

**COMPOUNDING, RECYCLING.** Compounding engineering focuses on rendering the compounding process more economical. Various approaches are presented for improving the economics, such as the use of more energy-efficient equipment, greater system availability and enhanced throughput.

## Efficiency as Benchmark

The machine and plant manufacturers offer versatile and powerful compounding systems. In order to meet growing demands for economy, energy-efficient and flexible systems are particularly in demand. Shorter cleaning and setup times lead to increased flexibility and installation availability. Also concepts for increasing the flow contribute to the cost of the treatment process. At the same time, the efficient use of raw materials is increasingly important. As a result, low power consumption and high productivity and flexibility play a major role in recycling, too.

### Coperion Optimized Feed

Coperion GmbH, Stuttgart, Germany, have boosted the throughput of their twin-screw extruders with its innovative feed enhancement technology (FET). A vacuum applied to a porous, gas-permeable wall section in the feeding zone sucks moisture and air out of the feed material. This compacting of the loose material doubles or trebles the material feeding capacity. The optimized feeding zone can be fitted to both the ZSK twin-screw extruder and the ZS-B twin-screw side feeder. Borealis AG, Vienna, Austria, has already successfully used this new technology in the production of talcum-filled compounds in pilot plants at its Innovation Headquarters in Linz, Austria. Plastic melts can be degassed with the ZS-EC twin-screw side degassing unit. The side de-

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**Fig. 1. MP 450 melt pump with a throughput for polyolefins of 65 t/h**

(photo: Coperion)

gassing unit can be retrofitted to existing machines and the standard models are designed for an absolute vacuum of 50 mbar. Lower degassing pressures are available on request. The UG 1250 underwater pelletizer is capable of processing more than 100 t/h of polyethylene. The die plate has a mean cutting diameter and contains up to 11,000 die holes. The UG is wear-protected and has hydraulic controls. It allows water flow rates of up to 1,500 m<sup>2</sup>/h. The Coperion UG 750 also delivers a solution that is specifically designed for pelletizing thermoplastic elastomers (TPE). The optimized water flow avoids turbulence and prevents collisions between cut, sticky TPE pellets. When it comes to polyolefin processing, the MP 450 polyolefin melt pump (**Fig. 1**) can manage up to 65 t/h. The involute gears of the melt pump run on hydrodynamic plain bearings, lubricated by the polymer melt. The process-dependent design factors of the melt pumps are calculated and specified for each product and project.

► **Hall 14, booth B33**

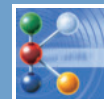
### Brabender Compounding on a Laboratory Scale

With its Plasti-Corder Brabender Lab-Station and Lab-Station EC torque rheometers, Brabender GmbH & Co. KG, Duisburg, Germany, offers flexible compounding systems on a laboratory scale. Both torque rheometers, in combination with the universal docking station, can operate kneaders and single-screw and twin-screw extruders. While the Plasti-Corder Lab-Station, rated at 16 kW, is designed for speeds ranging from 0.2 to 350 min<sup>-1</sup> and a maximum torque of 400 Nm, the Plasti-Corder Lab-Station EC is configured for lower speed ranges. By virtue of their modularity, the Plasti-Corder Lab-Station and Lab-Station EC allow the operation of small single-screw extruders, conical twin-screw extruders and laboratory

kneaders. Larger single-screw extruders and kneaders and co-rotating twin-screw extruders can be used with the Plasti-Corder Lab-Station. In addition to the Plasti-Corder Lab-Station series, the Brabender Plastograph is a benchtop version of a torque rheometer which acts as a measuring drive for small single-screw extruders, conical twin-screw extruders and small laboratory kneaders. Additionally, in the KEDSE 12/36 and KEDSE 20/40 lab compounding units (**Fig. 2**), Brabender has added two new compact, miniature twin-screw extruders with screw diameters of 12 and 20 mm and barrel lengths of 36 D and 40 D to its product portfolio. Both processing units have a tiltable barrel which enables the compounding steps to be assessed visually. Screw removal and barrel cleaning are also easier as a result. By virtue of the screws' modularity and the metering and venting ports, these laboratory extruders offer the



**Fig. 2. Laboratory KEDSE 20/40 twin-screw extruder** (photo: Brabender)



standard features of twin-screw extruders. The laboratory extruders are of particular interest to the plastics and pharmaceutical industries in the processing of tiny quantities of R&D materials.

