

## VAPOUR ABSORPTION CYCLE

### DOMESTIC ELECTROLUX REFRIGERATOR

- The domestic absorption type refrigerator was developed from an invention by Carl Munters and Baltzer Von Platen. This system is often called “Munters Platen System”.
- This type of refrigerator is also called “Three-fluids absorption system”. The three fluids used in this system are ammonia, hydrogen and water.
  - The “ammonia” is used as a refrigerant because it possesses most of the desirable properties. Though it is toxic, and not otherwise preferred in domestic appliances, it is very safe in this system due to absence of any moving parts in the system and , therefore, there is the least chance of any leakage.
  - The “hydrogen” being the lightest gas, is used to increase the rate of evaporation (the lighter the gas, faster is the evaporation) of the liquid ammonia passing through the evaporator. The hydrogen is also non-corrosive and insoluble in water. This is used in the low-pressure side of the system.
  - The “water” is used as a solvent because it has the ability to absorb ammonia readily.

#### Principle and Working of Electrolux Refrigerators.

Fig. 5.6. Shows a schematic diagram of an ‘Electrolux refrigerator’. It is a domestic refrigerator and is the best known absorption type of refrigerator. Here pump is dispensed with. The small energy supply is by means of a heater which may be electric or gas.

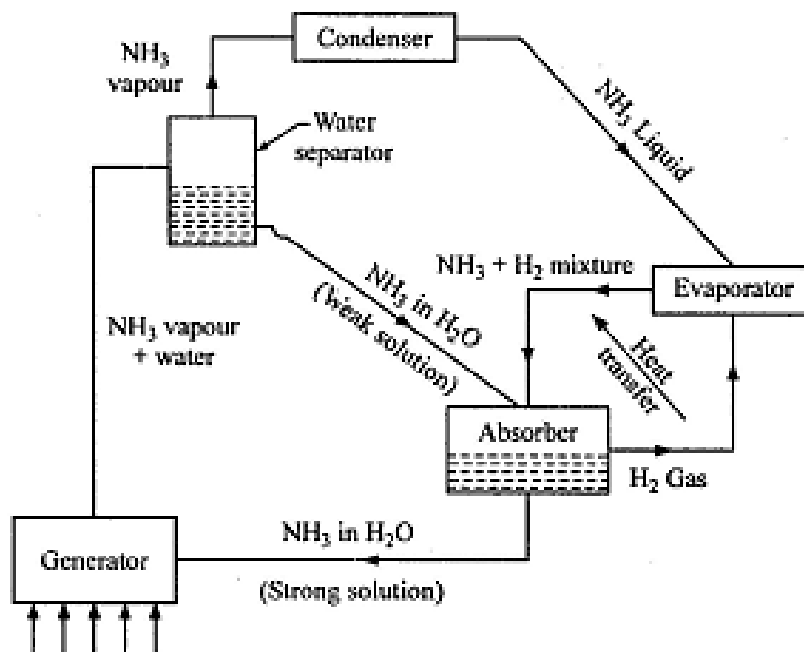


Fig. 5.6. Electrolux refrigerator.

**Principle.** The principle involved makes use of the properties of gas-vapor mixtures. If a liquid is exposed to an inert atmosphere, it will evaporate until the atmosphere is saturated with the vapor of the liquid. This evaporation requires heat which is taken from the surroundings in which the evaporation takes place. A cooling effect is thus produced. The partial pressures of the refrigerant vapor (in this case ammonia) must be low in the evaporator, and higher in the condenser. The total pressure throughout the circuit must be constant so that the only movement of the working fluid is by convection currents. The partial pressure of ammonia is kept low in requisite parts of the circuit by concentrating hydrogen in those parts.

**Working.** The ammonia liquid leaving the condenser enters the evaporator and evaporates into the hydrogen at the low temperature corresponding to its low partial pressure. The mixture of ammonia and hydrogen passes to the absorber into which is also admitted water from the separator. The water absorbs the ammonia and the hydrogen returns to the evaporator. In the absorber the ammonia therefore passes from the ammonia circuit into water circuit as ammonia in water solution. This strong solution passes to the generator where it is heated and the vapor given off rises to the separator. The water with the vapor is separated out and a weak solution of ammonia is passed back to the absorber, thus completing the water circuit. The ammonia vapor rises from the separator to the condenser where it is condensed and then returned to the evaporator.

The actual plant includes refinements and practical modifications (which are not included here). The following points are worth noting:

- The complete cycle is carried out entirely by gravity flow of the refrigerant.
- The hydrogen gas circulates only from the absorber to the evaporator and back.
- With this type of machine efficiency is not important since the energy input is small.
- It has not been used for industrial applications as the C.O.P. of the system is very low.

**Role of Hydrogen.** By the presence of hydrogen it is possible to maintain uniform total pressure throughout the system and at the same time permit the refrigerant to evaporate at low temperature in the evaporator corresponding to its partial pressure. Thus the condenser and evaporator pressures of the refrigerant are maintained as below:

- (i) In the condenser only ammonia is present, and the total pressure is the condensing pressure.
- (ii) In the evaporator hydrogen and ammonia are present; their relative masses are adjusted such that the partial pressure of ammonia is the required evaporator pressure.

These are achieved without the use of pumps or valves.

## **Advantages and Disadvantages of Electrolux Refrigerator over Conventional Refrigerators:**

### **Advantages:**

1. No pump or compressor is required.
2. No mechanical troubles, maintenance cost is low.
3. No lubrication problem; no wear and tear.
4. Completely leak proof.
5. Noiseless.
6. No chance of pressure unbalancing and no need of valves.
7. System may be designed to use any available source of thermal energy-process steam, exhaust from engines or turbines, solar energy etc.
8. Easy control, simply by controlling heat input.

### **Disadvantages:**

1. More complicated in construction and working.
2. C.O.P. very low.
3. The major disadvantages of this type of refrigerator are that if it is spoiled once, it cannot be repaired and has to be replaced fully.