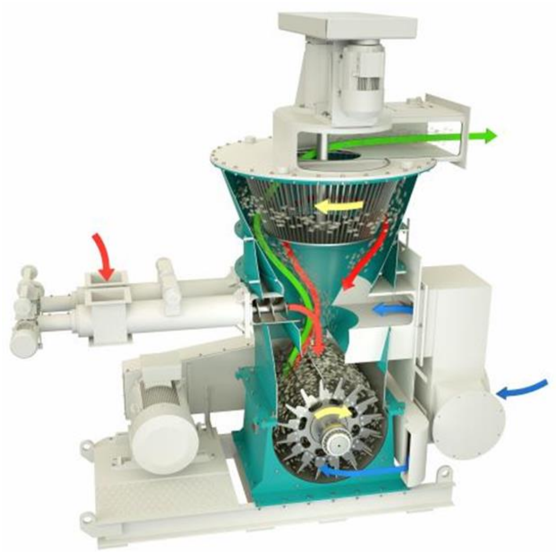


TURBOGRINDER

Impact Mill
Eirich Impianti

For dry grinding of ceramic raw materials, suitable to obtain huge savings in energy and less productions costs

Clay, Kaolin and Bentonites: The operations that have to be made have mainly three targets:

- refine the grain size to reduce the negative effects of some impurities and to increase the specific surface and therefore the reactivity

- create a homogeneous and plastic mass starting from different raw materials through a mixer in which are added water and possibly other additives

- frequently dry the raw materials during the comminution phase.

Nevertheless, the materials we are talking about in this report are generally considered tender materials and easy to grind, for their cohesion and plasticity, they may create big difficulties in some mills, making quite necessary to mix then together with harder materials. This measure makes more difficult the realisation of the recipes.

The more recent statistics indicate an increasing of the costs depending from the energy in the next ten years, that will cause less economic the wet grinding process in the ceramic industry.

As the most energy consumption for the grinding process is absorbed from the mill, it is necessary to employ high efficiency energy and thermal machines.

A valid answer to reduce the energy consumption and the investment and management costs is given from the Eirich Impianti **TurboGrinder** mills, **TG** type. The comminution of the three main raw materials, in fact is realized with low energy consumption, low wear and investment costs.

The operational management of the TG mills is very simple in comparison with the other mills that require to add hard material to the tender materials during the comminution.

The planning of the TurboGrinder TG type is based on the choice of more efficient mechanical actions for the comminution of the tender raw ceramic materials who are attributable to: moderate impact forces, slight compression, and overall cutting forces.

The repeated comparative tests executed in the Eirich Impianti lab have shown that the employment of a compression or impact mill for the comminution of tender materials leads to an unnecessary waste of energy.

Working principles of the TG Eirich Impianti mills

Based on the experiences we have developed a principle of optimal grinding for grinding of soft materials and packaging for medium and high finesse.
The dosed material enters the grinding chamber, where it is first subjected to mild forces of impact and compression. Subsequently while the material progresses on its path, the forces of impact and compression and decrease the friction forces and cutting progressively increase.
The motion of the material in the area of comminution is controlled by the speed of the rotor, by flow of air or carrier gas and the geometry of the system, variable as a function of the material to be ground.
After be transited in the area of comminution, designed to prevent bypass, the material is transferred to the pneumatic classifier place immediately above the mill. The material sufficiently fine is sucked by the air-solid separation system, while the particles having a particle size greater than that desired in the return area of grinding.

