No. 881,262. PATENTED MAR. 10, 1903

A. RAYMOND, DEC'D.

M. M. BARTELME, ADMINISTRATRIX.

CENTRIFUGAL ROLLER MILL.

APPLICATION FILED SEPT. 26, 1901.

3 SHEETS—SHEET 1.

Fig. 1

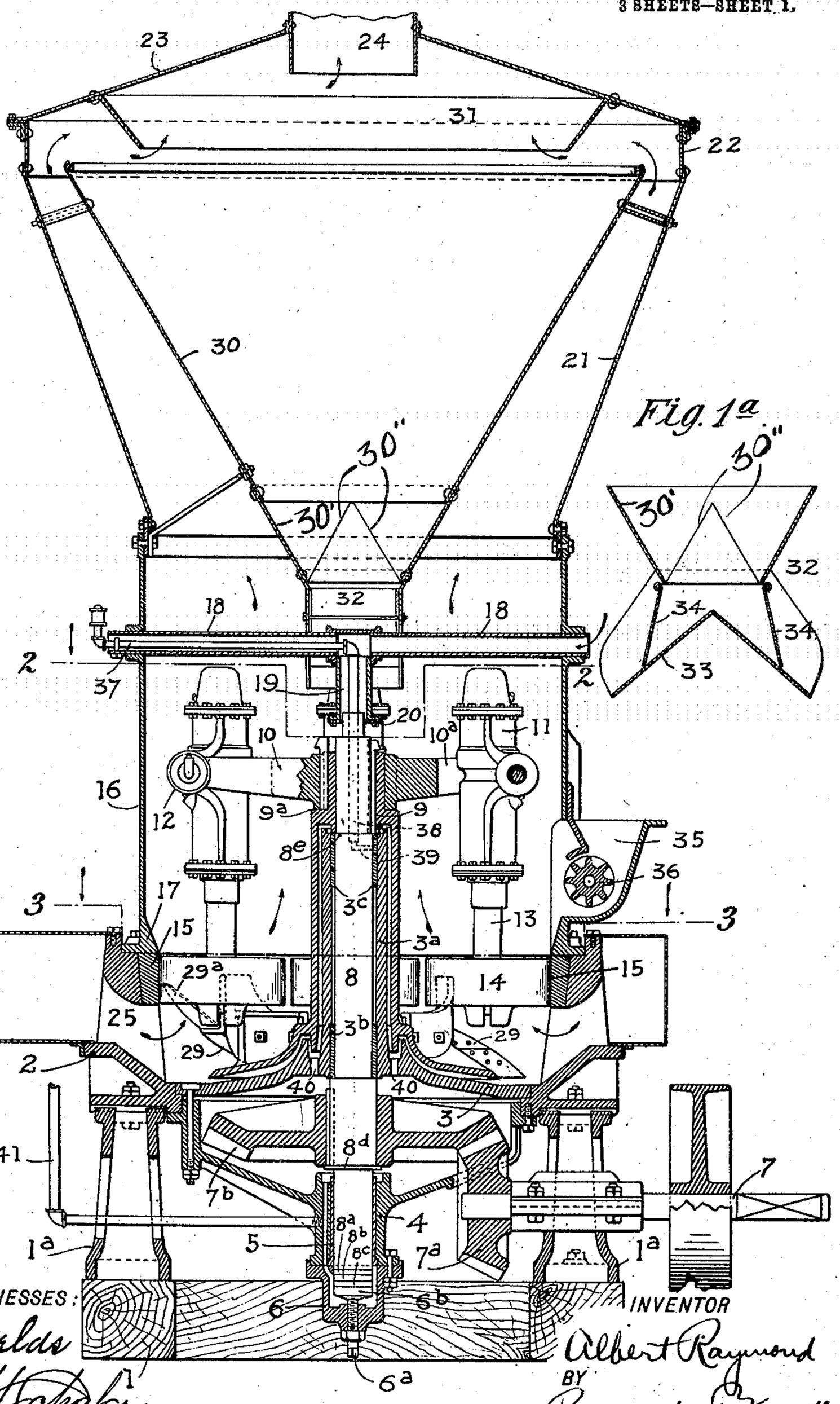


Fig. 1a

WITNESSES:

M. E. Shields

Arthur K. Schafer

INVENTOR

Albert Raymond

BY

Raymond & Barnett

ATTORNEYS

No. 881,262. PATENTED MAR. 10, 1908.

