

* Air compressor :

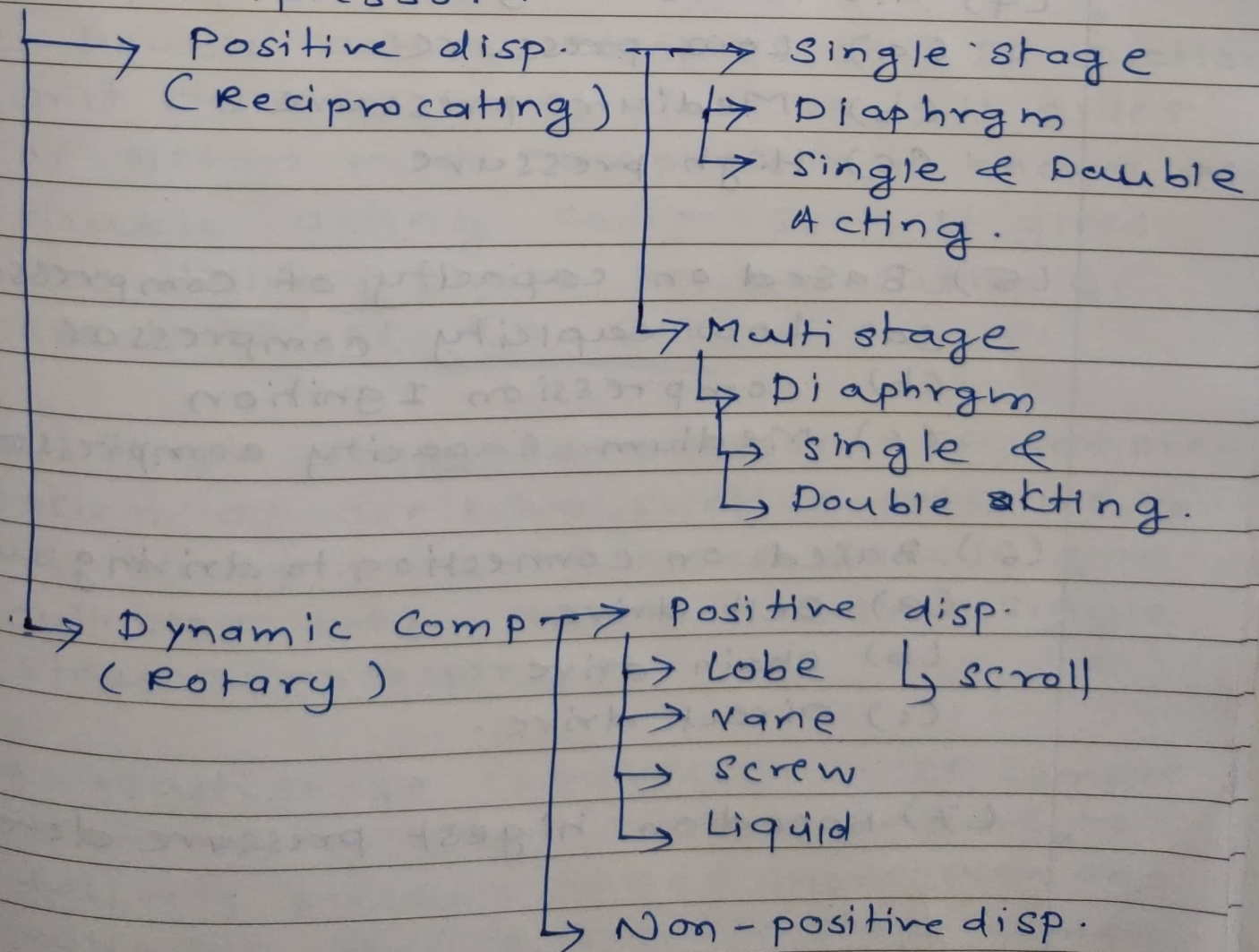
Air compressor is a device which is used to increase pressure of air from low pressure to high pressure by using some external energy.

In air compressor air is used as working substance

Compressors are work absorbing devices which are used for increasing pressure of fluid at expense of work done on fluid.

Compressors are similar to fans & blowers but differ in terms of pressure ratio.

Air compressor:



* Classification of air compressor:

(1) Based on principle of operation.

(a) Positive disp. compressor

(b) Non-positive disp. compressor.

(2) Based on number of stages:

(a) single stage

(b) multi stage

(3) Type of motion:

(a) Reciprocating

(b) Rotary.

(4) A/c to discharge of pressure,

(a) Low pressure

(b) Medium pressure

(c) High pressure.

