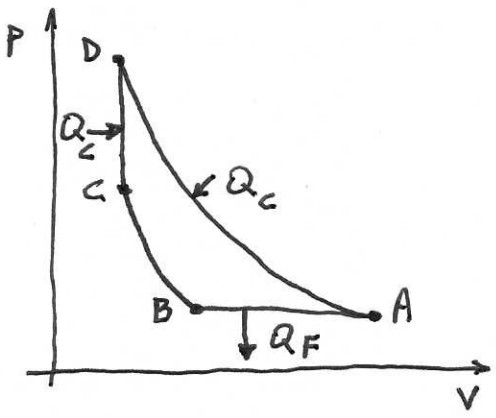

SCRIVIAMO TUTTI I VOLUMI IN FUNZIONE DI V_D

- $V_C = V_D$
- $V_B = \alpha V_D$
- $V_A = \beta V_D$

SCRIVIAMO TUTTE LE PRESSIONI IN FUNZIONE DI P_A

- $P_B = P_A$; $P_A V_A = P_D V_D$ (ISOTERMA) $\rightarrow P_D = \frac{V_A}{V_D} P_A \rightarrow$
- $P_D = \beta P_A$; $P_C V_C^{\gamma} = P_B V_B^{\gamma}$ (ADIABATICA) $\rightarrow P_C = \left(\frac{V_B}{V_D}\right)^{\gamma} P_A \rightarrow$
- $P_C = \alpha^{\gamma} P_A$

$$Q_C = n C_V (T_D - T_C) + nRT_D \ln\left(\frac{V_A}{V_D}\right) =$$

$$= \frac{\cancel{n} C_V}{\cancel{n} R} (P_D V_D - P_C V_C) + \frac{\cancel{n} \cancel{R}}{\cancel{n} \cancel{R}} P_D V_D \ln(\beta) =$$

$$= \frac{1}{(\gamma - 1)} (\beta P_A \cdot V_D - \alpha^{\gamma} P_A V_D) + \beta P_A V_D \ln(\beta) =$$

$$= P_A V_D \left[\frac{(\beta - \alpha^{\gamma})}{(\gamma - 1)} + \beta \ln(\beta) \right]$$

$$Q_F = n C_P (T_A - T_B) = \frac{\cancel{n} C_P}{\cancel{n} R} (P_A V_A - P_B V_B) =$$

$$= \frac{\gamma}{(\gamma - 1)} (P_A \cdot \beta V_D - P_A \cdot \alpha V_D) = P_A V_D \frac{\gamma (\beta - \alpha)}{(\gamma - 1)}$$

$$\varepsilon = 1 - \frac{Q_F}{Q_C} = 1 - \frac{\gamma (\beta - \alpha)}{(\beta - \alpha^{\gamma}) + \beta (\gamma - 1) \ln(\beta)}$$