Oct. 19, 1926. 1,603,639

C. J. REED

PULVERIZING APPARATUS

Filed Dec. 1, 1921 2 Sheets-Sheet 1

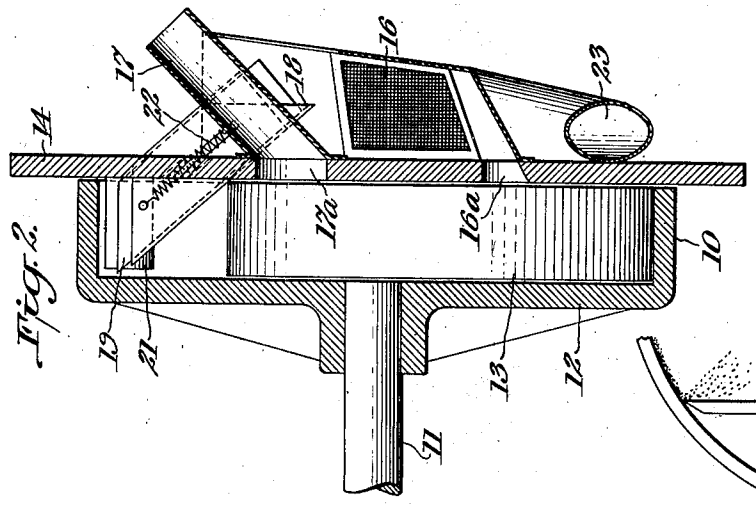


Fig. 2.

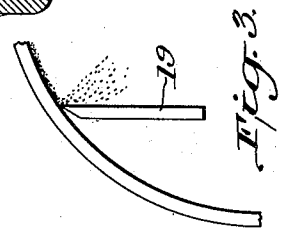


Fig. 3.

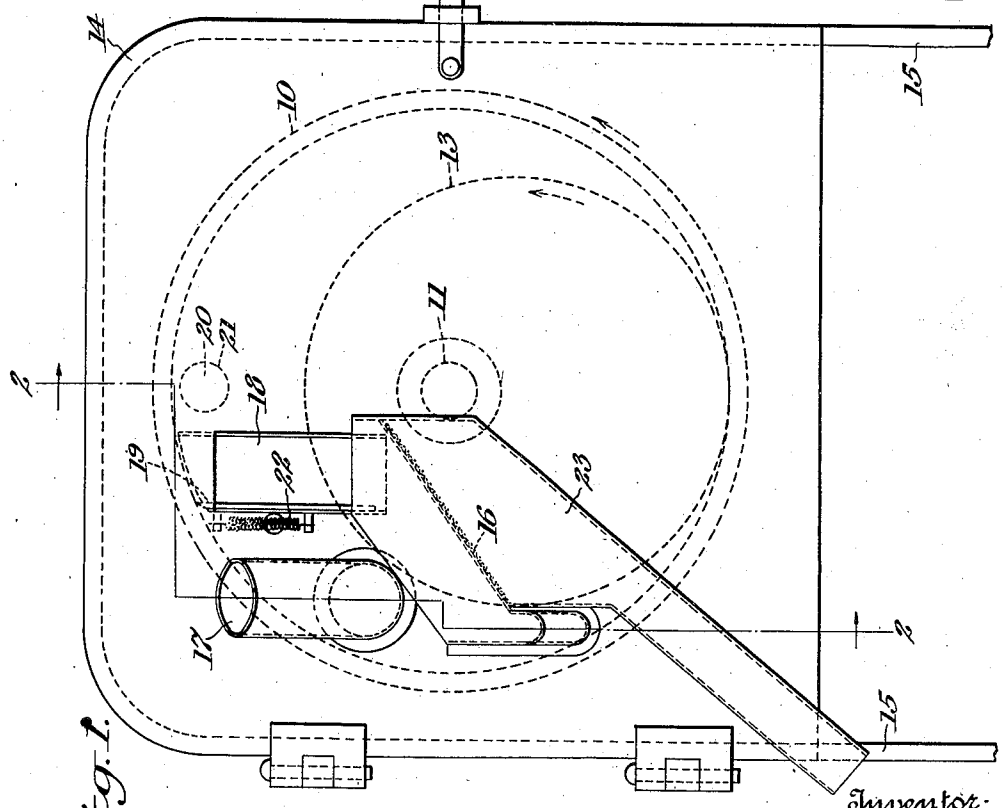


Fig. 1.

