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High-performance pulverizers for Europe

With the acquisition of the American company Reduction Engineering Scheer Inc. in Kent, Ohio in October 2015 by Maag Pump Systems AG, the Swiss company has added pulverizers to the product portfolio of the Maag group of companies. Until now that included melt pumps, melt filtration systems and pelletizing technology (strand and underwater pelletizing). Since mid of 2016 all sales- and service activities of Reduction Pulverizing Systems for Europe, Middle East and Africa (EMEA) are located at the site of Maag Automatik GmbH in Grossostheim, near Frankfurt (Germany). Along with establishing a dedicated Business Development team for the product line, a special testing room for pulverizers was set up in the Technical Center in Grossostheim, which is currently equipped with two machines of different sizes. A lab pulverizer type REX tech can be used for basic tests or to produce small sample quantities with little effort. A pulverizing system type RE 85XLP can be used to conduct tests under production conditions.

Through know-how transfer across different departments into the already existing test and lab infrastructure at the Maag Automatik GmbH site, the company as well as existing and potential customers benefit from many years of existing experience in plastics processing (photo 1). This combined knowledge allows professional preparation, execution and documentation of the trial run based on individual customer requirements.

„By focusing our activities on pulverizers as a product with a special market approach we have created the best possible conditions for supporting our customer out of the site in Grossostheim. Our network of branch offices and representatives of the Maag Group in Europe enables us to develop the respective markets more intensively and further expand our presence," notes Alexander Datzinger, Business Development Manager Pulverizer at Maag Automatik GmbH. Local warehousing of the most common wear- and spare parts shorten delivery times with economical shipping rates throughout Europe. Retrofit kits, which allow the use of the patented Disposable Discs on all existing pulverizers from Reduction Engineering built to date, are available from stock and can increase rates from 15-20% with reduced maintenance cost.

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Particle size distribution is a key factor for efficient Rotational Molding

The structure of the powder, in particular the individual particle size distribution for the respective application, remains one of the key factors in Rotational Molding - besides the Peak Internal Air Temperature (PIAT), the rotational speed as well as heating and cooling times of the mold(s). The target is a maximum particle size of either 500 or 600 μ and a specific distribution within this range based on the application. The finer fraction of the powder melts first on the hot mold surface and forms of a compact and smooth outer layer, whereas the coarser portion of the powder builds the supporting structure and defines the wall thickness of the finished part. The ratio between fine and course particles can be adapted for the particular application by adjusting the process parameters accordingly. A systematic trial program and experience in process and application engineering lead to the proper specification of the required powder properties. Standardized testing and measurement methods, e.g. screen analysis, flow characteristics and bulk density are used to define the quality of the produced powders and will give a good understanding of the expected characteristics during the Rotational Molding process.

Long standing expertise in pulverizing technology

Founded in 1992 Kent/Ohio based Reduction Engineering Inc. developed and manufactured its first pulverizers in close cooperation with local Rotational Molding companies with the aim of improving the available technology for pulverizing at that time. Constant development and improvements over time result in the current product portfolio with of four different types of pulverizers with different sizes. Up to now more than 800 Reduction Engineering pulverizers are in operation worldwide.

Lean Design for maximum efficiency

As simple as the general principle of an attrition mill appears to be, the details of the design of certain technical components are crucial to the overall performance of the pulverizer itself.

The core component of the pulverizer is the mill chamber which is horizontally orientated in order to eliminate the influence of gravity on distribution of the pellets and powder inside the mill thus avoiding the uneven wear pattern over the pulverizer discs which can be consequences of a vertical arrangement. The mill chamber holds two milling discs – the upper, stationary, and the rotating lower disc which is attached to a balanced flywheel and shaft assembly connected to the main drive via pulleys and V-belts. The motor is mounted next to the mill chamber and easy to

