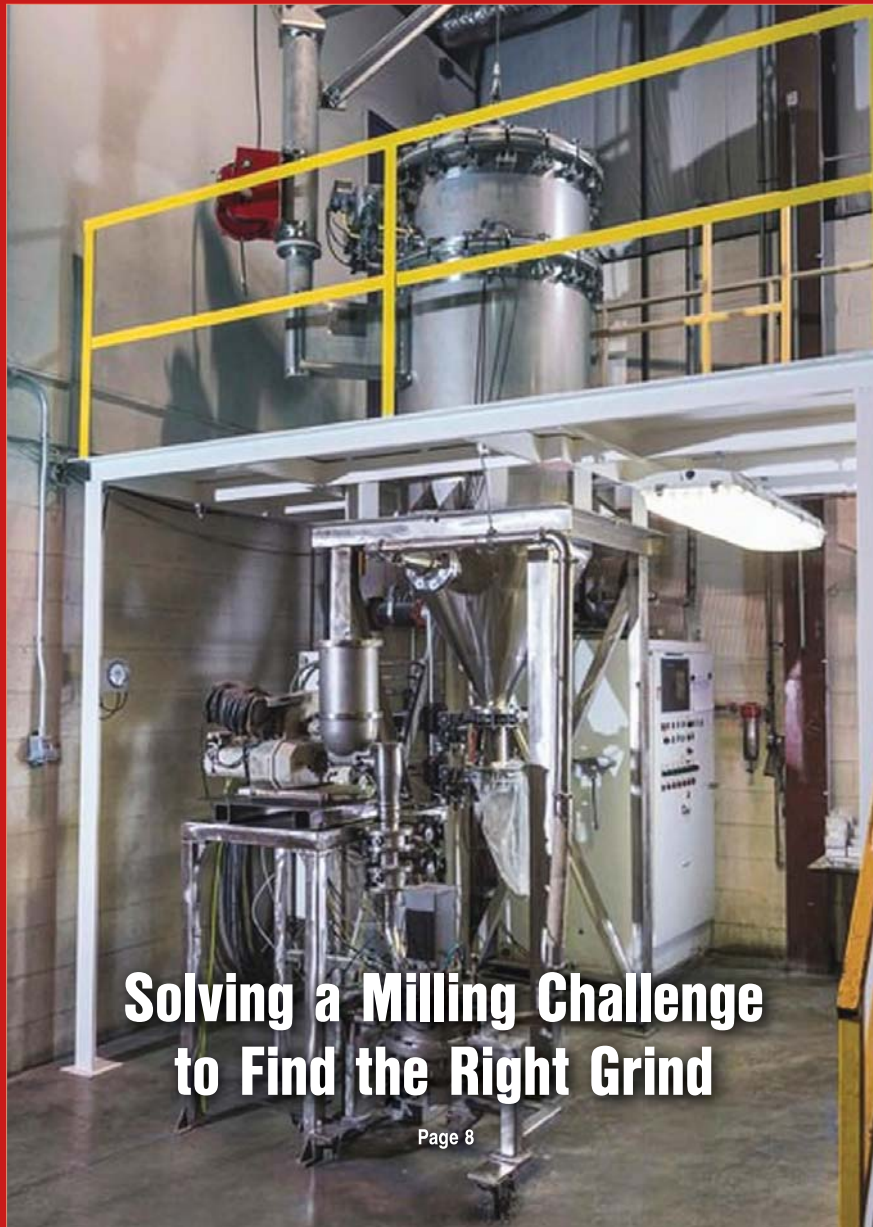


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Solving a Milling Challenge to Find the Right Grind

Page 8

Hammer Mills vs. Screen Classifying Cutters

Many specifiers are unaware of the many size reduction applications these machines have in common, or their relative strengths and weaknesses. Here are the similarities and differences of each machine and the best choice for various applications.

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Tech Challenges & Milling Strategies in Rare Earth Materials Size Reduction

Rare earth minerals are difficult to extract and process. Challenges persist through downstream powder processing stages, where high reactivity, sensitivity to contamination, and narrow operating windows complicate size reduction operations.