A. RAYMOND, DEC'D.

M. M. BARTELME, ADMINISTRATRIX.

CENTRIFUGAL ROLLER MILL.

APPLICATION FILED SEPT. 26, 1901.

3 SHEETS—SHEET 2.

Fig. 2.

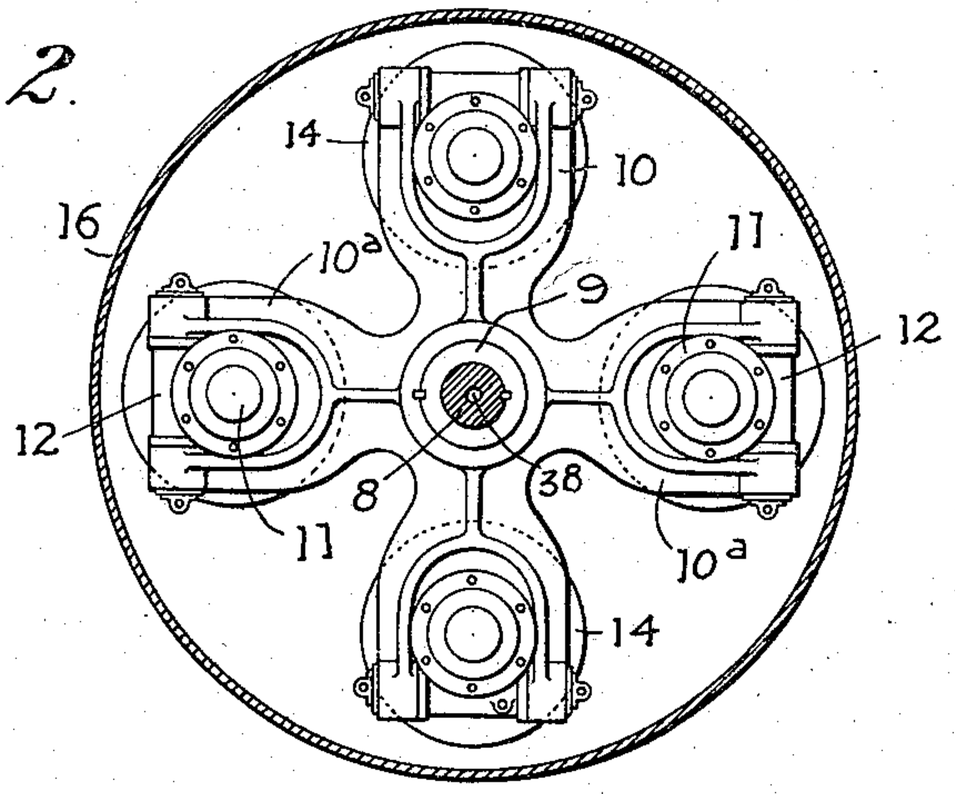
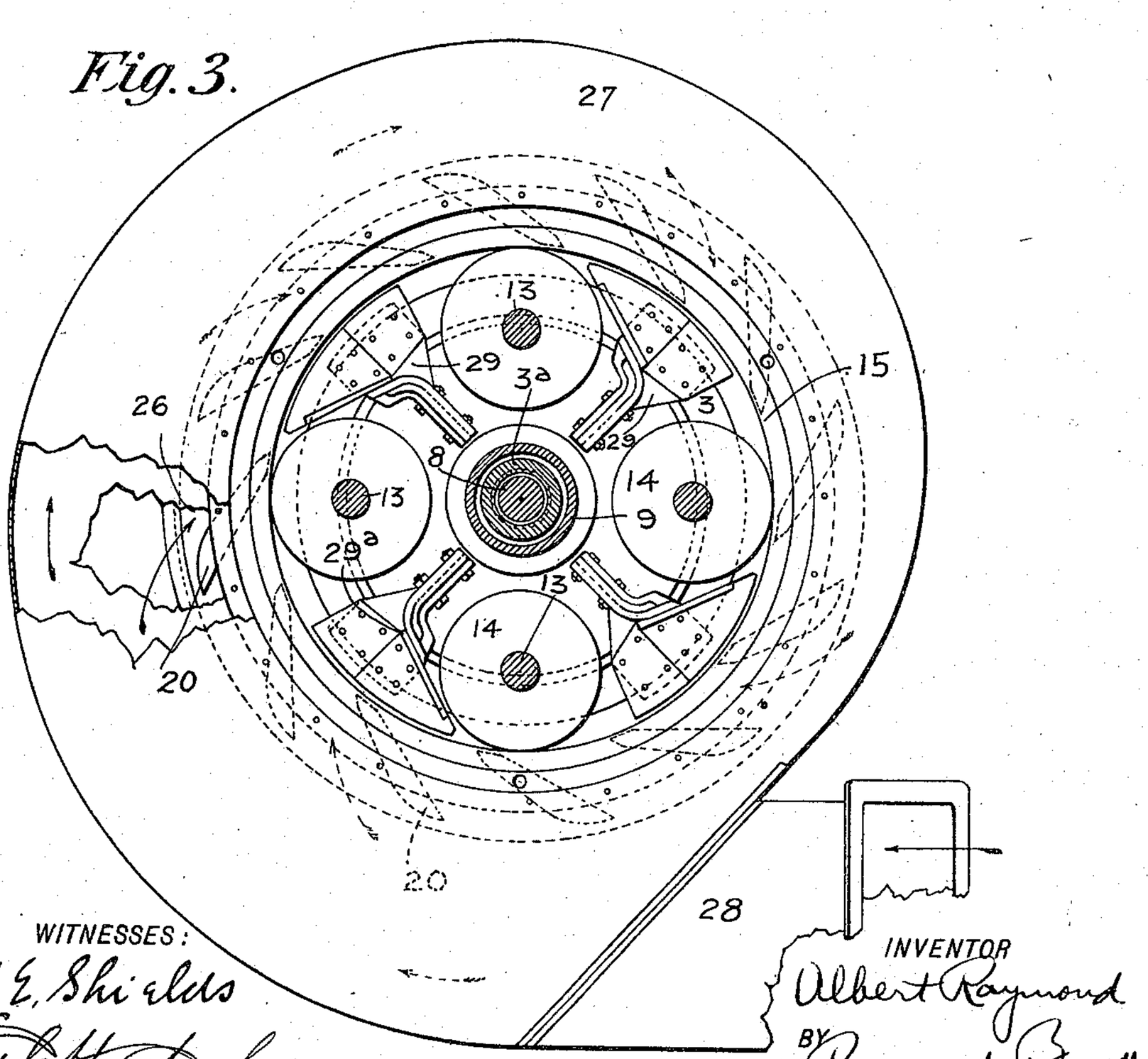


