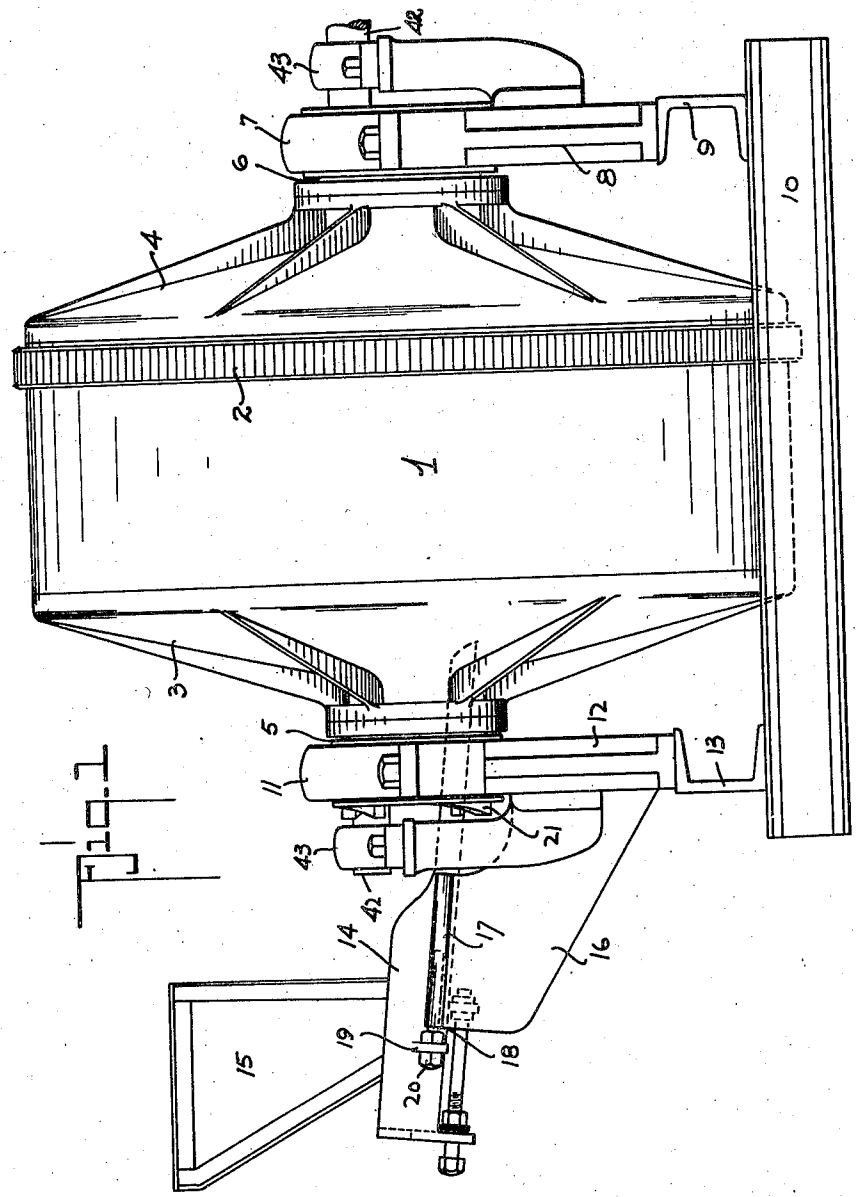
Feb. 15, 1938. W. A. BEAUDRY 2,108,160

CRUSHING MILL

Filed Nov. 9, 1935 2 Sheets-Sheet 1



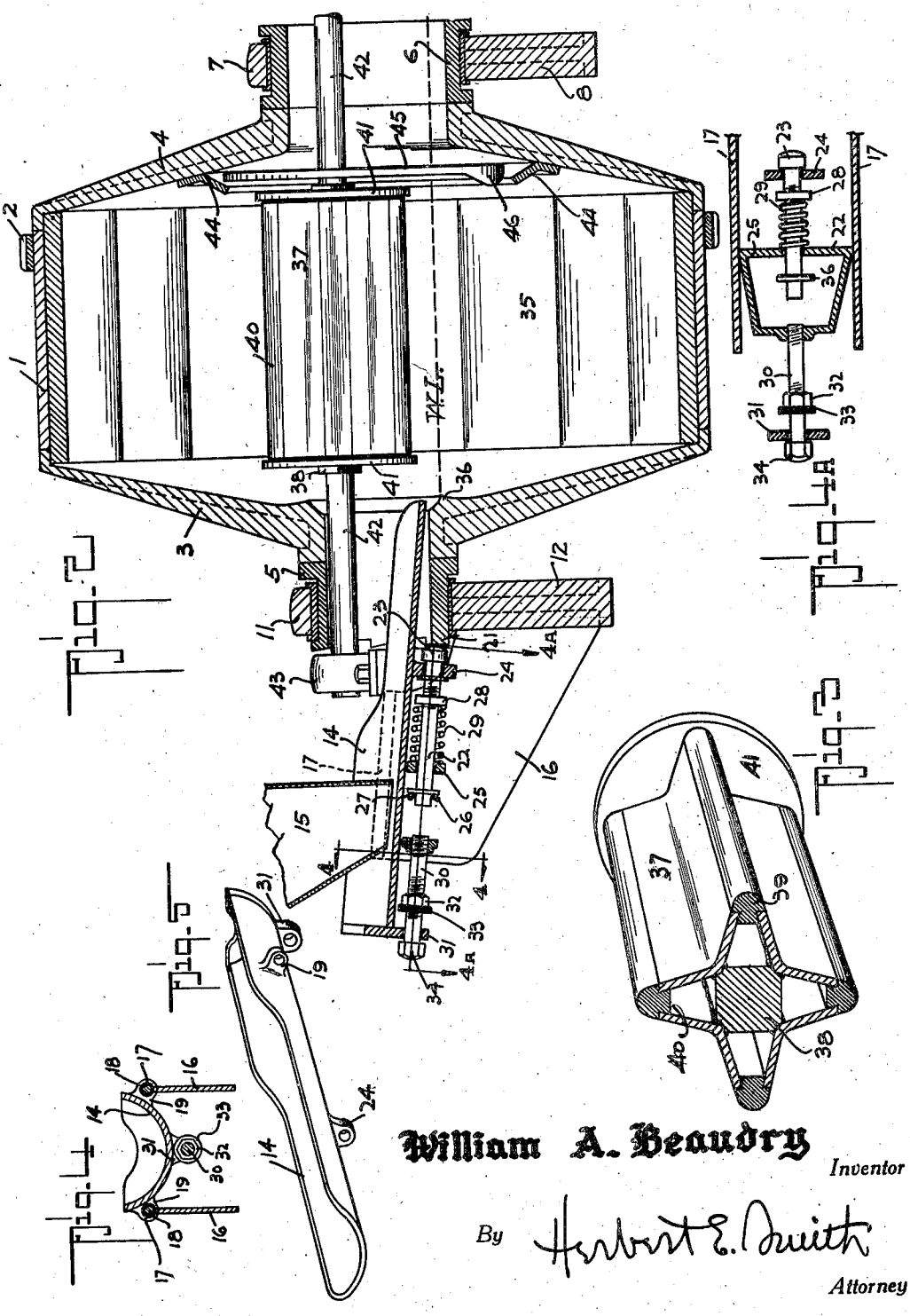
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CRUSHING MILL

William A. Beaudry, Wallace, Idaho

Application November 9, 1935, Serial No. 49,045

4 Claims. (Cl. 83—11)

My present invention relates to improvements in crushing mills of the rotary, horizontal axis type, having an axial feed mechanism by means of which a continuous or constant flow of wet pulp is uniformly maintained at the full capacity of the mill; and I also provide a novel arrangement of parts within the drum to control the discharge of pulverized materials from the mill.

The mill of the present invention is of that type illustrated in my pending application for patent Ser. No. 13,896, filed March 30, 1935, and the present invention involves improvements which increase the efficiency of mills of this type. The improvements, in addition to the feed mechanism at the adit end of the rotary drum, and the means for controlling discharge at the exit end of the drum, also include means for preventing loss or waste of material from the drum, as well as means for rendering more durable the rotor which operates within the drum.

While the mill of my invention is especially designed for pulverizing ore in the form of wet-pulp, it will be understood that other materials may also be treated in this manner. With regard to the wet pulp thus treated, a partially prepared rock-ore or mineral rock, together with water to form the pulp is fed to the drum of the mill, and the ore is reduced to a fineness suitable for feed to a mineral separator, and at the same time the reduced ore is classified at the discharge end of the drum.

After the wet pulp is fed to the interior of the drum, the material is first elevated and then permitted to fall freely in a perpendicular shower within the low-speed rotary drum into the path of a high-speed rotary or revolving bat, by means of which the material in the falling shower or screen is continuously batted, or violently tossed against the enclosing walls of the drum. Both the impact of the bat against the material, and the impact of the batted material against the wall of the drum, are effective in breaking up, crushing, or pulverizing the material.

Means are provided whereby the lighter, reduced, material is free for discharge from the drum, while the heavier or coarser material is restrained or confined in the drum until it is properly reduced for discharge from the drum.

