Jan. 15, 1952 H. KRONSTAD 2,582,547

COMMINUTING MILL WITH MEANS FOR LATERAL INJECTION OF FLUID THEREINTO

Filed Jan. 4. 1949 4 Sheets-Sheet 1

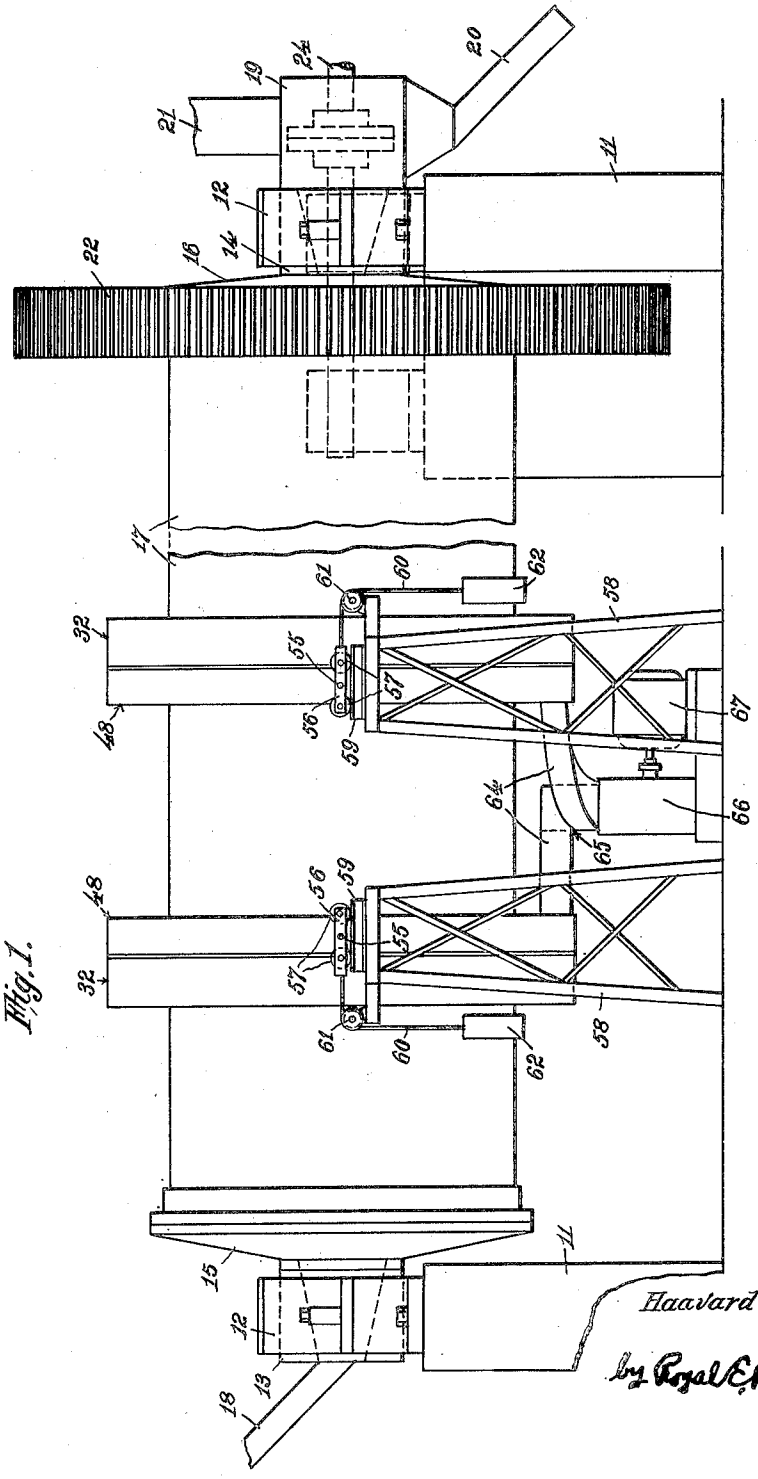


Fig. 1.

