J. B. HOOP.

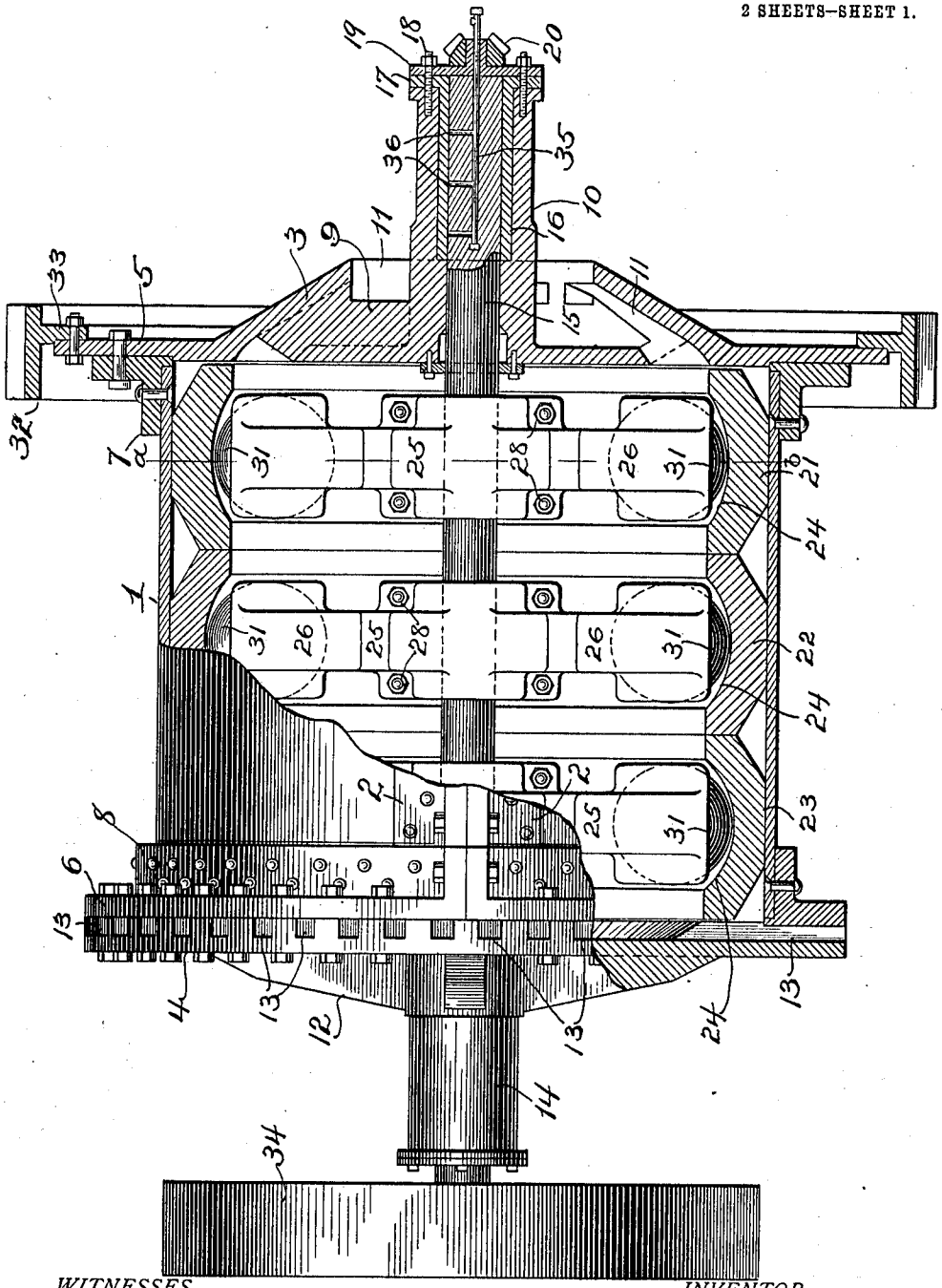
GRINDING MILL.

APPLICATION FILED APR. 19, 1910.