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2 Sheets-Sheet 2

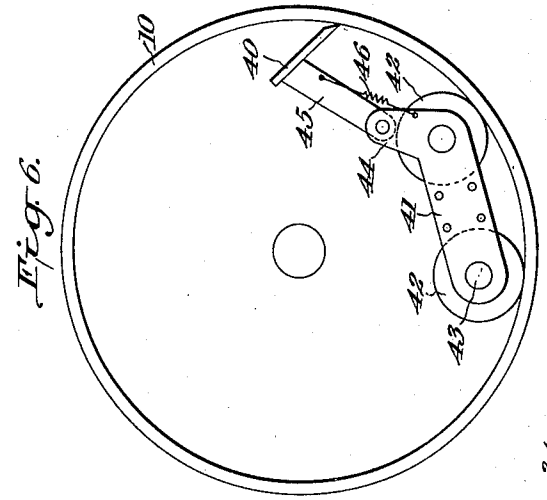


Fig. 6.

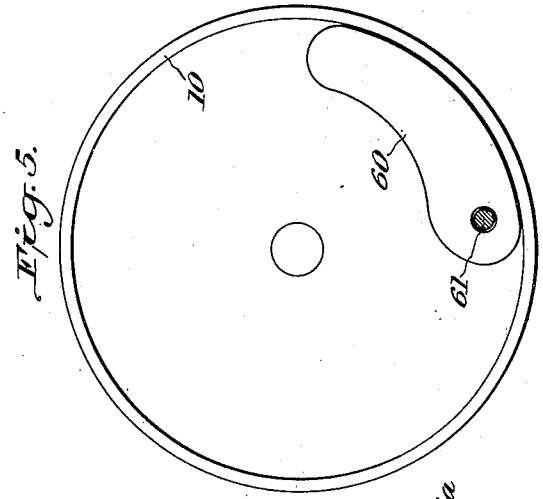


Fig. 5.

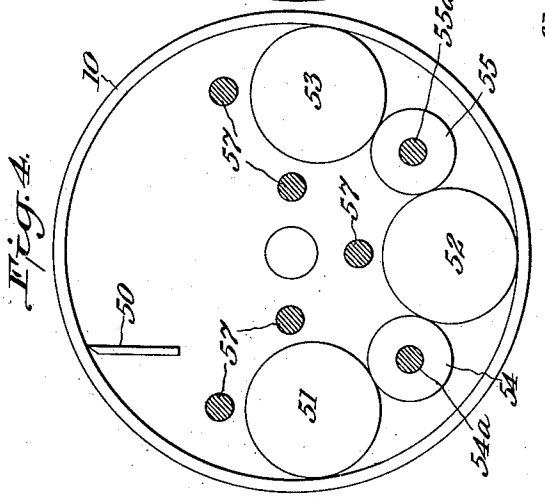


Fig. 4.

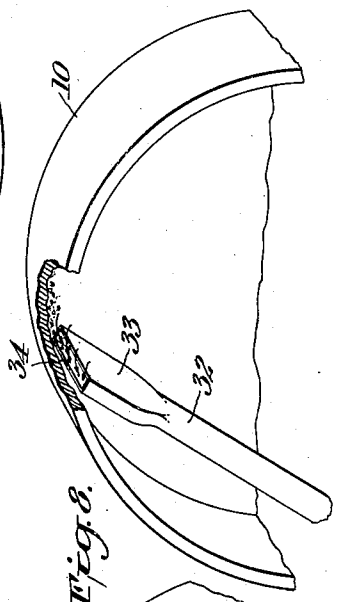


Fig. 8.

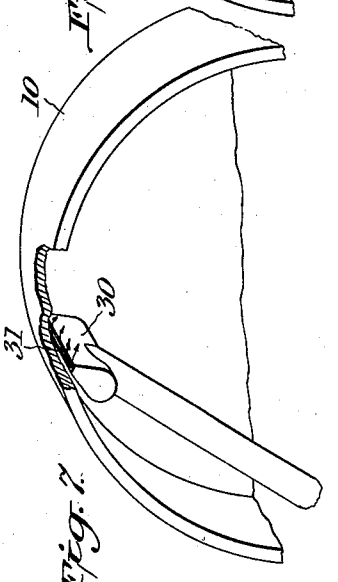


Fig. 7.

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Patented Oct. 19, 1926. 1,603,639

UNITED STATES PATENT OFFICE.

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PULVERIZING APPARATUS.

Application filed December 1, 1921. Serial No. 519,248.

