

Sept. 17, 1935.

J. P. WALES

2,014,640

GRINDING MILL

Filed Oct. 20, 1931

2 Sheets-Sheet 1

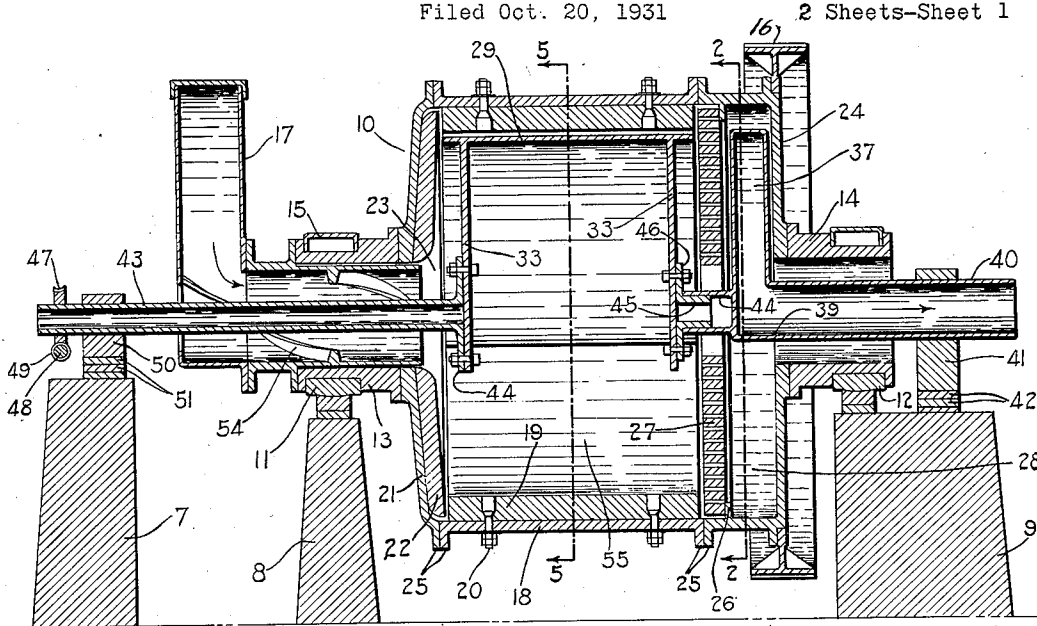


FIG. 1

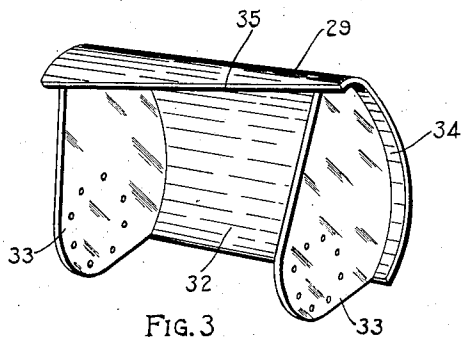


FIG. 3

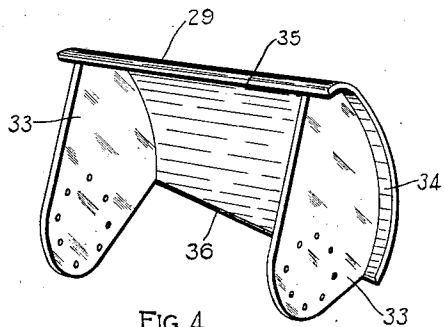


FIG. 4

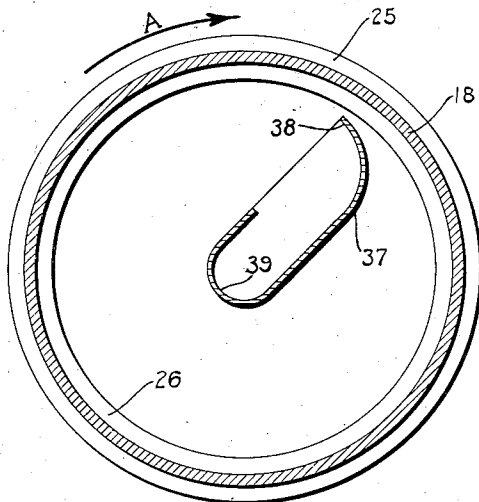


FIG. 2

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2 Sheets-Sheet 2

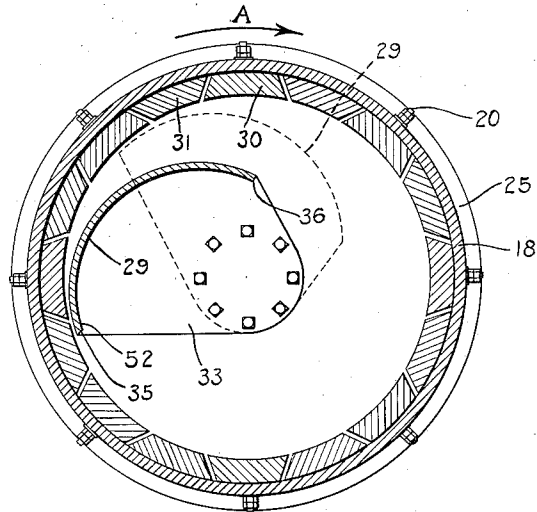


FIG. 5

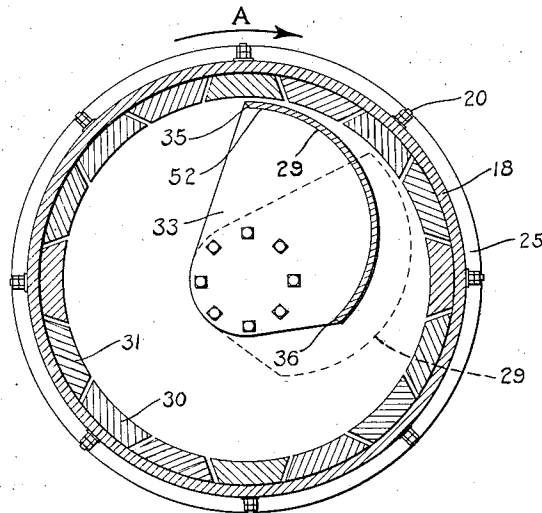


FIG. 6

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UNITED STATES PATENT OFFICE

2,014,640

GRINDING MILL

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4 Claims. (Cl. 83—9)

My invention relates to cylindrical grinding mills. An important object of the invention is to construct a cylindrical grinding mill that may be operated at a higher speed than heretofore possible.

In this art, it has been thought necessary to run a mill at less than the critical speed. The "critical speed" is that velocity of rotation that will cause the outer layer of grinding media to cling to the inner surface of the mill throughout rotation, by reason of centrifugal force. Of course, it is necessary that the grinding medium (balls, rods or pebbles) descend; i. e., fall or roll, toward the bottom of the mill during rotation, in order to grind material in the mill. If the grinding media cling to the inner wall of the mill throughout rotation thereof, no grinding takes place.

However, the faster that the shell is rotated, the higher it raises the grinding medium, the greater the impact, providing the grinding medium rolls or falls to the bottom, and the greater the kinetic energy of the grinding charge.

An object of the invention, therefore, is to obtain greater efficiency by rotating my mill at a velocity greater than the critical speed and yet prevent grinding media from clinging to the shell, as stated.

Another object is to eliminate the so-called "dead spot" in a grinding mill, which is the region in a grinding mill about which the grinding medium revolves, and in which region little or no grinding takes place.

A further object of the invention is to provide means to divert the grinding medium and material revolving at high speed, from any position around the inner surface of the mill toward the bottom, thus making available this increased energy for impact on the material and grinding media in the lower part of the mill.

Still another object is to eliminate lifters for the grinding medium and for the ground material.

Other objects reside in details of construction of parts and in novel combinations and arrangements of parts, which will appear in the course of the following description. In the drawings, like reference characters designate similar parts in the several views.