Page 18



6 Methods for Explosion Mitigation & Protection

Explosion mitigation and protection come in many forms, many of which are not costly. Mitigation and protection methods should be a standard part of the process at any facility that handles combustible dust.

Page 24



Battery Electrode Dry Coating

The new RF400 roller feeder is designed to optimize electrode dry coating material feeding in battery manufacturing. It mounts directly over the calender and ensures consistent, uniform distribution of electrode blends. The RF400's grooved feed roller and smooth scraper roller offer gentle, consistent feeding without material bridging in the outlet, as well as uniform material distribution on the calender roller.

Coperion K-Tron LLC, Niederlenz, Switzerland
+41 62 885 71 71 www.coperion.com



Bag Leak Detector

Designed for harsh industrial environments, the TriboPro Model L1 (Loop-powered) sensor by TriboTech Solutions utilizes dual-intensity (AC + DC) processing to capture the full spectrum particulate signal. Whether measuring flow / no-flow in pneumatic conveying, or minuscule picoamp (pA) background signals from a dust collector, the L1's stable circuitry can be used in all monitoring locations. They require no onsite calibration or zero-checking.

TriboTech Solutions, Manchester, NH 603-912-7702
tribopro.com



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MIXING/BLENDING



ROTARY BATCH MIXERS

Gentle mixing of dry blends with or without liquid additions in less than 3 minutes. Total discharge/rapid sanitizing. Capacities from 5 to 600 cu ft (142 ℓ to 17 m³).



ROTARY BATCH MINI MIXERS

Pilot/lab version of Rotary Batch Mixer gently achieves uniform blends in less than 3 minutes. No segregation upon discharge. Capacities from .25 to 15 cu ft (7 to 425 ℓ).



RIBBON/PADDLE/ PLOW BLENDERS

Off-the-shelf economy models to ultra-heavy-duty machines with removable agitator shafts. Capacities from 1 to 1,150 cu ft (.03 to 32 m³).



FLUIDIZED BED MIXERS

Twin, counter-rotating agitator shafts gently fluidize/blend in 30 seconds. Capacities from 0.2 to 283 cu ft (6 ℓ to 8 m³).



CYLINDRICAL PLOW BLENDERS

High-intensity batch blending of problematic bulk materials more effectively than ribbon/paddle/plow blenders. 1 to 400 cu ft (28 ℓ to 11 m³) capacity.



VEE CONE BLENDERS

Gentle, uniform blending with low energy usage. Optional liquid addition bar with intensifier. Total discharge/rapid sanitizing. Capacities from 0.25 to 200 cu ft (7 ℓ to 5.66 m³).



VARIABLE-INTENSITY CONTINUOUS BLENDERS

High-speed intensive mixing, or low speed, lower shear operation. Optional spray/injection ports for liquid additions or slurries. Diameters to 36 in. (91.4 cm), lengths to 8 ft (2.4 m).



ROTARY CONTINUOUS MIXERS

Gentle, thorough mixing with little or no degradation. Excellent de-dusting and spray coating capabilities. Diameters from 16 to 72 in. (40.6 to 182.9 cm), lengths to 24 ft (7.3 m).

SIZE REDUCTION



CENTRIFUGAL IMPACT MILLS (PIN MILLS)

Rotating impactor pin/disc assembly for fine and ultra-fine particle reduction and de-agglomeration, and intensive inline blending. Disc diameters from 8 to 34 in. (20.3 to 86.4 cm).



SCC™ SCREEN CLASSIFYING CUTTERS

Rapid throughput, with more precise sizing and fewer fines vs. hammer mills. Replaceable cutter tips. 10 to 72 in. (25.4 to 182.9 cm) wide inlets.



DE-CLUMPER™ LUMP BREAKERS

Reduces agglomerates and compacted materials. Precise particle sizing. 1 to 4 rotors from 12 x 12 to 48 x 48 in. (30.5 x 30.5 to 121.9 x 121.9 cm).