The invention relates to grinding and pulverizing apparatus and more particularly to that type of apparatus generally referred to as roller mills, ball mills and tube mills.

It is the general object of the invention to provide apparatus of the type mentioned which have a considerably higher relative capacity of doing work and a correspondingly higher efficiency than apparatus now in use.

Other objects will appear from the description and the accompanying drawings in which

Fig. 1 is an end view of an apparatus embodying the invention;

Fig. 2 is a section substantially on line 2—2, Fig. 1;

Fig. 3 is a fragmentary view of a detail;

Fig. 4 is an end view, partly in section, of another form embodying the invention;

Fig. 5 is a similar view of still another form;

Fig. 6 is an end view of still another form; and

Figs. 7 and 8 are fragmentary perspective views showing modifications of a detail constituting an essential part of the invention.

Having reference to Figs. 1 and 2, 10 represents a hollow drum or cylinder mounted upon and rigidly connected with a shaft 11. One end of the cylinder is closed by a head 12 to the center of which the shaft is attached. It may be mentioned here that in practice I prefer to mount two cylinders or drums upon opposite ends of a common shaft to be driven as a unit.

Within the cylinder is disposed a crushing element which has a surface in freely rolling or sliding contact with the surface of the cylinder. In the particular instance the crushing element is a roller 13 having substantially the same axial length as the cylinder.

Facing the open end of the cylinder and in close proximity thereto along its entire periphery is a cover plate 14 which closes the cylinder without causing frictional contact therewith. This cover plate is preferably carried upon hinges secured to the stationary frame work 15 so that it may, like a door, easily swing away from the cylinder to afford access to the interior.

The door 14 acts as a support for mechanical devices projecting into the revolving cylinder and operating in conjunction therewith as will be described more in detail. In the particular form shown in Figs. 1 and 2, the door carries a screen 16, a feed pipe 17, an outlet box or chute 18, a scraper 19, a stud 20 and buffer 21.

The feed pipe 17 registers with an opening 17^a for passing the material into the cylinder while the material which is too large to pass through the screen 16 reenters the cylinder through an aperture 16^a.

The scraper 19 is slidably mounted adjacent the outlet chute 18 and urged into contact with the surface of the cylinder by means of a spring 22.

The operation is as follows:

The material is fed into the cylinder through the feed pipe 17. The cylinder is turned in the direction indicated by the arrow and thereby causes the roller 13 to roll along its surface. The material which is carried up to the scraper is forcibly detached thereby, as clearly indicated in Fig. 3, from the cylinder and drops into the chute and then upon the screen. The material which is ground fine enough falls through the screen 16 upon a chute 23 from which it may be collected in the usual way, while the particles rejected from the screen are returned to the mill through the opening 16^a.

The cover itself may be perforated and act as a screen. In that case the material removed by the scraper is projected against the perforated cover instead of being thrown out through a single outlet. The particles too large to pass through the perforations remain in the drum until reduced to proper size.

The significance of the scraper is as follows:

Pulverizing apparatus of this character used at present are of a generally low-speed type. In contradistinction to that type of apparatus the apparatus embodying the invention may be termed a high-speed apparatus. Since the capacity of an apparatus of this type is proportional to the speed of revolution, the capacity of a high-speed apparatus is correspondingly greater than that of an apparatus of the low-speed type. It should be further noted that the impact of the rollers upon the material has

a greater pulverizing effect at high speed than at low speeds.

While I have shown the scraper forced against the surface of the cylinder by a spring, it is understood that it may be held in fixed position close to the surface so as to detach the material and reflect it into the chute.

There is considerable latitude both in regard to the form of the scraper and to its support. By the term "scraper" I mean any means which effects a detachment of the material from the surface of the cylinder. Thus as indicated in Fig. 7, a stream of air, water or other mobile material, may be directed against the cylinder surface from a nozzle 30 having a narrow slot 31 extending from one end to the other end of the cylinder. A stream or thin sheet of a fluid may be projected through the slot 31 against the wall of the cylinder at such velocity that the force of the impact is equivalent to the action of a mechanical scraper. The material detached by the action of the stream may be received in a chute or outlet box similar to that previously described in connection with Figs. 1 and 2. The water or other liquid by the impact with the wall of the cylinder is deflected into the outlet box and flows off carrying with it the pulverized material.