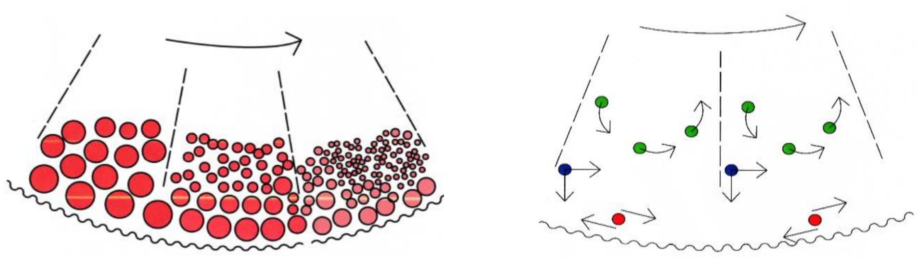


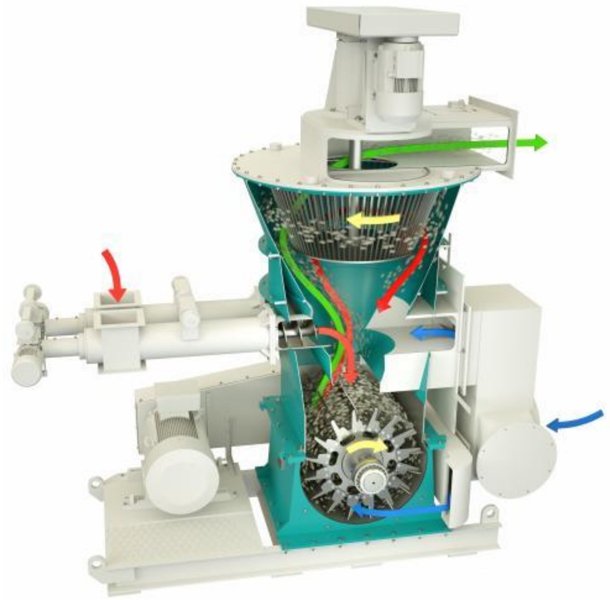
Fig 1 and Fig 2 - *Movements of the material in the mill and mechanical actions to which it is subjected*

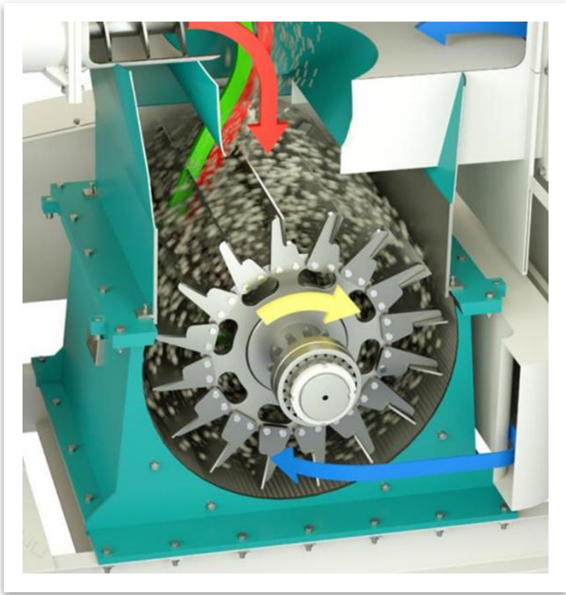
CONSTRUCTION

TurboGrinder TG type systems consist of:
- A body running welded profile box, bearing the feeding chute, the supports for the support of the rotor and the venue for the armor.

At the top is flanged to the classifier, which can be dynamic or static.
3 openings are provided with a valve for the introduction and regulation of the process air.
- A rotor welded steel, keyed to the shaft and prepared for rapid fixing the milling tools.
The milling tools built in special steel are easily replaceable.

The transmission of motion is realized by means of belts and pulleys.
Mills are available with power ranging from 7.5 kW to 355 kW.





KAOLIN

In this type of work the mill brilliantly shows all its features: low power consumption, high drying capacity and high flexibility.

In ***Figure 3*** are represented 3 granulometric curves of products obtained by grinding kaolin with a particle size <10 mm and a moisture content of 12%. In 3 products the final moisture content is 5% and the speed of the classifier was kept constant.

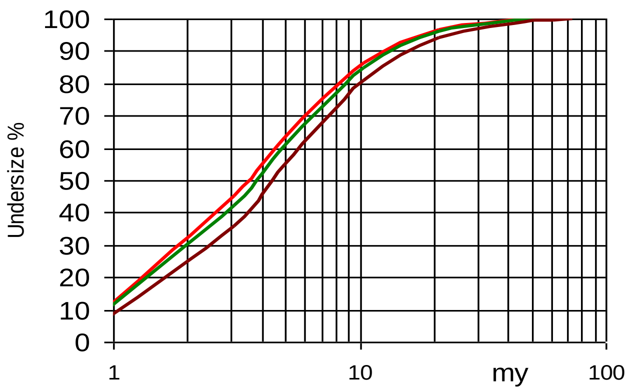


Figure 3 - Wet grinding of kaolin with simultaneous drying

It is interesting to note that the same top size the shape of the curves is different. It is noted in particular that the curve most end has a specific surface area of 30% higher than the curve with less purposes. The change in shape of the curves with the same top size and speed of the classifier is due to different settings of the mill TG.

