Oct. 21, 1941. R. C. NEWHOUSE 2,259,769

APPARATUS FOR REGULATING PULP LEVEL IN BALL MILLS

Filed Oct. 25, 1939

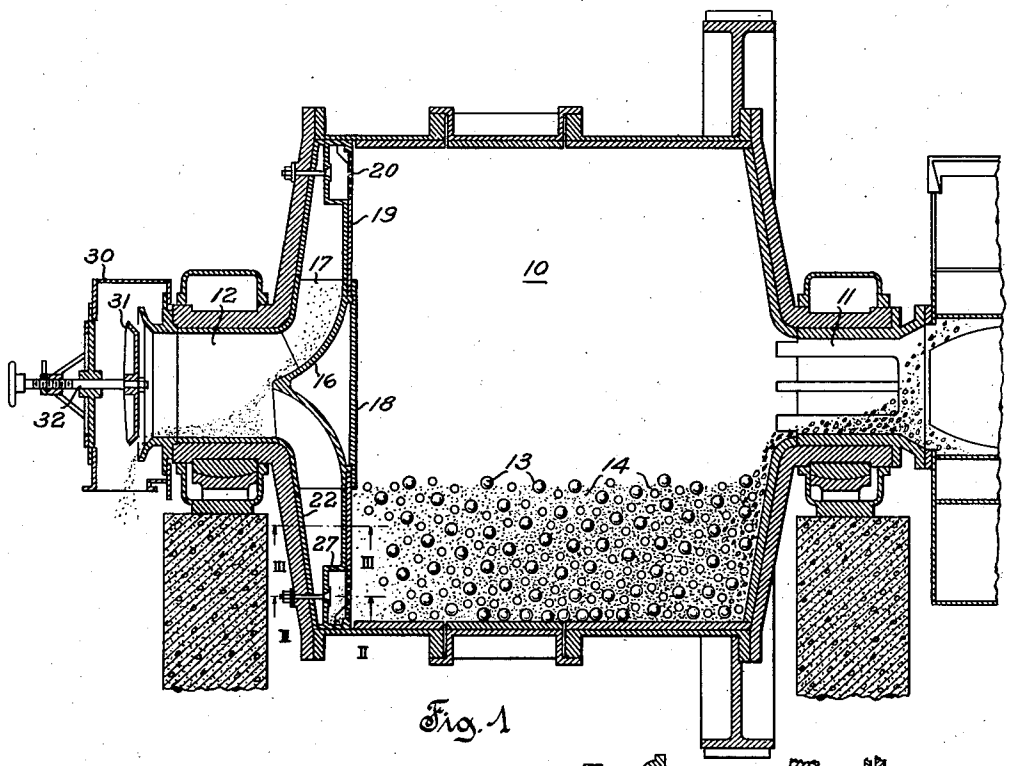


Fig. 1

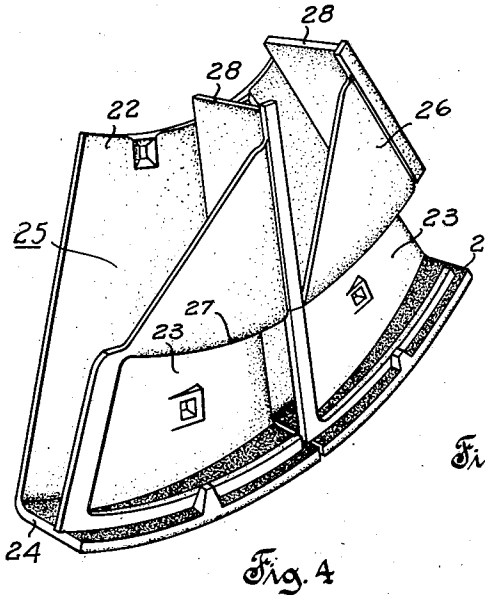


Fig. 4

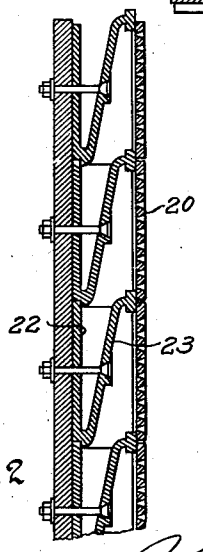


Fig. 2

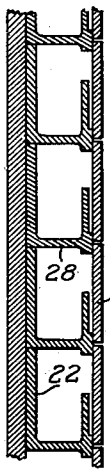


Fig. 3

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Patented Oct. 21, 1941

2,259,769

UNITED STATES PATENT OFFICE

2,259,769

APPARATUS FOR REGULATING PULP LEVEL IN BALL MILLS

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Application October 25, 1939, Serial No. 301,109

3 Claims. (Cl. 83—9)

This invention relates to a grinding mill and to a method of grinding ore, rock and other materials.

It is an object of this invention to provide a wet grinding mill in which the ground material is removed from the grinding chamber adjacent the cylindrical walls of the drum.