Fig. 3.



WITNESSES:

M. E. Shields

Carl H. Schaefer

INVENTOR

Albert Raymond

BY Raymond & Barnett

ATTORNEYS

No. 881,262. PATENTED MAR. 10, 1908.

A. RAYMOND, DEC'D.

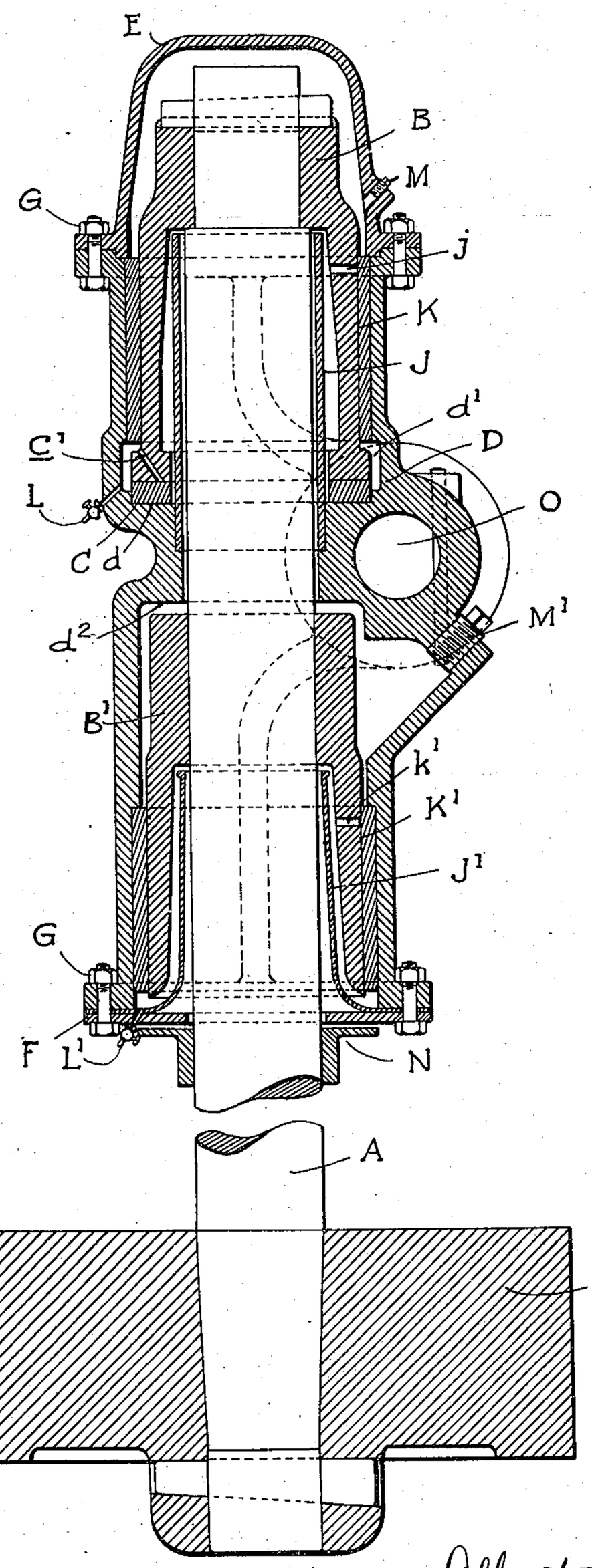
M. M. BARTELME, ADMINISTRATRIX.

CENTRIFUGAL ROLLER MILL.

APPLICATION FILED SEPT. 26, 1901.

3 SHEETS—SHEET 3.

Fig. 4



WITNESSES:

W. E. Shields

Albert J. Schafer.

INVENTOR

Albert Raymond

BY Raymond & Barnett

ATTORNEYS

UNITED STATES PATENT OFFICE.

ALBERT RAYMOND, OF CHICAGO, ILLINOIS; MARY M. BARTELME ADMINISTRATRIX OF SAID ALBERT RAYMOND, DECEASED.

CENTRIFUGAL ROLLER-MILL.

No. 881,262. Specification of Letters Patent. Patented March 10, 1908.

Application filed September 26, 1901. Serial No. 76,643.

To all whom it may concern:

Be it known that I, ALBERT RAYMOND, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Centrifugal Roller-Mills, of which the following is a specification.

My invention relates to that class of pulverizing mills, in which a plurality of crushing rollers is suspended within, and adjacent to, a crushing-ring, said rollers being suspended from a spider which is carried by a rotating central shaft.

The object of my invention is to provide a pulverizing mill of the class described, which shall more efficiently, as well as more rapidly, reduce the material to be operated upon to an impalpable powder and which shall be reliable in operation and easy of access.

Another object of my invention is to provide the roller-shafts of such a device with bearings and journal-boxes of such a construction as shall insure the most efficient and certain operation of the device, shall insure the continuous and adequate lubrication of the bearings of the roller-shafts, and shall, at the same time, effectively exclude dust, powder and other foreign substances from the roller-shaft-bearings.

A further object of my invention is to prevent the escape of lubricating oil into the interior of the mill.

These and such other objects as may hereinafter appear are attained by the devices illustrated in the accompanying drawings, in which—

Figure 1 is a vertical sectional view through a machine embodying my invention. Fig. 1^a is an enlarged detail of the return feed-valve, the same being taken at right angles to the line in which the same part is shown in Fig. 1. Fig. 2 is a cross sectional view on the line 2—2 of Fig. 1, looking in the direction indicated by the arrows. Fig. 3 is a cross-sectional view on the line 3—3 of Fig. 1, looking in the direction indicated by the arrows. Fig. 4 is an enlarged vertical section through my improved roller-journal-box, the roller-shaft being shown in elevation.

