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(54) **Gas-swept tube mill with built-in separator rotor.**

(57) A gas-swept tube mill has an inlet (2), a grinding chamber (6), a discharge chamber (7) and an outlet (3). The discharge chamber contains a separating rotor (10) which causes coarse fractions of the material to be flung outwards and returned via a scoop (9) to the grinding chamber for further grinding. The vanes of the rotor are surrounded by a frustoconical casing (12) which collects the coarse fraction and directs it backwardly over a corresponding frustoconically shaped wall (15) of the discharge chamber to the scoop (9). The material is swept from the grinding chamber into the discharge chamber through a spreader (13) having a frustoconically flared outlet (14) which spreads the material over the face of the rotor.

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GAS-SWEPT TUBE MILL WITH BUILT-IN SEPARATOR ROTOR.

The invention relates to a gas-swept tube mill of the kind,hereinafter referred to as of the kind described, having at least one tubular grinding chamber which is rotatable about its axis that is substantially horizontal; a discharge chamber which is positioned at an end of the grinding chamber and through which ground material is swept from the grinding chamber to an outlet; a separately drived separator rotor which is positioned in the discharge chamber coaxially with the grinding chamber and has radially outwardly extending vanes; and a scooping device for returning insufficiently ground material from the discharge chamber to the grinding chamber.

From GB-A-1,397,377 there is known a tube mill of the kind described, in which material ground in the grinding chamber is carried by means of the through-flowing conveying gas into the mill discharge chamber and into the separator in which the ground material is divided into a fine fraction passing out of the mill through the outlet, and a coarse fraction, which by the centrifugal effect of the separator rotor vanes is carried outwardly onto the discharge chamber wall from which the coarse fraction drops to the lower part of the chamber to be scooped back into the grinding chamber for further grinding.

The parts of the coarse fraction which are flung up into the upper part of the discharge chamber above the separator may, however, fall down into the separator to be flung out again in such a manner that an undesired recirculation of material may occur between the separator and the upper part of the wall of the discharge chamber.

Furthermore, the gas flow through the discharge chamber towards the mill outlet may tend to prevent material separated in the discharge chamber from moving back towards the scooping device, thus preventing renewed grinding of the material. This may also cause accumulation of material at the outlet end of the discharge chamber where that material may be carried upwards along the chamber wall due to the mill rotation and cascade into the area of operation of the rotor so that in this way another undesired material recirculation may occur.

These disadvantages affect adversely the mill efficiency, and it is the object of the invention to devise a mill of the kind described, in which these disadvantages are eliminated or at least significantly reduced.

According to the invention the object is achieved by a mill of the kind described, which is characterised in that a material-collecting casing is mounted on and circumferentially around the vanes of the separator rotor, the inner surface of the material-collecting casing being flared in the axial direction towards the scooping device and grinding chamber.

With this arrangement, the separated coarse material fraction is collected by the material-collecting casing all the way round the rotor which rotates at a supercritical speed. Owing to the flared shape of the collecting casing, together with the effect of the centrifugal force on the individual particles of the coarse fraction, this material will be carried back in the discharge chamber in a direction towards the grinding chamber away from the rotor.

By removing the coarse fraction from the operating zone of the separator rotor, there is avoided recirculation of material between the rotor and such part of the wall of the discharge chamber which surrounds the rotor. Furthermore the coarse fraction is carried in a direction towards the scooping device. The beneficial effect is increased if the inner surface of a wall of the discharge chamber, which rotates with the grinding chamber, is flared in the direction from the material-collecting casing towards the scooping device and grinding chamber.

Preferably, there is a spreading device through which material is swept from the grinding chamber into the discharge chamber, the spreading device being flared in the direction of flow to spread the material over the face of the rotor. The spreader also inhibits the material separated by the separator rotor, and discharged from its flared casing, from falling down into the carrier gas flow towards the rotor if the spreader projects into the discharge chamber.

The invention will now be explained in more detail with reference to the accompanying drawing, which diagrammatically shows a vertical, axial sectional view through a mill according to the invention.

