H. W. HARDINGE.

FEEDER FOR TUBE MILLS.

APPLICATION FILED MAY 11, 1916.

1,272,801. Patented July 16, 1918.

Fig. 1

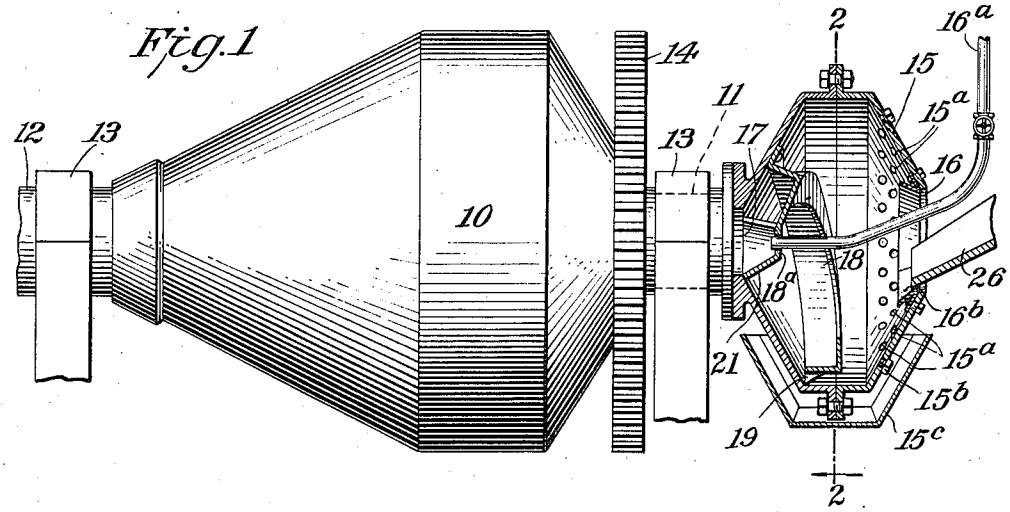


Fig. 2

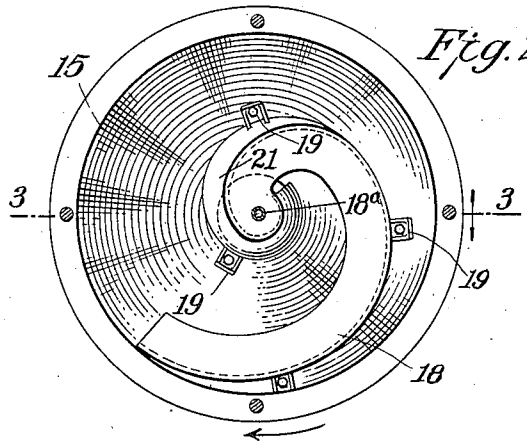


Fig. 3

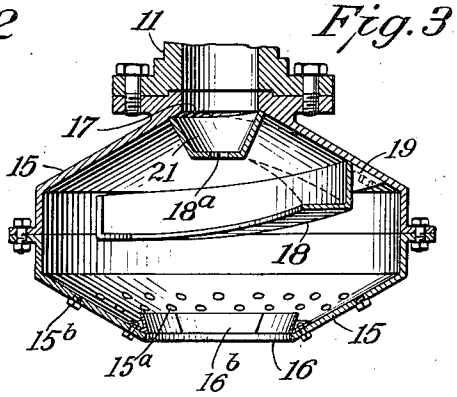


Fig. 4

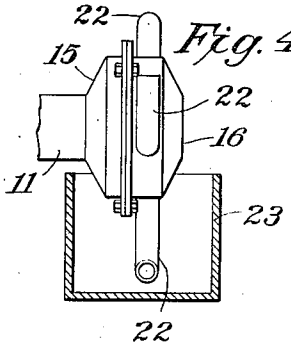
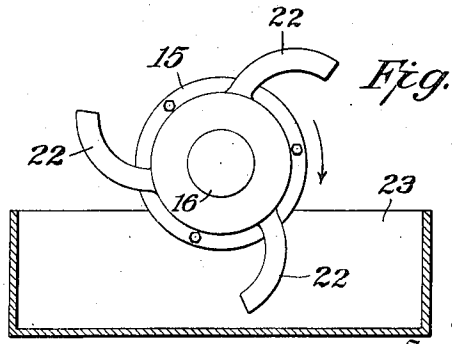


Fig. 5



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FEEDER FOR TUBE-MILLS.