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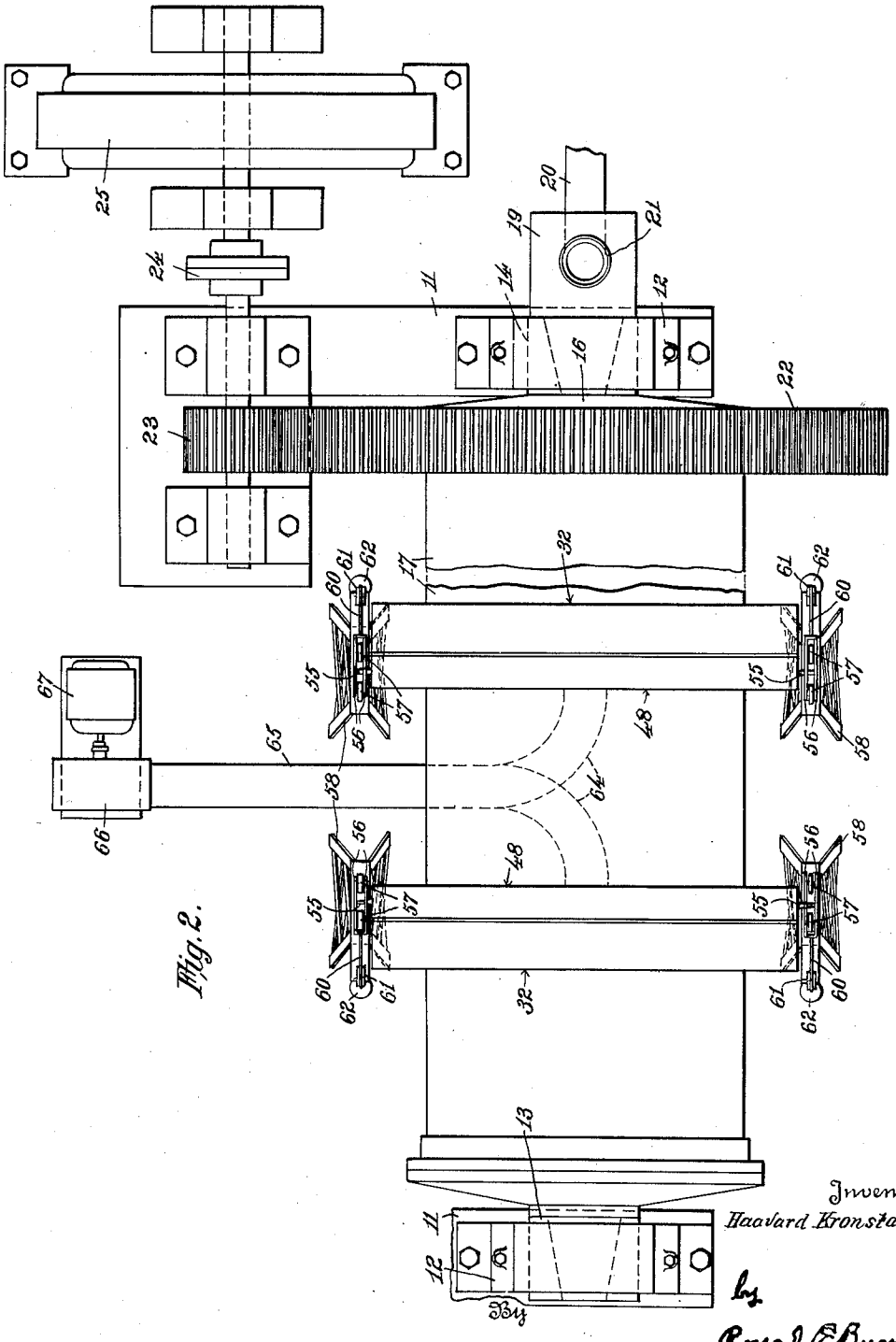


Fig. 2.

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Fig. 3.

