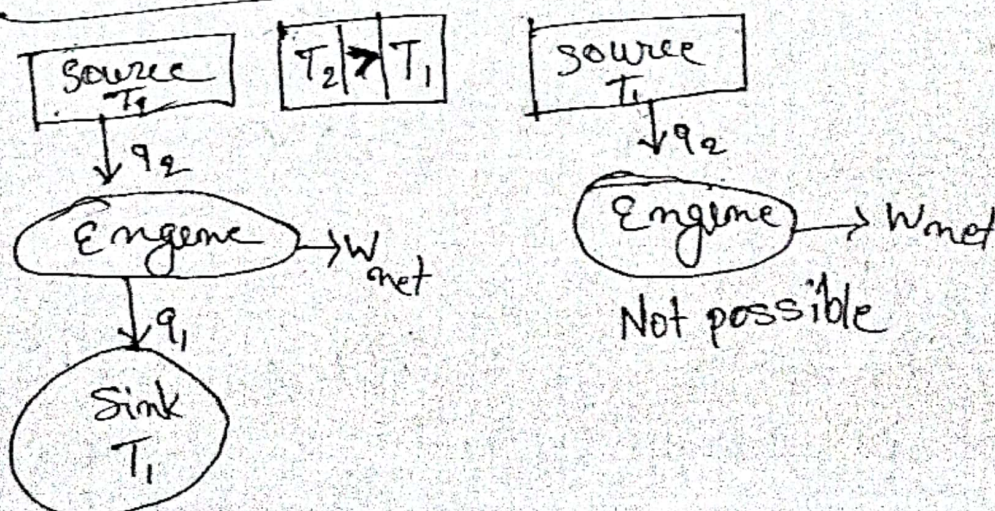


Kelvin-Planck Statement

There are two statements of the second law of thermodynamics.

Which are (i) Kelvin-Planck statement
(ii) Clausius statement.

Kelvin-Planck statement $\rightarrow$ It is impossible for a heat engine that operates in a cycle and produces a net amount of work if it exchanges heat only with bodies at a single fixed temperature or if the heat engine receives heat only from a single reservoir.



Feasible arrangement

The efficiency of a heat engine is given as.

$$\eta = \left(1 - \frac{T_1}{T_2}\right) \times 100 = \frac{W_{net}}{q_2} \times 100$$

$$\eta = \frac{q_2 - q_1}{q_2} \times 100$$

$$\therefore W_{\text{net}} = q_2 - q_1$$

where q_2 is the amount of heat rejected by the engine from the source which is at a constant temperature T_2 , q_1 is the amount of heat rejected by the engine to the sink which is at a constant temperature T_1 . What is the net work done by the heat engine

Now, if $q_1 = 0$ (considering there is no sink where heat is getting rejected)

$$\Rightarrow W_{\text{net}} = q_2$$

$$\Rightarrow \eta = \left(\frac{q_2 - 0}{q_2} \right) \times 100 = 100\%$$

But in real 100% efficiency is impossible to achieve. ~~This is~~ Kelvin and Planck proposed that it is impossible for a device to operate on a cycle where it produces work in a complete cycle by exchanging heat with only one reservoir.