E. S. GREGORY.

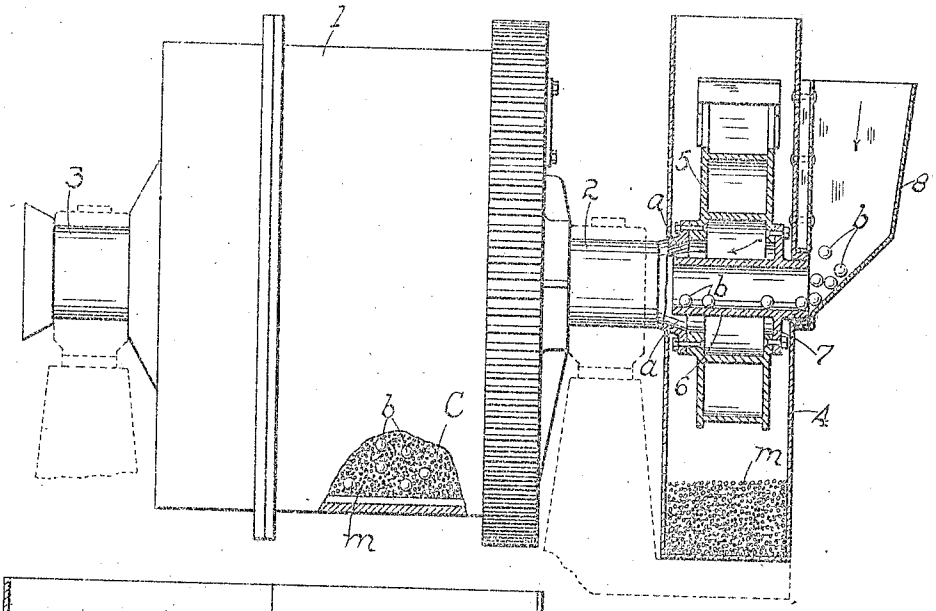
BALL MILL.

APPLICATION FILED NOV. 18, 1915.

1,190,401.

Patented July 11, 1916.

FIG. 1.



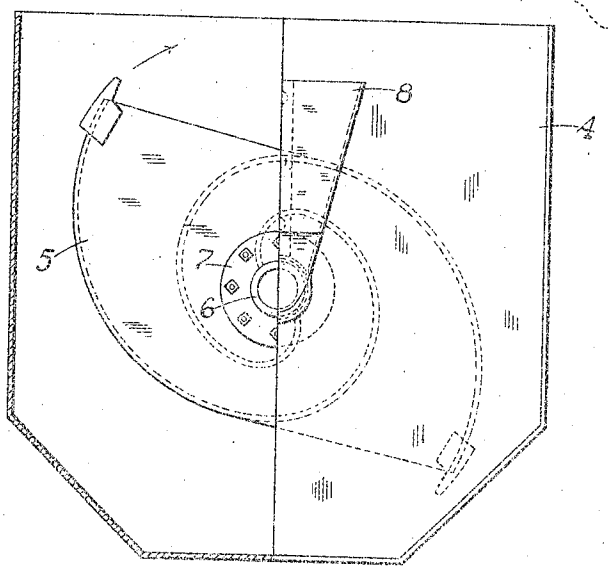


FIG. 2.

WITNESSES:

Harry A. Penny

Joseph Lichy

FIG. 3.

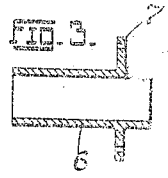
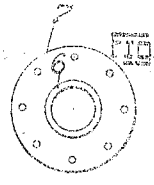


FIG. 4.



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BALL-MILL.

1,190,401. Specification of Letters Patent. Patented July 11, 1916.

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To all whom it may concern:

Be it known that I, ERNEST S. GREGORY, a citizen of the United States, residing at Anaconda, in the county of Deerlodge and State of Montana, have invented certain new and useful Improvements in Ball-Mills, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention has relation to improvements in ball mills; and it consists in the novel features of construction more fully set forth in the specification and pointed out in the claims.

The present improvement is directed to that class of crushing and disintegrating apparatus wherein the material is reduced to particles of the desired size by means of Danish pebbles or steel balls or equivalent freely movable crushing bodies acting by impact and attrition upon the charge temporarily confined within a suitable tumbling barrel, tube, vessel, drum or equivalent container, usually rotated about a fixed central axis, the opposite ends or heads of the barrel being respectively provided with intake and discharge openings for the material, as well understood in the art. The material is usually fed to the barrel in pulp form, a common form of feed device being a scoop operating in a launder or feed-box to which the pulp is supplied from any available source. The grinding pebbles of course wear and must be replaced from time to time by adding new pebbles or balls to the mill. It has been the usual practice to add these by either throwing them in at the discharge end of the mill, or by putting them in the feed box to be picked up by the regular scoop feeder. The first method can not be used in many cases on account of the screen with which many of the grinding mills are provided at the discharge end; and at best it is not a very satisfactory method of charging the mill. The other method, that of feeding the balls to be picked up by the scoop is not satisfactory especially when it is necessary to use feed scoops of large diameter, the pebbles or balls being very apt to become wedged between the moving scoop and the feed-box housing and to either tear the housing out or else break the scoop.