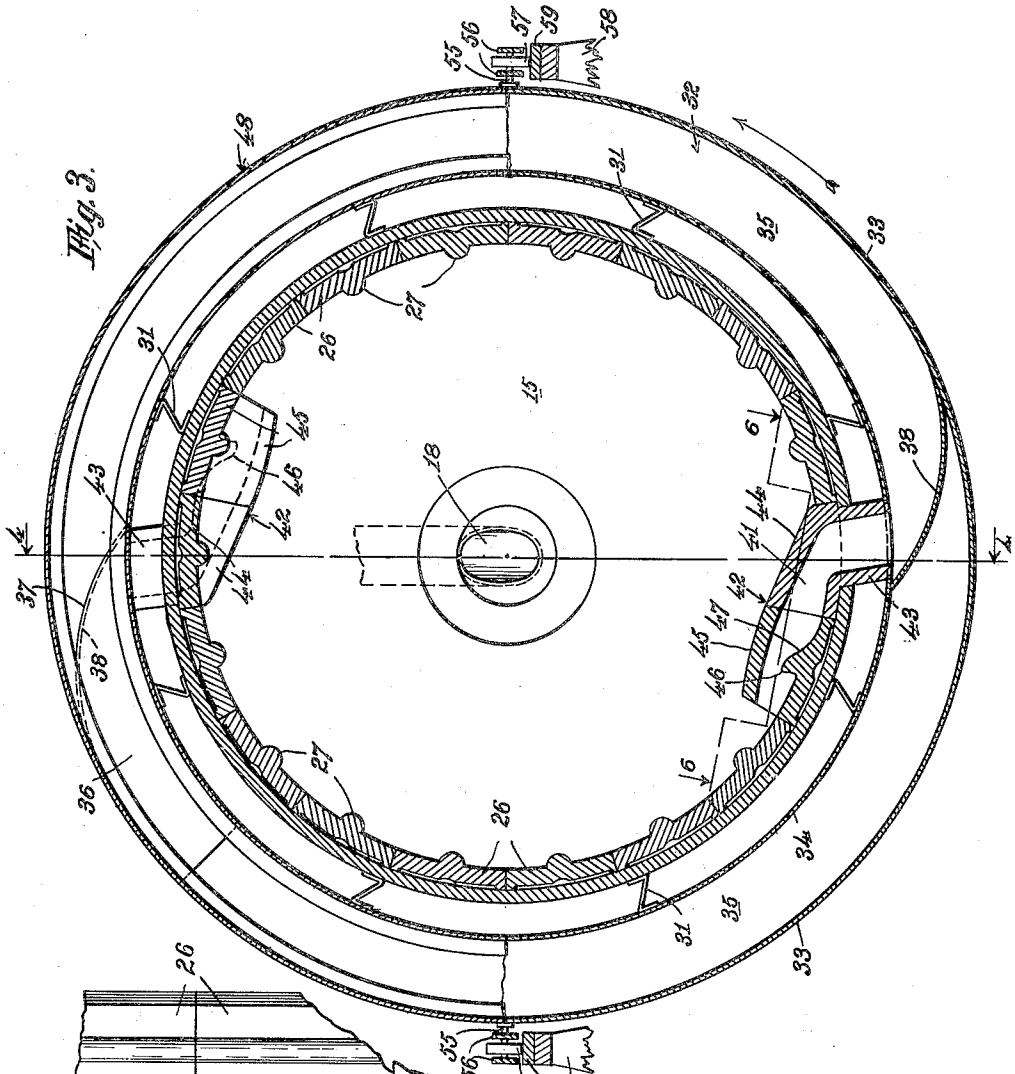
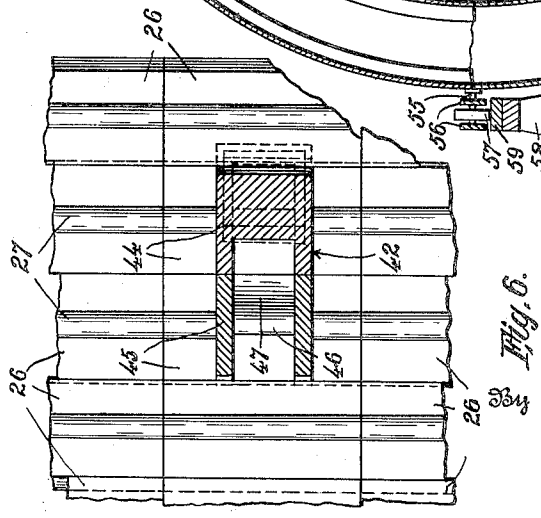


Fig. 6.



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Fig. 4.

