April 8, 1930. P. BODENSTEIN 1,753,685

DISCHARGE MEANS FOR TUBE OR BALL MILLS

Filed June 18, 1928

Fig. 1

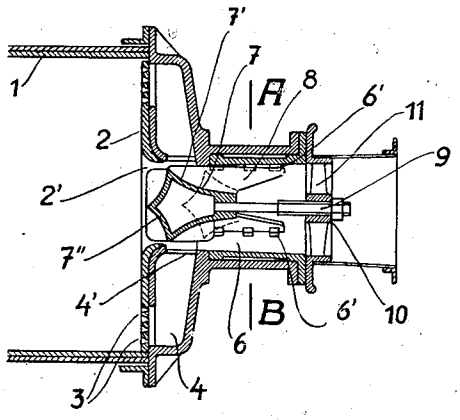
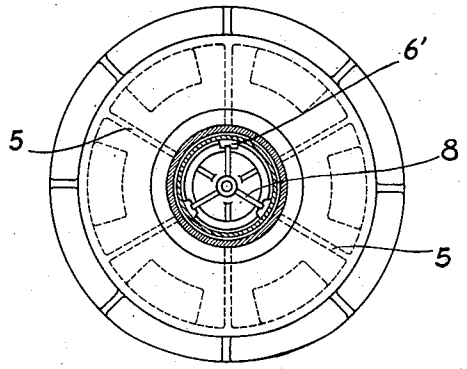


Fig. 2



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UNITED STATES PATENT OFFICE

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DISCHARGE MEANS FOR TUBE OR BALL MILLS

Application filed June 18, 1928, Serial No. 286,182, and in Germany June 27, 1927.

This invention relates to the wet grinding of materials in tube or ball mills provided with means for the continuous feeding and discharging of the material, and is particularly concerned with mills of the kind in which the ground material is discharged from the grinding member through openings, arranged in the discharge end wall of the mill, into a discharge chamber from which it is conveyed into the hollow discharge trunnion of the mill.

It frequently occurs that the discharged material is not quite of the required fineness, and for this reason it has hitherto been conveyed to special grading devices, where the coarser parts of the material were separated and then conveyed back to the mill for further grinding. This method of treatment however is complicated and expensive.

It is the object of the present invention to overcome the disadvantages above referred to by returning the discharged material flowing from the discharge chamber through the hollow trunnion, if said material is not of sufficient fineness, wholly or partly to the grinding chamber, while the liquid in the grinding chamber is kept back and the material so returned is separated in the liquid according to gravity. The larger particles of material sink down and are further ground, while the finer particles float on the surface and float away with the liquid rising over the lower edge of the hollow trunnion. The feed of the material to be ground is not interrupted, and the quantity of material fed need not be altered.

For this purpose an adjustable regulating device is provided in the hollow trunnion at the level of the discharge slot of the grinding chamber, by means of which the stream of material and liquid issuing from the discharge chamber of the mill can if required be wholly or partly conveyed back into the grinding chamber.

The regulating device may for instance be designed as a valve cone axially adjustable within the hollow trunnion. The regulating device is free to revolve with the trunnion but it may also be so arranged as to remain stationary within the trunnion.

In order that the said invention may be clearly understood and readily carried into effect, the same will now be described more fully with reference to the accompanying drawings which illustrate one construction of apparatus embodying this invention:—

Figure 1 shows the discharge end of a mill in longitudinal section.

Figure 2 is a section on the line A—B of Figure 1.

In the grinding drum 1 the material is subjected to a wet grinding process. This process is effected in the usual manner, the coarse material to be ground being fed with the addition of water and then disintegrated by the action of the grinding bodies to the desired degree of fineness. The disintegrated material enters the discharge chamber 4 through apertures 3 in the discharge end wall 2. Within the discharge chamber 4 there are provided ribs or blades 5 (see Figure 2) which raise the material to be ground and convey it into the hollow discharge trunnion 6 of the mill. In this trunnion 6 there is arranged a regulating device which according to the construction illustrated comprises a guiding cone piece 7. This guiding cone 7 is provided with vanes 8, arranged star fashion, that are longitudinally displaceable in the guiding grooves 6′ provided in the hollow trunnion 6 for the purpose of adjusting the guide cone 7. An axial displacement of the guide cone can be effected by turning a spindle 9 which is fixed to the head of the guiding cone and is seated with its free extremity in the internally screw-threaded boss 10 of the supporting ring 11. By adjusting the guide cone the quantity of the material to be discharged can be regulated, that is to say the material flowing from the discharge chamber through the discharge slot 4′ into the hollow trunnion 6 can be returned, if not ground to the desired degree of fineness, either wholly or in part to the grinding chamber.