The mill comprises a tubular mill casing 1, an inlet 2 for raw material to be ground in the mill, and for conveying and drying gas, and an outlet 3 for gas and finish ground material.

The mill casing is rotatably supported to rotate about its axis, which is substantially horizontal, on slide shoe bearings, not shown, on which the mill casing slides via two slide rings 4.

The mill casing has a drying chamber 5, a grinding chamber 6 and a discharge chamber 7, all of which rotate together relatively to the inlet 2 and outlet 3. In the diaphragm separating the drying chamber 5 and the grinding chamber 6 is mounted a scooping device 8. Another scooping device 9 is mounted in the diaphragm separating the grinding chamber 6 from the discharge chamber 7.

In the outlet end of the discharge chamber 7 is mounted coaxially a separator rotor 10, which is driven at supercritical speed via a shaft 11 from a driving mechanism, not shown. The radial vanes of the separator rotor 10 are encompassed by and fixed to a frustoconical material-collecting casing 12.

A spreader device 13, which rotates with the rest of the mill casing, extends from the grinding chamber 6 and partly through the discharge chamber 7 and has a frustoconical part 14 widening towards the separator rotor 10.

As appears from the drawing, the wall 15 of the discharge chamber is provided with substantially the same conicity as the collecting casing of the rotor 10.

The mill operates in the following way:-

Raw material and gas are admitted into the drying chamber 5 through the inlet 2. From the drying chamber 5 the material is passed into the grinding chamber 6 by means of the scooping device 8. The gas flows from the chamber 5 to the grinding chamber 6 through openings in the diaphragm separating the two chambers.

The gas together with the suspended ground material flows from the grinding chamber 6 into the spreading device 13 to the discharge chamber 7 and further to the separator rotor 10 as shown by dotted arrows. The separator rotor 10 divides the material suspension into a fine fraction, which is carried by the gas out through the mill outlet 3, and a coarse fraction, which, by the centrifugal effect, is carried onto the frustoconical collecting casing 12 of the rotor 10.

Because the rotor 10 runs at a supercritical speed its casing 12 collects the separated coarse material fraction which is thus prevented from falling back towards the rotor shaft. Due to the conicity of the collecting casing 12 and the action of the centrifugal forces on the particles of the coarse fraction, these particles are carried backwards, as indicated by full line arrows 16, in the discharge chamber 7 towards the scooping device 9, which scoops the coarse fraction from the discharge chamber 7 into the grinding chamber 6 for further grinding. The conicity of the discharge chamber wall 15 further improves the conveying of the coarse fraction from the separator rotor 10 towards the scooping device 9.

The conically shaped part 14 of the spreading device 13 spreads the gas/material suspension across the face of the rotor and further inhibits the coarse material fraction leaving the collecting casing 12 of the rotor 10 from falling down into the gas stream passing through the discharge chamber 7 and the rotor 10.