ATTRITION MILLS

Precise medium- to fine-grinding of friable and non-friable materials in narrow size ranges down to 100 mesh. Disc diameters from 12 to 36 in. (30.5 to 91.4 cm).



ROTARY KNIFE CUTTERS

Rotating blades cut against stationary blades, propelling on-size particles through a perforated screen with minimum fines. Sizes from 24 to 48 in. (61.0 to 121.9 cm).



HAMMERHEAD™ HAMMER MILLS

Coarse and fine grinding of fibrous and friable materials at high rates. 270° screens maximize area/capacity. 14.5 and 18 in. (36.8 and 45.7 cm) wide housings.



CX HEAVY DUTY CUTTERS

Single-rotor, high-torque cutter/hog for primary size reduction of larger, bulky materials. Solid rotor mass with replaceable tips. Widths from 12 to 36 in. (30.5 to 91.4 cm).



BULK MATERIAL SHREDDERS

Twin-shaft, with resharpenable shredder heads. Low speed, high torque, positive feeding, self-clearing. 6 to 12 in. (15.2 to 30.5 cm) diameter shredder heads.

For objective advice and side-by-side lab testing, contact the only manufacturer of all equipment shown



MIXING/BLENDING



SIZE REDUCTION

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Hammer Mills vs. Screen Classifying Cutters

By Steve Knauth, Munson Machinery Co. Inc.

Munson has found specifiers to be largely unaware of the many size reduction applications hammer mills and screen classifying cutters have in common, or their relative strengths and weaknesses. This article seeks to clarify the similarities and differences of each machine and identify applications in which one machine outperforms the other.

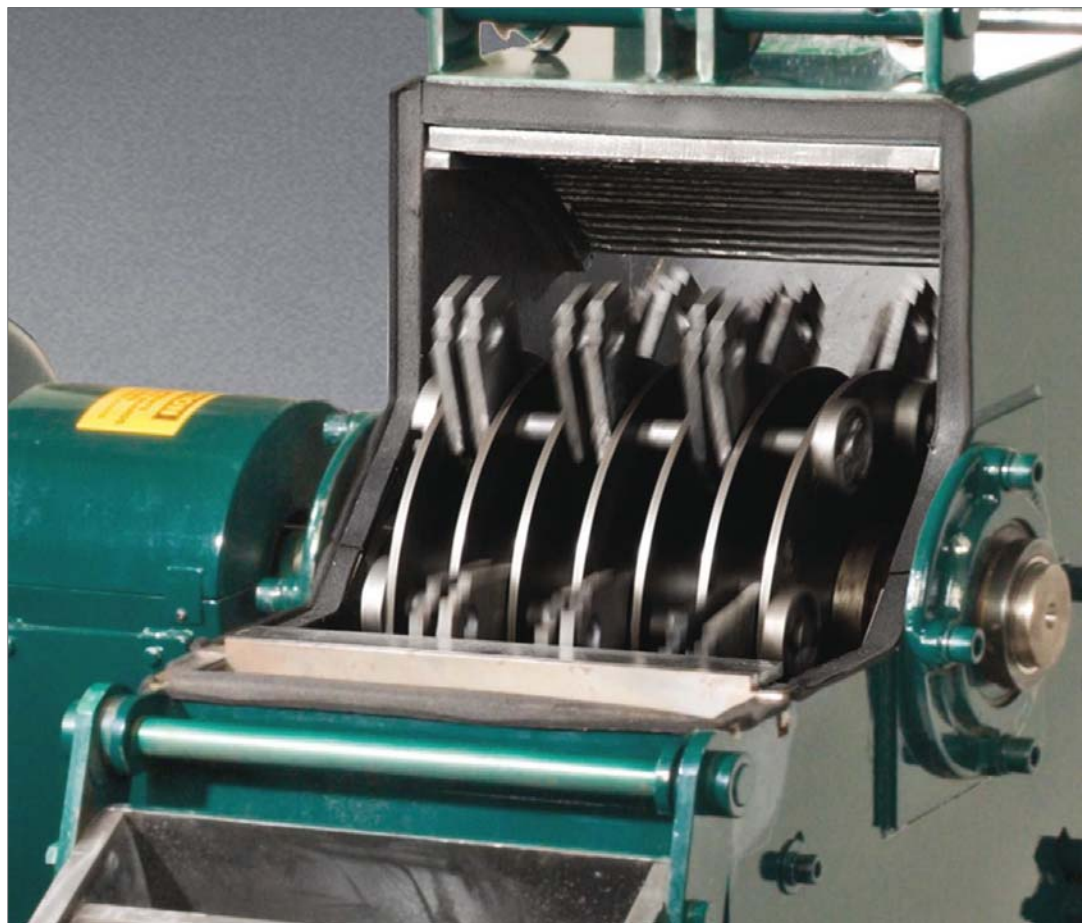
How Do Hammer Mills Work?

