

**Study of Fluid Energy Mill, Edge runner mill and end runner mill**

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# **FLUID ENERGY MILL/ JET MILL/ MICRONIZERS/ ULTRAFINE GRINDERS**

## **Principle-**

It works on the principle of impact and attrition. In this, the feedstock is suspended within a high velocity air stream. Milling takes place because of high velocity collisions between the suspended particles.

## **Construction**

- It consists of an elliptical pipe which has a height of about 2 meters and diameter may be ranging from 20 to 200 mm. The mill surface may be made up of either soft stainless steel or tough ceramics.
- Grinding nozzles (usually two to six) are placed tangential and opposed to the initial flow path of a powder.
- Compressed air is used at 600 kilopascals to 1 megapascals.
- Venturi feeder is provided in the path of the airflow. An outlet with a classifier is fitted to allow the escape of air.

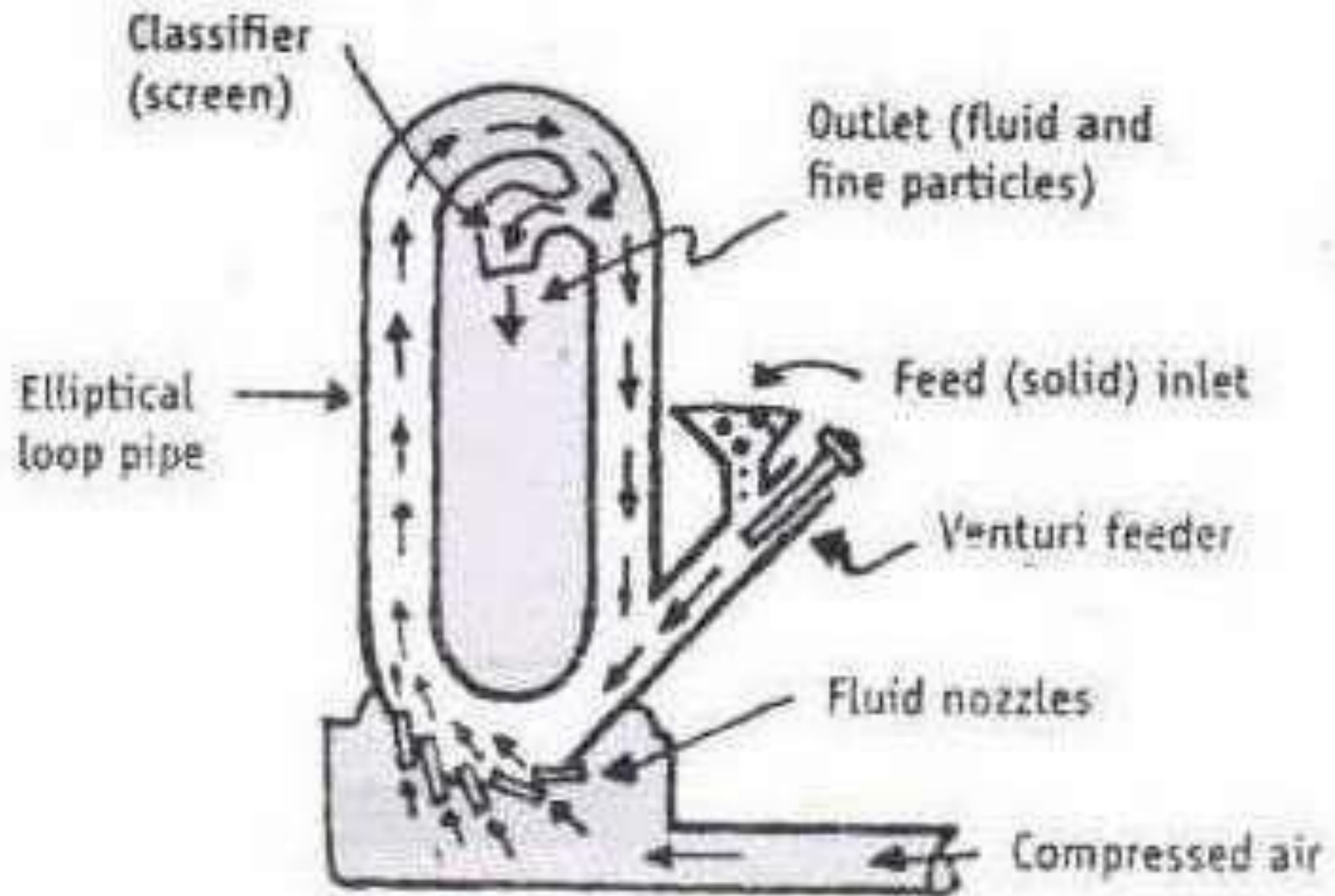


Figure 6-9. The construction of fluid energy mill.

**Working :** Powder is introduced through the inlet of venturi. The air entering through the grinding nozzles transport the powder in the elliptical or circular track of the mill. In the turbulent stream of air, the suspended particles collide with each other and break. Thus, impact and attrition forces operate in size reduction. The resultant small particles (by entrainment of air) are carried to outlet and removed by cyclone or filters.

The coarser particles undergo re-circulation in the chamber on account of its own weight. These re-circulated particles collide again with new in-coming feed stock particles. The powder remains in the mill, until its size is reduced sufficiently. Later it leaves via the sieve. Hence, fluid energy mill produces particles with narrow size distribution.

