F. E. MARCY.

ROLLER MILL.

APPLICATION FILED AUG. 14, 1918.

1,309,210.

Patented July 8, 1919.

3 SHEETS—SHEET 1.

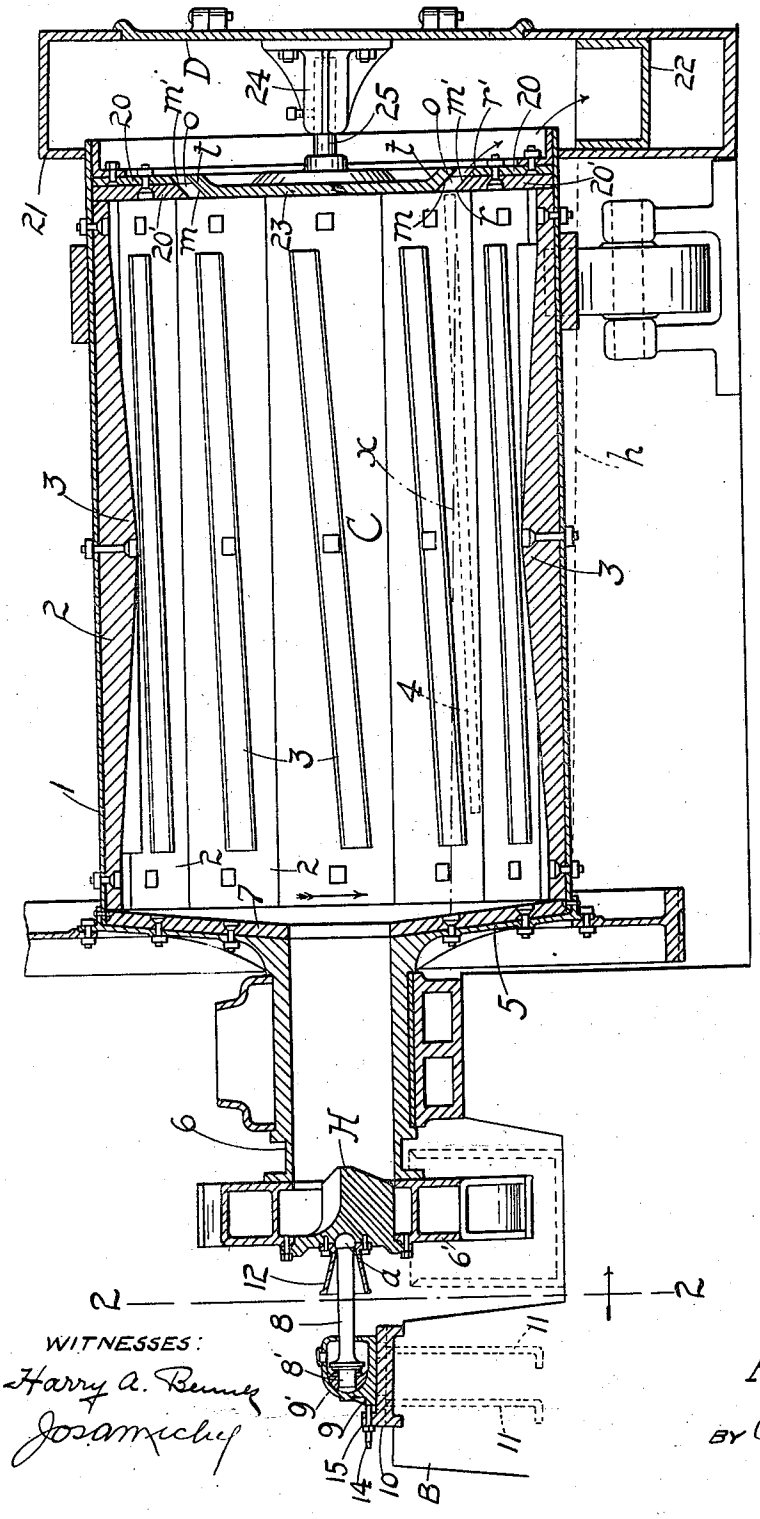


FIG. 1.

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3 SHEETS—SHEET 2.

