

# Construction and working of cyclone separator, air separator and filter bag

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# CYCLONE SEPARATOR

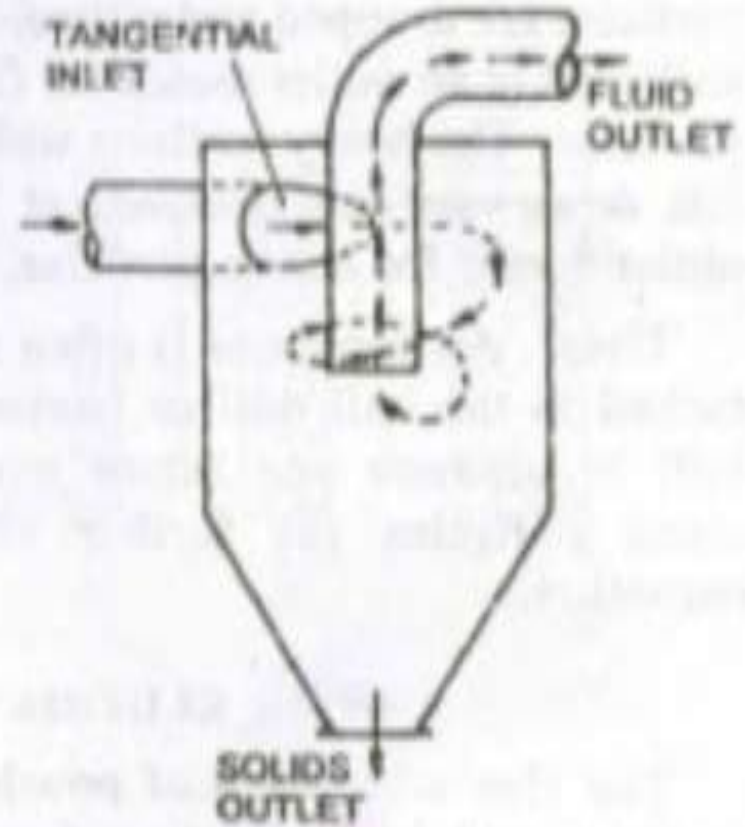
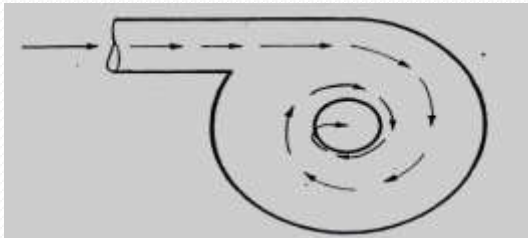
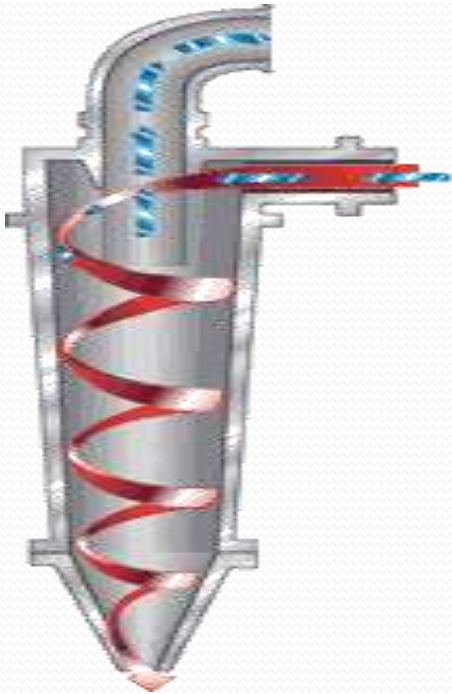


Fig. 6-2 Cyclone separator

Cyclone separator

# Principle

- In cyclone separator, the centrifugal force is used to separate solids from fluids.
- The separation depends not only on the particle size but also on density of particles.
- Hence depending on the fluid velocity, the cyclone separator can be used to separate all types of particles or to remove only coarse particles and allow fine particles to be carried through with the fluid.

# Construction

- It consists of a short vertical, cylindrical vessel with a conical base.
- In the upper part of the vessel is fitted with a tangential inlet.
- The outlet (solid outlet) is arranged at the base.
- Fluid outlet is provided at the centre of the top portion, which extends inwardly into the separator.
- Such an arrangement prevents the air short-circulating directly from the inlet to the outlet of the fluid.