1,021,191.

Patented Mar. 26, 1912.

2 SHEETS—SHEET 1.



WITNESSES

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FIG. 1.

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

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2 SHEETS—SHEET 2.

Fig. 2.

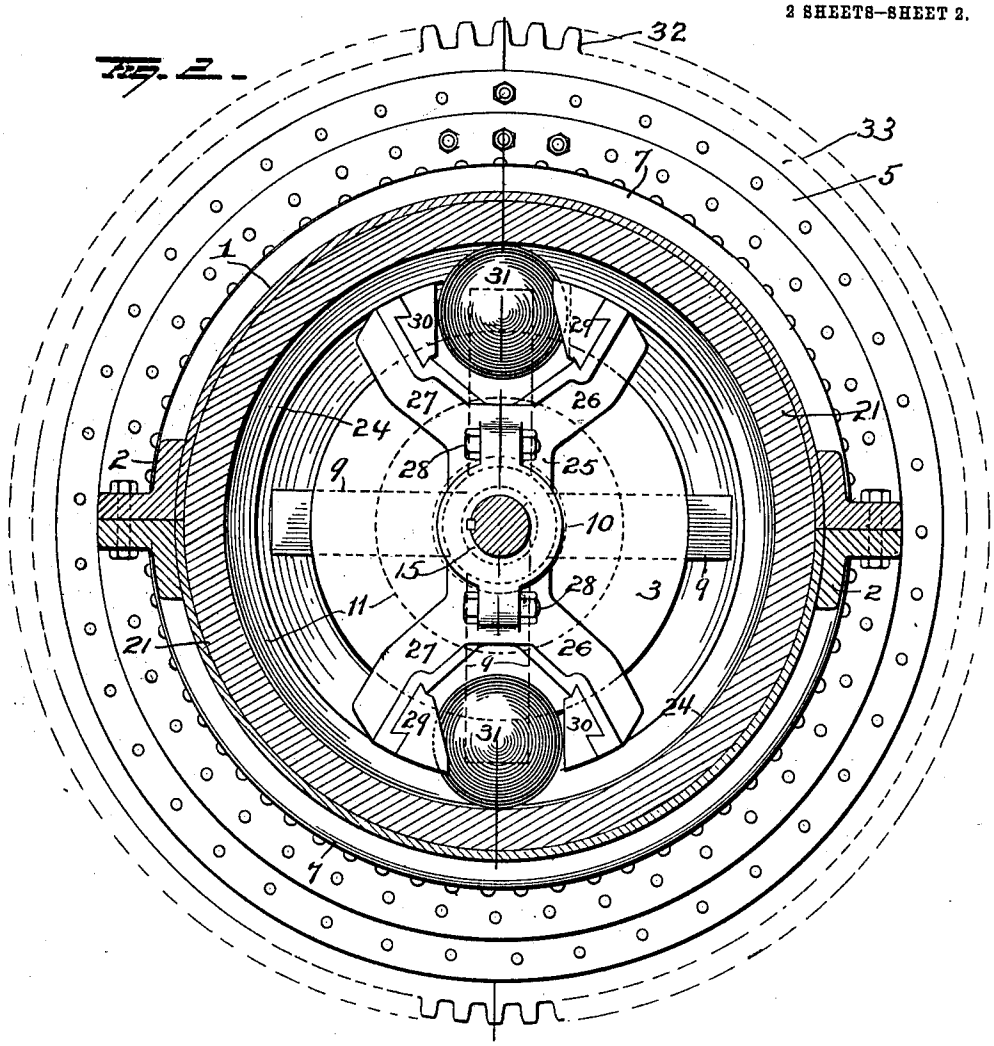
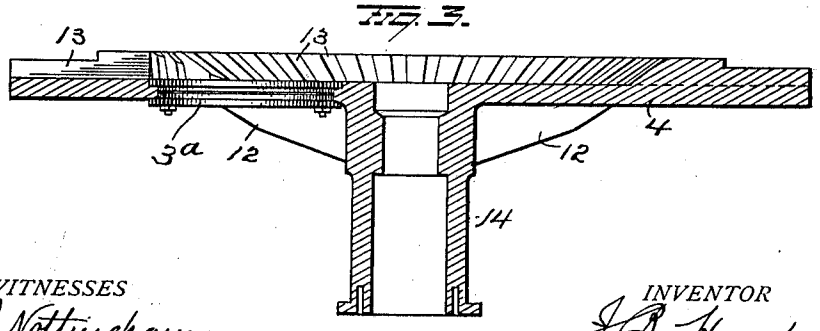


Fig. 3.