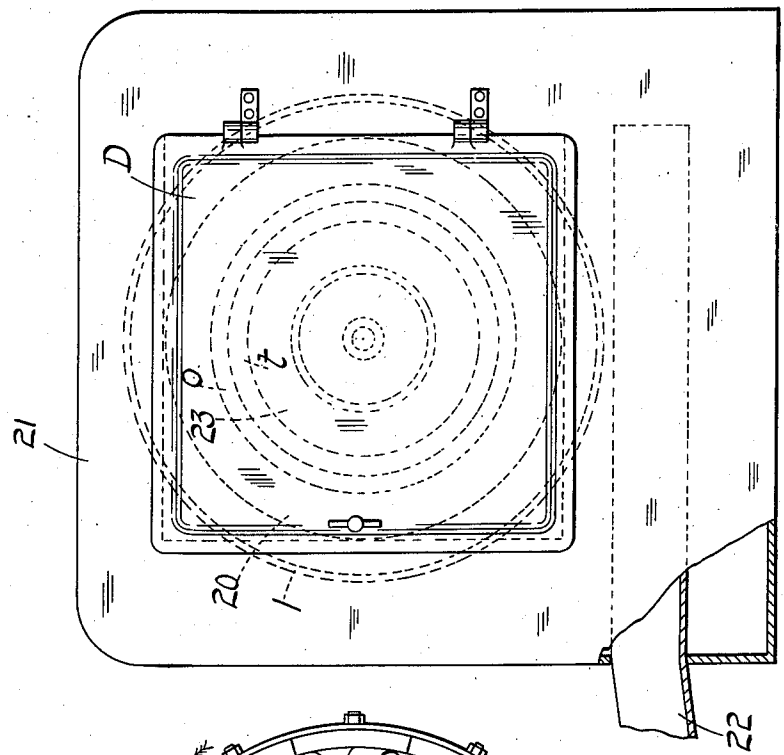


FIG. 1.

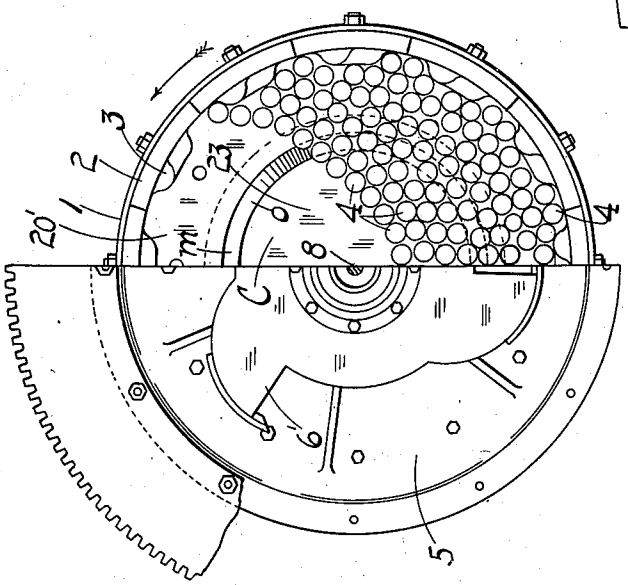


FIG. 2.

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Josamicky

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ATTORNEY.

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3 SHEETS—SHEET 3.

FIG. 4.

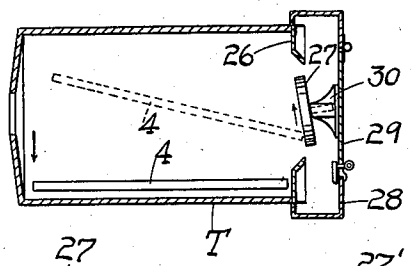
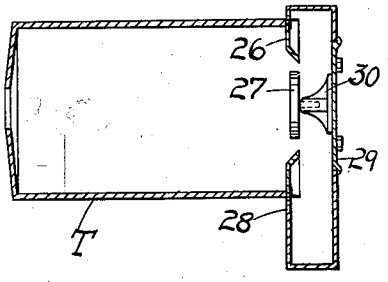


FIG. 5.



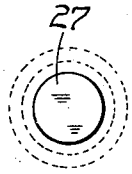


FIG. 6.

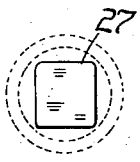


FIG. 7.

FIG. 8.

FIG. 9.

