Co-efficient of performance, $(\text{C.O.P.})_{ref.} = \dfrac{Q_2}{W}$ ...(5.2)

where, Q_2 = Heat transfer *from cold reservoir*, and

W = The net work transfer to the refrigerator.

For a **reversed heat engine** [Fig. 5.1 (*b*)] acting as a *heat pump*, the measure of success is again called the *co-efficient of performance*. It is defined by the ratio :

Co-efficient of performance, $(\text{C.O.P.})_{heat\ pump} = \dfrac{Q_1}{W}$ ...(5.3)

where, Q_1 = Heat transfer *to hot reservoir*, and

W = Net work transfer to the heat pump.

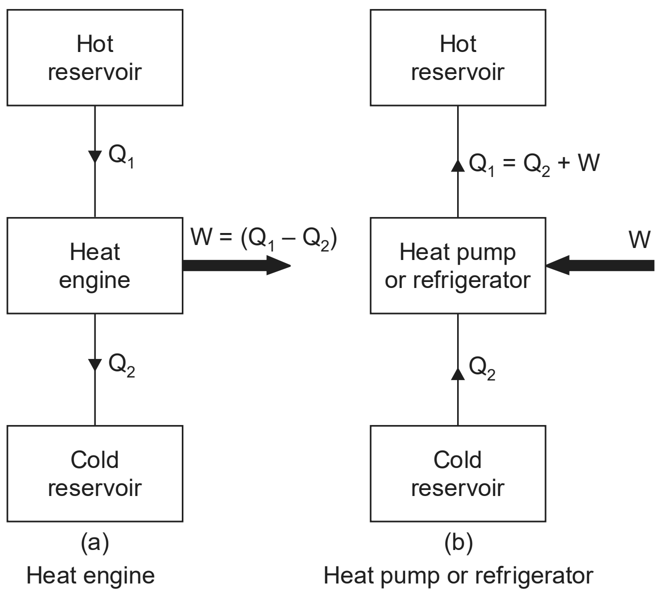

Fig. 5.1

In all the above three cases application of the first law gives the relation $Q_1 - Q_2 = W$, and this can be used to rewrite the expressions for thermal efficiency and co-efficient of performance solely in terms of the heat transfers.

$$\eta_{th} = \frac{Q_1 - Q_2}{Q_1} \quad ..(5.4)$$

$$(C.O.P.)_{ref} = \frac{Q_2}{Q_1 - Q_2} \quad ...(5.5)$$

$$(C.O.P.)_{heat\ pump} = \frac{Q_1}{Q_1 - Q_2} \quad ..(5.6)$$

It may be seen that η_{th} is *always less than unity* and $(C.O.P.)_{heat\ pump}$ is *always greater than unity*.

5.3. REVERSIBLE PROCESSES

A reversible process should fulfill the following *conditions* :

1. The process should not involve friction of any kind.
2. Heat transfer should not take place with finite temperature difference.