It is another object of this invention to provide positive pocket lifting means to raise such material from the bottom of the discharge chamber to a conical discharge head.

A further object of this invention is to provide a novel discharge means for a wet grinding mill which makes it possible to regulate the level of material in the mill while it is rotating in use.

Other objects will become apparent from the following description taken in conjunction with the attached drawing in which:

Fig. 1 is a central vertical section view through a wet grinding mill embodying features of this invention;

Fig. 2 is a developed view through a section of the discharge head taken on the line II—II of Fig. 1;

Fig. 3 is a similar view on the line III—III of Fig. 1; and

Fig. 4 is a perspective view of two segmental lifting pockets which form part of the discharge head of this invention.

Efficient grinding of material requires careful control of many factors. In addition to the rate and quality of feed and the weight and size of grinding media and speed of rotation of the mill, the amount of circulating load, the means for removing ground material from the grinding chamber and the level of material in the chamber are factors of extreme importance. A greater degree of control than has hitherto been possible over these last three factors is obtainable with the apparatus and method of this invention.

Referring to the drawing, Fig. 1 illustrates a rotary ball mill 10, provided with an inlet trunnion 11 and a discharge trunnion 12, and containing a charge of balls 13 and pulp (or slurry) 14. The pulp is discharged from the mill by means of the usual cone 16, provided with radial ribs 17.

The pulp or ground material is permitted to flow out of the grinding chamber only through a restricted area adjacent the periphery of the drum. The discharge end wall of the drum consists of a central blank or plate 18 and an annulus between said plate and cylindrical wall of the drum. In the mill illustrated herein, this annulus consists of segmental grid plates 19 which are provided with grid portions 20 near the periphery of the annulus. The pulp flows out of the grinding chamber through these peripheral grids.

The discharge head of the present invention comprises a plurality of positive lifting pockets 25. In the exemplification illustrated herein, each of these pockets 25 is formed by segmental plates 22, inclined segment plates 23 formed at an acute angle with plates 22, and arcuate flanges 24. Radially inward of inclined segment plates 23 are plate sections 26 which are parallel to plates 22 and are connected to inclined segment plates 23 by means of webs 27. Radial rib 28 connects one edge of plate 26 with an edge of segmental plate 22, and these ribs 28 form continuations of ribs 17. It will be understood that as the mill rotates, pockets formed by the members 22, 23, 24, 26, 27 will positively lift any pulp which has left the grinding chamber through grids 20, and will deposit such pulp on discharge cone 16 by means of ribs 28 and 17.

Mounted in stationary housing or bracket 30 is a trunnion valve 31 carried by threaded rod 32, which may be threaded in bracket 30. Manual adjustment of valve 31 relative to a valve seat in trunnion 12 may be effected by threading rod 32 toward and away from trunnion 12. This regulation of valve 31 is possible whether the mill is stationary or rotating in use. Any other suitable valve may be substituted for the valve described above.

With the construction described above, pulp is withdrawn adjacent the periphery of the mill and positively lifted to the discharge cone. Any pulp which is prevented from flowing out through the trunnion 12, because of the restriction of valve 31, will flow back into the pockets 25 and thereby regulate the amount of pulp flowing through the grid portions 20. The rate of discharge is susceptible of regulation at all times by means of valve 31. In this way the circulating load and the level of the pulp in the mill can be very easily regulated to suit varying speed conditions.

As used in the specification and claims, the term "pulp" also includes slurry, as well as other materials being ground.

It will be clear to those skilled in the art that various modifications and variations may be made in the embodiment disclosed herein. Such modifications and variations are included within the invention as defined in the appended claims.

It is claimed and desired to secure by Letters Patent:

1. Discharge means for a rotary grinding mill comprising an end wall provided with a discharge trunnion, a material retaining imperforate wall spaced from said end wall and provided with apertures adjacent only the peripheral wall of said drum, and radial ribs extending across the entire space between said end wall and said material retaining wall, at least those portions of said ribs which are coextensive with the apertured peripheral portion of said material retaining wall being arranged at an acute angle with said end wall, said material retaining wall abutting said radial ribs and being partially supported thereby.

2. A discharge diaphragm for a rotary mill comprising a plurality of segmental lifting members, each lifting member comprising a flat segmental imperforate plate provided with an arcuate wall at the larger end thereof, and a second segmental imperforate plate at an angle with said first segmental plate and forming a pocket between said plates and said arcuate wall, said second segmental plate being provided with a portion adjacent the smaller end thereof substantially parallel to said first segemental plate, and a web connecting said angular and parallel portions.

3. Discharge means for a rotary grinding mill comprising an end wall provided with a discharge trunnion, a material retaining imperforate wall spaced from said end wall and provided with apertures adjacent only the peripheral wall of said drum, and radial ribs extending across the entire space between said end wall and said material retaining wall, at least those portions of said ribs which are coextensive with the apertured peripheral portion of said material retaining wall being arranged at an acute angle with said end wall, each of said ribs substantially abutting its circumferentially adjacent ribs.

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