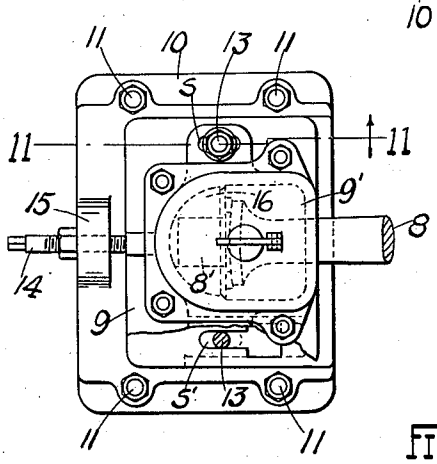
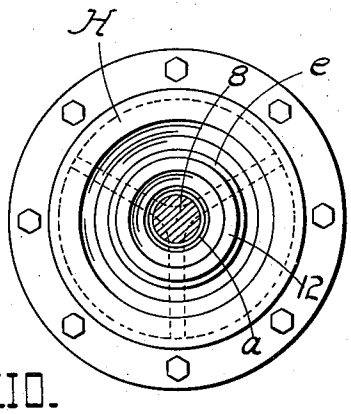


FIG. 10.



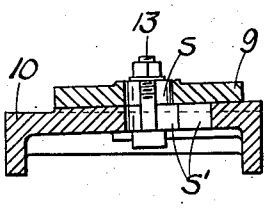


FIG. 11.

WITNESSES:

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UNITED STATES PATENT OFFICE.

FRANK E. MARCY, OF SALT LAKE CITY, UTAH.

ROLLER-MILL.

1,309,210. Specification of Letters Patent. Patented July 8, 1919.

Application filed August 14, 1918. Serial No. 249,901.

To all whom it may concern:

Be it known that I, FRANK E. MARCY, a citizen of the United States, residing at Salt Lake City, in the county of Salt Lake and State of Utah, have invented certain new and useful Improvements in Roller-Mills, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

As well understood in the art, roller (or rod) mills belong to that class of crushing and disintegrating apparatus wherein the material is reduced to particles of the desired size by means of freely moving crushing bodies in the form of longitudinally extended bars, rods, or rollers acting by impact and attrition upon the material confined within a tumbling barrel, drum, or equivalent tubular container or treatment vessel rotated about a fixed axis, the opposite ends of the barrel being respectively provided with intake or feed, and discharge openings for the material. The present improvement is directed to that type of mill in which one end of the barrel is left open and unobstructed (in contradistinction to the trunnion overflow type of mill) for the discharge of the material and for the direct insertion of the grinding rods into and their removal from the barrel, the advantage of such open end being apparent when we remember that the prevailing type of roller mill is provided with a head at each end, and that in order to gain access to the interior of the mill for purposes of repair or removal of worn out or kinked rods, one of the heads must be removed, thereby entailing much labor and consuming valuable time. In my improvement the interior of the mill is at all times readily accessible, the construction being such that while the material is free to directly discharge through the open end, the grinding rods are maintained permanently in the mill. In the present embodiment of my invention the retention of the grinding rods in the mill does not entirely depend either on the pitch of the mill, or on the inclination of the lifters disposed on the wall liner, but depends in considerable measure on a specially improvised guard or disk facing the discharge opening, against which the adjacent ends of the rods may impinge, said disk operating to direct the rods into the mill as they tumble across the crushing compartment and impinge against the disk during the rotation of the mill. One of the objects of the invention is to provide a rod-intercepting disk or guard of the character referred to that may be swung out of the way of the discharge opening whenever occasion arises to inspect the contents of the mill while the mill is revolving, the disk being preferably mounted on a swinging door of a housing positioned at the discharge end of the mill, said housing likewise serving as a deadener of the noise made by the tumbling of the crushing rods. Where a slight pitch is given to the mill a special bearing is provided to take up the thrust due to the pitch, said bearing dispensing with the necessity of employing the usual peripheral tire and guide rollers to hold a tilted mill against axial or longitudinal displacement. In the present embodiment of my invention the rod-intercepting or retaining disk coöperates with an inwardly projecting flange or diaphragm disposed at the discharge end of the tumbling barrel or drum, the free edge of the flange serving to build up the pulp line prior to the discharge of the finished product from the mill, said edge being spaced sufficiently from the disk to afford a free and unobstructed passage for the flow of the finished product from the mill. The invention comprises a combination of features the advantages whereof will be fully apparent from the following detailed description in connection with the accompanying drawings in which—

