R. W. GORDON AND A. C. DAMAN.

GRINDING MILL.

APPLICATION FILED NOV. 3, 1919.

1,381,987.

Patented June 21, 1921.

2 SHEETS—SHEET 1.

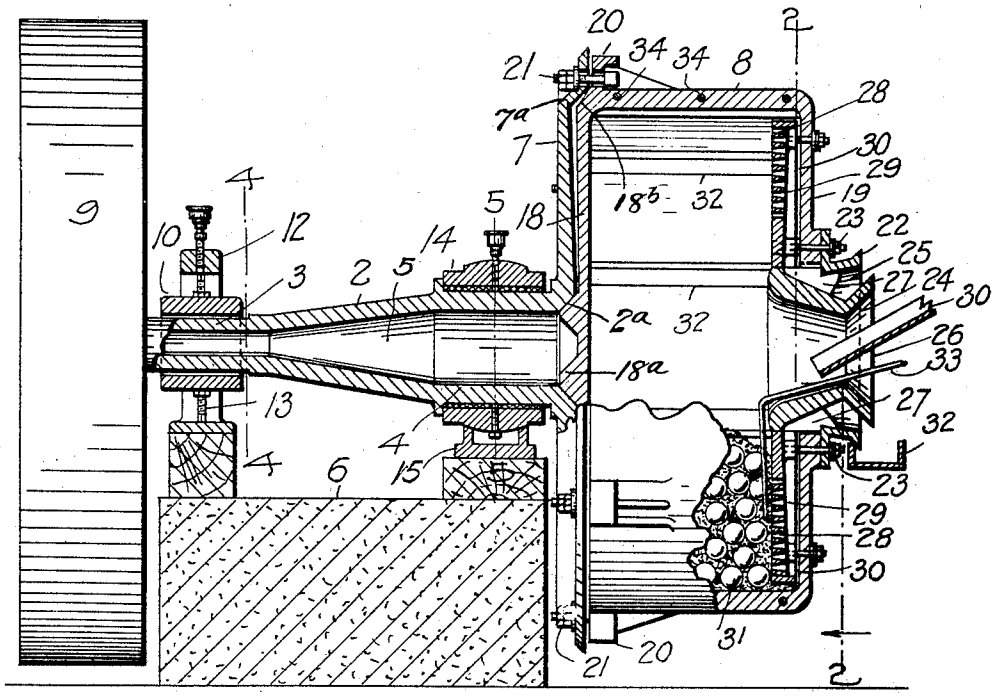

FIG. 1

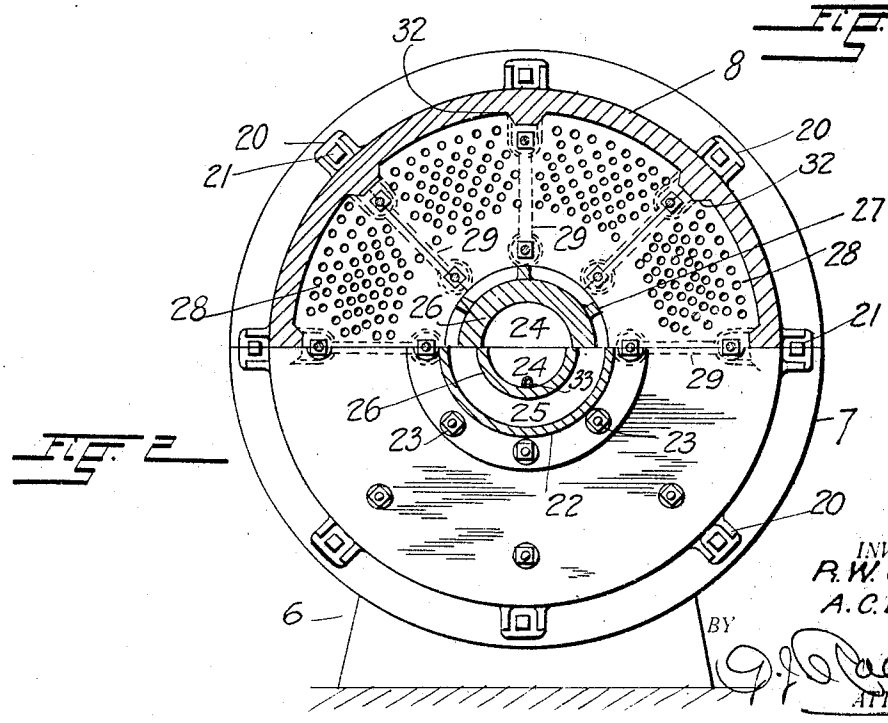

FIG. 2

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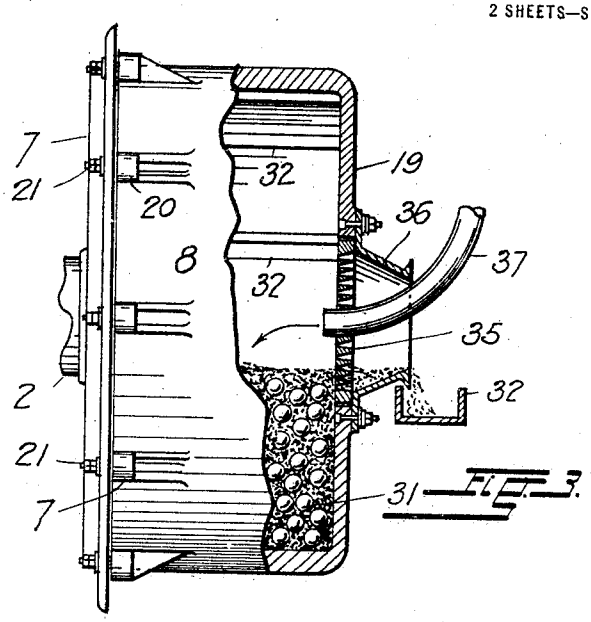

FIG. 3.

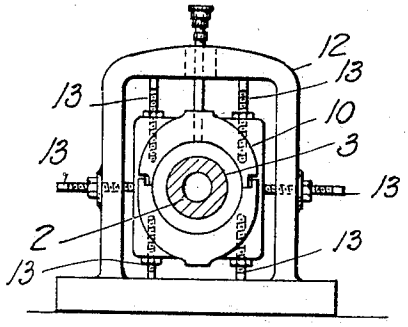

FIG. 4.

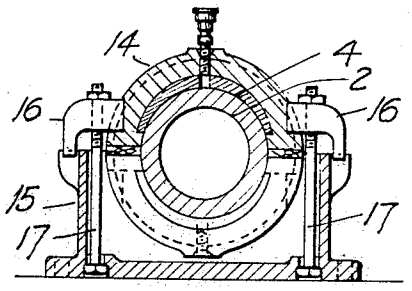

FIG. 5.

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UNITED STATES PATENT OFFICE.

ROBERT W. GORDON AND ARTHUR C. DAMAN, OF DENVER, COLORADO, ASSIGNORS TO THE STEARNS ROGER MANUFACTURING COMPANY, A CORPORATION OF COLORADO.

GRINDING-MILL.

1,381,987. Specification of Letters Patent. **Patented June 21, 1921.**

Application filed November 3, 1919. Serial No. 335,396.

To all whom it may concern:

Be it known that we, ROBERT W. GORDON and ARTHUR C. DAMAN, respectively a subject of George V, King of England, but having taken out first naturalization papers, and a citizen of the United States, residing at Denver, in the county of Denver and State of Colorado, have invented certain new and useful Improvements in Grinding-Mills, of which the following is a specification.

This invention relates to grinding mills of the type in which the comminution of ore or other material is effected by the grinding action of a mass of moving balls or pebbles within a rotating cylinder.

