3.4 Gyratory crusher

Principle of Operation:

A gyratory crusher consists of a concave surface and a conical head, both surfaces are typically lined with manganese steel liners. The inner cone has a slight circular movement, but does not rotate. The movement is generated by an eccentric arrangement, causing the rock to be crushed as it rotates and falls out of the crushing chamber.

Applications:

Primary crushing of various hard ores or rocks.

Advantages:

High capacity.

Uniform product size.

Simple structure.

Disadvantages:

High initial cost.

Maintenance is more complex than for jaw crushers.

Crushing Rolls:

Principle of Operation:

Crushing rolls consist of two counter-rotating rolls, one of which is spring-loaded to provide a gap opening between the rolls. Material fed to the gap is crushed by the action of the rolls.

Applications:

Reduction of various hard materials, including minerals, rocks, and ores.

Advantages:

Good control over product size.

Low wear rate.

Disadvantages:

Limited capacity.

Sensitive to fines and variations in feed material.

Grinders:

Principle of Operation:

Grinders use mechanical forces to break, shear, or crush particles into smaller sizes. They may involve impact, compression, or attrition forces.

Applications:

Grinding of various materials such as grains, spices, or coffee beans.

Types:

Ball Mills: Rotate around a horizontal axis, partially filled with the material to be ground.

Rod Mills: Similar to ball mills but use long rods for grinding.

Vertical Roller Mills: Utilize rollers to crush materials.

Advantages:

Efficient for fine grinding.

Versatility in handling various materials.

Disadvantages:

High energy consumption.

May generate heat leading to material degradation.

Hammer Mills:

Principle of Operation:

Hammer mills consist of a series of hammers (usually four or more) hinged on a central shaft and enclosed within a rigid metal case. Material is fed into the mill and impacted by the hammers.

Applications:

Size reduction in a variety of industries, including agriculture and mining.

Advantages:

Versatile and can handle a wide range of materials.

Simple design and low maintenance.

Disadvantages:

High energy consumption.

Prone to wear and tear.

Rolling Compression Mills:

Principle of Operation:

Rolling compression mills, such as roll mills and roll crushers, compress the material between two counter-rotating rolls.

Applications:

Used for crushing or grinding various materials, including minerals and industrial products.

Advantages:

Good control over product size.

Low wear rate.

Disadvantages:

Limited capacity.

Sensitive to variations in feed material.

Attrition Mills:

Principle of Operation:

Attrition mills use the principle of attrition (particle-on-particle impact) to reduce the size of materials.

Applications:

Used for grinding and blending various materials in industries such as pharmaceuticals and food processing.

Advantages:

Effective for fine grinding.

Versatile in handling different materials.

Disadvantages:

High energy consumption.

Can generate heat, affecting heat-sensitive materials.

Understanding the principles and characteristics of these size reduction equipment types is crucial for selecting the most suitable machinery for specific applications in industries ranging from mining and construction to food processing and pharmaceuticals.

Ball Mills:

Principle of Operation:

Ball mills utilize a rotating cylindrical chamber filled with balls to perform grinding or mixing actions. The material to be processed is placed into the mill along with the grinding media, and the rotation of the mill generates impact and attrition forces to break down the particles.

Applications:

Widely used in the mining and minerals processing industry for grinding ores and other materials. Also used in the pharmaceutical and chemical industries for mixing and blending.

Advantages:

Efficient for fine grinding.

Versatility in handling different materials.

Disadvantages:

High energy consumption.

Maintenance requirements.

Rod Mills:

Principle of Operation:

Rod mills are similar to ball mills but use long rods for grinding instead of balls. The grinding action is generated by the rotation of the mill and the cascading effect of the rods within the mill.

Applications:

Commonly used in the mining industry for grinding ores. Also used in the construction materials industry for the production of sand and gravel.

Advantages:

Better suited for coarse grinding.

Minimal over-grinding.

Disadvantages:

Limited in application for fine grinding.

Higher maintenance requirements.

Cutting Mills:

Principle of Operation:

Cutting mills involve the use of sharp knives or blades to cut or shear materials into smaller particles. The material is fed into the cutting chamber, where it is subjected to the cutting action.

Applications:

Used for size reduction of soft to medium-hard materials in various industries, including pharmaceuticals, food processing, and plastics.

Advantages:

Precise control over particle size.

Versatile for different materials.

Disadvantages:

Not suitable for hard or brittle materials.

Maintenance requirements for blades.

These additional topics cover different types of mills and equipment used for size reduction and materials processing, providing a comprehensive overview of the various tools available for different applications in industries ranging from mining to pharmaceuticals.