Figure 1 represents a middle vertical longitudinal section of the mill showing my improvements; Fig. 2 is a vertical cross-section on the line 2—2 of Fig. 1, one-half of the scoop-feed and barrel head being removed to expose the interior, and the driving gear being broken away; Fig. 3 is a front elevation of the housing at the discharge end of the mill; Fig. 4 is a middle longitudinal diagrammatic horizontal section of a mill showing a modified form of guard or rod deflecting disk; Fig. 5 is a middle longitudinal diagrammatic vertical section of a mill showing another modification of disk; Fig. 6 is an inner face elevation of the disk shown in Fig. 4; Fig. 7 is a similar view of a still further modification of disk; Fig. 8 is an enlarged middle vertical section of the thrust bearing coöperating with the scoop feed; Fig. 9 is a top plan of the bearing with certain parts broken away; Fig. 10

is a vertical cross-section on the line 10—10 of Fig. 8; and Fig. 11 is a vertical sectional detail on the line 11—11 of Fig. 9.

Referring to the drawings, and for the present to Figs. 1 to 3 and 8 to 11 inclusive, 1, represents a (preferably) cylindrical container, drum, tumbling barrel, or equivalent tubular member, the same being provided with a wall liner composed of a series of sections 2, the sections having formed thereon or secured thereto, suitable ribs 3 which serve as lifters for the grinding rods or rollers 4, the lifters being preferably warped as shown, that is to say, they are disposed at an incline to the elements of the periphery of the drum thereby assuming a spiral form where the drum is cylindrical. The inclination of the lifters is such that the ends nearest the feed end of the mill are in advance of, or precede the ends nearest the discharge end in the normal rotation of the mill (see arrows, Figs. 1 and 2). The feed end of the mill is closed by a head or cover 5 provided with a hollow feed or intake trunnion 6 to which the pulp is conveyed by a scoop feeder 6′ (or otherwise) as well understood in the art, the head being protected by the end liner 7 against which bear the adjacent terminals of the wall liner sections 2. When the mill is slightly pitched or inclined (to assist, if desired, in keeping the grinding rods well within the crushing compartment C) as in the present example, the thrust due to said inclination (the horizontal being indicated by the line *h* in Fig. 1) is taken up by a "flexible" thrust-shaft 8 interposed between the outer wall of the scoop feeder 6′ and the thrust bearing or casting 9 to which is bolted the cap plate 9′ (the two members operating as a unit), the member 9 being bolted to a base plate 10 which is in turn anchored to the foundation B by means of anchor bolts 11, a method well within the purview of the skilled mechanic. In the present embodiment of my invention the inner end of the thrust shaft terminates in a substantially spherical head *a* which is received by a correspondingly shaped socket *d* formed in the outer face of the hub H of the scoop-feeder, the adjacent portion of the shaft being protected by an outwardly flaring extension sleeve 12 bolted through the flange *e* directly to the hub H. The bearing or abutment 9 is united to the base plate 10 by means of bolts 13 transversing the elongated registering slots *s* and *s′* of the respective members, whereby the member 9 may be adjusted on the member 10. This adjustment is effected by the adjusting screw 14 mounted in a lug 15 cast with the base plate, the inner end of the screw bearing against the outer edge of the plate or casting 9. The slot *s′* is preferably T-shaped (Fig. 9) the enlarged end of the slot allowing for the free passage therethrough of the head of the bolt 13, which is subsequently brought under the narrow portion of the slot which receives the shank of the bolt. The shaft terminates at the outer end in a cylindrical portion 8′ which is received in a "ball" or semi-spherical bearing 16 housed between the members 9, 9′, (whose inner surfaces are made to conform to the curved surface of the member 16), the outer face of the bearing supporting a ring 17 surrounding the terminal portion 8′ and co-operating with a similar ring 18 likewise surrounding the terminal 8′ of the shaft and supported by the flaring or enlarged intermediate portion 8″ of the shaft, the rings 17, 18, being provided with race-ways for receiving the ball bearings 19. Other features of the bearing shown but not alluded to are well understood in the art and require no description in the present connection. Preferably, however, and to prevent lateral displacement of the ring 18 the base of the terminal 8′ of the shaft is formed with an offset or enlargement 8‴ which fits the ring 18 more or less snugly so that the latter may not shift in a plane transverse to the rotation axis of the thrust shaft.

In order to build up the pulp line (represented by the dotted line *x* in Fig. 1) I provide the discharge end of the mill with an inwardly projecting flange, ring, or diaphragm 20 protected by a liner 20′, said flange assisting (incidentally in pitched mills, and to a greater or less extent in horizontal mills) in keeping the grinding rods well within the crushing compartment C of the mill, it being understood of course that the principal member relied on to keep the rods in the mill is the retaining disk or guard previously referred to, and to be presently described. The flange, by building up the pulp line, permits the charge to be subjected to the grinding action of the rods (or their equivalent) for a somewhat longer period of time than would be the case were the flange dispensed with and the pulp line allowed to drop. The flange or ring of course in no wise interferes with the free introduction of the grinding rods into, or their removal from, the crushing compartment of the mill.