C L A I M S

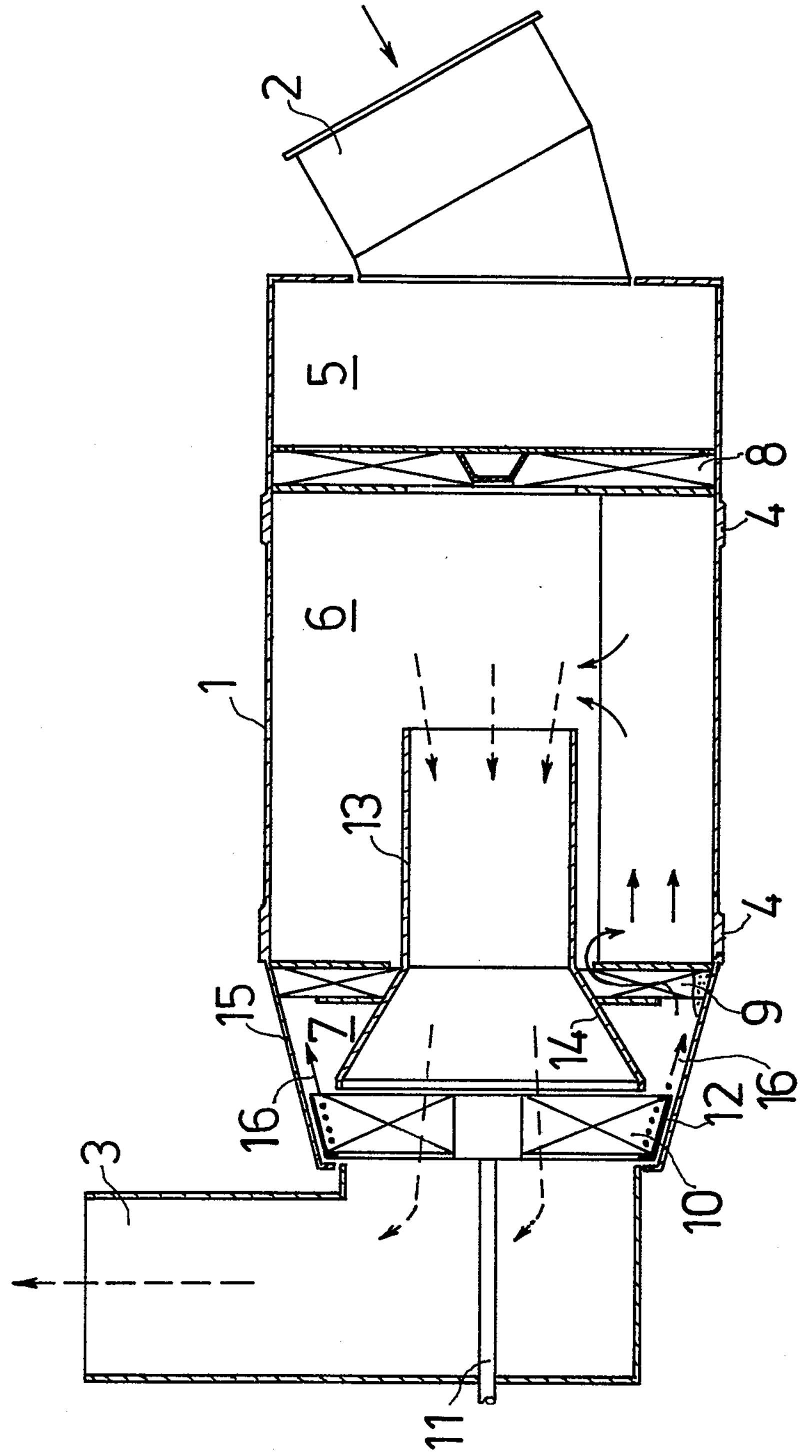
1. A gas-swept tube mill of the kind having at least one tubular grinding chamber (6) which is rotatable about its axis that is substantially horizontal; a discharge chamber (7) which is positioned at an end of the grinding chamber and through which ground material is swept from the grinding chamber to an outlet (3); a separately driven separator rotor (10) which is positioned in the discharge chamber coaxially with the grinding chamber and has radially outwardly extending vanes; and a scooping device (9) for returning insufficiently ground material from the discharge chamber to the grinding chamber; characterised in that a material-collecting casing (12) is mounted on and circumferentially around the vanes of the separator rotor (10), the inner surface of the material-collecting casing being flared in the axial direction towards the scooping device (9) and grinding chamber (6).

2. A mill according to claim 1, in which the inner surface of a wall (15) of the discharge chamber, which rotates with the grinding chamber, is flared in the direction from the material-collecting casing (12) towards the scooping device (9) and grinding chamber (6).

3. A mill according to claim 2, in which the material-collecting casing (12) and the wall (15) of the

discharge chamber are frustoconical with substantially the same angle of conicity.

4. A mill according to any one of the preceding claims, further comprising a spreading device (13,14) through which ground material is swept from the grinding chamber into the discharge chamber, the spreading device being flared in the direction of flow to spread the material over the face of the rotor (10).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