1,272,801. Specification of Letters Patent. Patented July 16, 1918.

Application filed May 11, 1916. Serial No. 96,765.

To all whom it may concern:

Be it known that I, HARRY W. HARDINGE, a citizen of the United States, residing at New York, county and State of New York, have invented certain new and useful Improvements in Feeders for Tube-Mills, of which the following is a full, clear, and exact description.

This invention relates to mills for grinding or disintegrating ores and other materials, particularly mills of the type known as tubemills or ballmills, comprising a rotating barrel or drum having at the end of the axis on which the drum rotates an inlet opening for the introduction of the ore or other material. Such mills usually rotate on hollow axial trunnions, in which case it is customary to deliver the ore to the mill by means of a chute extending into one of the trunnions, the ore being accompanied by a stream of water when the mill is used for "wet grinding". This method of feed is not altogether satisfactory, chiefly for the reason that the material backs up in the trunnion and overflows the same, so that the mill "slobbers", thereby keeping the surroundings wet and necessitating frequent cleaning of the floor. Moreover, fine particles of the material work their way into the trunnion bearings, causing rapid and destructive wear. It is accordingly the object of my present invention to provide an improved feeding device, whereby the drawbacks mentioned will be obviated. To this and other ends the invention consists in the novel features of construction and combinations of elements hereinafter described.

One form of the invention is illustrated in the accompanying drawing, in which—

Figure 1 is a side view of a ballmill of the conical type equipped with my improved feeder, the latter being shown in section on its axis of rotation.

Fig. 2 is a cross section of the feeder on the plane indicated by line 2—2 of Fig. 1.

Fig. 3 is a section on the plane indicated by line 3—3 of Fig. 2.

Fig. 4 is a side view of a modification of the feeder shown in Figs. 1, 2 and 3, and Fig. 5 is an end view of the same.

The mill 10 is provided with an inlet trunnion 11 and an outlet trunnion 12, mounted in bearings 13, and is rotated by any convenient means, not shown, through the agency of the large gear 14. The feeder 15 comprises a conical casing composed of two conical portions or halves detachably joined at their bases and having axial inlet and outlet openings 16, 17, respectively. Around the outlet opening is a flange by which it can be removably secured to the inlet trunnion, as by means of screws or bolts as indicated in Fig. 3. On the inside of the inner conical portion of the feeder (that is, the half next to the mill 10) is at least one open helical trough-conveyer 18, secured in any convenient manner, as by means of screws passing through ears 19. This trough extends from the periphery of the feeder to the axis thereof, following the inner surface, and opens into the trunnion 11 at the inlet opening 17 of the feeder.

The conveyer is distinctively an open-trough having not merely an open front or scoop-end (such as common to conveyers of the snail type) but an open top, the conical inner surface of the casing constituting the inner wall of the trough, and its outer wall being formed by a longitudinal upright flange over the top or upper edge of which there is free communication between the interior of the trough and that portion of the feeder casing external to the trough, as indicated in Figs. 2 and 3. The result of the open-top-trough arrangement is that, during the rotary movement of the feeder, the material contained in the casing will be taken into the trough over the top of its outer wall, as well as at its scoop-end, so long as the trough is moving through the material; and, on the other hand, any surplus or excess of material thus taken will, as the trough rises above the level of the material in the casing, escape over the top of the said outer wall of the trough and drop back again to the bottom of the casing, thus assuring an even feed without danger of blocking or choking.

The ore or other material to be ground is discharged into the feeder through the inlet opening 16 by a chute 26 and falls to the bottom, where it is picked up by the trough

