ThyssenKrupp Fördertechnik successful on the field of anode grinding

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In 2003 the German ThyssenKrupp Fördertechnik was awarded the order by a well-known Dutch aluminium product manufacturer to build a grinding and dressing plant for petrol coke and anode residues. The plant concept was developed and realised in close co-operation with the customer and the plant, including control systems and electricity, could be erected and put into operation by ThyssenKrupp Fördertechnik within a short construction period.

At the very beginning of the job the engineers took on a real challenge of designing the grinding plant very space-saving to erect it between resident buildings. Besides, the erection area was at the waterfront, so a "pilling" of the foundations became necessary, in order to reach maximum stability. The plant building itself is a steel construction with roof and walls fitted with sheets with trapezoidal corrugations from the first building platform. The basement was executed in concrete type of construction, due to static and acoustical reasons.
The products manufactured here make the basis of anode production for the aluminium industry. The raw material is processed in a way, thus a fines output of 8.0 t/h at a fineness of min. 4,400 cm²/g (Blaine) is gained. The essential of the plant is an air-swept tube mill, combined with several screens, separators, analysing devices, filters, apron feeders and conveyors to the storage and further processing systems (Fig. 1). It is driven by specially fitted automatic controlling and electric equipment, which make handling and observation by means of an integrated visualisation system very easy and comfortable.

Process description (Fig. 2)

In the beginning of the process the raw material is transported by screw conveyors to the pre-silos of the grinding system. One of these Pre-silos serves as storage for petroleum coke 0-8 mm and anode residues 0-16 mm with max. 0.5 % residual moisture, while the second silo is used for storing the fines with a particle size of 0-1 mm.
Both of the storages are steel plate constructions with in- and outlet openings as well as various installations to support the flow properties and to avoid material disintegration.
The level control is affected by means of load cells and measuring probes.

Both of the silo plants are equipped with manually operated shut-off valves. The second pre-silo is mounted with two additional outlets - one for material homogenization with discharge screw and bucket elevator, the other one for material transport to the tube mill. The dosed discharge from the silos takes place using proportioning devices, which are coupled to a flow meter for measuring the returned material quantity. The optimum mill filling degree is ensured by means of an electro-acoustic mill feed control (electric ear). The feed back is effected according to the formula "fresh material = constant", thus always ensuring an optimum feed material supply from the silos to the downstream tube mill.
After the proportioning devices the discharge material is led by means of guide chutes directly to the tube mill, where it is ground to finished material fineness. There is an additional possibility of feeding a partial flow of material 0-1 mm after the proportioning device of the fines silo to the riser duct after the tube mill, in order to achieve an optimum material feed to the separator.

The tube mill, the "heart" of the plant, is designed as "air swept grinding system" with a diameter of 2.4 m at a grinding path length of 6.5 m (Fig. 3). The mill interior is provided with a wear lining, consisting of lifting plates and corrugated liners. By the rotational movement of the tube mill the feed material is reduced between this shell lining and the grinding media, which are sorted according to quantities and diameters of approximately 20-60 mm. The ground material is removed from the mill by means of a discharge wall with slots for size limitation and to protect the grinding media from being discharged with the material. In support of the grinding process, floating material is "swept" off the mill by air from the system fan and then separated in the following separator and cyclone plant. A control flap, arranged before the tube, is regulating the air flow. The mill as well as the separator is dedusted by a fabric filter, while auxiliary devices, silo plants, proportioning devices etc. are dedusted by a separate filter plant.
A continuous movement of the mill is provided by an intermediate gear pinion drive, comprising a main gear with connected auxiliary drive. The auxiliary drive is used for positioning during repair work at the tube. In order to avoid friction during the starting phase, the mill is supported on slide bearings with oil circulating and starting lubrication.

After being ground the material enters pneumatically a dynamic separator (Fig. 4) via an outlet tube bend with riser duct. Here the fines are separated from the coarse material. The dynamic separator consists of an external casing, an internal cone for air guidance as well as the head casing with vane ring and basket rotor. Inner parts like internal cone and case walls are equipped with wear lining of aluminium oxide.

The vane ring guides the air within the separator, while the basket rotor is provided for discharging the finished from the coarse material. The coarse material is returned to the mill - via a flow meter - for further grinding, until it shows the required fineness. The separated fines are discharged from the conveying air flow of the cyclone plant and subsequently led to the filter plant.
The analysis and control of the finished product after cyclone and filter plant is done by means of an "Inline-Particle Size Analyser". The results of each analysis are used to adjust the separator and to correct the material fineness, which is possible by increasing or reducing the speed of the rotor. Analysing as well as sampling is effected in presettable intervals.

Sum up:

The plant is continually in operation since 2003, when operating results and guaranteed undertakings were exceeded with regard to the finished material capacity as well as the fineness, so that the customer accepted the plant directly after the testing period. Compared to similar plants in the same factory, a specifically higher output was achieved, resulting in a more efficient production and therefore an increased performance.
It has been no worth mentioning failures or down-times in the starting or operating phase, thus the plant prove itself and confirmed its reliability over the past three years. The high degree of automation and system control resulted in a cost reduction, which consequently raise the customer's competitiveness.
With this plant ThyssenKrupp Fördertechnik proved to be a competent and reliable partner in the field of petroleum coke and anode grinding.