Figure 1 is a longitudinal, vertical sectional view of an embodiment of my invention.

Figure 2 is a section taken on the line 2—2, looking in the direction of the arrows.

Figures 3 and 4 are perspective views of dif-

ferent constructions of baffles or scrapers comprised in the invention.

Figures 5 and 6 are cross sections taken on the line 5—5 of Figure 1, looking in the direction of the arrows, showing the baffle or scraper in several positions.

Referring more in detail to the drawings, the reference characters 7, 8 and 9 designate base members or supports upon which a grinding mill 10 is mounted. Bases 8 and 9 respectively support bearings 11 and 12 for trunnions 13 and 14 of the mill. The top of the bearings have oil caps 15.

The mill has a conventional ring gear 16 for driving same, and a dipper 17 for feeding material to the inlet trunnion 13. Helically arranged ribs 54 in the latter trunnion feed material into the shell 18, by rotation of the mill. The direction of rotation of the mill is shown by the arrow "A" in Figures 2, 5 and 6. The mill has a sectional lining 19 held in place by bolts 20. The bolts hold sections 30, whose edges converge toward the shell. Between these sections are other dove-tail sections 31, whose edges diverge toward the shell, as shown in Figures 5 and 6.

Head 21 at the feed end of the mill has a lining 22 provided with a beveled central opening 23 for the inlet of feed material. Head 24 at the discharge end of the mill supports the ring gear 16.

The shell and heads have abutting flanges 25 30, for fastening said elements together. Spaced from the mill end 24 is an internally projecting rim 26. A grid 27 of usual form is disposed within the mill against the rim 26, divides the shell into a grinding chamber 55 and a discharge space 28. The grid is arranged between the rim 26 and the end of the lining sections 19 of the shell.

A baffle or scraper 29 is provided within the mill. Figures 3 and 4 show different constructions of the baffle and Figures 5 and 6 show different arrangements of same within the shell. The baffle comprises a curved back member 32 and bracing members 33 conforming with the curved interior of the back member. The members 33 are spaced inward from the ends of the curved member, as indicated at 34. This space is large enough for a ball to enter without wedging. If this space were not provided, as the head liner and grid wore away from the braces, at a certain point the balls would wedge therebetween. Wedging is avoided by my arrangement.