CLAY

The clay has an average humidity of quarry between 15 and 22%.

The dry grinding presents the known advantages both in the production of coarse pottery that in the production of fine ceramics such as plants pressed tiles.

The technical results that are carried out by grinding with the mill TG are very interesting: we obtain a granulometry constant, but adjustable, and in any case sufficiently fine, in order to eliminate the harmful effects of calcinello and other impurities.

Of fundamental importance is the possibility of obtaining these results with clays having ground final humidity varying between 0.2 and 10%. The consequent advantage, from the point of view of saving of thermal energy is remarkable both in the case of processes involving granulation with a water content of 10-13%, both in the case of forming processes for extrusion requiring an average moisture content ranging between 15 and 20% depending on the type of mix and extruded.

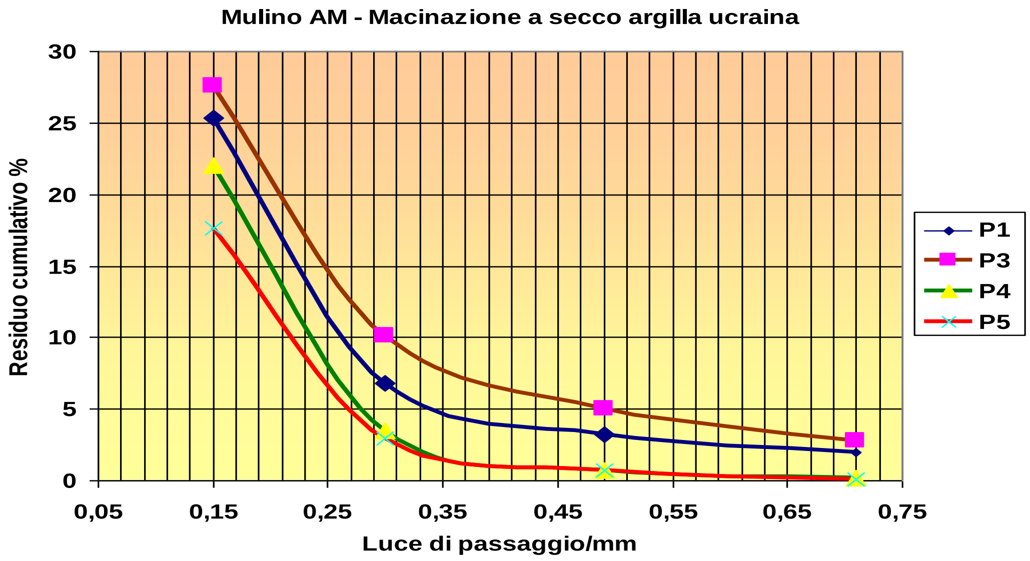


Figure 4 - Ukrainian Clay bricks with initial moisture 14% -15%, with peaks of 19%

The dry grinding mills with Eirich Impianti TG is a modern alternative to the preparation of plastic clays. The main advantages that are obtained are two: reduction of production costs and the possibility of keeping under control the process of preparation

The curves P1 and P3 are similar to those obtained by the final rolling mill with new cylinders. With the machining plastic already after a few hours these curves cannot be kept constant due to the wear. The presence of a classifier in TG technology allows to maintain a constant particle size over time.

The curves P4 and P5 are optimal for the elimination of defects arising from the presence of calcinello. In the presence of pyrite in significant amounts it is necessary to refine further the clay bringing it to a fineness of the curve P2 in Figure 5.

The energy consumption of the mill is 5kWh AM / t for most of the clays. It depends not only on the fineness choice of the type of clay used. The moisture of the clay-tout venant not affect the scope

and the absorption energy of the motor of the mill.
It is emphasized that the possibility of obtaining clays finely ground allows to put on the market manufactured with thin walls which allow, with a suitable design to increase the thermal insulation capacity of the clay.