Hammer mill hammer tips rotate at speeds approaching 300 mph, imparting a high-shear/low-resistance pulver-

izing action that reduces high volumes of materials per horsepower/kilowatt.

Centrifugal force causes pivoting hammers to stand at 90 degrees to the rotating shaft, striking material in mid-air, and smashing it at high speed against hardened breaker plate ridges until particles are sufficiently reduced to pass through a bedscreen.

Particle sizes are determined by the friability of the material and the size of bedscreen perforations, which can range from 1/32 to 3 inches (0.8 to 76 mm).



Hammers are shown here standing at 90 degrees to rotating shaft for demonstration purposes. (Safety interlocks prevent operation when the door is open during actual use.)



The underside of the safety-interlocked front access door shows radiused breaker plate sections inserted into machined channels.

The shaft assembly, which consists of a primary shaft, multiple discs, and hammer mounting bars, is often driven at 1,800 to 3,600 RPM by a high horsepower motor.

The hardened hammers can be reversed end-to-end and side-to-side, allowing all four cutting edges to be utilized before being replaced. A removable pin, recessed within a hardened steel guard, allows rapid removal of the secondary shafts, hammers, and spacers for servicing.

In addition, all corners of the hammers are generally stepped, offering three times the cutting edges of square-cut hammer tips for greater efficiency.

For general grinding, standard equipment normally consists of alternating heavy and light hammers. However, the type, number, and arrangement of hammers can be varied readily to optimize performance according to material characteristics.

Cylindrical breaker plates typically encircle the upper half of the mill chamber, while bedscreens encircle the lower half. However, when greater throughput of easily reduced materials is desired, a 90-degree section of breaker plate located below the hinged top section of the mill case can be substituted with a 90-degree cylindrical section of bed-screen, increasing total screen area to 270 degrees.

How Do Screen Classifying Cutters Work?

A screen classifying cutter's infeed throat houses a solid-mass rotor comprised of "interconnected parallelograms," each of which holds two opposing cutter tips that shear materials against twin, stationary bed knives at low rotor speeds, and additionally impart high impact at high rotor speeds.

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This cutaway of a screen classifying cutter shows a helical array of staggered, carbide tipped holders.



This closeup of a screen classifying cutter illustrates a helical array of carbide-tipped holders that continuously shear material against twin, stationary bed knives.

The parallelograms and cutter tips, with no frontal gaps between blades, are arranged in staggered helical arrays as standard, which distributes material evenly across the length of the chamber. This utilizes the full bed-screen area efficiently and ensures that all cutter tips and bed knives are subjected to uniform wear for the greatest longevity and lowest maintenance cost. Parallelograms can also be stacked in other configurations to accomplish specific size reduction tasks.

The hardened bed knives can be flipped to utilize both cutting edges, and can be resharpened multiple times, greatly extending service life.

In either case, materials are continuously reduced until particles pass through bedscreens that typically encircle 30° of the bed. Round bedscreens perforations range from 1/32 to 2 in. (0.79 to 51 mm) in diameter, while square perforations can range from 1 to 6 in. (25 to 152 mm), yielding uniform particle sizes.

The cutter tips, which are secured with machine screws for rapid replacement, are usually supplied with tungsten carbide tips as standard, and in several types of stainless steel and tool steel as options.

