{\frac{1}{\gamma}}$$

$$\eta_{th} = 1 - \frac{\gamma\left(r_p^{\frac{1}{\gamma}} - 1\right)}{\left(r_p - 1\right)}$$