(5) Based on capacity of compressor

(a) Low capacity compressor

(b) Compression Ignition

(c) Medium capacity compressor.

(6) Based on connection to driving unit

(a) Belt drive

(b) chain drive

(c) Direct drive.

(7) Based on highest pressure developed

(a) Low pressure compressor	upto 1 bar
(b) Medium	1 - 8 bar
(c) High	8 - 10 bar
(d) Super high	more than 10 bar

* Terminology :-

1. Single acting compressor :- If suction and delivery takes place ^{one side} of piston only that type of compressor is known as single acting compressor. It gives one delivery stroke per revolution of crank shaft. ($n = N$)

2. Double acting compressor :- If suction and delivery takes place on both sides of piston that compressor is known as double acting compressor. It gives two delivery stroke per revolution of crank shaft. ($n = 2N$)

3. Single stage compressor :- If compression of air from suction pressure to delivery pressure takes place in one cylinder only, then it is called single stage compressor.

4. Multistage compressor :- If compression of air from suction pressure to delivery pressure takes more than one cylinder, then it is multistage compression.

5. Free air delivered (F.A.D) :-
 If actual volume of air delivered at given pressure is expressed in terms of suction pressure & temp. then air delivered in m^3/s is called FAD. Notation: FAD
 SI unit: m^3/s

6. Displacement of compressor :-
 refers to piston swept volume in first stroke cylinder of compressor.

$$\text{Swept Volume} = \frac{\pi}{4} \times D^2 \times L$$

for single acting

$$= \frac{\pi}{2} \times D^2 \times L$$

for double acting

D = cylinder diameter
 L = stroke length.

7. Clearance volume (V_c) :- It is actual volume remained in cylinder after piston reaches its top dead centre during compression stroke.

V_c : Notation
 m^3 : unit.

(8) Compression ratio :- It is defined as ratio of volume of air before compression to volume of air after compression.

V_c : Notation

m^3 : Unit.

$$r_c = \frac{V_s + V_c}{V_c}$$

V_s : Swept volume

V_c : Clearance volume

(9) Pressure ratio :- It is ratio of pressure of air after compression to before compression, $\frac{P_2}{P_1}$.

Notation : r_p .

P_1 = After compression.

P_2 : Before compression.

* Single stage single acting reciprocating compressor

⇒ ① If suction and delivery take place on one side of piston only, the compressor is known as single acting compressor.

② In single acting reciprocating air compressor only single side of piston is used for compression of air.

③ Piston is directly driven by connecting rod & crankshaft enclosed in piston is used for compression of air.

④ It requires less floor space for installation.

⑤ Gives one delivery stroke per revolution of crank shaft ($n = N$)

⑥ Single acting reciprocating air compressors are always vertical.

⇒ Construction:

① Reciprocating compressor is type of positive displacement compressor, because it displaces fixed amount of air, (constant air delivered)

② It consists of cylinder, piston, inlet & discharge valve etc, it is driven through connecting rod & crank.

⇒ Working principle:

(A) Suction stroke:-

→ If piston moves downwards, pressure inside cylinder falls below atmospheric pressure. Due to this pressure difference, inlet valve gets opened & air is sucked in cylinder.

⇒ At inlet pressure until piston completes the suction stroke. Crank shaft is driven through prime mover, the inter valve.

(B) Delivery stroke:

- ① Delivery valves are mounted in cylinder head. Valves are pressure differential type i.e; valves automatically open & closes depending on pressure diff. across valves between outside & cylinder pressure.
- ② Piston moves upwards, pressure inside cylinder goes on increasing till it reaches delivery pressure. Delivery valve gets opened & air is delivered.
- ③ At end of delivery stroke, small quantity of air, at high pressure expands to aid suction (air at clearance volume).
- ④ At this stage inlet valves gets opened as a result of which fresh air is sucked into cylinder, & cycle is repeated.

* Double acting air reciprocating compressor

- ① If suction & delivery of air takes place on both sides of piston is known as double acting compressor.
- ② It gives two delivery stroke per revolution of crankshaft ($n = 2N$). Most heavy duty compressors are double acting.
- ③ Double acting compressor require more space as compared to single acting vertical compressor. As both side of piston are exposed to rapid change in temp. & pressure, there is chance of leakage.
- ④ Double acting ~~vertical~~ compressors are always horizontal.

⇒ Construction :

Same as in single acting compressor.

⇒ working principle :-

same, just add it happens on either sides. as we have different compartments for suction & delivery.

Applications:-