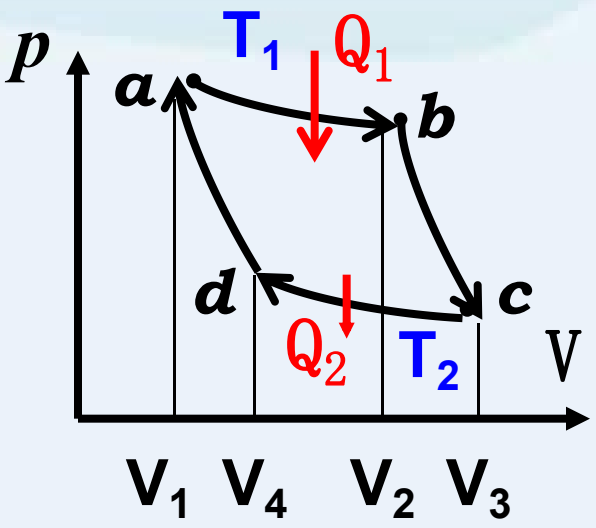
[讨论5]两个绝热线与横轴围成面积之间的关系

FangYi

$$A_{bc}=-\Delta E_2=\upsilon C_V(T_1-T_2)$$

$$A_{da}=-\Delta E_4=\upsilon C_V(T_2-T_1)$$

$$S_{da}=S_{bc}$$



[讨论6]两个卡诺循环，仅仅高温线不同，则两个循环低温cd过程相等的量是什么

$$Q_2=A_{cd}=\upsilon RT_2\ln(V_4/V_3)$$

[讨论7]两个卡诺循环，仅仅低温线不同，则两个循环的高温ab过程相等的量是什么

$$Q_1=A_{ab}=\upsilon RT_1\ln(V_2/V_1)$$

[讨论8]两个卡诺循环，仅仅低温线不同，其中一低温压缩使得体积减半，则高温ab过程系统对外做功？

$$Q_1=A_{ab}=\upsilon RT_1\ln(V_2/V_1)=\upsilon RT_1\ln(V_3/V_4)=\upsilon RT_1\ln 2$$

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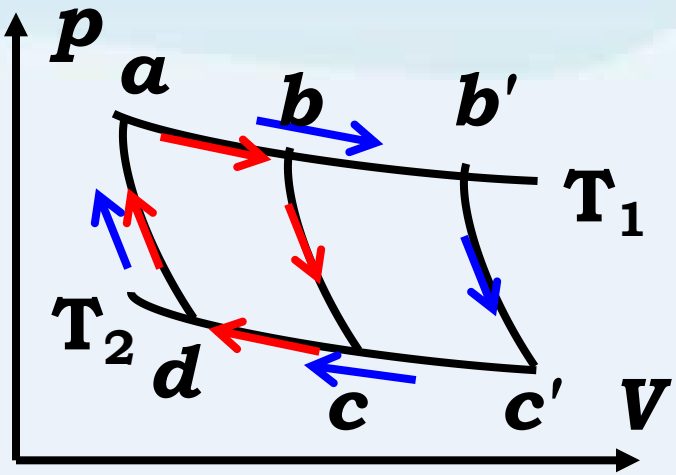
[讨论9]卡诺循环从*abcda*变为*ab′c′da*, 则

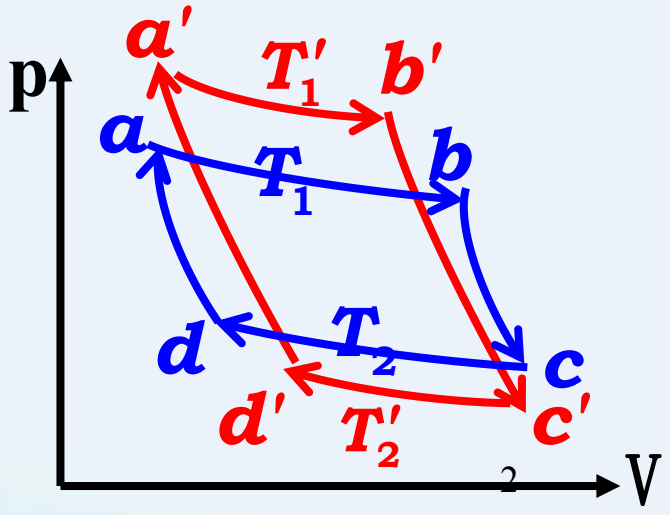
$A_{净}$ ↑, η =const.