## **USES:-**

To reduce the particle size of most of drugs such as antibiotics and vitamins.

## **Advantages:**

- It has no moving parts heat is not produced during milling.
- It is rapid and efficient method for reducing powder to 30 mm or less.
- No contamination is possible.

## **Disadvantages:**

- Not suitable for milling of soft, tacky and fibrous material.
- Equipment is expensive.

# EDGE RUNNER MILL:

## **Principle:**

The size reduction is done by crushing (compression) due to heavy weight of stones.

## **Construction:**

- It consist of two heavy rollers and may weigh several tons.
- The roller move on a bed which is made up of granite or stone.
- Each roller has a central shaft and revolve on its axis.
- The rollers are mounted on horizontal shaft and move around the bed.

## **WORKING:**

- The material to be ground is placed on the bed with the help of the scrapper in such a way that it comes in the path of the stone wheel.
- These stones revolve on its own axis and at the same time travel around the shallow stone bed.
- The outer part of the wheel has to travel a greater distance than the inner, so that size reduction is achieved by shearing as well as crushing.
- The material is ground for definite period.

- The powder is collected and passed through a sieve to get powder of required size.

**Uses :** Edge runner mill is used for grinding tough materials to fine powder. It is still used for plant-based products, while more sophisticated mills are used for chemicals and drugs.

**Advantages :** Edge runner mill does not require attention during operation.

**Disadvantages :** (1) Edge runner mill occupies more space than other commonly used mills.

(2) Contamination of the product with roller material is possible.

(3) The milling process is time consuming.

(4) It is not used for sticky materials.

(5) Energy consumption is quite high.



