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(54) GRINDING MILL DISCHARGE ARRANGEMENT

(71) We, OLIVER Y BATLLE, S.A., a company organised under the laws of Spain, of Avenida Martin Pujol, 278—284, Badalona (Barcelona), Spain, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a dispersing or grinding mill.

According to the invention, there is provided a dispersing or grinding mill having a generally cylindrical grinding chamber containing a generally horizontal drivable shaft carrying milling members, in which an exit for discharging the milled product is formed by a generally cylindrical screen which forms part of or surrounds the shaft and extends to an end wall of the grinding chamber, the screen being positioned to permit passage of the milled product through the screen and thence through a space defined between the screen and the shaft while preventing passage of milling elements through the screen.

The shaft may be hollow and can be cooled by internal circulation of a liquid coolant.

The seal may be formed by a pair of resilient annular flaps which surround the shaft adjacent to the milled product exit, and means are provided for feeding a liquid lubricant (which may also be a coolant) to a space defined by the flaps, the part of the shaft therebetween, and a surrounding wall.

Preferably, the apertures in the screen have an increasing cross-sectional area in the direction of movement of product being discharged.

A screen of the kind known as a 'JOHNSON' screen is suitable as the cylindrical screen. A 'JOHNSON' screen is a design of screen in which the cross-sectional area of the orifices varies as one passes from one surface of the screen to the other.

The invention will be better understood from the following description of an illustrative embodiment given with reference to the accompanying drawings in which:—

Figure 1 is a side elevation, partly in section, of an example of the invention including a screen-type discharge exit for the milled product, and

Figure 1A shows part of Figure 1 on a larger scale.

Referring firstly to Figure 1, the illustrated mill includes a generally cylindrical grinding chamber 10, a generally horizontal driven bored shaft 12 carrying milling members 14, a frame 16 which supports the chamber 10 from one end, and means for rotating the shaft 12 generally indicated at 18. As will readily be understood, in use of such a machine, the product to be milled or to be subjected to a dispersing action, such as paint, is fed into the grinding chamber 10 together with milling elements which, conventionally, may be balls or granules or flat chips of hard material. The chamber 10 has an inlet 18*a* for the substance to be milled, and the milling elements, if not already within the chamber, are charged *via* this inlet. The inlet pipe may have a pressure gauge 20. The milled product is discharged *via* a pipe 22, and the pressure in an exit chamber 24 (Figure 1A) is measured and indicated by a pressure gauge 26. The detailed construction of the mounting of the grinding chamber 10 and the sealing of the shaft 12 will be described later with particular reference to Figure 1A.

The shaft 12 at its outer end carries two pulleys 30, 32, each driven *via* endless belts generally indicated at 36. Naturally any suitable motor may be provided to drive the belt 36. The drive is taken to the shaft 12 *via* one or other of the pulleys 30, 32, allowing one to choose a selected rotation speed. Of course means may be provided for varying the speed of the motor, if desired, to allow greater variations. The shaft 12 is hollow, and secured to its outer end is a double pass rotary fluid connection, of a known design, indicated at 38. This

allows a liquid coolant such as water to be fed into the interior of the hollow shaft 12 *via* a pipe 40, the coolant liquid then being discharged *via* pipe 42. The shaft 12 is mounted in the housing 16 by bearings 44 and 46, the bearing 44 being urged in a leftward direction as seen in the drawing by a resilient biassing means constituted by a stack of annular disc washers some of which are indicated by 48.

The shaft 20 is hollow over at least the portion of it which extends within the grinding chamber 10, and it carries grinding members formed by discs 14. Although not shown, the discs 14 can be removed from and replaced on the shaft 12, their relative positions being determined by tubular spacers. Access to the interior of the grinding chamber 10 to enable this to be done is obtained by removal of an end wall 50. The wall 50 has a drain plug 52.

The grinding chamber 10 is mounted on the frame 16, and for this purpose the frame 16 broadens out into a housing 54 which terminates in a flange 56. The housing 54 encloses an inner end wall 60 (Figure 1A), which partly defines the exit chamber 24 and which carries an inner end wall 62 of the grinding chamber 10. The shaft 12 passes through the wall 62 and is sealed by an O-ring seal 64. The construction is such that the seal 64 can be replaced by removing an annular retaining seal 66 held by bolts 68.

Part of the shaft wall is constituted by a cylindrical screen 70. This forms the part of the shaft wall adjacent to the inner end wall 62. It provides the exit path for the milled product, and the size of the screen mesh is such that the milling elements cannot pass therethrough. The apertures in the screen may have an increasing cross-sectional area in the direction of movement of the product being discharged, that is to say in a radially inward direction. An adjacent portion of the shaft wall has radial apertures 72 therein, which permit the milled product to pass radially outwardly into the exit chamber 24 ,and thence to the exit 22. It will be seen that the seal 64 need only be such as to prevent passage of the milling elements past it, and an advantageous feature of the present invention is that the shaft 12, where it passes through the wall 60, is sealed by a seal of elegant and efficient design. A pair of annular flap seals 80 are retained by retaining rings 82 and 84, the latter being held in position by bolts one of which is shown at 86. The ring 82 together with the wall 60 defines an annular chamber to which any suitable lubricant liquid, which may also be a coolant liquid, is fed by a pipe 88. The lubricant may be the solvent liquid corresponding to that in the substance to be milled.