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maintain and service. The upper, stationary, disc is connected to the hinged lid of the mill chamber and can be cooled with chilled water if necessary. The gap between the rotating and stationary disc can easily be adjusted without opening the mill housing using Push- and Pull rods and checked through inspection ports at the side-wall of the mill. The raw material, mainly granules or regrind chips, is conveyed into the feed-hopper by a hopper loader or feed screw. From there, the material is transferred into the center of mill chamber through the inlet opening and the stationary disc by a vibratory feed-tray. The feed-rate is controlled by the PLC of the pulverizer and automatically adjusted depending on the temperature conditions in the mill and the motor load of the mill drive. From there the material passes centrifugally and evenly through the conical reducing gap between the milling discs and is progressively reduced to the desired size. After passing the discs the powder is conveyed out of the mill housing to a cyclone mounted on top of the mezzanine. The air blower performing the conveying also cools the mill by drawing ambient air into the system through the mill feed inlet. The powder is separated from the air inside the cyclone and then passes through a rotary valve into the sifter unit which has several screening decks depending on the capacity of the mill. "Good" material, passing the screen, is discharged whereas oversized material larger than the mesh size of the screen inserts gets fed back into the mill for re-processing. The final product can be packed directly in Octabins or bags after it leaves the mill or conveyed to a bagging station or intermediate silo.

Universal, flexible and service-friendly

Reduction pulverizers can be used for processing of almost all polymers including materials like rubber, materials which plasticize at low temperatures or are sensitive to shear. Besides using ambient air as the cooling media for the pulverizing process, liquid Nitrogen can be used to cool down the material in a separate unit prior to the pulverizer, as well as the machine itself during the pulverizing process.

In addition to the process of cooling the design of the milling discs plays an integral role to the performance of the pulverizer. The geometric layout and the arrangement of teeth on the disc are the main factor. They determine the size of particles and their distribution, the milling efficiency and the level of heat produced - which should be kept down to a minimum to allow higher throughput rates. To meet all those requirements Reduction Engineering has developed multiple disc designs for commodity polymers to very special applications. They also can be offered in different steel grades to accommodate, for example, abrasive wear due to the polymers themselves or their fillers.

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In order to eliminate the time- and cost consuming re-sharpening process for pulverizer discs, Reduction Engineering has introduced the patented Disposable Disc system at the beginning of 2011. Instead sending off the discs after removal to be reground as normally the case in the past, Disposable Discs simply get replaced by new ones, thus saving costs for transport and grinding service. The discs are only 8 mm thick and weigh 6 kg. Compared to the discs previously used, which can weigh 25 kg or more each, transport costs are significantly reduced. Thus a set of disposable discs can be send quickly and effectively by parcel service if necessary. The low weight also improves handling during installation and removal and reduces conversion time about a third. The opening that passes through the center of the disc is 40% larger in the Disposable Disc design which results in a significantly higher air flow, which improves cooling of the milling chamber and results in increased throughput rates compared to conventional disc design.

Special retrofit kits can be used to convert existing Reduction Engineering pulverizers to the Disposable Disc technology.

Other important process parameters besides the proper disc configuration are the gap size between the discs, feed-rate of the granules/chips, temperature inside the mill chamber, vacuum value in the material conveying pipes (monitored by the PLC) and last but not least the mesh size of the screens in the sifter unit.

Operator friendly control concept

Flexibility and ease of operation were on the top of the agenda when developing the control concept. The PLC is equipped with a touch screen display which is more or less self-explaining and clearly shows all necessary parameters as well as visualization of the process on the main operator page. Critical process parameters as well as minimum and maximum values of the integrated safety system are password protected and can only be changed by authorized employees. Teleservice and troubleshooting from a remote location is possible via an integrated Ethernet connection.

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<p>Photo: 1</p>		<p>Application Technology Department for Reduction Pulverizers. I. to r. Alexander Datzinger, Business Development Manager Pulverizer, Hans-Walter Hefner, Manager of the Maag-Automatik Technical Center, Frank Glöckner, Manager of Process Technology and Maximilian Höfling, Technical Support Pulverizer</p>
<p>2</p>		<p>The product portfolio of Reduction Pulverizing Systems ranges from a small lab Pulverizer REX tech up to a high performance Dual Mill REX duo^{PLUS} with rates exceeding 1.000 kg/h. Pulverizing System RE 85XLP shown.</p>
<p>3</p>		<p>One of the main characteristics of the Reduction pulverizers is the horizontally orientated mill chamber with the lower, rotating disc connected to the main drive and the upper, stationary disc connected to the hinged lid of the mill chamber.</p>
<p>4</p>		<p>Disposable Disc Retrofit Kit for installation in existing Reduction Engineering pulverizers.</p>

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