► Hall 10, booth A22

### KraussMaffei Berstorff Energy-efficient Compounding

KraussMaffei Berstorff GmbH, Hanover, Germany, offers a modular compounding installation which features various measures to increase energy efficiency and reduce setup and cleaning times. Studies by KraussMaffei Berstorff show that using a large extruder at medium speed can save more energy than operating a small extruder at high speed. The compounder therefore features a ZE 60 A UTX twin-screw extruder (Fig. 3). The extruder has a maximum speed of 600 min<sup>-1</sup>. The powertrain and extruder heating system have been optimized to further boost energy efficiency. Using a larger extruder at lower speeds generates a larger free volume in the processing section. This reduces mechanical stress on the material and wear on screw and barrel elements. To shorten setup and cleaning times during a product change, KraussMaffei Berstorff offers the entire compounding installation in an "EasyClean" design. Feed hoppers, material conduits lines to the metering devices and silos, and other connections are connected with clamp joints and clamped flange connections and can

### Dinnissen Rapid Material Change

So that plastics processors can perform a simple change of color and ingredients, Dinnissen BV, Sevenum, Netherlands, has developed the hygienic compact containment concept. This enables product changes to be made without the need for costly cleaning of the entire process line. The mixing systems are cleaned fully automatically with compressed air provided by compressed air tanks. An interval switch for the cleaning air ensures that the individual components are cleaned in the proper sequence. Another advantage of this dry cleaning concept is that powdered materials do not clump or caking. The mixers are readily accessible and support fast and thorough cleaning. The entire mixing system is designed to be dust-free. This concept shortens cleaning times during product changes. In addition, the combination of dual-shaft Pegasus mixer (Fig. 4) and an energy control program has been optimized for further energy savings.

► Hall 10, booth B26

be loosened without tools. Special sealing profiles ensure reliable tightness during the production process. For frequent product changes, a Mixomat can also be used. This device combines compounding functions such as conveying, weighing and mixing and features a large cleaning opening. A further component of the compounder is the central dust extraction system.

► Hall 15, booth C24



Fig. 3. The ZE 60 A UTX twin-screw extruder is equipped with active and passive measures to increase energy efficiency (photo: KraussMaffei Berstorff)

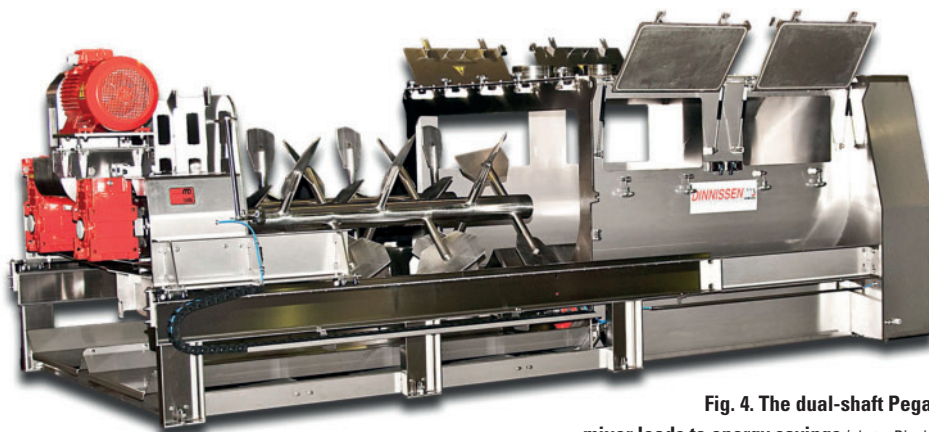


Fig. 4. The dual-shaft Pegasus mixer leads to energy savings (photo: Dinnissen)



Fig. 5. Installation for the production of PVC cable compounds (photo: Buss)