It is the primary object of the present invention to provide a mill of this character in which the grinding cylinder is detachably hung at an end of its driving shaft and counterbalanced by a driving pulley at the opposite end of the same.

A further object of the invention is to provide in a mill thus mounted, efficient means for discharging the ground product at the same side of the rotating cylinder at which the feed is admitted, and still another object is to provide convenient means of adjustment to take up wear in the bearings in which the shaft is supported and to constantly maintain the shaft in the right position for the operation of the mill at or near its point of highest efficiency.

The above and other objects all of which will fully appear in the course of the following description, we attain by the construction, arrangement and combinations of parts illustrated in the accompanying drawings in which like characters of reference designate corresponding parts throughout the several views, and in which—

Figure 1 represents a sectional elevation of our improved grinding mill in its preferred form;

Fig. 2, a vertical section taken on the line 2—2, Fig. 1;

Fig. 3, a sectional elevation of the grinding cylinder of the improved mill, showing certain modifications in its construction.

Fig. 4, an enlarged elevation of the adjustable bearing of the mill shaft shown in section on the line 4—4, Fig. 1, and

Fig. 5, an enlarged section of the self-adjusting bearing taken on the line 5—5, Fig. 1.

Referring to the drawings, the reference numeral 2 designates a hollow shaft having terminal journals 3 and 4 of different diameters at opposite ends of a tapering medial portion 5.

The shaft is rotatably supported in boxes which are mounted on a suitable foundation 6 and it has adjacent its larger journal, a circular plate or disk 7 for the detachable connection of the grinding cylinder 8 hereinafter to be described in detail.

A pulley 9 mounted at the opposite end of the shaft serves for its connection with a motor or other driving medium and it is made of sufficient weight to counterbalance the greater part of the grinding element and its load.

The bearing 10 which supports the smaller shaft journal adjacent the pulley, is adjustably held in a frame 12 through the intermediary of a plurality of set screws 13 which permit of its being moved in any desired direction for the proper adjustment of the shaft.

The other box 14 which surrounds the larger journal of the shaft adjacent the grinding cylinder, is supported by a ball-and-socket joint in a chair 15 and is held against excessive displacement by a hook-shaped pair of lugs 16 extending in notches of the box, and bolts 17 which connect the lugs to the base plate of the chair.

The openings through which the bolts extend are sufficiently large to permit of a limited oscillatory movement thereof in order to follow the automatic displacement of the box upon its chair when by manual adjustment of the other box the position of the shaft is varied.

The grinding cylinder of the mill consists of a cylindrical shell closed at its ends by integral heads 18 and 19 and provided with lugs 20 for its detachable connection with the carrying member 7 at the end of the driving shaft, by means of bolts 21. The closed or integral head 18 of the grinding cylinder is provided with a central tapered annular boss 18^a which fits into a tapered opening 2^a in the center of the carrier disk or plate 7. The grinding cylinder is also provided at its periphery with a beveled or

tapered portion 18[b] which fits within an angularly disposed annular flange 7[a] and the latter presents a beveled or tapering inner face to receive the peripheral tapered portion of the grinding cylinder. This construction of carrying member provides a setting for the closed end of the grinding cylinder.

The cylinder which is axially alined with the shaft upon whose end it is carried, has in its outer head 19 a central opening to receive and discharge the material under treatment.

In the form of our invention shown in Figs. 1 and 2, this opening is surrounded by a flanged rim 22 which is fastened to the head by bolts 23 and is divided into a central feed passage 24 and a surrounding annular discharge passage 25 by a short inwardly flaring and terminally funneled conduit 26 which is integrally connected with the rim by a series of distance lugs 27.

A grid or screen 28 spaced from the interior surface of the mill-head by equidistant radial ribs 29, adjoins the inner edge of the partitioning conduit 26 to provide a space 30 in connection with the annular discharge passage 25.