Another form of device equivalent to a scraper is shown in Fig. 8. A tube 32 has a flattened end portion 33 provided with a slot 34 extending from one end to the other end of the cylinder. The tube 32 may be connected to a source of negative pressure. The arrangement is very similar to the well known forms of vacuum cleaners. In this manner when the particles carried around by the centrifugal force due to the high peripheral speed of the cylinder come opposite the slot 34, the force of the negative pressure will cause the detachment and removal of the particles. The slot 34 must be wide enough to receive the largest particles which are to be removed.

As previously stated, the scraper may be supported in various ways. While I prefer to attach it to a stationary part as shown in Figs. 1 and 2, it is not essential that it be absolutely stationary. It is merely necessary that there be a relative motion between the cylinder and the scraper. Thus, as shown in Fig. 6, the scraper 40 may be attached to a movable frame carried by the rollers 42. The rollers are free to roll along the surface of the cylinder and have at their ends journals 43 upon which the plates 41 are mounted. The plates have upwardly extending apertured lugs 44 in which the arm 45 carrying the scraper 40 may be pivoted. A spring 46 may be applied to force the scraper into contact with the wall of the cylinder 10. The scraper in this case, instead of throwing the material out through the door, throws it down among the rollers, the finer particles being carried out as dust.

In Fig. 4, is shown another arrangement embodying the invention. The scraper 50 may be mounted as in the apparatus shown in Figs. 1 and 2. Three rollers 51, 52 and 53 are kept in a definite rolling relation to each other and to the cylinder by means of auxiliary smaller rollers 54 and 55 mounted upon shafts 54^a and 55^a. These shafts may be revolubly mounted in bearings attached to the outside of the door or cover plate (not shown) and extending through the door. The rollers 54 and 55 are made of smaller diameter so that they do not touch the inner surface of the cylinder. To prevent the rollers 51, 52 and 53 from getting out of place, buffers 57 may be provided. These buffers may be studs firmly attached to the door and may or may not carry loose sleeves.

This arrangement is well adapted for fine grinding. For very fine grinding the material may be removed as dust by a suction blast through a tube at the upper part of the door. The material removed by the scraper is thrown down among the rollers instead of throwing it out through a chute such as shown in Figs. 1 and 2.

While the invention is primarily applicable to an apparatus in which the pulverizing or grinding action is carried out by rollers, as above pointed out, it is of broader application. Thus, as shown in Fig. 5, a crushing weight 60 is pivotally mounted upon a stud 61 mounted upon the door (not shown). The weight 60 slides on the revolving surface of the cylinder and fits approximately the curvature of that surface. The upper surface may be of any desired form. The lower or grinding surface may be grooved, channeled, indented or otherwise modified to help carry the particles to be ground.

In the foregoing, I have pointed out several forms of apparatus embodying the invention. I am aware, however, that within the scope thereof various other forms may be evolved and that various changes may be made in the forms shown and described.

One of the outstanding features is the application of a scraper constructed and arranged to detach the material adhering to the wall of the cylinder under the action of the centrifugal force caused by a high peripheral speed. The inner surface of the cylinder must be turned to a substantially true surface revolution. While for the sake of simplicity I have referred throughout to a cylinder, any drum or drum-like body having a surface of revolution, may be used. The revolving member, whatever its shape, must be well balanced to operate satisfactorily at the high speeds contemplated.

The second feature which is instrumental in bringing about increased capacity and

efficiency with less cost of construction and operation is the stationary cover plate or door acting as a support for various mechanical devices functionally a part of the interior of the drum or cylinder.

I claim:

1. A pulverizing machine comprising a hollow drum revolubly mounted on a horizonal axis, a stationary closure for one end of the drum, a plurality of freely movable crushing rollers in the drum co-operating with the surface thereof to effect a grinding action, means for revolving the drum at a high speed, a frame interconnecting the rollers, means mounted on the said frame for continuously removing material from the drum and means near the top of the stationary closure for removing the fine dust resulting from the crushing action.

2. A pulverizing mechanism comprising a hollow drum adapted to revolve on a horizontal axis, one end being closed, two or more freely movable rollers in the drum and means movable with said rollers for removing material from the interior surface of the drum.

3. In a pulverizing machine, the combination of a hollow drum adapted to revolve on a horizontal axis, a stationary member for closing one end of the drum, a crushing member in the drum co-operating with the surface thereof to effect a grinding action, mechanism for revolving the drum at a high speed, and means extending through the stationary member into the upper part of the drum for continuously removing material therefrom, said means comprising a fluid pressure device including a nozzle extending transversely of the drum in close proximity to the surface thereof.

In testimony whereof, I affix my signature.

CHARLES J. REED.