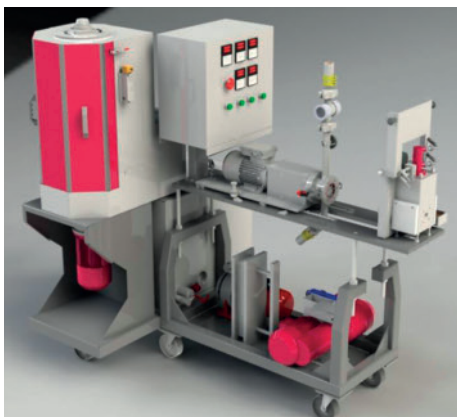
### Buss Cable Compounds as a Reference

Buss AG, Pratteln, Switzerland, has delivered the world's largest compounder for the production of PVC cable compounds to Kabelbedrijven Draka Nederland BV, Emmen, Netherlands (Fig. 5). Maximum throughput varies from 4,500 to 5,000 kg/h according to formulation. The compounder can process eight different formulations with minimal product changeover times and with no modification outlay. It features a heater-cooler pre-mixer and gravimetric feeding into the high-performance mixer. The four-flight

quantec 110 EV co-kneader has a kneader shaft diameter of 110 mm and a processing length of 15 D. The enlarged intake zone of the co-kneader accommodates even the largest filler volumes. The configuration of the mixing and kneading screw ensures homogeneous mixing of the material. After mixing, the PVC compound is transferred to a single-screw melt extruder which generates the pressure for subsequent pelletization. This is followed either by dry or water-mist pelletizing.

► Hall 16, booth A59





**Fig. 6. Laboratory underwater pelletizer conceived for material development and capable of throughputs ranging from 1 to 100 kg/h**  
(photo: Econ)

**Econ**  
**Pelletizing for the Lab**

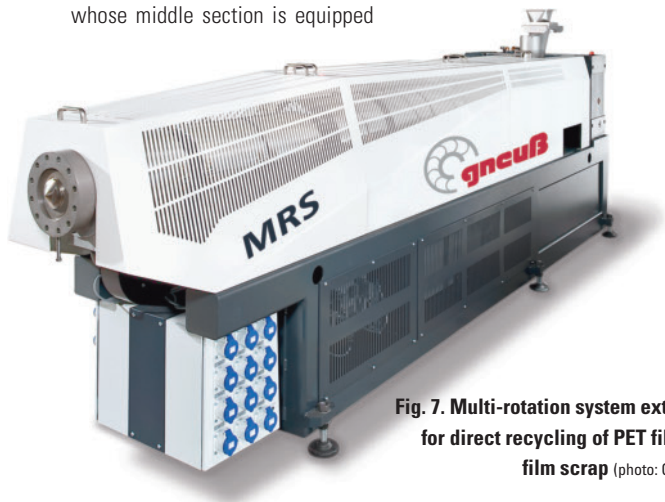
In its EUP 50 (Fig. 6), Econ GmbH, Traun, Austria, has developed a new laboratory underwater pelletizer. The pelletizer boasts integrated die-plate thermal insulation for easy handling, product diversity and good product quality. The pelletizer's compact centrifugal dryer can be cleaned in a few minutes. The pelletizer can be used to pelletize all thermoplastics, and elastomers and silicones. It has a throughput of 1 to 100 kg/h and is thus ideal for material developments, particularly in the plastics industry. The underwater pelletizer also lends itself to frequent material or color changes, such as the production of small amounts, e.g. in compounding and masterbatch operations.

► Hall 9, booth C55

**Gneuss**  
**All-in-One System for PET Waste**

Back at K2007, Gneuss Kunststofftechnik GmbH, Bad Oeynhausen, Germany, presented the multi-rotation system (MRS). The system serves in conjunction with a cutter-feeder combination, the RSFgenius filtration system and the VIS online viscometer as the first all-in-one system for direct recycling of PET fiber and film scrap. The installation has a throughput of 500 to 700 kg/h. The PET can be processed economically, without pre-drying. The MRS extruder (Fig. 7) is a single-screw extruder, whose middle section is equipped

with a rotating drum. Arranged along the axis of rotation inside the drum are eight barrel bores with recessed screw conveyors. The screw conveyors rotate counter to the direction of the drum and are driven by a gear ring. To ensure that melt flows into the barrels, their outer region is opened some 30%. Advantages of this system include simple temperature control of the drum, and the large surface area, which makes it possible to achieve a high degassing effi-



