2.8. (1)

$a\to b: Q_1 = C_V(T_b - T_a)$　　$PV=\nu RT \to \frac{T_b}{T_a}=\frac{P_b}{P_a}$　$\frac{T_c}{T_a}=\frac{V_2}{V_1}$

$c\to a: Q_2 = C_p(T_c - T_a)$

$\eta = \frac{Q_1-Q_2}{Q_1} = 1-\frac{C_p(T_c-T_a)}{C_V(T_b-T_a)} = 1-\gamma\frac{T_c-T_a}{T_b-T_a} = 1-\gamma\frac{V_2P_1-V_1P_1}{P_2V_1-P_1V_1}$

(2). $P_bV_b=P_cV_c \to P_2V_1=P_1V_2$.

$b\to c: Q_2 = W = \int \frac{P_2V_1}{V}dV = P_2V_1\ln\frac{V_2}{V_1}$

$\eta = \frac{Q_1+Q_3-Q_2}{Q_1+Q_3} = 1-\frac{Q_2}{Q_1+Q_3} = 1-\frac{C_p(T_c-T_a)}{C_V(T_b-T_a)+P_2V_1\ln\frac{V_2}{V_1}}$

2.12.

$\left(\frac{\partial f}{\partial l}\right)_T = \gamma\frac{A}{l}$.　$\left(\frac{\partial l}{\partial T}\right)_f = \alpha l$.　$\to \left(\frac{\partial f}{\partial T}\right)_l = \frac{\partial l}{\left(\frac{\partial T}{\partial f}\right)_l} = \frac{1}{\left(\frac{\partial f}{\partial l}\right)_T\left(\frac{\partial l}{\partial T}\right)_f} = -\gamma A\alpha l$

$\Delta f = -\gamma A\alpha l\Delta T$

$= \gamma A\alpha l(T_1-T_2)$ 得证.

2.13.

$\frac{\partial u}{\partial T}=C_V$.　$\frac{\partial h}{\partial T}=C_p$.　$\cdots\cdots\ \gamma=\frac{\partial p}{\partial \rho}$.

$\to \frac{\partial h}{\partial u}=\gamma$.

$E=\frac{1}{2}\rho A^2\omega^2 V$

$\frac{\partial E}{\partial V}=\frac{1}{2}A^2\omega^2\frac{\partial \rho}{\partial V}$.

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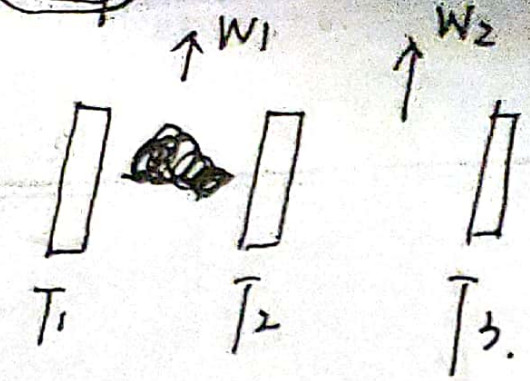
2.14



$\eta_1 = \frac{W_1}{Q_1}$. $\eta_2 = \frac{W_2}{Q_2}$

$Q_2 = Q_1 - W_1$

$\eta = \frac{W_1 + W_2}{Q_1}$.

$\eta_1 + \eta_2 - \eta_1\eta_2 = \frac{W_1}{Q_1} + \frac{W_2}{Q_1 - W_1} - \frac{W_1 W_2}{Q_1(Q_1 - W_1)}$

$= \frac{W_1 Q_1 - W_1^2 + W_2 Q_1 - W_1}{Q_1(Q_1 - W_1)}$

$= \frac{(W_1 + W_2)(Q_1 - W_1)}{Q_1(Q_1 - W_1)}$

$= \frac{W_1 + W_2}{Q_1} = \eta$ 得证.

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