

FEEDING SYSTEMS for hammer mills

Good grinding starts with the feeding

Hammer mills are among the most common mill types for many applications in the grinding of grain or other biomass raw materials; for example, in the production of animal feed or in the food industry.

Good grinding depends, on the one hand, on the technical design of the hammer mill itself (sieve surface, impact surface, motorisation, speed and sieve perforation) and, on the other hand, on the aspiration of the mill (air volume flow, air velocity, filter type, filter surface).

In addition, the feeding of the hammer mill also plays an important role. The grinding plant can only be operated efficiently with optimum feeding and the appropriate dosing of the input material.

Tietjen feeding systems

Founded in 1959, the German company Tietjen Verfahrenstechnik specialises in the design and manufacture of customer-specific grinding systems. The heart of every plant is of course the hammer mill, of which Tietjen now manufactures 48 different types, from the simple self-conveying mill for small businesses to the computer-controlled large capacity mill with automatic screen change for 24-hour operation with reduced personnel.

It goes without saying that Tietjen has also intensively dealt with the optimal product feed for

Tasks of the feeding system

The feeding system for a hammer mill essentially has four important tasks to fulfil:

Distribution of the feed material: The distributed feed of the product over the entire width of the hammer mill has a significant influence on the grinding process, because only in this way can the existing impact and screen surface of a hammer mill be fully utilised. In addition, wear is reduced because the screens and beaters are worn more evenly. An even distribution also leads to an energy-efficient use of the mill's drive power.

Adaptation to product properties: Particularly in product mixtures (eg in the post-grinding of animal feed), products that are heavier and easier to grind (eg barley and corn) may be present as individual layers in the premix. The feeding system has the task of adjusting the throughput capacity of the mill to the product present in the mixture, so that the mill is always operated at its optimum operating point. For this purpose, the load of the mill motor is monitored and the conveying capacity of the feeding device is controlled on the basis of the motor current (load-dependent dosing).

Separation of impurities: Due to harvesting, handling, storage, etc, the raw material may contain impurities such as metal parts or stones, which can lead to considerable damage if they get into the mill (eg sieve breakage). Contact of foreign matters with the rapidly rotating components of the mill can also lead to sparking and, associated with this, to a risk of fires and explosions. The feeding equipment therefore has the task of reliably separating foreign parts in front of the mill.

Aspiration air intake: In addition to charging the mill with the material to be ground, feeding systems are usually also used to supply the aspiration air required for the grinding process. According to European ATEX guidelines, in the event of an explosion, this air intake opening must be designed in such a way that there is no risk of human life being endangered by escaping pressure shocks and/or flames. In addition, whirled up dust could lead to secondary explosions.

hammer mills and provides several feeding devices (See Picture 1). As early as the 1960s, Tietjen was one of the first manufacturers to launch a vibratory feeder with magnetic drive and load-dependent dosing via a thyristor control system. Later, an electronically adjustable slide was added to the vibratory feeder, which adapts the layer height to the different products to be ground. A magnet at the end of the trough separates ferromagnetic foreign bodies (See Picture 2).



The vibratory feeder type R is still part of the product range today and, due to its design with large cross-sections, is mainly used for coarse feed material such as wood. It has the disadvantage that there is only one magnet and non-magnetic foreign matters such as stones are not separated which makes it not state of the art anymore for grain applications.

Therefore, Tietjen has developed two further feeding systems, both of which have a cascade with two magnets for improved separation of magnetic foreign particles and a separation of non-magnetic impurities through air separation by means of the aspiration air sucked in: The drum feeder type DA and the Air-Gravity-Separator type AGS.

With the drum feeder DA, the feed material is dosed by a slowly rotating drum which speed is controlled load-dependently by a frequency converter. As an option, an electronically controlled slide is also available, which adapts the layer height individually according to the different raw products (See Picture 3).

The drum feeder is ideal for free-flowing products such as compound feed or grain at high throughput rates. It is characterised by its compact design and enables the hopper to be placed directly above the mill. An integrated empty detector automatically locks a flap at the end of the grinding process so that no shut-off of the pre-bin is required.

The Air-Gravity Separator AGS is also suitable for free flowing, but especially for floury and oily/fatty bulk materials such as pet food or fish feed. This device is a foreign body separator with the already mentioned magnets cascade and air separation through the aspiration air. The material to be ground is usually dosed via a speed-controlled screw conveyor, in some cases also via a rotary valve (See Picture 4).

The use of a dosing screw conveyor in combination with the Air-Gravity-Separator allows placing of the pre-bin separately from the mill. This makes this solution particularly interesting when space in the plant is limited or when existing feeders need to be replaced. Old, no longer ATEX-compliant vibrating feeders, are often replaced by AGS Separators and screw conveyors in existing installations.

Explosion protection

Explosion protection has always been a focal point at Tietjen—and also with regards to the feeding equipment. All feeding systems are 0.4 bar pressure shock resistant and flame penetration proof. They are also optionally available for installation in ATEX Zone 22 (II 3 D) and with a special valve developed by Tietjen, the A-Vent, which securely closes the aspiration air intake in the event of an explosion to protect the surrounding plant.

The pneumatically locked flap inside the drum feeder also serves to insulate the grinding system from the upstream process in case of an explosion. For the other two feeding devices (vibratory feeder and AGS-Separator), appropriate protective systems such as the Tietjen safety slide or rotary valves must be provided.

Conclusion

When planning grinding systems with hammer mills, it is also important to have a suitable feeding system in order to make the best possible use of the mill's power resources in an energy-efficient manner.

In addition to the process engineering aspects and the product properties, the choice of a suitable feeder must also take into consideration the available space in the plant and the applicable regulations for explosion protection. Tietjen offers tailor-made solutions that take all these aspects into account.

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