**Fig. 7. Multi-rotation system extruder for direct recycling of PET fiber or film scrap** (photo: Gneuss)

ciency. The multi-screw drum has now been certified by the U.S. Food and Drug Administration for compounding post-consumer goods to regrind for food contact. Additionally, the filter area of the RSFgenius melt filter models has been increased by optimizing the melt channels. As a result, it will be possible in the future to use the next-smaller filter model, without sacrificing extrusion performance. Together with an improved heater design, the overall outcome is an energy-efficient filtration system.

► Hall 9, booth A38



**Fig. 8. Compact in-line crystallizer with a Vacurema for compounding bottle regrind** (photo: Erema)

**Erema**  
**Progress in PET Recycling**

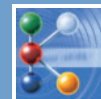
An upgrade to the TVE extrusion system of the Erema TVEplus recycling line from Erema Engineering Recycling Maschinen und Anlagen GmbH, Ansfelden/Linz, Austria, makes for more efficient and economical recycling of plastics, says the manufacturer. The recycling installations feature the usual material flow: Material is conveyed to the installation on a conveyor belt and is then shredded and transferred to the compounding extruder. Before the extrudate is discharged, the melt is degassed and filtered. The extrudate can then be pelletized and dried. Melt filters are now placed ahead of the degassing system, with an interposed mixing section, and this arrangement allows even difficult waste materials, such as multi-layer and printed packaging films, to be pelletized. A compact crystallizer developed for the Vacurema technology (Fig. 8) keeps the acetaldehyde content of PET pellets below 1 ppm. Consequently, recycled PET bottle flakes compounded using Vacurema technology can be approved for renewed contact with food. To reduce energy demand, Erema recycling installations can be equipped with the new ecoSAVE

technology. In addition, 3S, a subsidiary of Erema, offers laser-clad armored screws up to 6 m long and screw diameters of 50 to 500 mm. The Lasex method employed achieves hardness values of 57 HRC. Furthermore, at K2010, 3S will present wear-resistant barrels for conical twin-screw extruders, along with a new wear-measurement system.

► Hall 9, booth C05

**Hellweg**  
**Small Lump Granulator**

For small start-up lumps, Hellweg Maschinenbau GmbH & Co. KG, Roetgen, Germany, offers a small lump granulator for single-stage shredding. A particular feature of the granulator is that the material is peeled off the start-up lump, and so blocking of the rotor prevented (Fig. 9). The rotor has four blades that can be used on both sides and resharpened many times. The rotor has a diameter of 260 mm and an effective width of 240 mm. As a result, given a screen hole diameter of 5 to 12 mm and a drive power of 15 kW,



throughput rates of 80 to 180 kg/h are achieved. The granulator is suitable for polyolefins and many engineering plastics. The regrind is homogeneous and has a low dust content.

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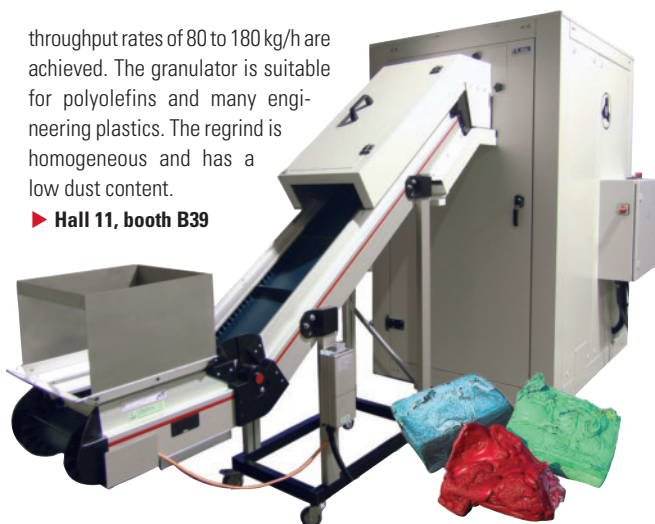


