Horizontal Disk Mill

Type LME / LMK

The successful disk grinding system sets new standards regarding efficiency and flexibility
The Operating Principle

The Development

The first open agitator bead mill by NETZSCH-Feinmahltechnik was developed in 1963. This vertical agitator bead mill was equipped with an eccentric disk agitation system “molINEx” which activated the grinding media within a cylindrical grinding tank both axially as well as radially. In 1974, the first horizontal agitator bead mill with eccentric disks was introduced to the public. A flat screen integrated in the chamber floor served as hold-back system for the grinding media. In the following years, the grinding media separation systems, the geometry of the grinding disks and the various grinding chamber materials were further developed.

The General Construction

- An agitator shaft with grinding disks is mounted within a horizontally arranged grinding tank
- The grinding media in the grinding tank is activated by the grinding disks
- The product flows axially from the inlet through the grinding chamber and is ground by the shearing and impact forces of the grinding media
- The product is separated from the grinding media by a screen system at the end of the grinding chamber

The Product and Grinding Media Movement

- Depending on the screen system - centrifugal separation system or separation gap system - the product is fed either on the bearing side or floor side with a pump to the grinding chamber and flows axially through the chamber
- The grinding media is radially accelerated on the surface of the grinding disks
- A mixing cell with an axial product and grinding media exchange is formed in the active area of a grinding disk
- In the area of the grinding wall the grinding media is forced to a flow inversion to the agitator shaft which is caused by the suction effect of the grinding disk
- The largest energy input is achieved at the circumference and at the flanks of the grinding disks as well as in the stator area which is subtend to the grinding disks
The Machines

- Continuous disk milling system with horizontal grinding tank arrangement
- Uniform distribution of the grinding media through the entire grinding chamber
- Disk agitator activates the grinding media with high intensity
- Different grinding disk agitation systems in different materials, adjusted to your application
- Product-specific adjustable, wear resistant grinding chamber designs in different materials
- Use of grinding media from 0.1 - 6.35 mm
- Various, high efficient separation systems
- Wide range of applications in the area of low viscosity products e.g. textile inks to high viscosity products e.g. newspaper printing inks (offset)
- High productivity at a low space requirement
- Easy handling enables flexible processing in short preparation times

Options

- Visualization of the process parameter and relationship to plant control
- Control of the dispersing process according to the specific grinding energy
- Grinding media filling device
- Grinding media lifting device
- Heating / cooling aggregate e.g. for chocolate, offset printing inks

<table>
<thead>
<tr>
<th>Machine type</th>
<th>LME 4</th>
<th>LME 12</th>
<th>LME 20</th>
<th>LME 60</th>
<th>LME 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grinding chamber vol. [l]</td>
<td>4</td>
<td>12</td>
<td>20</td>
<td>60</td>
<td>120</td>
</tr>
<tr>
<td>Batch size [l]</td>
<td>10 - 100</td>
<td>50 - 250</td>
<td>100 - 500</td>
<td>200 - 1000</td>
<td>500 - 2500</td>
</tr>
<tr>
<td>Drive [kW]</td>
<td>4 / 5.5</td>
<td>13.5 / 15</td>
<td>18.5 / 22</td>
<td>37</td>
<td>55 / 75</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Machine type</th>
<th>LME 200</th>
<th>LME 300</th>
<th>LME 500</th>
<th>LME 1000</th>
<th>LME 3000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grinding chamber vol. [l]</td>
<td>230</td>
<td>300</td>
<td>560</td>
<td>1000</td>
<td>3000</td>
</tr>
<tr>
<td>Batch size [l]</td>
<td>1000 - 10000</td>
<td>&gt; 2000</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Drive [kW]</td>
<td>75 / 90</td>
<td>90 / 110</td>
<td>160 / 200</td>
<td>315 / 355</td>
<td>1100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Machine type</th>
<th>LMK 4 *</th>
<th>LMK 20 *</th>
<th>LMK 45 *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grinding chamber vol. [l]</td>
<td>4</td>
<td>20</td>
<td>45</td>
</tr>
<tr>
<td>Batch size [l]</td>
<td>10 - 100</td>
<td>50 - 250</td>
<td>200 - 1000</td>
</tr>
<tr>
<td>Drive [kW]</td>
<td>5.5</td>
<td>18.5 / 22</td>
<td>30 / 37</td>
</tr>
</tbody>
</table>

* LMK (for ceramic and mineral products)
The Applications

Horizontal Disk Mill Type LME
- Printing inks
- Paints
- Pigments
- Textile dyes
- Magnetic coatings
- Paper coatings
- Plant protectives
- Ores
- Pharmaceuticals
- Cosmetics
- Food: e.g. cocoa, chocolate, ...
- Biotechnology: e.g. cell treatment
- Minerals

Horizontal Disk Mill Type LMK
- Technical ceramics
- Utility ceramics
- Ceramic masses and glazes
- Ceramic pigments
- Minerals

The Grinding Disk Geometries

Centrical Disk System
- Uniform, symmetrical acceleration and activation of the grinding media
- Especially suitable for wearing products
- High energy input due to large grinding disk surfaces