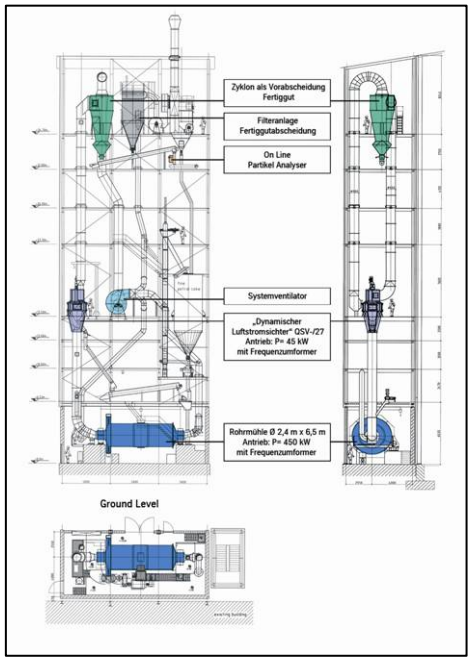

Bild 1: Luftstrommahlanlage zur Anodenvermahlung, von ThyssenKrupp Fördertechnik errichtet

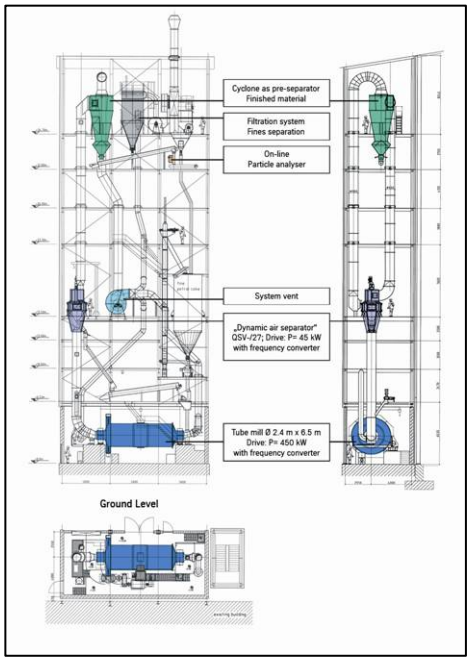

Fig. 1: Air- swept grinding plant for anode grinding, built by ThyssenKrupp Fördertechnik

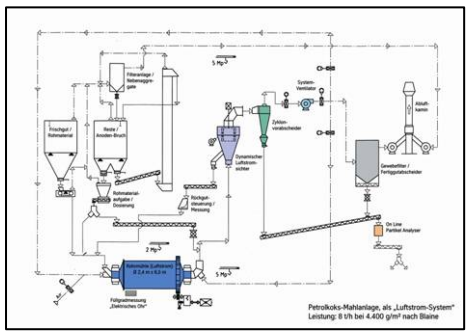

Bild 2: Fließschema der Anlage

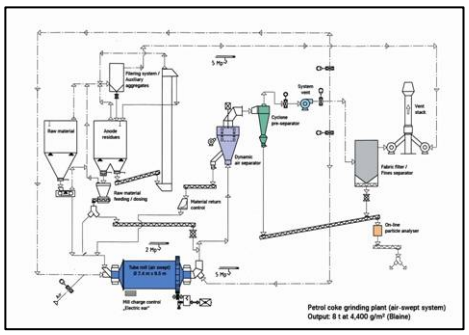

Fig. 2: Flow sheet of the plant

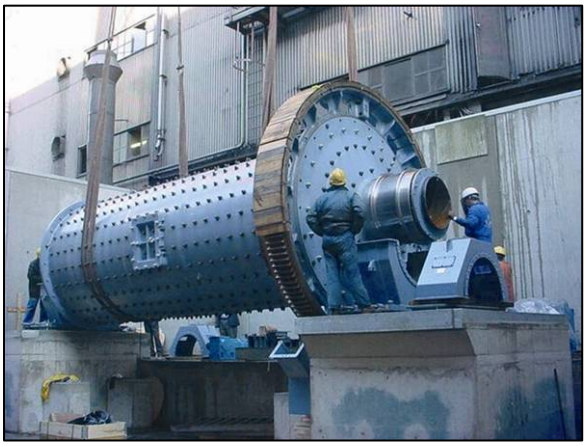

Bild 3: Die Luftstrommühle während der Installation

Fig. 3: The tube mill during installation

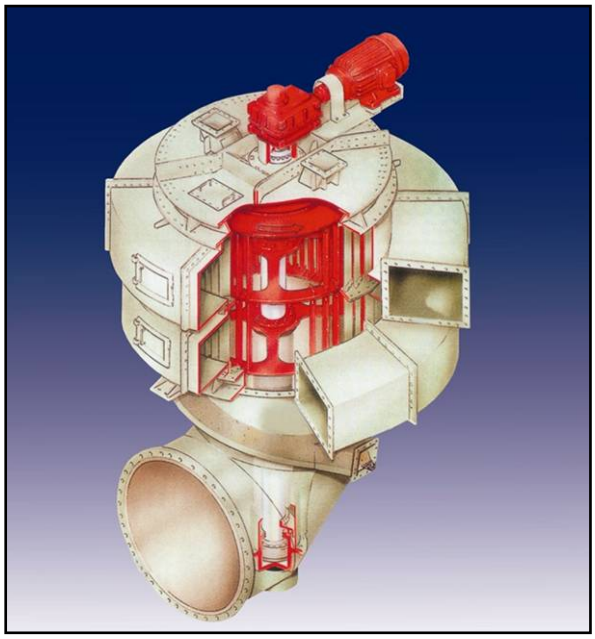

Bild 4: Querstromsichter Typ QS

Fig. 4: Cross-stream separator series "QS"