The wall 62 is connected to the housing 60 by any suitable means, such as bolts 90. These pass through a radially extending flange 92 of the housing 60, the flange 92 having a cut away portion to receive an O-ring seal 94. The inner cylindrical wall 96 of the grinding chamber 10 has a radial flange 98 at its inner end, the flange defining a confronting flat surface which engages the O-ring 94 and faces the flange 92. A clearance between the flanges 92 and 98 allows thermal expansion of the wall 96, due to changes in temperature during operation. This consruction can be regarded as a unique "floating" type of mounting of the inner wall 96, and it has been found after extensive tests to be of great advantage in dealing with the problem of expansion and contraction of the wall 96 during operation of the machine. A flange 100 is bolted by bolts 102 to the flange 56, thereby supporting the grinding chamber 10 by one end thereof. Inner and outer walls 104, 106 define a cooling jacket to which a coolant fluid is fed *via* an inlet pipe 108 and from which it is removed *via* an outlet pipe 110. An O-ring seal 112 is provided in a suitable recess in the retaining ring 100.

An advantage arising from the positioning of the cylindrical screen 70 is that its rapid rotation provides a centrifugal force on any particles or material which may tend to be lodged in the apertures, throwing this material radially outwards and thus effecting a "self-clearing" action. In addition, the rubbing of the milling elements on the outer surface of this screen also has a cleaning action. The mill may readily be disassembled for cleaning or for maintenance. In addition, the grinding chamber wall, coolant jacket, and retainer ring 100 can all be removed bodily merely by unscrewing the bolts 102. This provides ready access to the change the milling members 14. The seal shaft 12 and permits one to clean or formed by the pair of annular flaps 80 has been found effective to virtually preclude any leakage of milled product from the exit chamber 24.

The separator screen disclosed herein, when used in a grinding mill as illustrated, has the advantage that its conditions of use are such as to minimise abrasion thereon and to minimise blinding or blockage. The centrifugal force throws the product and the grinding medium radially outwardly. No regulating mechanism is required, and consequently there is no need to involve oneself in the complexities of adjusting an annular gap such as arise in the construction shown in British Patent Specifications No. 1 325 835. The separation of the grinding medium from the product has been found to be both reproducible and effective.

WHAT WE CLAIM IS:—

1. A dispersing or grinding mill having

a generally cylindrical grinding chamber containing a generally horizontal drivable shaft carrying milling members, in which an exit for discharging the milled product is formed by a generally cylindrical screen which forms part of or surrounds the shaft and extends to an end wall of the grinding ing chamber, the screen being positioned to permit passage of the milled product through the screen and thence through a space defined between the screen and the shaft while preventing passage of milling elements through the screen.

2. A mill according to claim 1 in which the shaft is hollow and can be cooled by internal circulation of a liquid coolant.

3. A mill according to claim 1 or 2 in which a seal formed by a pair of resilient annular flaps surrounds the shaft adjacent to the milled product exit, and means are provided for feeding a liquid lubricant (which may also be a coolant) to a space defined by the flaps, the part of the shaft therebetween, and a surrounding wall.

4. A mill substantially as hereinbefore described with reference to and as illustrated in Figure 1A of the accompanying drawings.

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1566752 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