[讨论10]两卡诺循环:1(*abcda*)和2(*a′b′c′d′a′*),
面积相等则η　η′, $Q_{吸}$　$Q'_{吸}$

解: $\eta = 1 - \frac{T_2 \downarrow}{T_1 \uparrow}$　　$\eta < \eta'$

$Q_{吸} = \frac{A}{\eta \uparrow}$　　$Q_{吸} > Q'_{吸}$



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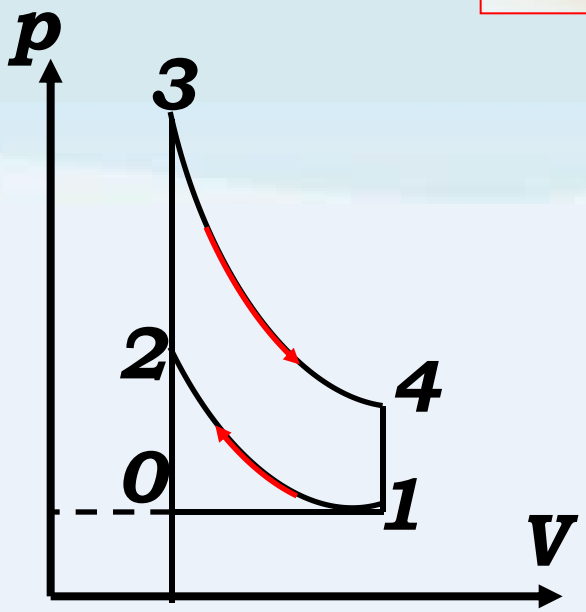
[讨论11]奥托循环效率

0进气1绝压2点火3
绝膨4排气1扫气0



解：$Q_{吸} = \upsilon C_V (T_3 - T_2) > 0$

$Q_{放} = \upsilon C_V (T_1 - T_4) < 0$

$$\eta = 1 - \frac{|Q_{放}|}{Q_{吸}} = 1 - \frac{T_4 - T_1}{T_3 - T_2} = 1 - \frac{T_1}{T_2}$$

12: $V_1^{\gamma-1} T_1 = V_2^{\gamma-1} T_2$

34: $V_2^{\gamma-1} T_3 = V_1^{\gamma-1} T_4$

$$\Rightarrow \frac{T_1}{T_2} = \frac{T_4}{T_3} = \frac{T_4 - T_1}{T_3 - T_2}$$

$$\Rightarrow \eta = 1 - \kappa^{1-\gamma}$$

绝热容积压缩比

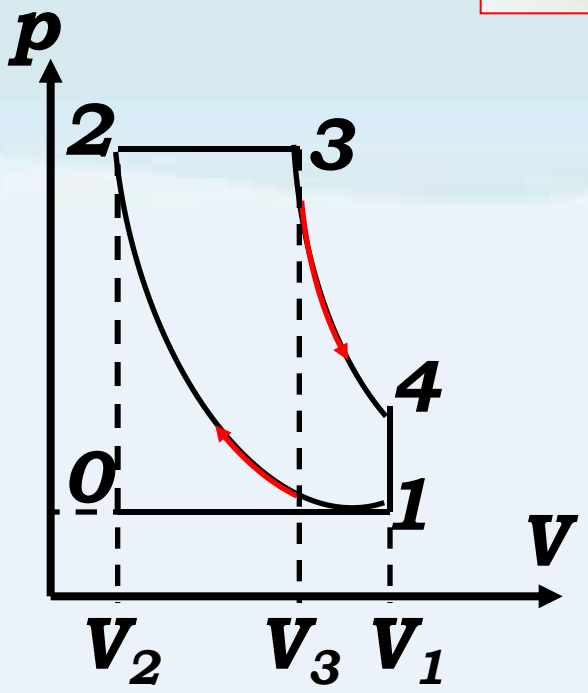
κ ↑→ η ↑

[讨论12]求狄塞尔循环效率

FangYi

0进气1绝压2点火

3绝膨4排气1扫气0



解：$Q_{吸} = \upsilon C_p (T_3 - T_2) > 0$

$Q_{放} = \upsilon C_V (T_1 - T_4) < 0$

$$\eta = 1 - \frac{|Q_{放}|}{Q_{吸}} = 1 - \frac{(T_4 - T_1)}{\gamma (T_3 - T_2)}$$