In the accompanying drawings I have illustrated one exemplifying structure for accomplishing the results above set forth, but it will be understood that changes and alterations may be made in the physical embodiment of my invention, within the scope of my claims, without departing from the principles of the invention.

Figure 1 is a side elevation of a crushing mill embodying my invention.

Figure 2 is a longitudinal vertical sectional view through the operating parts of the mill, the base or foundation being omitted for convenience of illustration.

Figure 3 is a sectional detail in perspective of the rotary bat.

Figure 4 is a detail sectional view through the feed trough at line 4—4 of Figure 2.

Figure 4a is a detail, sectional view through the said trough support at line 4a—4a of Figure 2.

Figure 5 is a detail perspective view of the feed trough.

The rotary drum, which is of cylindrical shape and designated as 1 is provided with an external gear ring 2 that is engaged by a suitable complementary drive-gear, to slowly revolve the drum, and the cylindrical drum is fashioned with the usual tapered ends or heads 3 and 4. The heads of the drum are provided with trunnions 5 and 6 rigidly fixed thereto in suitable manner, and the larger trunnion 6, which forms the discharge end of the drum is journaled in bearings 7 supported on the frame 8, which in turn is supported on a cross beam 9 and sills 10.

The smaller trunnion 5, forming the intake or feed-end of the mill is journaled in bearing 11 mounted on the frame-plate 12, which is also supported on a cross beam 13 and the sills 10.

The wet-pulp is fed to the intake end of the drum by means of an oscillating feed trough 14 that is disposed at the longitudinal axis of the rotary drum, in slightly inclined position. The material is fed by gravity to the trough from an elevated hopper 15, and the trough is jolted and caused to reciprocate beneath the open mouth or lower end of the hopper so that the material may be fed in a constant and uniform stream through the trough and deposited within the rotary drum.

The trough is supported with its delivery end within the intake trunnion, by means of a pair of spaced webs 16, 16 rigid with the frame plate 12 and located at opposite sides of the longitudinal axis of the drum, and the upper edges of these webs terminate in guide tubes 17 which form stationary supports for the side bars 18. These side bars 18 slide or reciprocate in the tubular guides, and the slide bars are rigidly connected to the exterior of the trough by means of perforated lugs 19, and lock nuts 20, the lugs be-

ing integral with the trough. The slightly inclined trough is reciprocated longitudinally of the drum, as by jolts, due to the successive actions of four cams 21 fashioned in suitable manner at the outer end of the intake trunnion, which cams operate as the rotary drum revolves. These cams co-act with a complementary cam bar or plunger 22, which has a cam-head 23 in engagement with the cams, and the plunger is supported beneath the trough, at its longitudinal center in a perforated ear or lug 24 rigid with the bottom of the trough, in such manner that the plunger or bumper bar moves with the reciprocating trough.

At its outer end this cam-bar projects freely through a hole in the inner end of a rectangular yoke 25 rigidly supported between the two webs 16 of the frame plate 12, beneath the trough, and on the projected end of the bar, within the rectangular yoke, is a washer 26 retained by a cotter pin 27. Between the inner end of the fixed or stationary yoke, and an adjustable washer 28 threaded on the cam bar, is interposed a spring 29 that is coiled about the cam bar, and this spring which holds the cam head against the cams, also provides resilient means for forcing the trough on its inner stroke inwardly of the trunnion after the cam action has caused the outstroke of the trough.

The inner end of the yoke thus supports the cam bar, and the outer end of the yoke supports the free end of an adjusting bolt 30 alined with the cam bar, which bolt is threaded into the yoke and journaled as well as supported in a perforated lug 31 alined with the lug 24 and integral with the underside of the trough. Between the journaled end of the bolt and the yoke an adjusting nut 32 is threaded, and a cushion washer or bumper 33 is also mounted on the bolt adjacent the lug 31, and the bolt is fashioned with a head 34 exterior of the lug 31. By means of the bolt which is adjustable with relation to the stationary yoke, and the adjusting nut 32 on the bolt, the length of the stroke of the trough may be adjusted or varied to suit different conditions, and the movement of the trough may be adjusted to prevent lost motion.

This reciprocating movement of the trough dislodges the material from the superimposed hopper and the material is fed in a constant stream through the intake trunnion to the interior of the drum, where it is picked up, and dropped in a shower or screen by the successive buckets 35 lining the cylindrical portion of the rotary drum. At the inner end of the intake trunnion the head 3 of the drum is formed with an annular flange 36 which is countersunk at its trunnion-side to guide the inflowing material, and at the drum-side of this flange the inner face of the head 3 is slightly dished for the purpose of guiding the falling material, or screen, away from the intake trunnion.