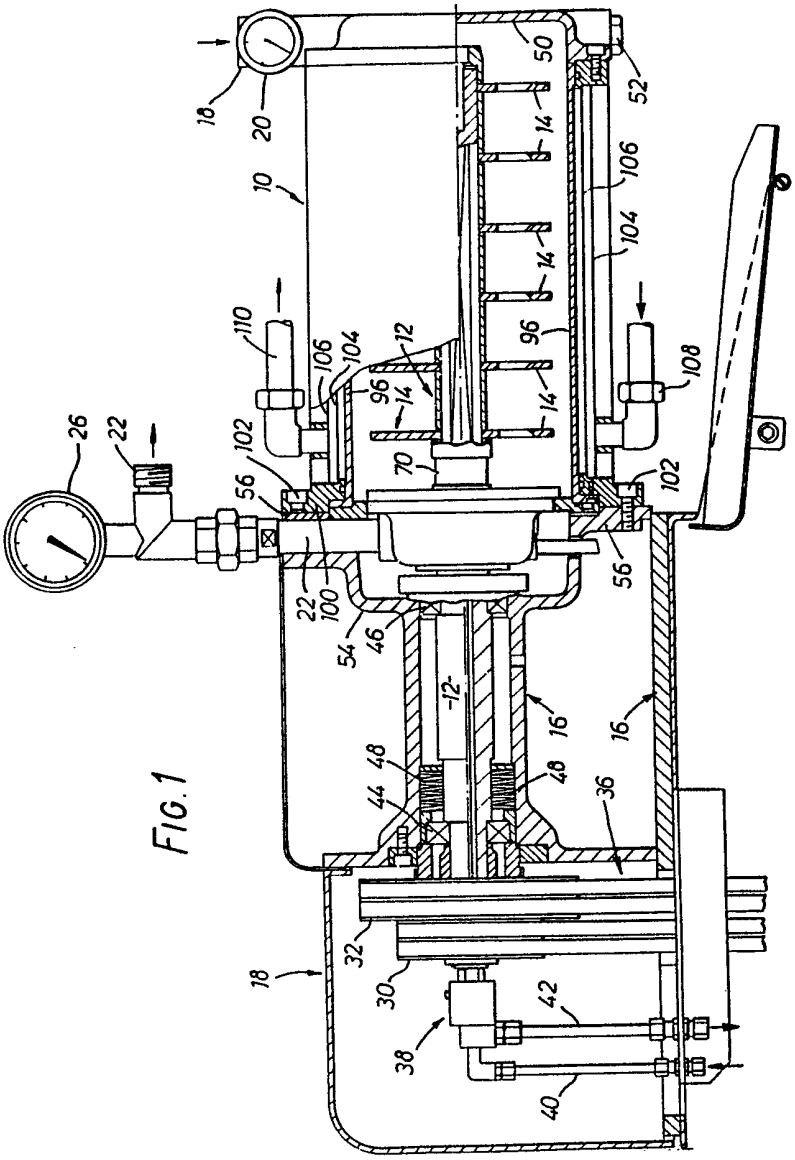

FIG. 1

1566752 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 2

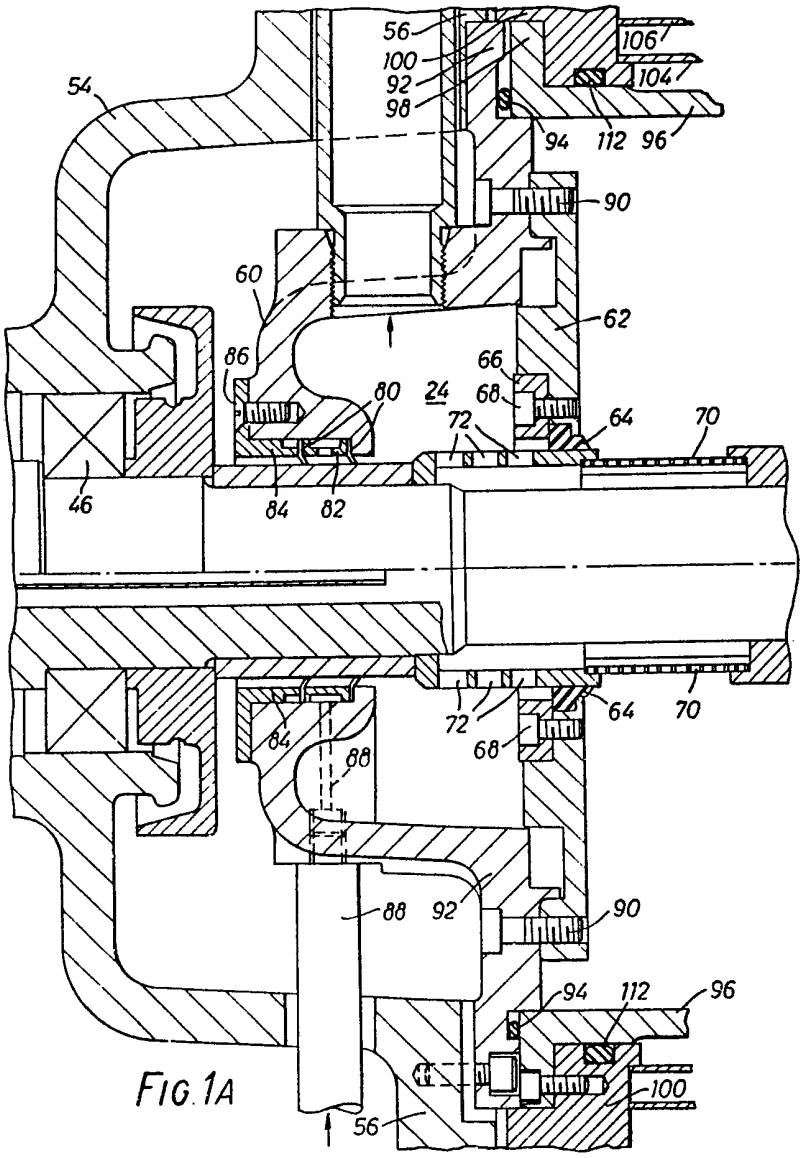

FIG. 1A