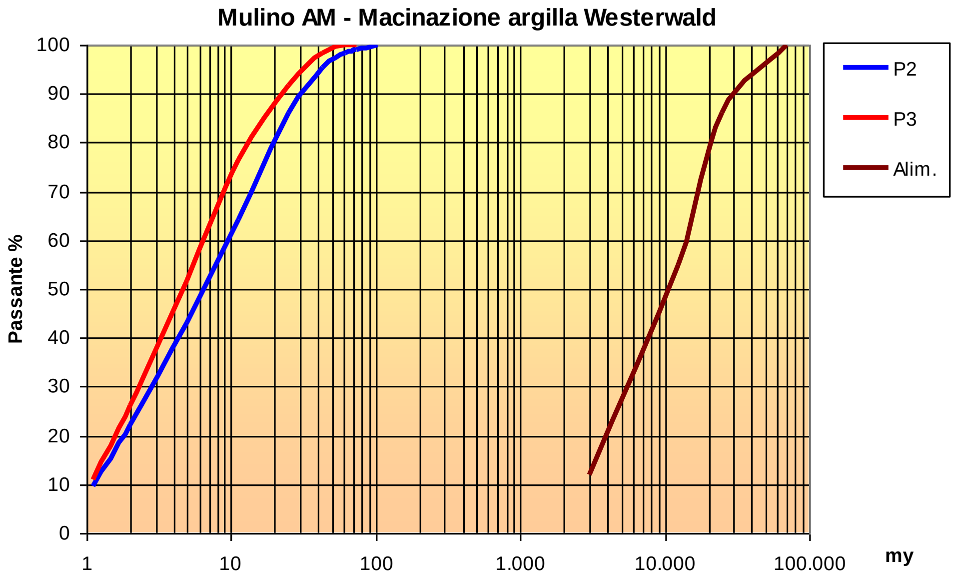


Figure 5 - Westerwald clay

Grinding Westerwald clay moist with simultaneous drying for the production of tiles. Figure 5 shows the distribution curves of the 'clay-ground dry with TG mill for the production of porcelain tile and for the production of glazed porcelain tile.
The moisture of the clay-tout venant is 16%, the clay ground 6%.

Ratio of size reduction Da50/dp50 = 2,100 for the product bigger and 2,750 for the finest product.

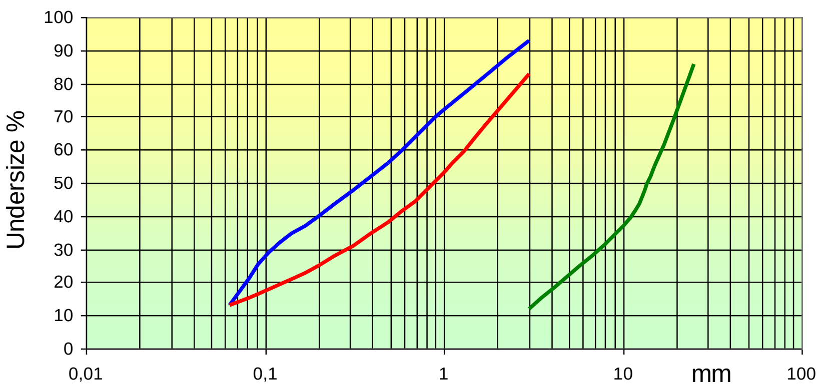


Figure 6 - Westerwald clay

Comminution of Westerwald clay moist with simultaneous drying in the mill type Eirich Impianti **TG** without binder. The product obtained is a granulate: the green curve of Figure 6 refers to the feeding, the red curve to granulate biggest and the blue curve to granulate finer.
Reduction ratio granulometric Da50/dp50 = 15 for the product bigger and 42 for the finest end product.

BENTONITE

Although belonging to the family of clays is known that the bentonite is more challenging to grind compared to classical clays. The greater ability to retain water, combined with the thixotropy and marked tendency to agglomerate to cancel the apparent characteristics of fragility determined by the typical characteristics of the clays which are: fine primary particle size, ease of disintegration and low hardness.
The **TG** mills have four aspects that make them particularly suitable for the grinding of bentonite:
1. Ability to grind wet bentonites with high levels of humidity, provided they are fed. It can in fact work bentonites with moisture that reached up to 28% and more;
2. Very low thermal energy requirements for drying despite the tendency of the bentonite to retain water;
3. Energy grinding low and not affected by moisture;
4. Ability to grind bentonite without drying it thoroughly: you can get a ground product with final humidity adjustable between 10 and 16%. Applying this technique you are sure not to excessively raise the temperature of the bentonite and saves thermal energy.