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UNITED STATES PATENT OFFICE.

JAMES B. HOOP, OF PORTLAND, COLORADO, ASSIGNOR OF ONE-HALF TO WHITNEY NEWTON, OF DENVER, COLORADO.

GRINDING-MILL.

1,021,191. Specification of Letters Patent. Patented Mar. 26, 1912.

Application filed April 19, 1910. Serial No. 556,422.

To all whom it may concern:

Be it known that I, JAMES B. HOOP, of Portland, in the county of Fremont and State of Colorado, have invented certain new and useful Improvements in Grinding-Mills; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in grinding mills of that type known in the art as ball and drum mills, and is particularly designed for reducing such material as Portland cement clinker.

The object of my present invention is to provide a mill of the type specified in which the application of energy for pulverizing will be enhanced and to so construct the mill as to reduce wear to a minimum and facilitate the making of repairs.

With this and other objects in view the invention consists in certain novel features of construction and combinations of parts as hereinafter set forth and pointed out in the claims.

In the accompanying drawings, Figure 1 is a longitudinal sectional view partly in elevation, of a pulverizing mill embodying my improvements, Fig. 2 is a view in section on the line *a*—*b* of Fig. 1, and Fig. 3 is a sectional view of the head 4.

1 represents a revoluble drum made of boiler metal or sheet steel and comprising two members, to the meeting edges of which angle-bars 2 preferably of steel are secured and these angle-bars at diametrically opposite sides of the drum are bolted together as clearly shown in Fig. 1. Heads 3 and 4 are located at respective ends of the drum 1 and provided respectively with annular flanges 5—6. Rings 7—8 are secured at respective ends of the drum 1. These rings are made angular in cross-section and the outwardly projecting members thereof are bolted to the flanges 5—6 of the respective heads 3 and 4. The head 3 at the inlet end of the mill is made hollow and with a series of compartments formed by radial ribs 9 and made integral with this head 3 is a tubular journal 10, around which an inlet opening 11 is formed in the head for the reception of material coming from a suitable feeding device not shown. The head 4 at the outlet end of the mill is suitably braced by means of ribs 12 and at intervals this head 4 is provided with slots which coöperate with the angle-ring 8 to form discharge outlets 13,—as shown in Fig. 1. This head is also provided with a man-hole (closed by a cover 3^a) to permit access to the interior of the mill. The head 4 is also provided with a tubular journal 14 and mounted in the journals 10 and 14 of the respective heads and passing centrally through the drum is a shaft 15. To afford proper bearings for this shaft, a removable bearing sleeve 16 is located within each of the journals 10 and 14 and provided at the outer end with an annular flange 17 secured by means of screws 18 to the end of the journal. The screws 18 at the end of the journal 10 also secure in place, a head or plate 19 carrying a pinion or sprocket 20 intended to transmit motion, through the medium of suitable gearing to the feed mechanism not shown.

Any desired number of grinding rings are located within the drum 1,—three such rings 21, 22 and 23 being shown in the drawings and each of these rings is made interiorly with a groove 24. Arms 25 are secured to the shaft 15 and each of these arms comprises two members 26—27 fastened together by means of bolts 28 and at each end the arm members 26—27 diverge one from the other and are provided with saddles 29 and 30. The saddles 29 are recessed while the saddles 30 are made plain as shown in Fig. 2 of the drawings and between the saddles 29 and 30 of the respective pairs carried by each of the arms 28, grinding balls 31 are disposed. These grinding balls cooperate with the grooved inner faces of the grinding rings to pulverize or reduce the material. It will be observed that the diameters of the grooved grinding surfaces are different in the several grinding rings 21, 22 and 23,—increasing toward the outlet head 4 of the mill. The object of this is to give uniform outward motion of the material as it is fed into the mill. In the present instance, three grinding rings are shown and it will be noted that the groove of the grinding ring 21 has a larger radius than the grooves of rings 22 and 23. This is so designed that the balls 31 can get better action on the coarse material as it enters the mill through the head 3. The groove in the ring 22 is of smaller radius than that of the