Fig. 9. Lump granulator for shredding start-up lumps (photo: Hellweg)

### Herbold Saving Energy while Shredding

By using stuffing screws, Herbold Meckesheim GmbH, Meckesheim, Germany, can force-feed the granulators in its SB series. This increases the throughput of the granulator and saves on energy (Fig. 10). HB series granulators are used for shredding whole bales of film, foamed plastics and injection molded and blow molded parts in a single step. For highly contaminated plastic waste, such as agricultural film, Herbold has developed the HGM wet shredder. This

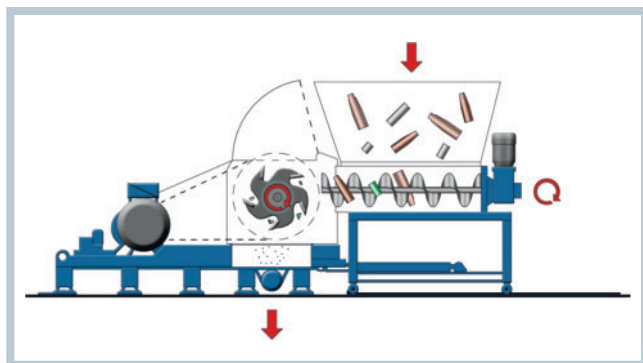


Fig. 10. Energy-saving concept (photo: Herbold)

reduces the wear problems that beset agricultural-film cleaning installations and increases their efficiency. The Herbold product portfolio further includes a "plastcompactor" for producing free-flowing agglomerates, and newly developed pulverizers.

► Hall 9, booth B42

### Rodent Recycling Energy-Saving Newcomer

Rodent Recycling Machinery GmbH, Pucking, Austria, was founded in 2009 and is a member of KUAG Group, Pucking. Recycling installations from Rodent Recycling offer lower energy consumption due to a rethink of the cutting geometry in the shredder, the optimized screw and improved material feeding. The installation's water-cooled die face pelletizer has also been optimized, so that even materials with high MFR values can be processed. Subsequent drying is performed by a dryer, without centrifuge.

► Hall 9, booth D73

### Kreyenborg Optimized Wear Protection

A melt filter for the direct manufacture of PET fibers, films and packaging tape will be presented by Kreyenborg GmbH, Münster, Germany, with its K-SWE-4K/75 RS. This filter offers a large filtration area with continuous processing. It is thus suitable for compounding processes involving high contaminant levels and high process engineering requirements. In the field pelletization, the wear protection of the underwater pelletizer of Bruck-

due to quick-change wear sleeves in the water box and in the pelletizer's inlet and outlet. The rotor of the downstream dryer, too, no longer needs to be totally replaced when worn, because individual components can be replaced. The pelletizer's automatic mode of operation also eliminates strand breaks that occur in brittle materials. A larger version of the pelletizer can be used for pelletizing EPS micro pellets. Kreyenborg Plant Tech-



Fig. 11. Infrared rotary kiln for batch drying and crystallization (photo: Kreyenborg Plant Technology)

mann Kreyenborg Granulierteknik GmbH, Münster, has been improved. Wear costs, especially in the pelletization of glass fiber-reinforced compounds, can be reduced through the use of wear-protected blades and the specially coated die plate. In addition, installation availability is increased

nology GmbH Co. & KG, Senden, Germany, will be exhibiting a newly developed, discontinuous infrared rotary kiln (Fig. 11). The rotary kiln utilizes short-wave infrared radiation and is particularly suitable for drying and crystallizing masterbatches.