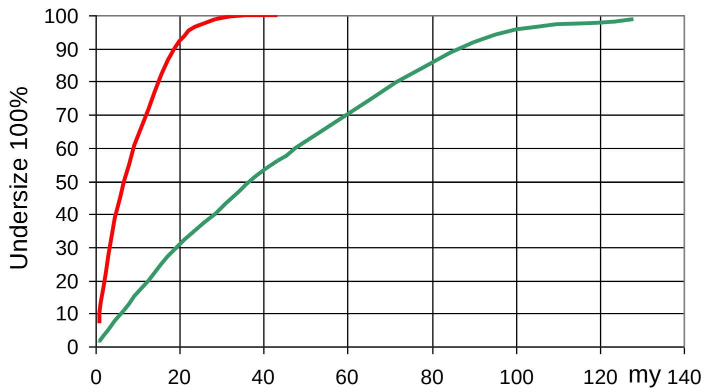


Figure 7 - *Grinding of wet bentonite with TGmill with contemporary drying. Are represented two curves of ground bentonite feeding the mill with 28% humidity*

CONCLUSIONS

The **TG** series have filled a gap in the field of dry grinding.

Represent the state of the art, when it comes to grind or disaggregate dry continuous, soft products or products which have already milled assumed a secondary particle size greater than the primary one.

The installation of mills **TG** advisable, working the above materials, when you want to get a top-grain with size between 20 µm and 400 µm and minerals have already dry when you want to make a grinding process with contemporary drying. In addition to the possibility of obtaining products micronized and can obtain granulates with grain size less than 2 mm approx. The main advantages of **TG** are: ease of operation, limited investment cost, low wear costs, ease drying of complex products.

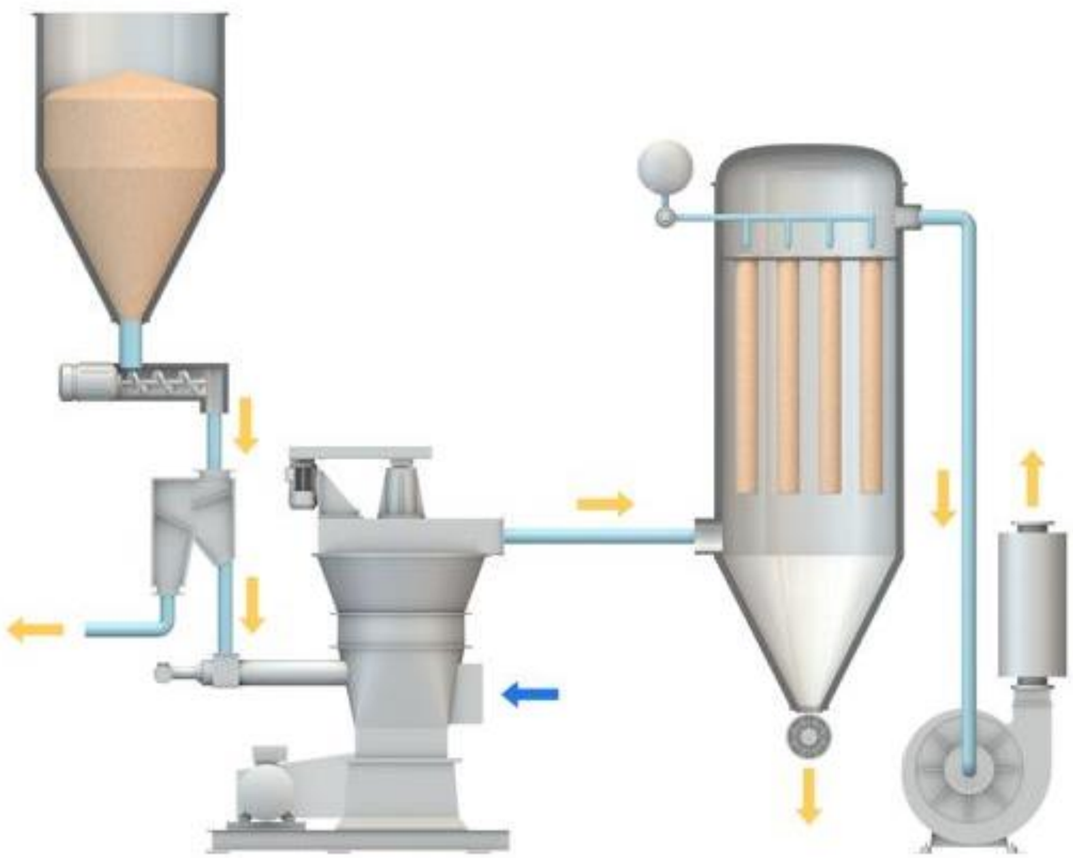


Figure 8 – *Typical flowsheet*