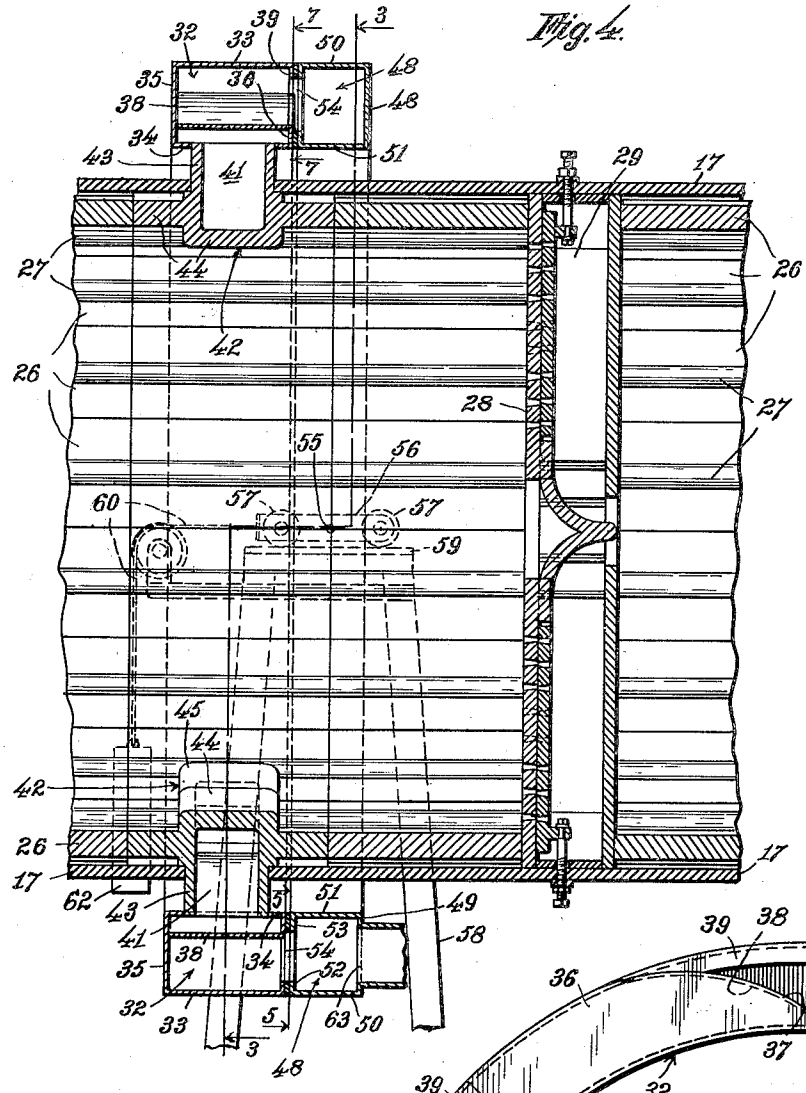


Fig. 7.

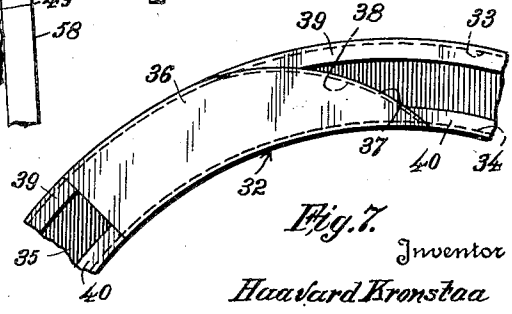
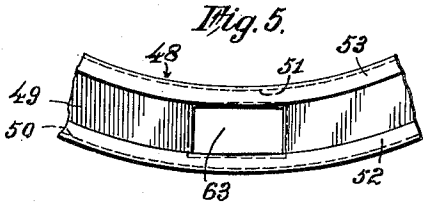


Fig. 5.



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UNITED STATES PATENT OFFICE

2,582,547

COMMINUTING MILL WITH MEANS FOR LATERAL INJECTION OF FLUID THEREINTO

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Application January 4, 1949, Serial No. 69,227

1 Claim. (Cl. 241—54)

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This invention is concerned with mills for reducing the granular or particle size of solid matter such as rock, ores, material for subsequent conversion into cement clinker, etc., to the desired degree of comminution, and it relates particularly to rotary mills that are divided into a plurality of grinding chambers.