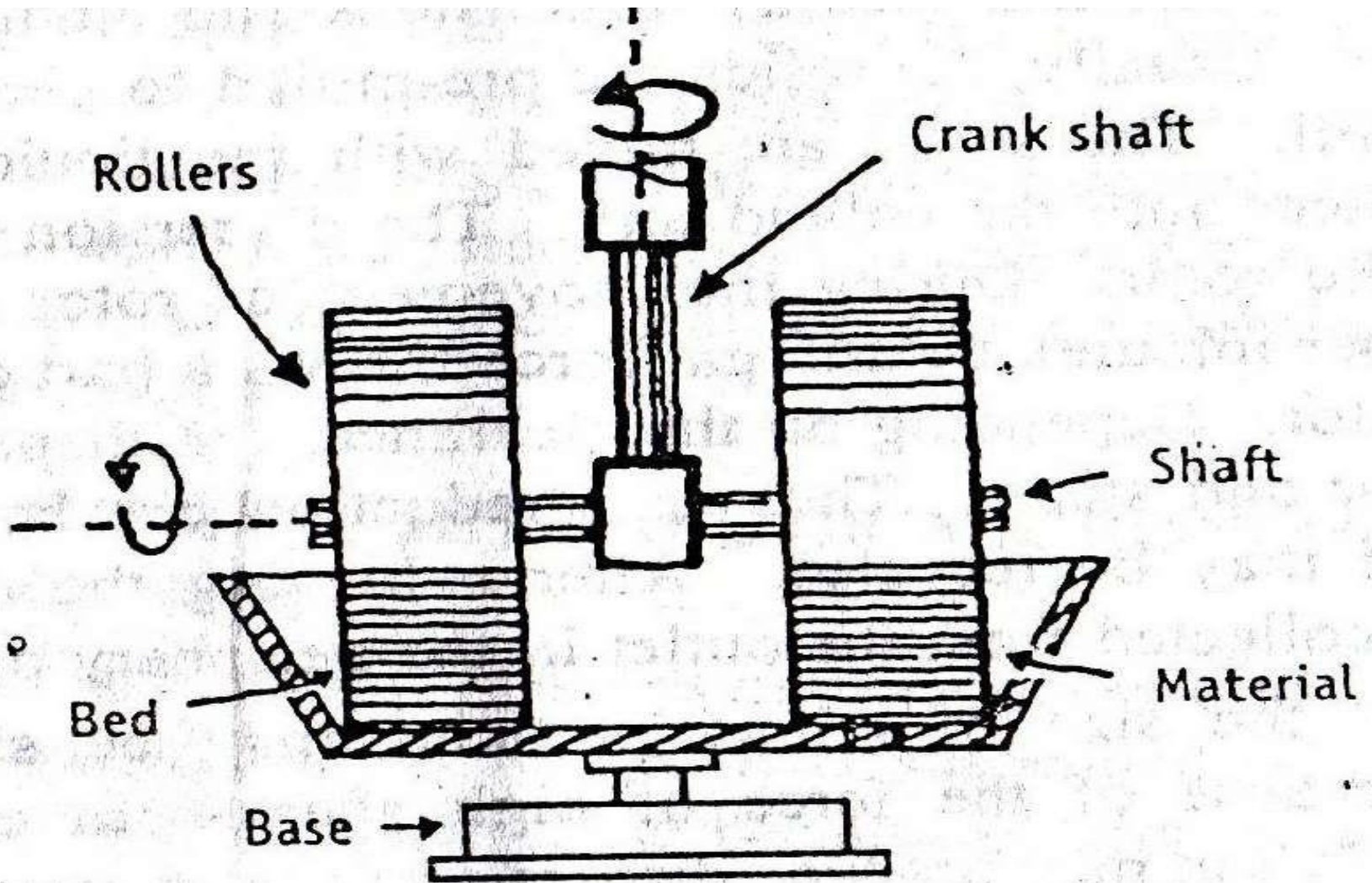


Figure 6-11. Construction of edge runner mill.



## END RUNNER MILL:

### **Principle:**

Size reduction is done by crushing due to presence of heavy weight steel pestle. Shearing stress is also involved during the movement of mortar and pestle.

### **Construction:**

- It is considered as mechanical mortar and pestle.
- It consist of a steel mortar which is fixed to a flanged plate.
- The construction of mortar is connected to horizontal shaft bearing a pulley so the plate with mortar can be rotated at high speed.
- The pestle is dumb-bell shaped and bottom of pestle is flat.