► Hall 9, booth A44, A48 and A55

### M-A-S Extruder with Direct Drive

Constant maximum torque across the entire speed range can be achieved with the conical co-rotating twin-screw extruders of Maschinen und Anlagenbau Schulz GmbH (M-A-S), Pucking, Austria, thanks to a torque

drive (Fig. 12). The rugged design allows the extruder to be coupled directly to the distributor drive, creating a closed and torque-rigid power flow. Monitoring the torque with a drive-control unit that switches off →

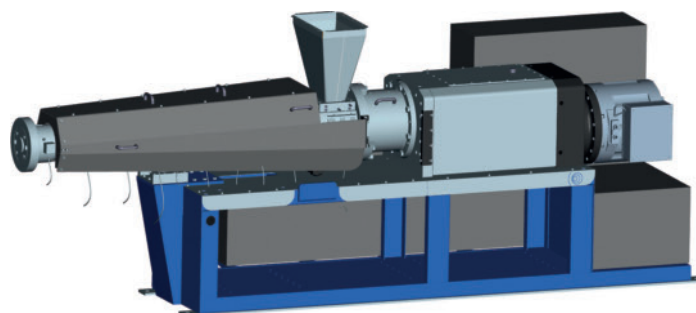


Fig. 12. Co-rotating twin-screw extruder with fitted torque drive (photo: M-A-S)



when overloaded eliminates the need for a coupling. The new drive concept yields a more energy-efficient extruder, which is especially attractive for the processing and recycling of polyethylene terephthalate (PET) and polyolefins and the compounding of wood plastic compounds and materials with low bulk density that must be treated gently.

► Hall 9, booth B56

### Weima Modular Shredder Systems

The modular shredder system from Weima Maschinenbau GmbH, Ilsfeld, Germany, is ideal for shredding start-up lumps, films and hollow bodies. Special ram systems are available as appropriate for start-up lumps, films and hollow bodies. Since the ram systems ensure easy access to the cutting system, quick cleaning and maintenance are possible. The cutting system features a rotor and various sizes and shape of knives.

► Hall 9, booth A59

### Nuga Preliminary Shredding with One Screw

Adding to its patented CentriCut cutting mill concept, Nuga AG Kunststoffschneidmühlen, Balgach, Switzerland, has developed the ConCut single-screw pre-shredder (Fig. 13). The single-screw pre-shredder was developed as a flexible solution for shredding, e.g., bulky parts, start-up lumps, including hot lumps directly at the production site for in-line recycling, as well as for shredding fibers and films, either as a stand-alone

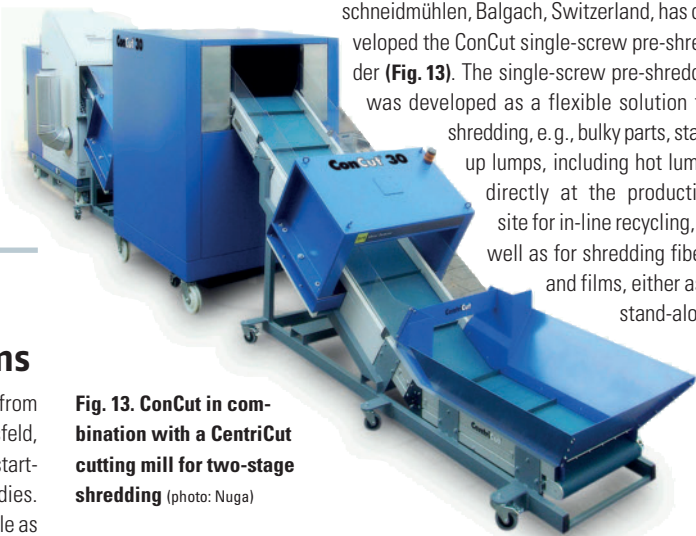


Fig. 13. ConCut in combination with a CentriCut cutting mill for two-stage shredding (photo: Nuga)

solution or in combination with cutting mills for two-stage shredding.

Throughput rates are up to 1,500 kg per hour, depending on the size, installed power capacity of 11 kW to 30 kW max. and the input material to be processed. The hopper and rotor are designed specifically to dovetail with each other for optimum feeding of the material without the need for stuffing devices.

