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Wolf

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[54] **GRINDING METHOD AND VIBRATING MILL FOR PERFORMING THIS METHOD**

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[51] **Int. Cl.** **B02c 17/14**

[58] **Field of Search** 241/18, 23, 26, 31, 241/65, 153, 175

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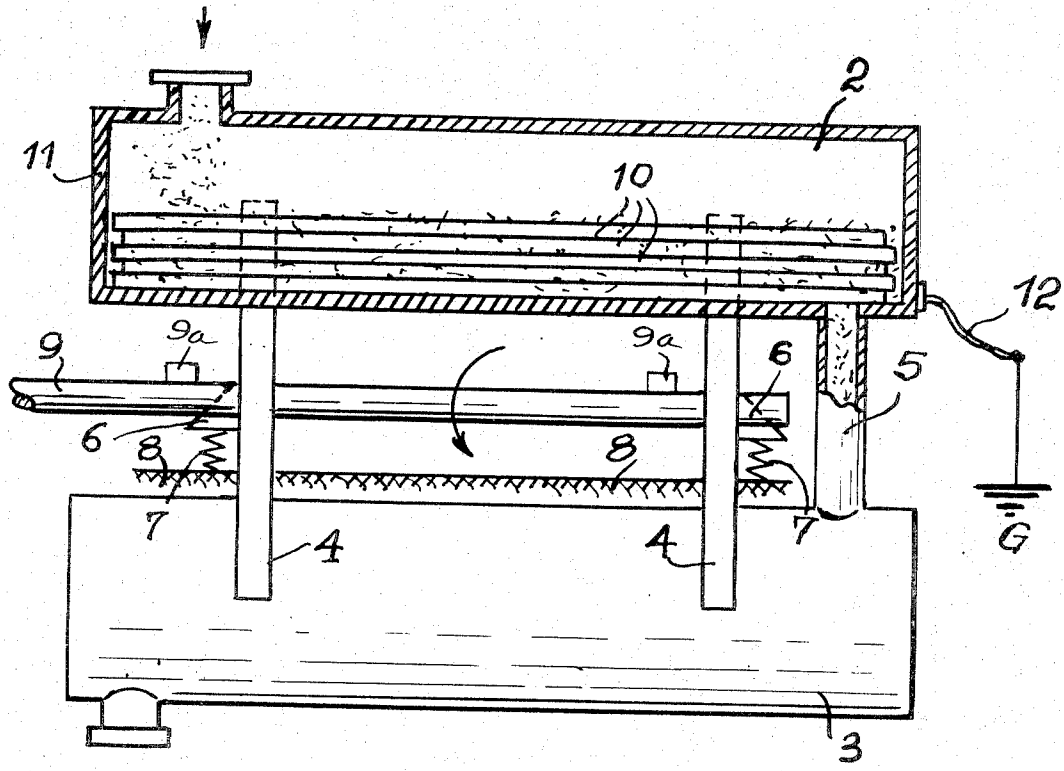
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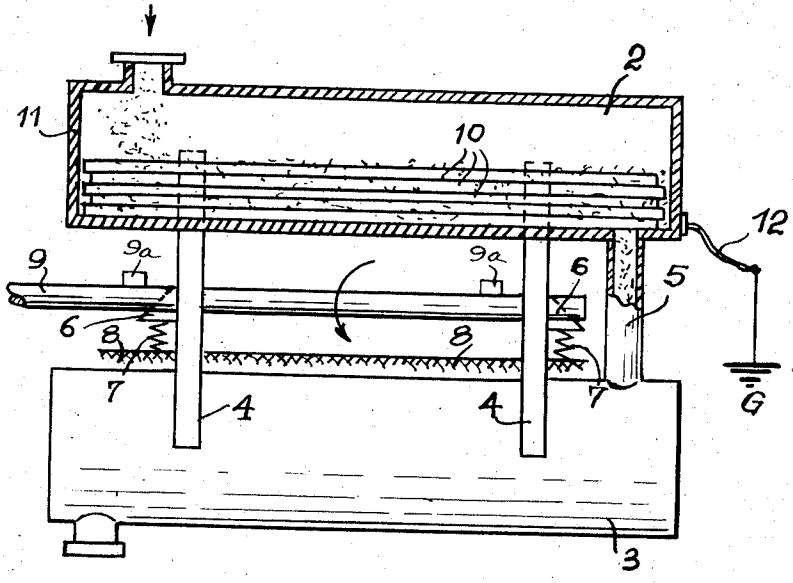
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[57] **ABSTRACT**