The object of the present improvement is to overcome the objections inherent in both the old methods, the scheme employed being to introduce the balls through the hollow trunnion through which the feed-scoop discharges into the crushing compartment of the mill.

The advantages of the invention will be apparent from a detailed description thereof in connection with the accompanying drawings, in which—

Figure 1 represents a side elevation of a conventional ball mill, with the pulp feed-scoop, ball-feed, and feed-box (or launder) in middle vertical transverse section; Fig. 2 is an end elevation of one-half of the ball-feed or hopper, and of the feed-box, one-half of the latter being in vertical section so as to expose the pulp feed-scoop; Fig. 3 is a longitudinal middle section of the replaceable ball-feed tube; and Fig. 4 is an end view of the same.

Referring to the drawings, 1 represents a rotatable cylindrical container, drum or tumbling barrel (or equivalent tubular member) terminating in hollow intake and discharge trunnions 2 and 3, respectively, as well understood in the art, the intake or pulp-feed trunnion terminating in the feed-box or launder 4 to which the pulp or crushed ore *m* is delivered from any suitable source (not shown). Secured to the trunnion 2 within the box 4 is the pulp feed-scoop or feeder 5 by which (in the rotation of the member 1) the pulp is picked up and automatically discharged through the trunnion into the crushing compartment C of the member 1 as well understood in the art.

In the present embodiment of my invention I provide the feed-scoop with an axially disposed ball-feed pipe or tube 6, preferably of cast iron, the same being secured to the outer face of the feed-scoop through the flange 7 formed on the pipe, the said pipe being renewable as the same wears out. The flange 7 is removed a short distance from the outer terminal of the pipe, said terminal being supported by the outer wall of the box 4 as shown (Fig. 1). The said pipe 6 obviously rotates with the feed-scoop 5 and with the member or tumbling barrel 1, the several members rotating as a unit. To the outer wall of the box 4 is bolted or otherwise secured a ball hopper 8 into which the balls or equivalent movable crushing

bodies *b* are dumped, said balls automatically finding their way into the ball-feed tube or pipe 6, whence they discharge into the trunnion or tubular member 2 and jointly with the pulp find their way into the crushing compartment C. As shown in the drawings, the pipe 6 partially enters the trunnion 2, leaving an annular space *a* between the pipe and the outer end of the trunnion for the free passage of the pulp from the feed-scoop, to said trunnion. The pulp thus flows from the feed-scoop around the ball-feed pipe 6, through the annular passage *a* into the trunnion 2 whence it is discharged into the crushing compartment of the mill, the balls *b* rolling from the hopper 8 through the pipe 6 into the trunnion 2 and thence into the mill. Thus it will be seen that the present improvement overcomes all the objections inherent in the old methods of feeding the balls or pebbles to the mill. In order that the balls may freely gravitate from the hopper 8 into the feed-tube 6, the outer end of the latter terminates flush with the inner vertical wall of the hopper as shown in Fig. 1. In this way the balls encounter no obstruction as they roll into the tube.

I may of course depart from the details of construction here shown without in any wise departing from the spirit or nature of the invention. In the present structure the trunnion 2 serves as a tubular discharge for the feed-scoop, but it is obvious that I may provide a special discharge pipe for the scoop independent of the trunnion without a departure from the spirit of my invention.

Having described my invention what I claim is:

1. The combination with a tumbling-barrel or container rotatable about a fixed axis and having a crushing compartment provided respectively with intake and discharge openings for the material disposed about said axis, a pulp-feed adapted to be charged from the exterior and provided with an axial tubular member discharging the material to be crushed into the compartment aforesaid, a stationary holder for the crushing bodies provided with a discharge opening, and a ball-feed tube leading from said opening and discharging into the tubular member aforesaid.

2. In combination with a tumbling-barrel or container rotatable about a fixed axis and having a crushing compartment provided with a hollow axial intake trunnion, a pulp-feeder discharging into said trunnion, a ball-feed tube axially traversing the pulp-feeder and forming an annular passage-way with the outer end of the trunnion for the flow of the pulp therethrough into the trunnion, a stationary hopper discharging into the ball-feed tube, the outer terminal of said tube being flush with the inner wall of the hopper to permit of ready gravitation of the balls into the tube without obstruction.

3. In an appartus of the character described, a rotatable pulp-feeder provided with an axial discharge, a detachable ball-feed tube axially traversing said pulp-feeder, said tube being provided with a securing flange coupled to the pulp-feeder wall and removed a suitable distance from the outer end of the tube, a stationary feed-box provided with a wall for the support of said outer end of the tube, and a ball-hopper secured to the feed-box for delivering the balls to said tube.

4. In combination with a tumbling-barrel or container rotatable about a fixed axis and having a crushing compartment provided respectively with intake and discharge openings for the material disposed about said axis, a pulp-feed adapted to be charged from the exterior and provided with an axial tubular member discharging the material to be crushed into the compartment aforesaid, a stationary holder for the crushing bodies provided with a discharge opening, and a ball-feed tube leading from said opening and discharging into the tubular member aforesaid, the discharge end of the tube being spaced a suitable distance from the inner walls of the tubular member.

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

ERNEST S. GREGORY.

Witnesses:
WALLACE N. TANNE,
ALBERT E. WIGGIN.