One drive is sufficient

New type of mill is reducing costs in the production of powder coating

Thomas Schneider,
Hanau

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Today, powder coatings belong to the preferred varnish systems in a lot of branches of industry. Previous fields of application in the coating of metal surfaces will be extended in the near future by new developments also for other fields. Therefore, the powder coating market is a field with high growth rates and surely a bright future. For the grinding of powder coatings with defined upper particle size limitation a new classifier mill with simplified design was developed.

Basically, powder coatings are most different mixtures of synthetic resins, pigments, fillers and additives. 4 main types can be differed, according to the application of the type of synthetic resin: Epoxy/ Polyester-, (TGIC-)Polyester-, Epoxy- and Polyurethane-powder coatings.

During the production, in the first instance the single recipe-components are pre-mixed in suitable mixer systems before they are plastified to a homogeneous mass by special extrusion aggregates. At the end of the extrusion process, the hot product is exiting via a fishtail die, is then conveyed to a pair of cooling rollers and is here cogged to a wide band. A subsequent cooling conveyor is cooling the product further down to ambient temperatures, before it is pre-crushed on a subsequently installed crusher to so-called "Chips" with a particle size of approx. 5 to 20 mm.

For a further processing of the finished powder coating without problems, a defined fine grinding of those pre-crushed "Chips" is necessary. The fine grinding process is setting the following requirements on the final product and the grinding plant to be used:

- To reach a smooth varnish surface, free from specks, for standard qualities a powder free from oversized particles with a particle size of d99 = 100 µm, resp. for special qualities up to 30 µm (d99), is necessary.
- To obtain a high flowability of the powder when applying, the share of ultra-fine particles < 10 mm has to be minimized.
- For the production of different colours and shades of colours, partly only small amounts of product are processed batch by batch. The grinding plant has therefore to be designed for quick and easy cleaning.

For that reason, for the fine grinding of powder coatings so-called "Classifier Mills" are used, to achieve an exact upper particle size limitation at a maximun steep particle size distribution. With this, a combination of a conventional impact grinding and an air classifying is achieved, which are mutually put together in one machine housing, and are therefore representing an internal grinding/classifying cycle. Normally, the grinding disc as well as the classifier wheel of these machine types are driven separately, to influence the operating conditions for grinding and classifying independently.

One drive for classifier wheel and grinding disc

The new developed impact mill type "CP" of the company Netzsch-Condux, located in Hanau, is working with a clearly simplified conception, without having to renounce the advantages of adjustable operation conditions. The main difference of this new mill design, compared to the classifier-mill-systems that have been on the market so far, is the one-rotor design of the machine with only one drive! Grinding disc and classifier wheel are torsionally strongly connected and are driven by one motor.