In the present embodiment of my invention the discharge end of the mill or drum 1 is loosely received by, and terminates within, a stationary housing or casing 21, access to the interior of the housing and hence to the interior, or crushing compartment of the mill being had through a suitable hinged door D on the front wall of the housing 21 as shown. The finished product discharged from the mill and flowing over the bottom portion of the free edge of the flange 20 is caught in the upper horizontal portion of

the inclined launder 22 by which it is conducted to any point for further treatment. Incidentally the housing 21 serves to arrest the splashing from the mill and to deaden the noise resulting from the grinding action and tumbling of the rods. The housing however serves another and perhaps more useful purpose, namely, to support the guard plate or disk 23 by which the grinding rods are intercepted, and thus prevented from dropping out of the mill should a rod at any time tend to roll or tumble toward the discharge opening, the end of the rod striking the inner face of the disk which causes the rod to be forced back into the mill. Preferably, the disk or guard 23 is secured to the swinging door of the housing, a suitable post or bracket 24 projecting from the inner face of the door being availed of for the immediate support of the disk. In the main form the disk is provided with a stem 25 which is inserted into a socket of the bracket and set-screwed thereto, but any other method of securing the same could be resorted to. The disk is formed with an outwardly flaring flange or rim t thereby imparting to the disk a more or less dish-shaped form, the inner inclined face m of the rim overlapping the inner edge r of the liner 20′ of the flange 20 of the mill, and being substantially parallel to the bevel face m' of the liner 20′ and flange 20, whereby there is formed between the opposing faces m, m', a frusto-conical pasage-way o for the discharge of the finished product. Preferably, the free edge of the rim t and the outer overflow edge r' of the flange are disposed in the same transverse plane through the rotation axis of the barrel. The inclination of the passage-way o prevents any rod from working out of the mill no matter to how small a cross-section the rod may have been reduced, as the occasion can never arise where a rod would take such an inclined position as to cause the rod to slip out of the passage-way.

In practice I may change the form and disposition of both the flange 20 and disk 23. Thus, in Fig. 4, I show a combined annular and conical flange 26 operating in conjunction with a guard or circular disk 27 mounted at an incline to the rotation axis of the barrel, the inner face of the disk thus presenting an inclined surface of impact to the end of a rod 4 which happens to strike it, the result being that the rod is forced inwardly and kept permanently in the crushing compartment of the mill. The disk 27 may be either rigid or free to turn about its axis. It may be circular as shown in Figs. 4 and 6, or it may be square or polygonal as shown in the modification 27′ in Fig. 7. Again, in lieu of mounting the disk 27 at an angle or incline to the barrel axis I may mount the same at right angles thereto as shown in the modification in Fig. 5. Here again the disk may be round or square or some other form, and may be rigid or rotatable about its point of support. In Figs. 4 and 5 the barrel is indicated by T, the housing at the discharge end by 28, the door of the housing by 29, and the supporting brackets for the disks by 30. These views are more or less diagrammatic, no attempt being made to show details of construction. In all the forms described, the disks or guards for intercepting the grinding rods are shown as mounted to a swinging door carried by a housing at the discharge end of the mill. It is apparent however, that the disk (or its equivalent) may be hinged or otherwise secured to, or mounted on, any fixed support not necessarily a housing, the housing not being indispensable because in no wise affecting the operation of the mill; the object sought being to provide a disk or guard which may be moved into position opposite the discharge opening of the barrel for deflecting and intercepting any rod which may tend to become dislodged or projected out of the mill. Neither am I to be limited to a guard or disk operating in connection with a flange such as 20, 26, since the flange so far as the action of the disk is concerned might be omitted. It is apparent from the foregoing that the mill is susceptible of a variety of changes without involving a departure from either the nature or spirit of the invention.