Usually balls, rods, or other loose tumbling elements in the drum of such mills contribute to grinding action.

It is an object of the invention to provide means to force air or other fluid in whirling streams into the grinding chambers through the side wall of the drum, to facilitate grinding action, and also more effectively to cool the interior of the mill remote from the feed end.

When considered with the description herein, characteristics of the invention are apparent in the accompanying drawing, forming part hereof, wherein association of an adaptation of the invention with a cylindrical shell ball mill is disclosed.

Like reference-characters refer to corresponding parts in the views of the drawing, of which—

Fig. 1 is a side elevation of the mill;

Fig. 2 is a plan view thereof;

Fig. 3 is a section on line 3—3, Fig. 4;

Fig. 4 is a section on line 4—4, Fig. 3;

Fig. 5 is a section on line 5—5, Fig. 4;

Fig. 6 is a section on line 6—6, Fig. 3;

Fig. 7 is a section on line 7—7, Fig. 4.

In the drawing, 11 designates supporting pillars on which are mounted bearings 12, in which rotate a hollow feed trunnion 13 and a hollow discharge trunnion 14 extending outwardly from end walls 15 and 16, respectively, of a drum having a cylindrical outer side wall 17.

A feed element, as indicated by 18, is associated with the trunnion 13, and a discharge hood 19, discharge pipe 20, and a pipe 21 leading to a dust collector are associated with the trunnion 14.

The drum is rotated by a gear 22 fast thereon, which is driven by a pinion 23, shafting 24, and motor 25.

The drum is lined with longitudinal plates 26 secured to the drum wall, and the plates have longitudinal ribs 27. The interior of the drum is divided into chambers by a division head 28, which has radial spider arms or vanes 29. The ribs 27 contribute to the cascading of material being ground in the mill during its rotation.

Parts of the mill thus referred to, which are more or less conventional, are shown as a basis for explaining the present invention, which relates to association with a mill of this type of

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means to inject whirling streams of fluid sidewise into one or more of the treating chambers thereof.

The invention provides a continuous bearing surface, or a plurality of them, around the circular side of the drum, a passage, beginning in the annulus of the surface or surfaces, extending into the drum, a chamber-containing member having a bearing surface in contact with that of the drum, an opening from the chamber alignable with the drum passage, means to prevent rotation of the member, and means to force fluid into the member, so that it is injected into the drum between its ends as it rotates during grinding operation of the mill. An adaptation of the invention having those characteristics is that hereafter described.

Members 31, secured to and extending outwardly from the cylindrical wall of the drum, holds fast thereon an annular wind box 32.

The wind box is substantially a three-wall structure, which is formed with an outer wall 33, an inner wall 34, and a back wall 35 joining the walls 33 and 34. It has arcuate openings or ports extending substantially throughout its annulus opposite to back wall 35 between plates 36. Those plates are at opposite places on the annulus, and they are connected to the outer and inner walls 33 and 34.

The rear edge 37 of each plate 36 is curved and recedes from the outer wall 33 to the inner wall 34, and a partition 38 of corresponding curvature is joined to the plate at that edge and to those walls and divides the interior of the box into chambers.

The material of walls 33 and 34 is right turned at their free edges, except at the plates 36, to afford flat concentric arcuate bearing members 39 and 40, respectively. These members and plates are arranged so that their bearing surfaces and the outer surface of the plates are in the same plane. Those surfaces are to form a running seal with parts of a chamber-containing member.

Two diametrically positioned passages 41 extend from a discharge port of the wind box to the interior of the drum, first in somewhat radial disposition and thence inside of the drum close to and substantially parallel with the lining thereof. Each of these passages is in a member 42. That member has a neck 43, which extends into the drum from the wind box at a place covered by a plate 36 and close to the partition 38, and the member extends from the neck inside of the drum in approximately parallel disposition close to the wall thereof.

Although each member 42 may be in one piece, practically it may be of blocks 44 and 45 fitted close together at their abutting sides and shaped to be fastened close against the inner side of the drum and for their width to displace equivalent lengths of lining plates 26.