Like letters and figures of reference indicate the same parts in the several figures of the drawings.

Referring to the accompanying drawings, 1 indicates a rectangular framework constituting a base, upon which are mounted supports 1^a which carry the bowl or base-ring 2. Mounted upon an annular shoulder within the base-ring 2 is a base-plate 3, while bolted to the base-ring 2 and the base-plate 3 is a casting 4, which carries a bearing 5. Bolted to, and depending from, the lower end of the casting 4 is a step-box 6. Journaled within one of the supports 1^a, at one side of the machine, is a drive-shaft 7, upon the inner end of which is mounted a gear-wheel 7^a, which meshes with the crown-gear 7^b, which is rigidly secured to the main shaft 8 of the machine. The lower end of the main shaft 8 rests upon a series of alternately arranged steel and bronze washers 8^a, 8^b, 8^c, the lowermost of which washers rests upon a disk or washer 6^b, which is non-rotatively mounted upon an adjusting screw 6^a, which is screw-threaded through the bottom of the step-box 6. The bearing 5 and the washers 6^b and 8^a, 8^b and 8^c are all arranged in an oil-chamber within the casting 4 and the step-box 6.

The crown-gear 7^b rests upon a collar or shoulder 8^d on the shaft 8. The bottom plate 3 is provided with a centrally disposed, upwardly extending bearing-sleeve 3^a, which carries bearings 3^b, 3^c, within which the shaft 8 rotates.

9 is a hub, which is rigidly secured to the shaft 8 and is carried upon a shoulder 8^e on the shaft 8. The downwardly depending portion of the hub 9 is enlarged so as to form a sleeve, which, at its lower end, carries a series of plows 29.

10 is a spider, which is rigidly secured to the hub 9 and is carried on an annular shoulder 9^a on the hub 9. The spider 10 comprises a plurality of forked arms 10^a, within the forks of which are pivotally suspended roller-journal-boxes 11 upon trunnions 12. Mounted within the journal-boxes 11 are roller-shafts 13, carrying the crushing-rolls 14, which are disposed within, and adjacent to, the crushing-ring 15. This crushing-ring is preferably in the form of a truncated cone and is seated just within the upper edge of the bowl 2.

By means of the adjusting-screw 6^a, the shaft 8, and consequently the rolls 14, may

be adjusted vertically so as to bring the rolls in proper position opposite the crushing-ring 15.

16 is a cylindrical casing, which is bolted to an annular shoulder upon the upper edge of the bowl 2 and is provided at its lower edge with an annular inwardly extending tapered shoulder 17, which rests upon the upper edge of the grinding ring 15 and holds it in position against displacement in an upward direction. Extending across the casing 16 is a horizontal air-duct 18 leading to a centrally disposed and depending air-duct 19, at the lower end of which is a disk 20, which disk is provided with a central perforation within which is loosely fitted the upper end of the shaft 8. To the upper end of the casing 16 is secured a flaring or cone-shaped section of casing 21 leading to a cylindrical ring 22, which is closed by a cap 23, through which is provided an escape-opening 24 leading to any suitable means for inducing a current of air such for instance, as the exhaust fan F shown in Fig. 1.

By means of tangentially arranged partitions 25, the bowl or ring 2 is provided with a series of tangential air-inlets 26 completely surrounding my machine. These air-inlets lead from the interior of my machine to a housing 27, which is attached to and surrounds the bowl 2 and leads by a tangential connection 28 to any suitable air supply.

The hub 9 is provided at its lower end with a series of plows 29, corresponding in number with the crushing-rolls. These plows are provided with vertical ribs 29ª, which extend tangentially along the inner edges of the plows to points slightly inside of the crushing ring 15 and directly in front of the crushing-rolls 14. The floors or bases of the plows extend diagonally upward from a point adjacent to the upper surface of the base-plate 3 to a point about midway of the height of the crushing-rollers 14.