The grinding operation of the mill does not differ materially from that of other mills of the general class or type referred to, the pulp being fed to the crushing compartment of the mill through the hollow trunnion 6, the material being ground by the crushing bodies 4 in said compartment. The finished product is discharged through the open discharge end of the mill, the pulp line being maintained substantially at the level x (Fig. 1), the stream flowing over the edges r, r', of the flange (20, 20′), as indicated by the arrows in Fig. 1 where the pulp is shown as being discharged into the launder 22. The warped lifters 3 of course assist in keeping the grinding rods in the mill but these are not claimed in the present connection forming as they do subject matter for a distinct application for patent. Features shown but not alluded to are well understood in the art and require no description in the present connection.

Having described my invention what I claim is:

1. In a mill of the character described, a tumbling barrel having a feed end and a normally open discharge end, longitudinally extended loose, and freely moving grinding rods in the barrel, a fixed support, and a member disposed symmetrically about the rotation axis of the barrel and having its

periphery spaced from the inner walls of the barrel to form a suitable passage-way for the material, and means for movably mounting said member to said support to permit said member to be brought into proper position for arresting any rod tending to fall out of the barrel.

2. In a mill of the character described, a tumbling barrel having an open discharge end, longitudinally extended loose, grinding rods in the barrel, an inwardly projecting annular flange secured to the barrel at said discharge end, a fixed support, a plate disconnected from the barrel disposed interiorly to the boundaries defining the discharge opening of the barrel, and means for movably attaching said plate to the fixed support to permit the plate to be brought into position for arresting any rods tending to fall out of the barrel.

3. In a mill of the character described, a tumbling barrel having an open discharge end, an inwardly projecting flange secured to the barrel at said discharge end for building up the pulp line in the barrel, and a movable guard adapted to be held in a fixed position within the flange and being spaced therefrom to form a passage-way for the material.

4. In a mill of the character described, a tumbling barrel having an open discharge end, an inwardly projecting annular flange secured to the barrel at said discharge end, a fixed support, a plate disconnected from the barrel movably secured to said support and adapted to be moved into position adjacent the flange, the said plate being spaced from the inner free edges of the flange to form an annular passage-way between the flange and the plate.

5. In a mill of the character described, a tumbling barrel having a feed end and a normally open discharge end, longitudinally extended, loose, freely moving grinding rods in the barrel, an overflow flange or ring at the discharge end, a stationary support, a plate disconnected from the barrel hinged to said support and adapted to be swung into position adjacent the plane of the opening of the ring to prevent the rods from falling out of the barrel, the outer portions of the plate being spaced from the overflow edge of the ring to form a passage-way for the material.

6. In a mill of the character described, a tumbling barrel having a feed end and a normally open discharge end, grinding bodies free to tumble in said barrel, and a guard disconnected from the barrel and normally out of contact with the grinding bodies, positioned at the open end of the barrel for arresting the grinding bodies against accidental discharge from the barrel, a suitable passage-way being formed between the walls of the barrel and guard for the discharge of the material from the barrel.

7. In a mill of the character described, a tumbling barrel having a feed end and a normally open discharge end, longitudinally extended loose, freely moving grinding rods in the barrel, a guard disconnected from the barrel and positioned at the open end of the mill and presenting to the ends of the rods a surface of impact disposed across the axis of the barrel and inclined to the plane of rotation of the barrel, and adapted to deflect the rods in proper direction to prevent their discharge from the barrel, said guard and barrel having between them a passage-way for the discharge of the material from the barrel.

8. In a mill of the character described, a tumbling barrel having a feed and a discharge end and mounted to rotate about an axis inclining downwardly toward the feed end, a feeder secured to said barrel and rotatable therewith at said feed end and provided with an outer rounded socket in the line of the rotation axis of the barrel, a bearing opposite the socket and spaced therefrom, a shaft having one end mounted rotatably in said bearing, the opposite end of the shaft terminating in a rounded head frictionally engaging the walls of the socket aforesaid.

9. In a mill of the character described, a tumbling barrel having one end open, grinding bodies free to tumble in the barrel, and a circular guard disconnected from the barrel positioned across the rotation axis thereof at the discharge end and forming with the inner walls of the barrel an annular passage-way between said walls and the periphery of said guard for the flow of the material.

10. In a mill of the character described, a tumbling barrel having a feed end and a normally open discharge end, grinding bodies free to tumble in said barrel, and a movable guard rotatable about a fixed axis and spaced and disconnected from the barrel, adapted to be brought into position opposite the discharge end for arresting any grinding body tending to tumble out of the barrel.

In testimony whereof I affix my signature, in presence of two witnesses.

FRANK E. MARCY.

Witnesses:
ROBERT E. MARK,
C. L. CUNDICK.