A device is described for fine grinding of plastics in which the horizontally mill is charged with the plastic to be ground and with liquid nitrogen for making the plastic brittle. The grinding chamber contains an assembly of loose grinding rods. The rods are somewhat shorter than the length of the grinding chamber, whereby during the operation of the mill at least a few of the rods will strike against the end walls of the grinding chamber and transfer to these end walls, which are grounded, the electrostatic charges formed on the surface of the particles of the ground plastic and which by said rods are conducted to said end walls and from there to the ground.

3 Claims, 1 Drawing Figure




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GRINDING METHOD AND VIBRATING MILL FOR PERFORMING THIS METHOD

The invention relates to for vibrating mills, particularly for the fine-grinding of plastics, and is also directed to a vibrating mill performing a grinding operation.

When fine-grinding some materials, particularly when fine-grinding of plastics in a vibrating mill, it was found that the grinding capacity of such materials decreases rapidly, particularly when the materials to be ground have the property of becoming electrostatically charged. The decrease in the grinding capacity is caused by the fact that under the influence of an electrical charge the individual material particles adhere to each other and form larger agglomerates. The agglomerates act as buffers between the individual grinding bodies and consume a substantial part of the energy without causing a grinding operation. In order to obtain, nevertheless, a fine or superfine grinding, it was heretofore necessary to substantially prolong the grinding operation. Another result of the electrostatically charged material is that the ground material, in view of the formation of the agglomerates, could not be classified or graded. Since the finish product, i.e. the superfine particles, as a result of their larger specific surface are inclined to a high degree to the formation of agglomerates and therefore could not be sufficiently separated from the insufficiently ground material. During the fine-grinding of mineral materials one attempted to reduce the electrostatic charge or to eliminate the same entirely by spraying water into the grinding chamber during the grinding operation. This method, however, is only then effective when the material to be ground or the ground material reacts on its surface with the moisture in the atmosphere of the grinding chamber in such a manner that an electroconductive coating is formed on each particle. In materials, however, which cannot come in touch with water or which do not react with water, this method cannot be employed. When, as in this case, during the grinding of plastics the material to be ground is made brittle with the assistance of refrigerants, then this mentioned water spraying is not at all suitable in view of the ice formation.

It is, however, known to employ as grinding bodies for the grinding of material in vibrating mills, so-called grinding rods. These grinding rods, however, are only employed for the purpose of a preliminary grinding operation, namely for grinding a relatively coarse material. The fine or superfine grinding operation which starts, in view of the required energy and time requirement, a material which has already been ground previously is performed by grinding bodies having a spherical form or a so-called cylpebs, i.e. by cylindrical shapes.

The object of the invention is a grinding method and a grinding device for the fine and superfine grinding of materials, such as a vibrating mill, in which materials having electrostatic properties may be ground with a reasonable application of grinding energy and grinding duration. In accordance with the invention, one employs as grinding bodies so-called well-known metal rods, the length of which is only slightly shorter than the length of the grinding chamber, whereby the end faces of the grinding chamber are grounded. It was discovered with surprise that in spite of the employment of grinding rods which heretofore had only been employed for a preliminary grinding operation, it is now possible to obtain a very good fine or even superfine grinding of the materials mentioned. This is due to the fact that during the grinding operation always the ends of a few of the metal rods are in engagement with the wall of the grinding chamber, not only the rods adjacent the walls of the grinding chamber are in engagement with the walls of the grinding chamber, but principally the rods disposed in the interior of the assembly of the grinding bodies engage the chamber wall. Of all of the parallel rods in the interior of the grinding rod assembly, always a few strike against the end walls of the grinding chamber during the operation of the vibrating mill, so that the electrical charges on the material particles in the interior of the grinding body assembly are conducted outwardly and to the ground.