Arranged within the cone-shaped portion 21 of the casing is a funnel or hopper 30, above which a tapered deflecting-ring 31 is suspended from the cap 23. At the lower end of the hopper 30 is arranged a valve 32, comprising an inverted V-shaped base-plate 33, above the inclined sides of which are hung swinging valves 34. As the valve 32 is square and the hopper 30 is round it is necessary to square the lower end of the hopper so as to make a joint between the hopper and the valve. In order to produce the square lower end on the hopper I provide the latter with an extension 30′ which extension where it is connected to the lower end of the hopper is round and, where it is connected with the valve is square and in the drawing the lines 30″ indicate the shoulders which are formed in squaring the lower end of the extension 30′ of the hopper.

Arranged at one side of the casing 16 is a feed-opening or hopper 35, provided with a feeding and agitating device 36.

37 is an oil-supply-pipe which leads through the air-ducts 18 and 19 to a central oil-duct 38 within the shaft 8, from the bottom of which oil-duct a transverse duct 39 leads to the bearing 3ᶜ, from which bearing the surplus oil will flow between shaft 8 and sleeve 3ª to bearing 3ᶜ. Should oil be fed too freely to the pipe 37, the surplus will flow over the upper end of the sleeve 3ª, thence downwardly between said sleeve and the hub 9 and will ultimately escape through openings 40 in the base-plate 3, thereby preventing the escape of such oil into the interior of the pulverizing chamber.

The bearing 5 is lubricated by oil supplied through the oil-pipe 41.

The operation of my device is as follows: Power being transmitted to the machine by means of the shaft 7 and gearing 7ª, the shaft 8 is caused to rotate and the hub 9 and spider 10 will rotate therewith, causing the crushing-rolls 14 to travel around within the ring 15, said crushing-rolls and their shafts 13 also rotating, while the plows 29, mounted upon the hub 9, will travel in unison with the crushing-rolls 14. The roller-journal-boxes 11 being pivotally suspended upon the trunnions 12 within the forked arms 10ª of the spider 10, the centrifugal force imparted to the rolls 14 will throw the rolls against the crushing-ring 15. It will also be noted that with the trunnions passing through journal boxes at the sides thereof furthest from the central shaft, the crushing rolls will be so hung that they will hang normally with their crushing faces in contact with the crushing ring. At the same time, an air-blast is induced through the tangential connection 28 into the housing 27, and passing through the tangential openings 26 between the partitions 25, becomes a gyratory current as it enters the pulverizing-chamber below the rolls 14; and, still gyrating, passes upward within the casing 16, between the casing section 21 and funnel 30, then is deflected by the ring 31 and finally passes through the ring 31 and out at the discharge opening 24. The material to be crushed or pulverized, now being fed to the machine through the hopper 35, is dropped directly upon, or in front of, the crushing-rolls 14 and the plows 29. The material fed in front of the plows is caught up by the broad forward edges of the plows and thence is directed by the plows to a point between the crushing-rolls and the crushing-ring, between which it is ground and pulverized as it escapes from the narrow ends of the plows. The material so crushed is immediately carried upward within the casing by the gyrating current of air, the gyrating current giving the material a longer travel before escaping from the machine and thereby allowing more opportunity for the

uncrushed portions to drop back within the machine, while the more thoroughly crushed portions are carried upward and over the upper edge of the funnel 30, at which point the further deflection and retarding of the air current will permit of the remaining coarser particles dropping within the funnel 30, while the thoroughly pulverized material is carried away through the discharge opening 24 to any suitable dust-collector. The coarser particles dropped within the funnel 30 will pass through the valve 32 back to the crushing mechanism, the base 33 of the valve serving to direct such particles toward the crushing rolls. The material falling back within the machine is again caught up by the plows 29 and thrown by the plows between the crushing-rolls and the crushing-ring until all the material has been thoroughly pulverized and carried away by the gyratory blast. The tendency of the induced blast through the machine will be to create an exhaust within the pulverizing-chamber, by virtue of which a current of air will be drawn in through the air-ducts 18, 19 and between the disk or collar 20 and the shaft 8, thereby insuring that material from the pulverizing-chamber will not work through between the collar 20 and the shaft 8, whence it might find its way into the oil-ducts and the shaft-bearings.