## **Working**

- The solids to be separated are suspended in a stream of gas (usually air).
- Such a feed is introduced tangentially at a very high velocity, so that rotary movement takes place within the vessel.
- The centrifugal force and vortexing throws the solids to the walls.
- As the speed of air diminishes, the particles fall to the conical base and are discharged through the solid outlet.
- The fluids (air) can escape from the central outlet at the top.

## **Uses**

- Cyclone separators is used to separate the solids from gases.
- It is also used for size separation of solids in liquids.
- It is used for separating the heavy or coarse fraction from fine dust.

## **Advantages**

- Low capital cost
- Ability to operate at high temperature
- Low maintenance requirements (no moving parts)

## **Disadvantages**

- Unable to process sticky materials
- High operating cost due to pressure drop

(Vortex-a whirling mass of fluid or air, especially a whirlpool or whirlwind.)



# AIR SEPARATOR

## Principle

- It works on the same principle as that of cyclone separator.
- But in this case the air movement is obtained by means of rotating disc and blades.
- To improve the separation, the stationary blades are used. By controlling these blades and the speed of rotation, it is possible to vary the size at which separation occurs.



## AIR SEPARATOR

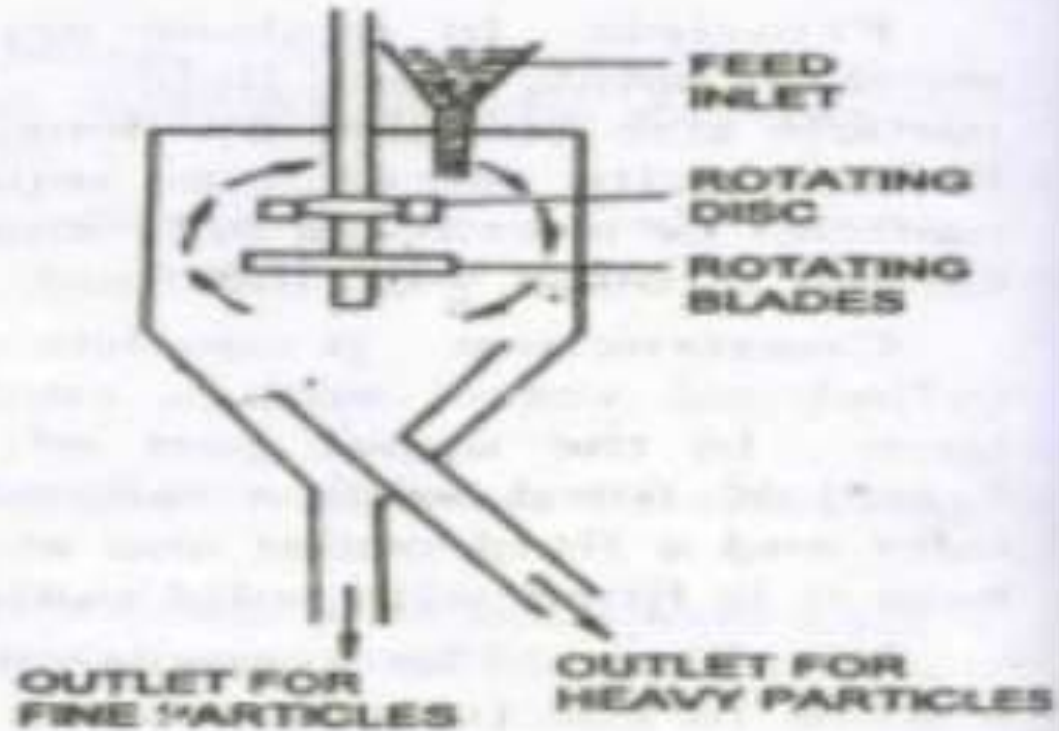


Fig. 6.3 Air separator

## **Construction**

- It consists of a cylindrical vessel with a conical base.
- In the upper part of the separator the vessel is fitted with feed inlet, and at the base there are two outlets, one for fine particles and other for heavy particles.
- The rotating disc and rotating blades are attached to the central shaft, to produce air environment or movement.

## **Working**

- The disc and blades are allowed to rotate by means of a motor.
- These produce a current of air as shown by the arrows.
- The sample powder is introduced through the feed inlet.
- The feed falls on the rotating disc.
- The fine particles are picked up and carried into space, where air velocity is sufficiently reduced.
- The fine particles are dropped and are ultimately collected at the outlet meant for fine particles. The heavy particles which fall downward, are removed at the outlet meant for heavy particles.



## **Uses**

Air separator is often attached to the ball mill or hammer mill to separate and return oversized particles for further size reduction.