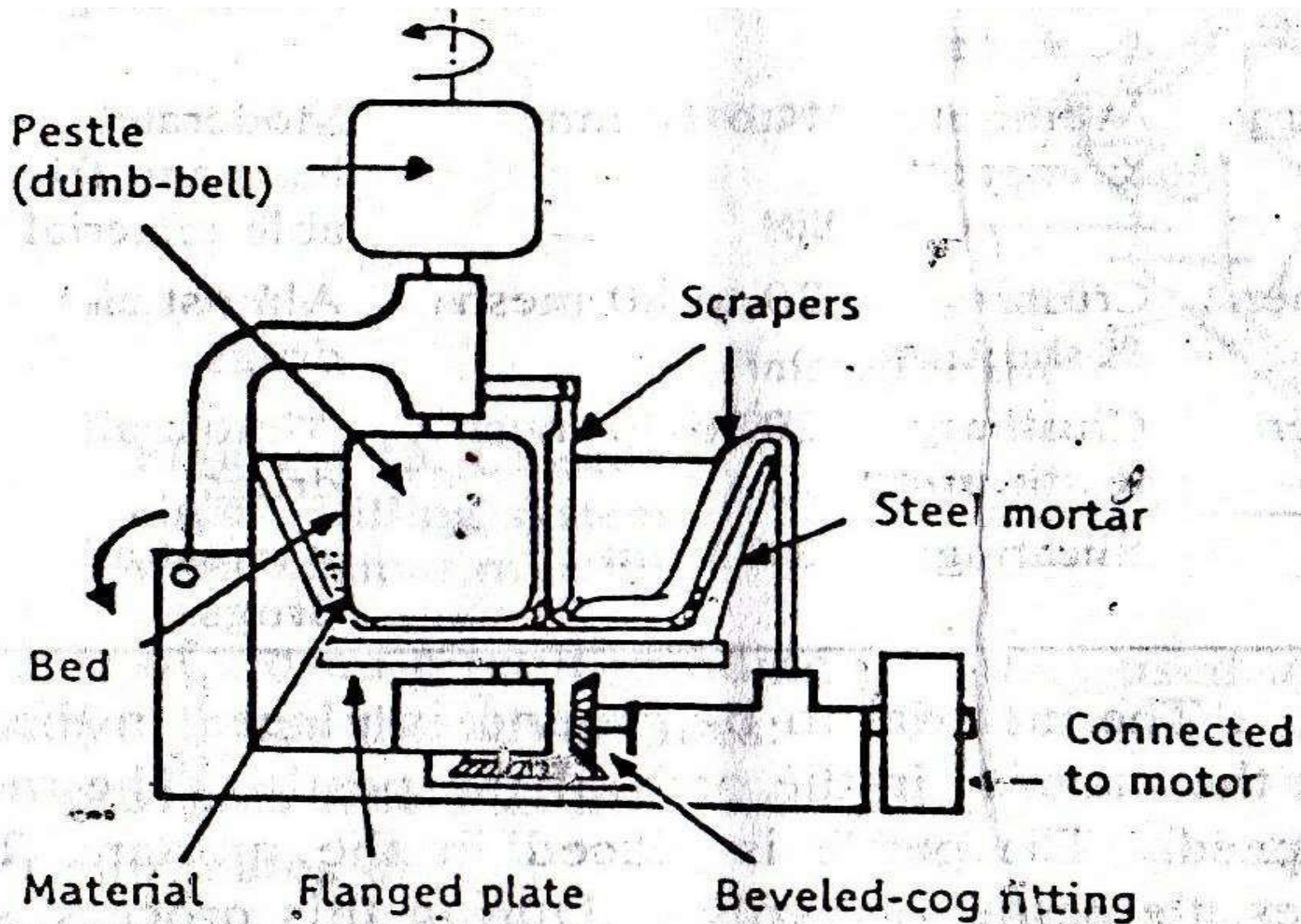


Figure 6-12. Construction of end runner mill.

- Construction of pestle is done in such a way that it can be raised from mortar for cleaning and emptying.

### **Working:**

- The material to be ground is placed in the mortar. The scraper puts the material in the path of the pestle.
- The mortar revolves at high speed and the pestle is placed in the mortar.
- The revolving mortar causes pestle to revolve.
- During this process, size reduction is achieved by shearing as well as crushing.
- The material is collected and passed through a sieve to get the powder of desired size.



**Uses :** End runner mill is suitable for fine grinding. Now a days, this mill is replaced by more efficient and sophisticated milling equipment.

**Disadvantage :** End runner mill is not suitable for drugs, which are in unbroken or slightly broken conditions.