It is evident from the foregoing description that, when my machine is in operation, the journal-boxes 11 are suspended in a cloud of more or less finely pulverized material, and it has been found in practice that there is much difficulty in excluding such finely powdered material from the roller-journal-boxes, where such material would seriously interfere with the rotation of the roller-shafts 13. It has also been found that the problem of mounting the roller-shafts to the best advantage and keeping the same freely lubricated, without allowing oil to escape into the pulverizing-chamber, has not been easy of solution.

My dust-proof journal-box for the roller-shafts is constructed as follows: 13 indicates a shaft, upon the lower end of which is rigidly mounted a crushing-roll 14. Keyed, or otherwise suitably attached, to the upper end of the shaft 13, is a bearing-sleeve B, which supports and rotates with the shaft 13. The lower flanged end of the sleeve B is supported, and rotates, upon an end-thrust bearing C, which is mounted within an annular shoulder *d* within the journal-casing D, while the sleeve B also rotates within a vertical bearing K, fitted within the upper portion of the casing D. The casing D is provided with a terminal cap E and a base-ring F, which are securely attached to the casing by stud-bolts G, so as to have a tight joint between the casing D and the cap E and base-ring F. The interior of the casing D is divided into connecting upper and lower chambers.

Fitted at one end within the passage between said chambers is a sleeve J, which extends upwardly within the bearing-sleeve B, but not in contact therewith, to a point above the upper edge of the bearing K. The internal diameter of the sleeve J is somewhat greater than the diameter of the shaft 13, which rotates freely within it. So also the passage between the upper and lower chambers of the casing D is of greater diameter than the diameter of the shaft 13. The flanged end of the bearing-sleeve B and the end-thrust bearing C, upon which it rests, are located within an annular enlargement within the casing D, whereby an oil-chamber *d'* is provided, within which chamber the flanged end of the bearing-sleeve B rotates upon the end-thrust bearing. To facilitate the supply of oil to the bearing surfaces between the end of the sleeve B and the bearing C, I provide oil-ducts *c'*, through the flanged end of the bearing-sleeve B. So also the annular space between the sleeve J and the bearing-sleeve B forms an oil-space or chamber, from which oil-ducts *j* lead to the bearing surfaces between the sleeve J and the bearing B. It will thus be seen that the upwardly projecting sleeve J forms a dam, whereby oil will at all times be maintained at such a height as to completely surround the bearings C and K, and there will be no escape of oil except when the supply of oil overflows the top of the sleeve or dam J, in which event it will flow down between the sleeve J and the shaft 13 and thence to the bearings in the lower chamber of the casing D. Further, by by reason of the rapid rotation of the sleeve B, the oil within the sleeve B will be thrown by centrifugal force through the duct *j*, whence it will pass between the bearing surfaces of the sleeve B and the bearing K into the oil-chamber *d'* and back again through the ducts *c'*, thereby providing a circulation of the oil around the bearings. From time to time, as it may be desired to remove the old oil and renew the supply of lubricating fluid, the old oil may be drawn off through the pet-cock L, and the new supply of oil fed through the feed-opening M.

Within the lower chamber of the casing D is a second bearing arranged substantially as before described, a bearing-sleeve B' being rigidly secured to the shaft 13 and rotating within a bearing K', which is fitted within the lower portion of the casing D. The lower end of the bearing-sleeve B' does not, however, rest upon any end-thrust bearing, the weight of the shaft and roller being carried by the bearing-sleeve B and end-thrust bearing C.

Surrounding the shaft 13 and extending upwardly within the bearing-sleeve K' is a "dam" or sleeve J', which is flanged at its lower end, such flanged portion being securely clamped between the lower end of the

casing D and a base-ring F. Oil-ducts k' through the bearing-sleeve B′ lead from the oil space between said bearing-sleeve B′ and the sleeve or dam J′.

In addition to the oil supply by the overflow from the upper portion of the casing D, the lower portion of the casing is provided with an oil-feed-opening M′ and is also provided at its lower end with the pet-cock L′, from which old oil may be withdrawn. Rigidly mounted upon the shaft 13, at a point immediately below the base-ring F, is a deflector N for retarding the entrance of pulverized material into the journal-box.

At one side the journal-box is provided with an opening O, within which is rigidly secured a trunnion 12, as shown in Fig. 2.