12: $\dfrac{T_2}{T_1} = \kappa^{\gamma-1}$

23: $\dfrac{T_3}{T_2} = \dfrac{V_3}{V_2} = \rho$

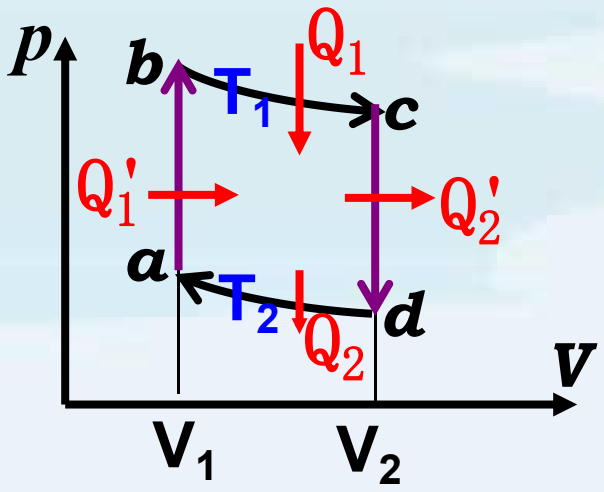
34: $\dfrac{T_4}{T_3} = \left(\dfrac{\rho}{\kappa}\right)^{\gamma-1}$

$\Rightarrow \eta = 1 - \dfrac{\rho^{\gamma} - 1}{\gamma(\rho - 1)\kappa^{\gamma-1}}$

κ：绝热容积压缩比

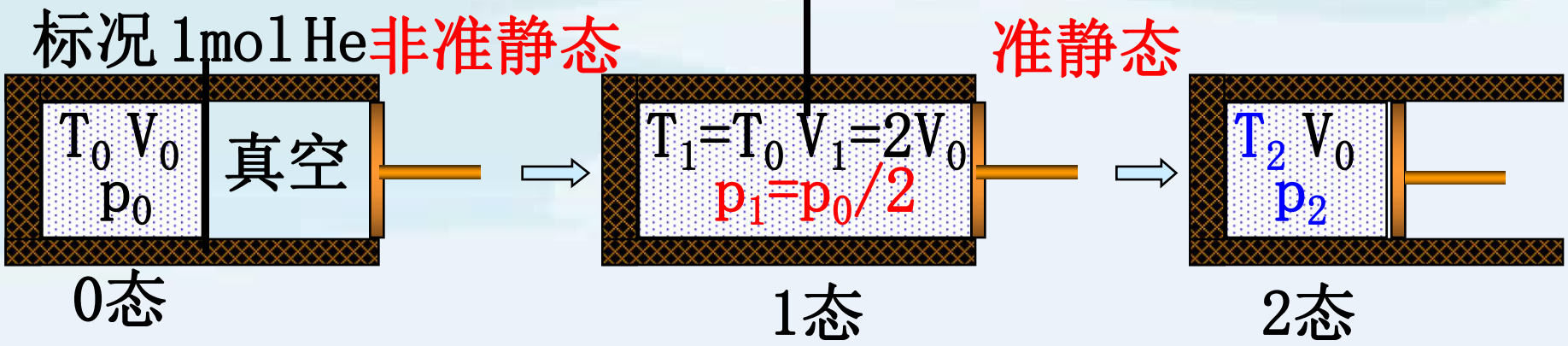
ρ：定压容积压缩比

Stirling cycle



$$\eta = \frac{Q_{NET}}{Q_1 + Q_1'}$$

[例题7-6]抽去等间隔隔板，平衡后缓左推活塞，压回原处. 求T_2及p_2.（气缸活塞均绝热）



$p_0V_0 = \upsilon RT_0$　　$p_1V_1 = \upsilon RT_1$　　$p_2V_0 = \upsilon RT_2$

解：0→1 自由膨胀　　1→2 绝热压缩　　$\gamma = \dfrac{C_p}{C_V} = \dfrac{5}{3}$

$T_1 = T_0$

$V_1 = 2V_0$

$p_1 = p_0/2$

$(2V_0)^{\gamma-1}T_0 = V_0^{\gamma-1}T_2 \Rightarrow T_2 = 2^{2/3}T_0$

$(\dfrac{p_0}{2})(2V_0)^{\gamma} = p_2V_0^{\gamma} \Rightarrow p_2 = 2^{2/3}p_0$

非准静态:过程方程不成立,但首末态的状态方程成立