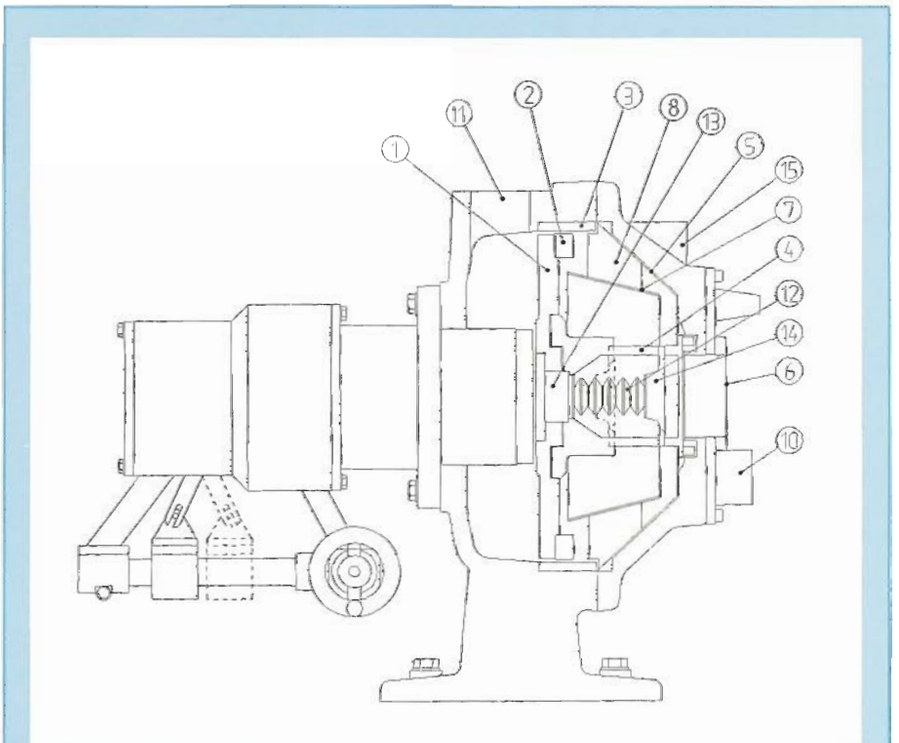

Figure 1: Sectional drawing of new classifier mill type "CP" with just one drive

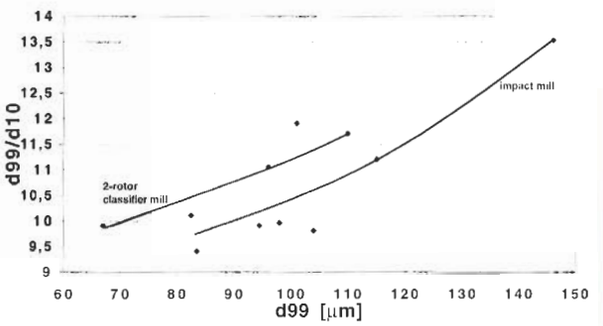

Figure 2: Comparison of particle size distribution between impact mill and conventional 2-rotor classifier mill

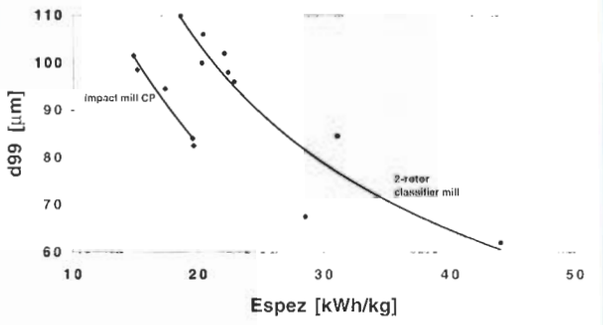

Figure 3: Comparison of specific energy requirement between impact mill and conventional 2-rotor classifier mill

Optimised grinding effects are achieved by the infinitely adjustable speed and the adjustment of the air volume velocity. The radial velocity of the process gas in the classifying area can be changed via an integrated mechanical adjustability of the classifier wheel height – at continuous volume velocity – and thus the separation of the single product particles can be influenced.

On the sectional drawing *(Figure 1)* the function of this new mill can be seen: The beaters (2) are arranged on the horizontally fixed mill rotor (1), they are peripherically surrounded by a grinding track (3). The classifier wheel (4) is on the same shaft as the mill rotor (1) and has an axially slidable bottom (14). This bottom is adjustable from outside during operation by means of the shaft (12) which is also axially slidable and torsionally strongly guided in the drive shaft (13). The process air is fed via the stud (11), the product is fed pneumatically via the stud (10) or gravimetrically via the stud (15). The inner product circulation is guaranteed by the outer (5) and inner (7) guide cone; guide vanes (8) guarantee on optimum oncoming flow to the classifier wheel (4). The ground product is discharged through the fines outlet (6).

Extensive trials carried out with a standard powder coating have shown that with the new Impact Mill type CP the fineness ranges of d99 30 – 100 µm, which are necessary for the powder coating industry, are representable with no problems. In direct comparison with a conventional two-rotor design classifier mill, the new Impact Mill CP shows a clearly steeper particle size distribution, which means a lower share of fines at the same upper particle size fineness. This is clearly illustrated on *Figure 2* – here the ratios of d99/d10 dependent on the upper particle size fineness are shown.

Furthermore, the new mill has a clearly lower power consumption: When using the new Impact Mill CP, only approx. 75 % of the specific energy of a conventional classifier mill is needed, related to a final size of d99 = 100 µm for an epoxy-powder coating. Also this comparison of the two mill-systems is further illustrated in the diagram of *Figure 3*.