The ribs of the screen divide the space into a series of buckets in which the ground material is lifted to a point of discharge at the upper portion of the annular passage 25, and the screen is for convenience in production and installation made up of segmental sections which adjoin each other medially of alternate ribs 29.

The grid-sections are attached to the cylinder head by bolts passing through openings formed by complementary grooves in the portions of the ribs at their adjoining ends, part of the bolts being those employed to secure the rim and conduit to the head.

In the operation of the mill, the material to be ground is fed from a launder 30 into the rotating cylinder through the central passage 24 of the opening in its outer head and is subjected to the grinding action of a mass of balls or pebbles 31 which are intermittently lifted by tumbling ribs 32 on the inner circumference of the cylinder and cascade with part of the pulp, into the constantly agitated mass in the lower portion of the same.

The ground product passes through the apertures of the screen or grid into the divided space 30 and is lifted on the radial ribs for its delivery into the annular discharge passage of the opening in the head of the cylinder, whence it passes across the rim 22 into a subjacent launder 32.

To facilitate the separation of the ground product in case the material under treatment is of more than ordinary density, a supply of water may be introduced into the mill in close proximity to the grid by a pipe 33 extending through the feed passage of the opening in the mill head.

The great simplicity of construction of our improved mill in comparison with other grinding machines of the same type does not detract from its practicability in use nor does it lessen its capacity, and although the feed and the discharge both pass through one opening in the head of the rotating cylinder, they do not interfere with one another or with the continuous operation of the mill.

The cast iron grinding cylinder reinforced by steel rods 34, is made in one piece without the detachable heads and linings found in ball mills at present in common use. The cylinder being detachably mounted on the plate at the end of the driving shaft is readily removed when worn, and replaced by another, and the entire structure is maintained in the proper position for efficient operation by adjustment of the box around the small journal of the shaft.

In the modification shown in Fig. 3 of the drawings, the central opening in the outer cylinder head is undivided and covered by a screen 35 which separates the ground product discharged through the opening by an overflow of liquid in the material under treatment.

An outwardly tapering rim 36 around the opening, establishes the overflow level and the material and liquid is fed into the cylinder through a pipe 37 projecting through a central opening in the screen.

It will be seen that an important feature of the invention as described hereabove and disclosed in the drawings, is the balanced relation between the driving pulley at one end of the rotary shaft and the grinding cylinder at the opposite end of said shaft. The bearing 10, it will be noted is adjustable vertically and laterally and affords a means whereby the balanced relation may be effected accurately.

Having thus described our invention what we claim and desire to secure by Letters-Patent is:

1. A mill of the class described comprising a rotary shaft, inner and outer bearings for the said shaft, the inner bearing having a ball and socket joint and the outer bearing having means for adjusting the shaft both vertically and horizontally, a carrying member rigid with the inner end of the shaft and a grinding cylinder adjustably connected to said carrying member.

2. A mill of the class described comprising a rotary shaft having inner and outer bearings, the inner bearing being provided with a ball and socket joint and the outer bearing having vertical and horizontal adjusting means located at diametrically opposite points, a carrying member arranged at the inner end of the shaft and provided with a central tapered opening and having

a circumferential interior taper, a grinding means provided with a centrally tapered boss fitted within the tapered opening in the center of the carrying member, said grinding means being also provided with a tapered periphery fitting the circumferential taper of the said member, peripheral adjusting means connecting the said member and the grinding means and a counterbalancing pulley mounted on the outer end of the said shaft.

3. A mill of the class described comprising a rotary shaft having terminal journal portions of different diameters and a tapering intermediate portion, a bearing receiving the larger end of the shaft and provided with a ball and socket joint, an adjustable bearing receiving the smaller end of the shaft and provided with means for moving the same vertically and horizontally, a carrying member rigid with the larger end of the shaft and forming a seat and a grinding cylinder having a closed end fitted in the seat of the carrying member and adjustable thereon.

In testimony whereof we have affixed our signatures.

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