What Are the Pros & Cons of Hammer Mills?

PROS

- Hammer mills reduce a wide range of friable and fibrous materials into particle sizes from coarse down to 200 mesh, determined by friability of the material.
- Hammer mills offer larger bedscreens (typically 180° to 270°) than screen classifying cutters (typically 30°), processing higher volumes of material, and yielding greater output per horsepower/kilowatt than screen classifying cutters.
- Hammer mills are more effective than screen classifying cutters at fine grinding of <40 mesh.



Ceramic strips before and after being processed by a hammer mill.

Glass before and after being processed by a hammer mill.

CONS

- Since a hammer mill must rotate at high speed to keep the hammers standing at 90° to the rotating shaft, it imparts more energy into the product, producing a greater percentage of undersize particles.
- Many non-friable products, such as soft rubber and certain plastics, cannot be pulverized effectively by a hammer mill.
- Unsuitable for sanitary applications.

What Are the Pros & Cons of Screen Classifying Cutters?

PROS:

- Screen classifying cutters cut as well as impact material at variable speeds, yielding particles more uniform in size and with less dust than hammer mills, and with less heat generation.
- Screen classifying cutters can reduce many semi- and non-friable products, such as rubber and plastics more effectively than hammer mills.
- Screen classifying cutters are more readily modified to accept long, linear strips of material continuously.
- Screen classifying cutters are available in sanitary/washable versions.

CONS:

- Because the bedscreens of screen classifying cutters is significantly smaller than that of hammer mills (typically 30° versus 180° to 270°), they reduce significantly less material/hr. than a hammer mill of equivalent rotor length.



Wood chips before and after being processed by a screen classifying cutter.

Carbon fiber before and after being processed by a screen classifying cutter.



Both hammer mills and screen classifying cutters employ bed screens with apertures through which particles of the desired maximum size exit the milling chamber.

Matching Machines to Applications

Hammer mills excel at high volume size reduction of friable materials when undersize particles and dust are acceptable.

Screen classifying cutters, which cut as well as impact material at variable speeds, offer greater particle size control with fewer fines, and the ability to reduce a variety of semi- and non-friable materials, in addition to friable materials.

Both machines offer extreme durability and excel at medium (8-40 mesh) and coarse (4-8 mesh) grinding, and coarse reduction (>4 mesh), of fibrous materials, large agglomerates, crystals, and flakes, while screen classifying cutters offer incremental advantages when reducing granules,

resins, abrasives, plastic regrind, wood, metal powders, rubber, spices, and grains.

When the requirements of a given application fall squarely within the capabilities of one machine, the above generalizations may help determine which machine should be quoted.

More often, however, differences in the performance of each machine will vary according to the shape, size, bulk density, friability, and required throughput of the user's actual material, making the case for side-by-side lab testing of both machines.

		MATERIAL REQUIREMENTS										EQUIPMENT REQUIREMENTS									
		FIBROUS MATERIALS POWDERS	CRYSTALS FLAKES	LARGE AGGLOMERATES GRANULES	ABRASIVE MATERIALS RESINS	PLASTIC REGRIND	METAL POWDERS WOOD	RUBBER	SPICES	GRAINS	COARSE GRINDING (>40 MESH)	BULK REDUCTION (4-8 MESH)	CONTROL LABLE SIZING	SANITARY DESIGN	HIGH THROUGHPUT	CLASSIFICATION	MAINTENANCE	DURABILITY			
	Excellent																				
	Fair																				
	Good																				
	Poor																				

Steve Knauth is marketing & technical manager at Munson Machinery Co. Inc. (Utica, NY) Established in 1823, Munson Machinery is a world leader in mixers, blenders, and size reduction equipment for bulk solids materials. Munson offers 17 high-performance equipment lines, each with numerous models to meet specialized requirements in the chemical, pharmaceutical, nutritional, food, coffee/tea, refractories, powder metal, and other industries. For more information, call 315-797-0090 or visit munsonmachinery.com.

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