As shown in Figures 3 and 4, the edges of the curved back member 32 may be non-parallel, as 55

by cutting either the front edge 35 or the rear edge 36 at a bias.

In the space 28, a relatively stationary scoop 37 is arranged with its lip 38 adjacent the inner surface of the space. By this means, ground material that is fine enough to pass through the grid, is scooped off of the circumferential wall of the space 28, and the material falls into a trough 39 at the bottom of the scoop 37. Were this scoop not used, the pulverized material would adhere to the wall of this space, on account of the rapid rotation of the mill. From the trough 39, the material runs out of the mill through the pipe 40.

The scoop 37 is supported on a standard 41 on the base 9. Wedge blocks 42 between the base and the standard are used to adjust the scoop in a vertical plane. The pipe 40 and its associated scoop 37 may be rotated relative to the standard, to adjust the scoop in a rotary path, relative to the shell wall.

The baffle 29 is supported at one side on a shaft 43, by being bolted to a flange 44 on the shaft. The other side of the baffle is supported by telescoping members 44 and 45 on the scoop 37 and on the baffle respectively. The telescoping member 44 is shown as being integral with the scoop and the member 45 is shown as being bolted to the baffle through the medium of a flange 46 on the member 45.

To effect rotary adjustment of the baffle 29, as shown in full and dotted lines in Figures 5 and 6, the shaft 43 is rotated by a worm gear 47 controlled by a worm 48 on a shaft 49. The shaft 43 is supported on a standard 50 on the base 7. Wedge blocks 51 beneath the standard are utilized for vertical adjustment of the shaft 43.

In the operation of the mill, it is no doubt clear that the direction of movement of the balls, or other grinding medium, is controlled by the bias cut of the edges of the curved back member. Moreover, it is thought clear without further illustration, that the back member of the baffle may be of any other plain, geometrical shape, such as a square, rectangle, parallelogram, right angle triangle, etc., and may be flat, concave, convex, a logarithmic spiral (as shown in the drawings), a parabola, a hyperbola, etc. in section.

Lip 52 of the baffle is preferably near the inner periphery of the mill shell. As can be seen, it is desirable that the space between this lip and the shell liner be less than the diameter of the grinding medium (balls, for instance), even at the point of greatest wear of the shell liner sections. Thus wedging of the balls between the lip and the liner sections can be avoided. The lip 52 is preferably beveled, as shown in Figures 5 and 6.

The position of the baffle and scoop 37, or either of them, may be changed as desired. The position of the baffle is altered in a rotary path by the worm 49 and worm gear 47. Due to the pivotal support for the baffle by the telescoping members 44 and 45, the baffle may be adjusted relative to the scoop 37. The scoop is rotated by turning the conduit 40. The height of the scoop 37 and

the shaft 43 is regulated by the number and position of the wedge blocks 42 and 51.

The mill during operation is rotated at greater than the critical speed, and as the balls, or other medium, and material strike the baffle, they are diverted at high speed from the centrifugal path by means of the baffle, and are forced to impinge on the material and other balls or medium below. The scoop 37 scrapes off the pulverized material that has passed through the grid and is clinging to the inner surface of the space 28 on account of the comparatively rapid rotation of the mill.

The feed material is lifted up by the dipper 17, travels through the trunnion 13 by reason of the spiral ribs 54, and is discharged through the trough 39 and conduit 40 after grinding.

A distinct advantage of the present mill is the fact that the active, working volume is greater than heretofore attained.

It is to be understood that changes may be made 20 in the details of construction and in the combination and arrangement of parts without departing from the broad principle or the spirit and scope of the invention.

What I claim and desire to secure by Letters Patent is:

1. A grinding mill comprising a rotary shell having inlet and discharge openings, a grid in the shell, separating same into grinding and discharge chambers, a stationary baffle in the grinding chamber, a scoop in the discharge chamber, and supports for the baffle and for the scoop extending through the inlet and discharge openings, the scoop and baffle being pivotally connected through the grid.

2. A grinding mill according to claim 1, in which telescoping members on the scoop and baffle afford the pivotal connection.

3. A grinding mill comprising a rotary drum having an inlet and an outlet at opposite ends, a deflective baffle having a cutting edge contiguous to the inner circumferential surface of the drum, to interrupt the rotary movement of material congregated against said surface under the influence of centrifugal force, a grid spaced from the outlet end of the drum to provide a chamber for the product of the grinding action, and a scoop in said chamber to remove the product from under the influence of centrifugal force for its movement to and through the outlet.

4. A grinding mill comprising a rotary drum having an inlet and an outlet at opposite ends, a deflective baffle having a cutting edge contiguous to the inner circumferential surface of the drum, to interrupt the rotary movement of material congregated against said surface under the influence of centrifugal force, a grid spaced from the outlet end of the drum to provide a chamber for the product of the grinding action, and a stationary scoop in said chamber to remove the product from under the influence of centrifugal force, having a discharge conduit in the outlet.

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