► Hall 9, booth B11

### Starlinger From PET Bottle Flakes to Film

At two booths, Starlinger & Co. GmbH, Vienna, Austria, will display their recycling installations. The recoSTAR universal 65 VAC installation boasts a newly developed feed system. In particular, film, fibers, fabrics and nonwovens can now be recycled with greater reliability and at higher rates. The recoStar PET installations can now recycle PET at a rate of 3,600 kg/h. Also available is a 15,000-liter reactor for increasing the intrinsic viscosity and decontamination by the so-called

solid-state polycondensation principle. Polyolefins, engineering plastics, foamed materials, or PET bottle flakes can be recycled and processed directly by connecting the recycling installation directly to a film extruder (Fig. 14). Thanks to this innovative in-line solution, for example, packaging film for food contact can be made from PET bottle flakes.

► Hall 9, booth D21,  
Hall 16, booth B47



Fig. 14. recoStar basic inline recycling solution (photo: Starlinger)

### Uth Fine-meshing Strainers in the Mixing Line

To enhance the product quality and economics of rubber, silicone and tire manufacture, Uth GmbH, Fulda, Germany, offers innovative fine-mesh straining of finished blends in the mixing line. Where blends are frequently changed, the roll-ex series of extruders can be cleaned quickly and thoroughly. Thanks to its modular design, the roll-ex system can be combined with two-roll feeder, a single-screw extruder or a conical twin-screw extruder. Standard throughput rates range from 70 to 6,000 kg/h.

► Hall 15, booth D41

### Scheer Under a New Banner

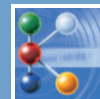
C. F. Scheer & Cie GmbH & Co. KG, Stuttgart, Germany, will be presenting itself for the first time under the new company name of Reduction Engineering GmbH. Its expanded prod-



Fig. 16. This strand pelletizer is offered by Reduction Engineering, the new name for Scheer (photo: Reduction Engineering)

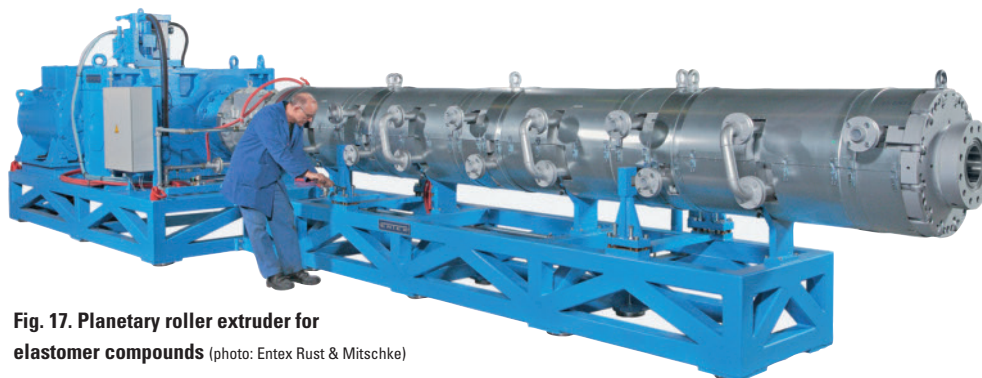
uct portfolio contains new developments in the field of strand pelletization (Fig. 16) and an underwater pelletizer of in-house design with a thermally insulated die plate. Also available are energy-saving powder mills as compact, all-in-one systems with pellet metering, conveying system and classifiers.

► Hall 9, booth E37

**Entex****Planetary Roller Extruder for Elastomer Compounds**

Entex Rust & Mitschke GmbH, Bochum, Germany, has designed a planetary roller extruder (Fig. 17) for compounding elastomers. Unlike the batch process, planetary roller extruders yield homogeneous elastomer compounds combined with a self-cleaning effect and precise temperature control. To this end, the extruder is composed of four rollers in series with a total processing length of 5,600 mm and a pitch circle diameter of 400 mm. An increased tothing width reduces wear and improves service life. In order that the compact installation may achieve throughputs of 6,000 kg/h, it comes with a 1,000-kW motor with appropriate gearing.

► Hall 16, booth A42



**Fig. 17. Planetary roller extruder for elastomer compounds** (photo: Entex Rust & Mitschke)

**Conclusion**

For machinery and equipment makers, the emphasis is on improving efficiency. To this end, they have adopted different approaches. Innovations are primarily to be found in the field of energy efficiency. Other approaches aim for greater plant availability or increased throughput rates. ■

**Florian Puch,**  
Aachen, Germany