When the guide cone 7 is in the end position shewn in full lines in Figure 1, the material is diverted, by means of the curved guide surface 7′ of the guide cone 7 in the hollow trunnion, to the discharge end of the latter. When the guide cone however is in

the end position denoted by dotted lines, the material is returned, by means of the guide surface 7'' of the guide cone, through the central opening 2' in the discharge end wall to the grinding chamber. The material so returned is separated according to gravity by the liquid present in the mill. The coarser particles sink down and are further disintegrated, whilst the finer particles float on the surface. In the intermediate positions of the guide cone 7 the quantity of ground material discharged can be regulated at will. If the water level, owing to the material being conveyed back into the grinding chamber, rises above the edge of the central discharge opening 2' of the end wall 2, the fine particles floating in the turbid liquid are washed away through the hollow trunnion. Even when a practically perfect return of the material from the discharge chamber into the grinding chamber takes place, there still remains between the regulating device and the hollow trunnion sufficient free space through which the liquid and the fine particles floating therein can be conducted away. The regulating device itself may be of various shapes. It can, as illustrated, revolve with the drum, or it may be arranged so as to be stationary within the hollow trunnion, that is to say it may be fixed to a stationary frame.

What I claim is:—

1. In a device for the wet grinding of material, a grinding drum coaxially arranged with a discharge chamber and a hollow trunnion, said drum and said chamber having a common perforated wall, and adjustable means within said discharge chamber for returning any desired portion of material from the chamber to the drum.

2. In a device of the character described, a grinding drum, a discharge chamber and a hollow trunnion, said discharge chamber communicating with said drum and said trunnion through central openings and with said drum also through apertures located near the periphery of said drum, and adjustable means within said chamber for returning from the chamber to the drum any desired amount of material entering said chamber through said apertures, said adjustable means being adapted to permit liquid and fine material suspended therein to pass through said trunnion.

3. In a device of the character described, a grinding drum, a chamber separated from said drum by a wall having perforations near the periphery of said drum, and means in said chamber for moving material from the periphery towards the center of said chamber, means for discharging material from said chamber, means within said chamber for returning material to said drum, and means for regulating to any desired degree the proportion of material discharged from the chamber and material from the chamber to the drum.

4. In a wet grinding mill, in combination with a grinding drum, a discharge chamber partially separated at one side from said drum by a wall having openings near its periphery and a central opening and communicating at the other side with a hollow trunnion, means in said chamber for transporting material from its periphery to its center, and adjustable means within said chamber comprising a substantially double cone shaped valve member for returning any desired amount of said material through said central opening into the drum, but permitting the passing of overflow through said trunnion.

5. In a device of the character described, a grinding drum, a chamber separated at one side from said drum by a wall having a central opening and apertures near its periphery and communicating at the other side with a hollow trunnion coaxial to said drum and said chamber, substantially radial paddles in said chamber, a substantially double cone shaped body in said chamber, said body being coaxial with said drum and said chamber and adjustable in the direction of its axis.

6. In a device of the character described, a grinding drum, a hollow trunnion by which said drum is supported, a chamber separated at one side from said drum by a wall having a central opening and apertures near its periphery and communicating at the other side with said hollow trunnion by a port coaxial to said central opening, substantially radial fins in said chamber, a substantially double cone shaped body within said chamber having a circumferential edge concentric to the edges of said central opening and said port, and means for moving said body axially in said chamber between said openings and said port.

7. In a device of the character described, a grinding drum, a chamber separated at one side from said drum by a wall with a central opening and apertures near its periphery and communicating on the other side through a circular port with a hollow trunnion coaxial to said drum and said chamber and comprising means for transporting material towards its center, a substantially cone shaped body within said chamber having a diameter slightly smaller than the diameter of said circular opening, and means for moving said body axially in said chamber between said opening and said port.

8. In a device of the character described, a grinding drum, a chamber separated at one side from said drum by a wall with a central opening and apertures near its periphery and communicating at the other side with a hollow trunnion coaxial to said drum and said chamber and having longitudinal guides, substantially radial paddles in said chamber, a

substantially double cone shaped body in said chamber comprising radially arranged vanes sliding in said longitudinal guides of said trunnion, and means for moving said body in said guides.

9. In a device of the character described, a grinding drum, a chamber separated at one side from said drum by an annular wall with apertures near its periphery and communicating at the other side with a hollow trunnion coaxial to said drum and said chamber, longitudinal guides in said trunnion, substantially radial paddles and a substantially double cone shaped body in said chamber said body comprising radially arranged vanes sliding in said guides, and means comprising a screw and nut, for moving said body in said guides.

10. In a wet grinding mill, in combination with a grinding drum, a chamber separated at one side from said drum by an annular wall with apertures near its periphery, substantially radial fins in said chamber for transporting material entering through said apertures from the periphery towards the center of said chamber, said chamber having at the other side a discharge port coaxial with drum and chamber, distributing means in said chamber for returning part of the material transported by said fins into said drum and for discharging the other part into said discharge port, and means for adjusting said distributing means so as to vary the amount returned.

11. In combination, a wet grinding drum having an end wall with a central opening and apertures near its periphery, a chamber adjacent to said end wall, adapted to receive coarse material through said apertures and fine material through said central opening, means for transporting said coarse material towards the center of said chamber, a hollow trunnion connected to, and adapted to receive material from said chamber, and adjustable means within said chamber and said drum for directing any desired amount of said coarse material into the drum, but permitting the fine material to pass through the trunnion.

The foregoing specification signed at Berlin, Germany, this 4th day of June, 1928.

PAUL BODENSTEIN.