The invention will now be described with reference to an example of a vibrating mill illustrated in the accompanying drawing and performing the grinding method of the invention.

A thermoplastic synthetic resin which is to be finely ground and which possesses electrostatic properties, is first made brittle with the assistance of a refrigerant. In this case liquid nitrogen is used in order to make a fine grinding of this material possible in a vibrating mill. The chilled plastic granulate, by adding more refrigerants, is introduced into the vibrating mill.

When the vibrating mill is provided with a filling of grinding bodies comprising spherical bodies, it was found that the electrostatic charge of the material particles was so high that the grinding capacity during the normal time period of grinding dropped substantially and a determination of the grinding capacity with the assistance of a screen analysis was not possible, because the very fine particles, namely the end product-,formed agglomerates which appeared to be coarsely ground and could not be separated.

In accordance with the invention, the spherical grinding bodies were replaced by parallel disposed metal rods, the length of which was approximately 20 mm shorter than the length of the grinding chamber. Furthermore, the grinding chamber 2 has attached to at least one of its end walls a grounded conductor 12. It was discovered that in spite of the apparently unfavorable grinding rods, it was possible to obtain a fine and superfine grinding of the plastic to be ground, and that the electrostatic charge of the ground material was completely lead away and a formation of disturbing agglomerates did not take place, but was prevented. A screening and therewith a classifying or grading of the ground material is then possible.

Referring now to the accompanying drawing, the vibrating mill of the invention comprises two vertically spaced horizontal grinding chambers 2 and 3 connected with each other by vertical braces 4, while the interiors of these chambers are in communication with each other by at least one vertical tube 5. The braces 4 have lateral projections 6 between their ends engaged by springs 7 supported by the stationary base 8 of the mill. A horizontal drive shaft 9 with unbalancing weights 9*a* thereon cause the grinding chambers to vibrate. The upper grinding chamber 2 is shown in section to disclose the parallel metal grinding rods 10 therein, which are somewhat shorter than the length of the grinding chamber 2, but during the operation of the mill will be moved lengthwise so as to knock with their ends intermittently against the end walls 11 of the

grinding chamber. At least one end wall **11** of the grinding chamber has attached thereto a copper mesh band connected to a conductor **12** which leads to the ground G.

What I claim is:

1. A vibrating grinding mill for fine-grinding material such as plastics in which the material to be ground is chilled by a liquid nitrogen, comprising:

a grinding chamber in which the material is ground and which is mounted to be vibrated;

an assembly of loose metallic grinding rods having a length slightly shorter than the length of said grinding chamber;

and means grounding at least one end wall of the chamber the length of said rods being such that the ends of the rods strike against the end walls of the grinding chamber during the grinding operation so as to lead away the electrostatic charges formed on the particles of the ground material and transferred to said grinding rods through the grounded end wall.

2. A vibrating grinding mill comprising:

means forming a horizontally disposed vibrating grinding chamber having a circumferential wall and end walls;

an assembly of loose, parallel metallic grinding rods in said grinding chamber having a length being slightly less than the length of said grinding chamber;

driving means connected to the chamber for vibrating said chamber;

and means grounding at least one of said chamber end walls whereby during operation of the mill at least some of said grinding rods engage against the grounded end wall so as to lead away the electrostatic charges formed on the particles of the ground material and transferred to said grinding rods, the length of said rods being such that the ends of the rods strike against the end walls of grinding chamber during the grinding operation.

3. A vibrating grinding mill constructed in accordance with claim **2**:

wherein the mill includes a second horizontally disposed vibrating grinding chamber having a circumferential wall and end wall;

an assembly of loose parallel metallic grinding rods in said second grinding chamber having a length being slightly less than the length of the grinding chamber;

means grounding at least one end wall of said second grinding chamber;

said driving means being connected to both of said chambers;

resilient support means supporting said chambers;

and a passage communicating between said chambers for the flow of material therebetween.

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