groove in the ring 21 for the reason that the material passing from ring 21 to ring 22 is finer and said ring 22 therefore requires a groove of smaller radius to do effective grinding. The groove of the grinding ring 23 is still smaller in radius than the groove of grinding ring 22 and is the same radius as the balls 31 traveling in this groove. The material passing grinding ring 22 to grinding ring 23 is still finer and the groove in ring 23 is necessarily the same radius as the balls 31 traveling in it, in order to thoroughly pulverize the material to a fine powder,—after which, the pulverized material is discharged from the mill through the outlets 13.

For the purpose of rotating the drum 1 and its contained grinding rings, a gear wheel or pulley 32 is employed and provided interiorly with an annular flange 33 bolted to the peripheral flange 5 of the head 3. Motion may be imparted to this gear wheel or pulley from any suitable source of supply. For the purpose of rotating the shaft 15 and the grinding balls carried by the arms thereon, (either in the same direction as that of the rotation of the drum 1 or in a direction reverse to that of the latter) a pulley 34 is secured to one end of said shaft 15 and receives motion from any suitable source of power.

The ends of the shaft 15 are provided with lubricant ducts 35 with which radial passages 36 communicate for supplying lubricant to the bearing sleeves 16 within the journals 10 and 14 and thus maintain the bearings of said shaft 15 properly lubricated.

It will be observed that the drum is driven independently of the rotating shaft and balls and may be run at any desired speed, either contrary to or coinciding with the direction of rotation of the balls, as may be best adapted to the material to be ground or the conditions of its use,—and the control of the rotation of the drum is positive and not contingent on friction from the balls therein. The drum, being made in sections, can be readily taken apart to permit repair or renewal of parts and can then be easily and quickly reassembled.

By making the inlet or feed head 3 of the mill hollow and dividing the same in compartments by radial webs 9, the material entering the mill will be evenly distributed to the grinding mechanism, and these radial webs also act as spokes to strengthen the head 3. The fineness of the material delivered is controllable in part by the speed of rotation of the drum. The more rapid the rotation of the drum the more rapid the delivery and the coarser the material delivered and conversely the finer.

Having fully described my invention what I claim as new and desire to secure by Letters-Patent is,—

1. In a grinding mill the combination with a drum consisting of a sheet metal cylinder and detachable heads and a series of cylindrical grinding rings having grooves successively increasing in diameter and diminishing in radius from the inlet to the outlet of the mill, of rotating arms, and grinding balls carried by said arms, and adapted to operate on material in said grinding grooves, substantially as set forth.

2. In a grinding mill, the combination with a rotary cylinder, a series of independent grinding rings secured side by side in the cylinder, the grinding grooves of said rings successively increasing in diameter and decreasing in radius from the inlet to the outlet of the mill, and the adjacent faces of said grooves forming flat partitions over which the material passes from one groove to the other, of a rotary shaft, a series of arms secured to said shaft, and grinding balls carried by said arms, substantially as set forth.

3. In a grinding mill, the combination with a rotary cylinder provided at one end with a head having an inlet chute formed therein, and at the opposite end with a head having discharge grooves formed therein, a series of grinding rings secured side by side within the cylinder, the inner faces of said ring being on a plane with the inlet and discharge passages of the cylinder, said rings being provided with grinding grooves of increasing diameter from the inlet to the discharge outlets of the mill, of a rotary shaft, a series of arms secured to the shaft and grinding balls carried by said arms, substantially as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

JAMES B. HOOP.

Witnesses:
R. J. Morse,
J. M. Leonard.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."