$= hf_1 + x_1 hfg_1 - hf_2 = h_1 - hf_2$

= heat rejected during cd $= x_2 hf_2$.

Work Done = Heat absorbed − Heat rejected.

$= (h_1 - hf_2) - x_2 hfg_2 = h_1 - (hf_2 + x_2 hfg_2) = h_1 - h_2$

This shows that work Done during the cycle is equal to the difference b/w Total heats at point b & C.

$$\text{Efficiency} = \frac{\text{work Done}}{\text{heat supplied}} = \frac{h_1 - h_2}{h_1 - hf_2}$$

Q:10 Define the term Equivalant Evapouration?

Ans It is the quantity which when multiplied by the Amount of steam Genrated at a given Pressure from water at a given temp. gives the equivalant evapouration from and at 100°C

if f = fector of Evapouration.

Then equivalant evapouration from and at 100°C

= Actual evapouration × f

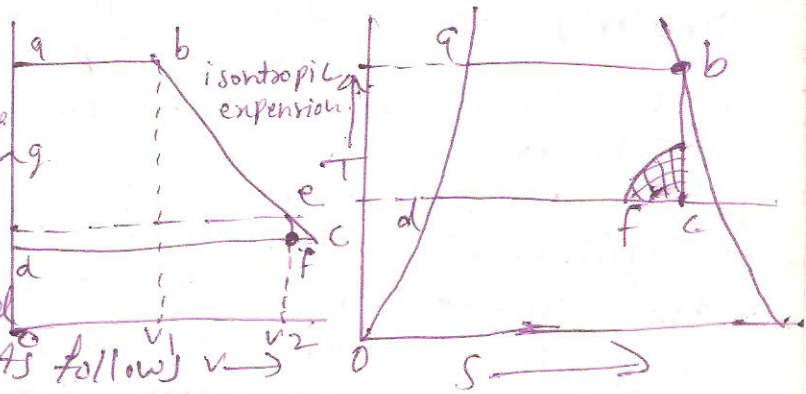
$$= \text{Actual evapouration} \times \left(\frac{h - hf_1}{2258}\right)$$

$$\boxed{F = \frac{h - hf_1}{2258}}$$

Q:11 Explain the Principle of Regenerative Rankine cycle.

Ans:- **Modified Rankine cycle:** The Area of the P-V diag. of the Rankine cycle represents the work Done. The work Done obtained near the toe end of P-V diagram is very small. It is not even Sufficient to overcome the work lost in friction due to reciprocating Parts.

The adiabatic expension is Terminated at e the Pressure is then Allowed to drop Suddenly to P_3 at Const-Volume. The line ef Represents this operation.



The work Done during the modified Rankine cycle can be calculated As follows

Let $P_1 V_1 U_1$ and h_1 Apply to initial condition of Steam at b

$P_2 V_2, U_2$ and h_2 apply to condition of Steam at C

P_3 and hf_3 apply to condition of water at d

Work Done during the cycle /kg of Steam.

= area abefd = area gabe + area gefd

$= (h_1 - h_2) + (P_2 - P_3) \times V_2$

heat Supplied $= h_1 - hf_3$

The modified Rankine $\eta = \dfrac{(h_1 - h_2) + (P_2 - P_3) \times V_2}{h_1 - hf_3}$.

workdone during the cycle of steam

= area abefd = area oabh + area hbem − Area odfm

$= P_1V_1 + (U_1 - U_2) - P_3V_2$

heat supplied $= h_1 - hf_3$

The modified Rankine $\eta = \dfrac{P_1V_1 + (U_1 - U_2) - P_3V_2}{h_1 - hf_3}$

Q:12 write a short Note on

Ans: 1. Boiler Accessories: see Q.

2. Gibbs and Helmholtz functions: This law concerning changes in energy and entropy. The thermodynamic potentials are

1- Enthalpy $H = U + PV$ 2. Gibbs fun $G = H - TS$.

3. Helmholtz free energy $F = U - TS$.

As per Clausius inequality.

$$dS \geq dQ/T$$
$$\geq dU + PdV/T$$

$$\Rightarrow dS - \frac{dU + PdV}{T} \geq 0 \Rightarrow TdS - dU - dW \geq 0$$

$$\Rightarrow -dF - dW \geq 0 \Rightarrow -(F_P - F_R) - W \geq 0$$

for a process without work.

$$F_R \geq F_P$$

This shows that As per the second law a workless isothermal reaction is not feasible unless the Helmholtz fun. of the greater than or equal to the Helmholtz fun. of products.

Similerly for a flow reaction Gibb's fun.

$$G_R \geq G_P$$

Q:13 Give the constructions details of the Locomotive Boiler.?

Ans) Locomotive boiler is a fire tube boiler. It is made of cylindrical shell. I fitted with fire box at one end and smoke box at the other end. coal is burnt on grate in fire box and five gases pass through number of small fire tubes surrounded by water in the shell.