(the mill and feeder revolving in the direction of the arrow in Fig. 2), which acts in the manner of an Archimedean screw. It will be observed that the conveyer is not a spiral, but a conical helix, of helico-spiral form, beginning at or about the plane indicated by the line 2—2 of Fig. 1 and terminating at the outer end of the inlet trunnion 11. Accordingly the material transported by the conveyer not only is carried radially inward but also has a movement parallel to the axis of the mill, and hence it meets the trunnion at an obtuse angle to the axis instead of at a right angle. Moreover, the bottom of the trough is preferably inclined, as indicated at 21, so that the material does not change its direction of flow abruptly on reaching the outlet 17. The net result is that the material enters the inlet trunnion with greater velocity and momentum and hence passes through the trunnion more freely and more effectively drives before it any material that may have remained in the trunnion. Also, if any material falls down out of an upper part of the trough as the feeder revolves it does not escape from the trough altogether but slides down the inclined (conical) wall of the feeder and into the part of the trough which is immediately below. If the chute momentarily delivers more material than the conveyer can carry, the excess is not spilled out on the ground or floor but simply remains in the bottom of the feeder casing until the conveyer comes around again. Slobbering due to irregular rate of supply to the feeder is thus entirely eliminated if reasonable care is exercised to see that the supply is not so fast as to cause the feeder actually to overflow.

If desired, a pipe 16ª may be provided, extending through the inlet opening 16 into a suitable aperture 18ª in the inner portion of the trough 18, for discharging a jet of water to aid the flow of material through the trunnion into the drum. In case of dry grinding, the pipe is used for an air jet. I may also provide a lip or flange 16ᵇ around the inlet opening 16, on the inside. This lip receives the impact of the material discharged by the chute 26 and so protects the edge of the opening itself from wear, the lip being renewed when worn out. The lip also serves to prevent escape of material which, carried up by the ascending side of the casing, slides down the incline as it approaches the highest point of its travel.

Sometimes there is too much water delivered with the ore or other material, and in order to get rid of the excess before it enters the drum the feeder casing may be provided with one or more circumferential series of escape apertures, as 15ª. When a large proportion of the water is to be removed, all the escape apertures are left open, so that only so much water will be retained as can be held by the space below the lowermost aperture, the rest escaping through the open holes. If more water is to be retained, the holes of the first series are closed, as by means of screw plugs 15ᵇ. If all the water is to be retained, all the holes are closed, as will be readily understood. A trough or launder 15ᶜ is provided below the feeder to carry off the water.

In the modification shown in Figs. 4 and 5 the feeder is also provided with external conveyer-arms or scoop-arms 22, bent spirally in the direction of rotation so as to scoop material from the vessel 23 in which the conveyer-arms dip. Material thus picked up is delivered into the feeder casing, and is there picked up by the conveyer-trough and delivered to the inlet trunnion of the mill. If material is intentionally supplied to the vessel 23, the chute 20, Fig. 1, can be used or not, as desired. Or the vessel 23 can be used merely to catch material overflowing from the feeder by reason of supplying material thereto at too fast a rate.

It is to be understood that the invention is not limited to the embodiments herein specifically illustrated and described but can be embodied in other forms without departure from its spirit.

I claim:

1. The combination with a tube mill rotatable about its axis having an axial inlet opening, of a feeder comprising a rotary hollow conical casing having an axial outlet communicating with said opening, and an open-top trough-conveyer of helico-spiral form carried by the casing inside of the same and following the conical inner surface of the casing from its periphery to its axial outlet, over the upper longitudinal edge of which conveyer there is free communication between the interior of the trough and the surrounding casing.

2. The combination with a tube mill rotatable about its axis having an axial inlet opening, of a feeder comprising a rotary hollow conical casing having an axial outlet communicating with said inlet opening, and an open-top trough-conveyer of helico-spiral form following the conical inner surface of the casing from its periphery to its axial outlet, the conical inner surface of the casing constituting the inner wall of the trough and the outer wall of the trough consisting of a longitudinal flange over the upper edge of which there is free communication between the interior of the trough and the surrounding casing.

3. A feeder for tube mills comprising a rotatable hollow conical casing having an axial outlet, and an inlet opening, a helico-spiral open-top-trough-conveyer within the feeder, following the conical inner surface of the feeder to the axial outlet, the conical in-

ner surface of the feeder constituting the inner wall of the trough and the outer wall of the trough consisting of a longitudinal flange over the upper edge of which there is free communication between the interior of the trough and the surrounding casing, the bottom of the conveyer being inclined at said outlet to facilitate the discharge of the material from the trough through the outlet, and means for discharging a jet of water or air outwardly through the outlet opening.

In testimony whereof I hereunto affix my signature.

HARRY W. HARDINGE.