It will thus be seen that, with a journal-box and bearing so constructed, not only may dust and other foreign substances be efficiently excluded, but a sufficient supply of oil may be maintained at all times within the journal-box to completely surround all of the bearings, so that they shall constantly rotate within chambers filled with oil, while, at the same time, there will be no escape of oil from the journal-box into the interior of the pulverizing machine unless too great an amount of oil is fed to both the upper and lower bearings within the journal-box, as an excess fed to the upper bearing only will overflow into the lower bearing and adjacent oil spaces, which, in turn, must be filled to overflowing before any oil can escape from the journal-box.

It will further be observed that, with my journal-box constructed as shown in Fig. 4, there is room for a slight vertical play of the shaft 13 within the journal-box and the arrangement of the upper edge of the bearing-sleeve B′, with relation to the shoulder d^2 formed within the journal-box, is such that said shoulder d^2 will act as a stop to the vertical movement of the shaft, thereby insuring that the base-ring F, the dams and the bearings shall be protected against injury which might otherwise be caused, should the accidental interposition of refractory material below the roll 14 cause a sudden and violent vertical movement of the shaft 13.

Although I prefer the embodiment of my invention in the form shown in the drawings, obvious modifications thereof will occur to those skilled in the art. Such modifications, however, do not constitute a departure from the spirit of my invention, but are contemplated thereby.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In a crushing machine the combination with the main shaft, of a base plate, a bearing sleeve carried by said base plate, a bearing fitted within said sleeve, means for leading oil to said bearing, a hopper extending over said sleeve, and an overflow passage leading from said bearing to an opening through said base plate, substantially as described.

2. In a machine of the class described, the combination with the main shaft, of a base plate, a bearing-sleeve carried thereby, a bearing for the main shaft fitted with said sleeve, a hopper extending over said sleeve to said base-plate, a flange on said hub extending over said base plate, an annular groove within said base-plate, a complementary shoulder on said hub, an escape opening through the bottom of said groove, and an oil overflow passage leading from said bearing to said escape opening, substantially as described.

3. In a machine of the class described, the combination with the main shaft, of a spider, a journal box pivotally suspended from said spider, journal and thrust bearings mounted within said journal box, a bearing-sleeve arranged to rotate within said journal-bearing and upon said thrust bearing, a roll-shaft carried by said bearing-sleeve, a dam arranged within said sleeve and a crushing-roll mounted upon said shaft, substantially as described.

4. In a machine of the class described, the combination with the main shaft, of a spider rigidly secured thereto, a closed journal box pivotally suspended from said spider, a roll-shaft suspended within said journal-box and arranged to rotate therein, annular oil-chambers within said journal-box and surrounding said roll-shaft, bearings for said roll-shaft arranged within said oil-chambers, an overflow from one of said oil-chambers to the other, means for supplying oil to said oil-chambers, and a crushing-roll rigidly secured to the lower end of said roll-shaft, substantially as described.

5. In a crushing machine the combination with the main shaft of an air inlet conduit, a disk at the lower end of said air inlet conduit, within which is loosely fitted said main shaft and an oil supply pipe leading through said air inlet conduit, substantially as described.

6. In an apparatus of the class described, the combination with a pulverizing chamber, of a main shaft extending upwardly therein, a hollow support for the upper end of said main shaft, projecting downwardly into said chamber and loosely engaging the upper end of said shaft, an air inlet duct extending transversely of said pulverizing chamber and leading to said hollow support and an oil supply pipe leading through said air inlet duct, substantially as described.

7. In a device of the class described, a roll-shaft mounting, comprising a journal box, an end bearing mounted within said journal box, a bearing-sleeve, resting upon said end bearing and having a limited longitudinal play within said journal box, and a roll-shaft extending within said bearing-sleeve and keyed

thereto, means for excluding dust from said journal-box, comprising a cap upon the upper end of said journal box, a perforated plate loosely closing the lower end of said journal-box and surrounding the roll-shaft, and a deflecting plate comprising a collar closely surrounding the roll-shaft and mounted thereon a short distance below said perforated plate and a flange extending substantially parallel with the lower ends of said perforated plate.

ALBERT RAYMOND.

Witnesses:
M. E. SHIELDS,
E. Y. GRIDLEY.