The constant feed of material maintains the level of the wet pulp at the line W L in Figure 2, and the successive buckets 35 being submerged and passing through the pulp, pick up the material and then drop the material in a shower or screen.

In the path of the stream of falling material, which of course includes solids, is located a rotary bat located in horizontal position above the water level W L. As best seen in Figure 3 the rotary bat is of cruciform shape in cross section and the four vanes are made up of pairs of angular plates 37 mounted rigidly on a central bar 38, with the outer edges of the plates of a pair joined rigidly by longitudinally extending wear-strips or bars 39, dovetailed at 40 to the adjoining edges of a pair of plates. This cruciform arrangement of the vanes provides exterior grooves in the bat that perform the functions of buckets to catch the falling material, and the ends of these grooves or buckets are closed by circular heads 41, rigid with the vanes, to prevent displacement of the material from the ends of the buckets.

The central bar 38 is provided with journal ends 42 that project through the upper portions of the hollow trunnions 5 and 6 from the interior of the drum, and these journal ends are supported in bearings 43 exterior of the drum bearings. The rotary bat, as illustrated, is located above the longitudinal axis of the rotary drum, and it is driven in suitable manner, at a speed greatly in excess of the rotary movement of the drum so that the successive streams of material falling from the top of the low-speed drum will each be batted by a vane of the rotary bat.

The impact of the falling solids on the bat, may to some extent, break up some of the solids, but the main crushing action, or reduction of the solids takes place when the successive vanes of the rotating bat toss the solids laterally, across the interior of the drum, against the wall of the rotary drum.

Within the interior of the discharge head 4 of the drum is fixed a deflecting ring 44 attached to the inner face of this head and arranged concentrically about the discharge trunnion with the inner periphery of the ring moving in a path above the periphery of one of the retaining heads of the rotary bat. Thus, as the deflecting ring moves with the drum, any material falling on the deflecting ring is guided or deflected onto the rotary bat. This ring also prevents splashing of water through the outlet or discharge trunnion of the drum.

To control the outflow or discharge of the wet-pulp through the discharge trunnion I employ a circular baffle plate 45, which is suspended loosely on one of the journal ends of the rotary bat within the deflecting ring 44 and located between the ring and the discharge opening of the head 4. This is a non-rotary baffle plate, and its lower end, which is submerged below the water line W L and below the lower part of the open discharge trunnion, is provided with a weighted portion 46, that maintains the baffle plate in its suspended position on the journal of the rotary bat. In this position, the baffle plate prevents discharge of material at the water line through the discharge trunnion, and the plate causes the wet-pulp to discharge, indirectly, from the drum, under the plate and over the deflecting ring into the discharge trunnion.

This arrangement of the baffle plate and deflecting ring causing an indirect discharge from the drum insures that the material crushed or pulverized and floating at or near the water line, must pass out underneath the baffle plate, and all coarser material will be retained within the drum by the baffle plate. Only that material which has been reduced to such fineness as to float freely in the water and be carried away by the outflow of water is thus discharged from the drum. Thus the ground or reduced material is classified, the fines being discharged, and the coarse material being retained within the drum until sufficiently reduced.

Having thus fully described my invention, what

I claim as new and desire to secure by Letters Patent is:—

1. In a crushing mill of the horizontal axis type, the combination with a rotary drum having a discharge trunnion and a fluid level for wet pulp extending through the trunnion and a rotary bat having a shaft extending through the trunnion, of a stationary baffle plate mounted on said journal between the bat and said trunnion, and said plate having a weighted lower portion submerged below the water level.

2. The combination with a rotary drum having a discharge trunnion and a fluid level extending through the trunnion, a rotary bat in the drum, and a shaft therefore extending through the trunnion, of a deflecting ring mounted in the drum concentric with the trunnion and partially submerged below the water level, a stationary baffle plate mounted on the journal within the ring, and said plate having a weighted lower portion submerged below the water level.

3. The combination in a crushing mill of the horizontal axis type having tapering heads and trunnions therein, of an annular flange surrounding the intake trunnion and adapted to deflect falling material toward the center of the drum, an annular deflecting ring concentrated with the discharge trunnion and mounted on one of said heads, a rotary bat mounted within the drum between said flange and ring and a stationary baffle plate mounted between said ring and discharge trunnion.

4. The combination in a crushing mill with a rotary drum, of a rotary bat therein, said bat being of cruciform shape in cross section and comprising angular plates forming grooves, said plates arranged in pairs, the adjoining edges of each pair of plates having a wear-bar and means for fastening said bar to said adjoining edges, and said bat having circular heads at its opposite ends forming end walls for the grooves.

WM. A. BEAUDRY.