TriNEx™ Disk System
- Further development of the system „moliNEx“ the most successful disk grinding system in the world
- Radial acceleration of the grinding media at additionally radial impulse with high frequency
- Optimized grinding disk geometry makes highest energy inputs possible
The Separation Systems

- Formation of an annular gap by a rotating inner ring and a stationary outer ring
- The grinding media is kept while the product flows out of the separation gap
- No counteracting force to the sweeping force of the product flow
- Gap forming parts of hard materials (also tungsten carbide and ceramics)

Type DC (rotor-slotted pipe)
Dynamic-Cartridge-System

- Internationally patented separation system that is distinguished by an extensive slotted screen that looms centrically into the grinding media released scope area of the separation rotor
- The separation rotor forms the enlargement of the agitator shaft
- The product/grinding media suspension flows around the rear edge of the rotor into the separation area that is formed between the rotor and the slotted screen
- The grinding media is repressed through the open rotor gaps into the outer area while the product flows through the slotted screen
- Centrifugal forces counteract the sweeping force of the product

Type RG (separation gap)
Rotating-Gap-System

- Further development of the separation system type DC for the use of smallest grinding media; even for products with high viscosities and throughput rates
- Maximum screen relief due to pre-classifying disk
- The product enters the pre-classifying area through the axial cutouts of the last grinding disk
- Carried grinding media is centrifuged outward within this area while the product flows axially through the borings of the pre-classifying disk into the separation area
- Formation of a circulation flow that counteracts the axial product flow

Type DCC (classifying rotor)
Dynamic-Classifying-Cartridge-System
The Grinding Chamber Materials

- We offer a variety of grinding chamber materials to meet the requirements of different products and to guarantee the product compatibility.
- Tungsten carbide, stainless steel or wear resistant steel materials are available.
- Grinding chamber designs in different wear resistant polymers as well as good coolable white or black ceramics are available for the iron-free grinding process.

The Plant Concepts

The Plant for Technical Ceramics

The solid is mixed in the batch tank \( \bullet \) prepared with liquid components. The suspension is fed via the agitator bead mill \( \circ \) to the circulation tank \( \odot \) by the use of a hose pump \( \star \). If the filling passage is finished, the circulation grinding starts via the circulation tank \( \odot \), the hose pump \( \star \) and the agitator bead mill \( \circ \). After achieving the final quality the product is fed in an emptying passage to the storage tank \( \triangle \). Meanwhile, a new product batch can be prepared in the batch tank \( \bullet \). The product is fed to the second process line by another hose pump \( \star \). This line is formed by an agitator bead mill \( \circ \), circulation tank \( \odot \) and storage tank \( \triangle \). The process repeats as described.

<table>
<thead>
<tr>
<th>Product</th>
<th>Fineness $d_{50}$ [µm]</th>
<th>Throughput [kg/h]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barium titanate</td>
<td>&lt; 1.2</td>
<td>360 - 450</td>
</tr>
</tbody>
</table>
The Plant for White Paint

The solids are fed to the Intensive Mixer PMD-VC via the bag feeding station with integrated blank worm condenser. The pre-dispersing process takes place in a batch. After finishing, the product is pumped by the use of a gear pump into a storage tank. The grinding in passage operation is then being started. The product is pumped by an additional gear pump from the storage tank to the horizontal disk agitator bead mill type LME and ground in passage operation. Meanwhile, a new product batch is pre-dispersed in the Intensive Mixer PMD-VC.

The Plant for Newspaper Rotational Offset (black)

The solid components, e.g. carbon black, are prepared in a feeding silo. The necessary liquid components are prepared in the mixing tanks and. The Ψ-MIX™ works with one of both mixing tanks in circulation operation. The solid is being dosed with high throughput to the Ψ-MIX™ via a rotary valve. The suspension is fed via tangential nozzles into the process zone of the mixing aggregate. A high wetting stream is formed. After the mixing procedure, the pre-dispersed product of one of the mixing tanks or is continuously ground via two in-line arranged agitator bead mills type LME and. Next, the product can be pumped into an agitator tank (not shown) to adjust the final viscosity.

Production example with PMD-VC 2500 and LME 100

<table>
<thead>
<tr>
<th>Product</th>
<th>Fineness [µm]</th>
<th>Throughput [kg/h]</th>
</tr>
</thead>
<tbody>
<tr>
<td>White paint</td>
<td>&lt; 10</td>
<td>1200 - 1600</td>
</tr>
</tbody>
</table>

Production example with Ψ-MIX™ and two LME 200

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Coldset black</td>
<td>85</td>
<td>approx. 100</td>
<td>5</td>
<td>250 - 300</td>
</tr>
</tbody>
</table>
For Mechanical Process Engineering

- Wet Grinding
- Mixing
- Dispersing
- Kneading
- De-Aeration

- Dry Grinding
- Agglomeration
- Classifying
- Press Outs
- Laboratory Use

Service and Competence - Worldwide and Close to our Customer

- We offer customized solutions for your requirements
- A state-of-the-art application laboratory with a separate area for processing high-tech products and applications of life science is available in Selb/Bavaria
- Testing provides:
  - Extensive quality analysis and test recording
  - Intensive discussion on the results
  - Scale-up to your production requirements
- Project planning and management / Start up service / After sales support

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