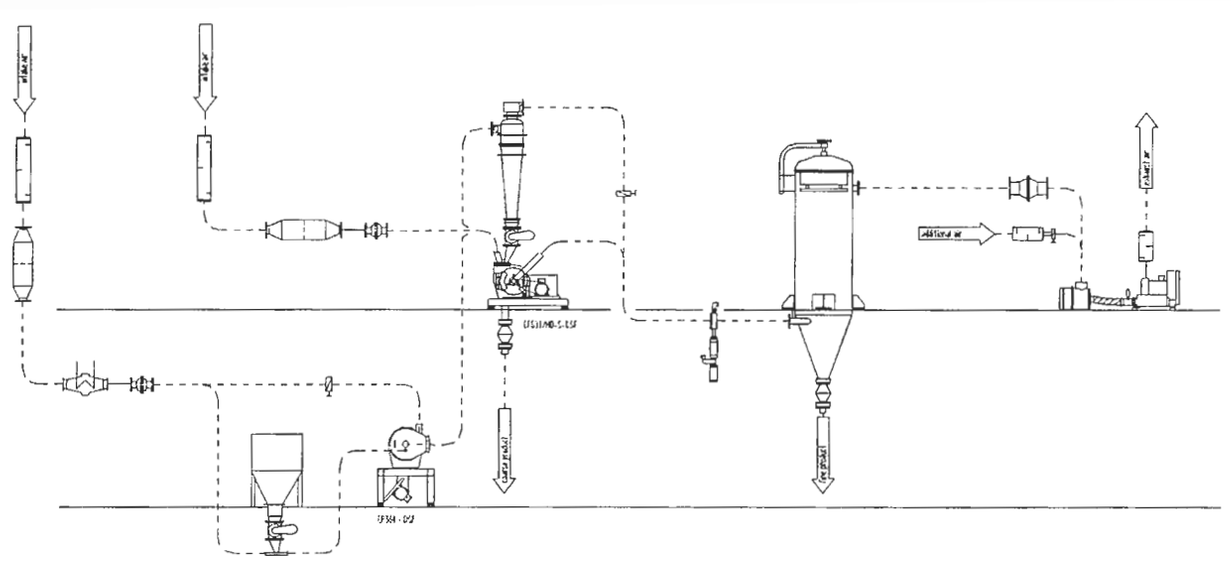

Figure 4: Flowchart of a complete milling- and classifying system

The assembling of such a grinding plant is usually in pressure shock resistant design up to 10 bar (g). After the grinding the product is discharged in product containers via cyclone separators and the process air with contents of fine dust is filtered in automatical filter units.

In case of extreme requirements concerning the final product, a following classifying step is necessary, in order to reduce the fine particles < 10 µm as far as possible. To achieve at the same time the highest possible output of final product, for the subsequent classifying of the ground powder coating another product of Netzsch-Condux Mahltechnik GmbH can be used: The High Efficiency Classifier type CFS/HD-S. For example: With this classifier, a reduction of the fines < 10 µm from 12 % down to 3 % is possible, at a product loss of totally only 7,8%.

Hereinafter, a complete grinding and classifying plant for powder coating is described, mainly consisting of the Impact Mill type CP and the High-Efficiency Classifier type CFS/HD-S (*Figure 4*). The pre-crushed powder-coating chips are fed from a product container placed on the ground via an injector system into the Impact Mill. After the grinding, the product is pneumatically conveyed – via the process air – to a high-efficiency cyclone separator. From there, the powder is directly conveyed to the Classifier CFS/HD-S with a rotary valve underneath, which is at the same time serving as air seal. After the separation, the undesired share of fines is extracted in the subsequently installed dust filter. The "coarse product" resp. final product is discharged underneath of the Classifier via a double flap valve.

NETZSCH-CONDUX
Mahltechnik GmbH
Rodenbacher Chaussee 1
D-63457 Hanau/Wolfgang
Telefon 0 61 81/5 06-01
Telefax 0 61 81/57 12 70
e-mail: ncx@netzsch.com
http://www.netzsch.com/gd

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