# Bag filter

## Principle

- In bag filter, size separation of fines (or dust) from the milled powder is achieved in two steps.
- In the first step, the milled powder is passed through a bag filter (cloth) by applying the suction on the opposite side of the feed entry.
- This facilitates the separation.
- In the next step, pressure is applied in order to shake the bags so that powder adhering to the bag falls off, which is collected from the conical base.

## Construction

- It consists of a number of bags made of cotton or wool fabric.
- These are suspended in a sheet metal container.

- A hopper is arranged at the bottom of the filter to receive the feed.
- At the top of the metal container, a provision is made for the exhaust.
- Adjacent to this, a bell crank lever arrangement is made to bring the filters to normal atmospheric conditions.

## **Working**

- The working of bag filter consists of two steps.
- In the first step, the feed is separated from air by passing it through the cloth bags.
- In the subsequent step, the bags are shaken to collect the fines that are adhered to the bags.
- These two steps follow in succession and are controlled at different intervals with the help of a bell crank lever arrangement.

## **Uses**

- These are used along with other size separation equipment, Example- cyclone separator.
- These are used to remove the fines from cyclone discharge.

## **Advantage**

- It is extremely useful for removing fines, which cannot be separated by other methods.
- These can be used even to remove dust. The ordinary household vacuum cleaner is a simple bag filter.

## **Disadvantage**

- Bag filter is not size separating equipment as such.

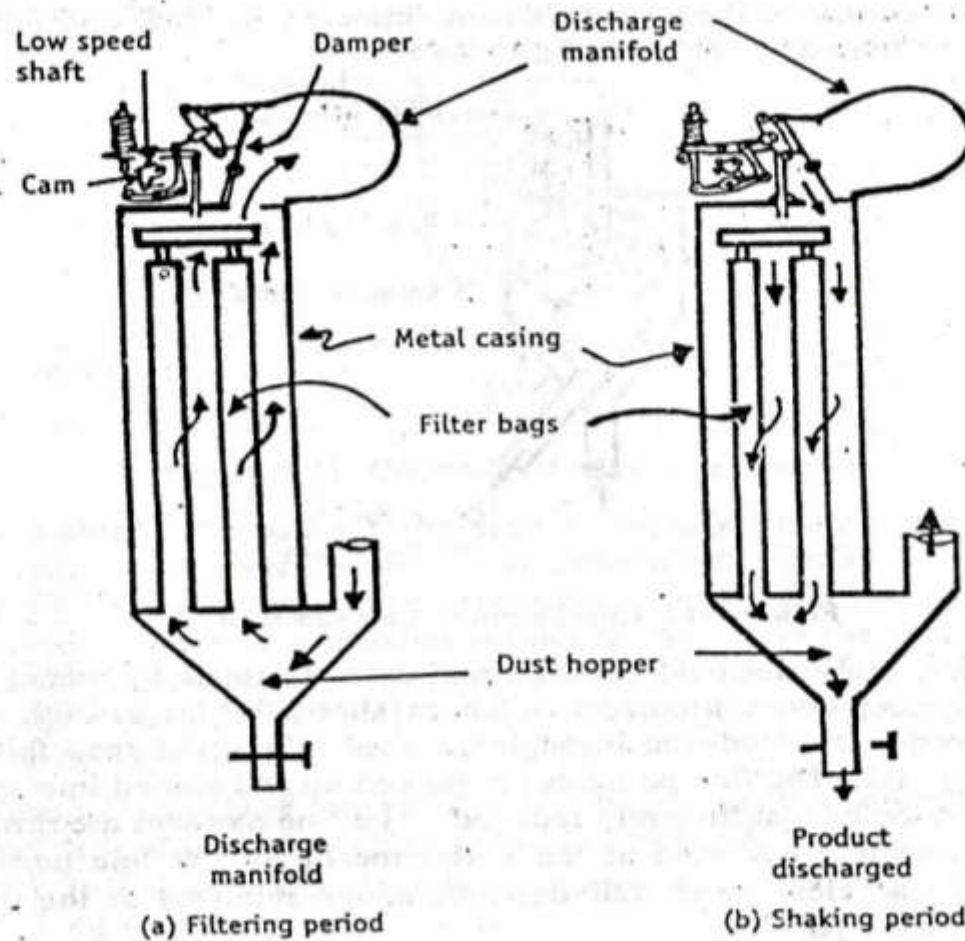


Figure 7-13. Construction of bag filter.