Each member 42 has in its passage near the discharge end a rib or protuberance 46. The side 47 thereof that receives impact of in-flowing fluid slopes from one wall of the passage to the tip of the rib or protuberance. Thus the member 42 has a discharge end of nozzle-like form, with the rib or protuberance 46 restricting the size of the passage and intensifying the fluid stream emanating therefrom. Moreover, the rib or protuberance prevents grinding bodies and comparatively large particles of material being treated from entering the passage in some circumstances.

An annular non-rotating wind box 48 is associated with the wind box 32. It is the chamber-containing member hereinbefore mentioned. It has an opening at one side that may extend substantially throughout its annulus, and otherwise is closed by a side wall 49, an outer wall 50, and an inner wall 51. The opening of the box 48 is alignable with those of box 32, when the two boxes are together.

The material of walls 50 and 51 is right turned at their free edges to afford flat concentric bearing members or rings 52 and 53, respectively, of curvature corresponding to that of the bearing members 39 and 40 of the rotating box 32. A gasket or seal ring 54 may be interposed between the two sets of bearing members.

The non-rotating wind box is kept in close association with the rotating wind box at their bearing surfaces and prevented from rotation in any suitable manner.

For example, as shown by the drawing, diametrically positioned radially disposed members 55 extend from the non-rotating box. Each of these members extends through plates 56, between which are journaled wheels or rollers 57. Pillars 58, on opposite sides of the mill, carry tracks 59 on which the rollers ride. A cable 60, attached to the plates 56, operates over a pulley-wheel 61 on each of the pillars, and by urge of weight 62 thereon draws and keeps bearing rings 52—53 of the box 48 against the bearing rings 39—40 of the box 32. Thus a tight running surface joint is maintained at the bearing surfaces of the two boxes. The box 48 is prevented from rotating with the box 32 by the shafts 55 resting on the late-roller structure 56—57.

One wind box structure, to this point, has been described. The drawing shows two such structures for separate chambers between which is a division head 28. Ordinarily, when two wind box structures are used, the non-rotating boxes 48 face each other; that is, both of them are between the two companion rotating wind boxes. Thus, pull of cables 60 is in opposite directions against the rotating boxes and the drum. Consequently, urge in one direction that might produce undesirable urge on the drum bearings is counteracted by substantially equal cable urge in the opposite direction.

Air or other fluid is supplied under pressure to the non-rotating wind boxes through their intake ports 63 by bifurcated parts 64 of a conduit 65 connected with the discharge outlet of a fan 66 driven by a motor 67.

When the drum is rotating in direction of the arrow in Fig. 3, the material being treated and the grinding bodies move upwardly with the

ascending arc of the drum and cascade over to the other side. The heavy mass in the drum, during these movements, is subjected to streams of air discharged thereinto adjacent to the drum wall and thereafter moving transversely through the mass. These currents operate, between ends of the drum, to loosen particles of the material from the grinding bodies, ribs, vanes, division heads, and other elements in the drum, and more uniformly disperse the material among the grinding bodies.

Altogether, the whirling and swirling action of the laterally and circumferentially injected air enhances the grinding process, with results superior to the conventional method of introducing air axially at the feed end of the apparatus.

Moreover, injection of air currents into the drum between its feed and discharge ends operates more effectively to reduce temperature of the contained mass even to the last division head near the discharge end. Thus, to the place of discharge, the mass is cooled to a greater degree than by air introduced only at the feed end, which, by the time it has gone through some of the drum, has become relatively hot.

Mills of the kind with which this invention ordinarily is associated usually are quite massive, and together with the balls or other grinding bodies and material being treated constitute a ponderous mass.

After drive effort of the operating elements is stopped to discontinue rotation of the drum, the contained mass adjacent to the upwardly moved arc of the drum is of such weight as to start oscillation of the drum before it comes to a full stop.

During the phases of oscillation opposite to the normal direction of rotation indicated by the arrow in Fig. 3, some particles of the material are apt to enter the rotary wind box through the passage 41 of the then backwardly moving member 42 in the then lower portion of the drum. The passage at the nozzle tip usually is small enough to prevent entrance of grinding bodies, and small grinding bodies and large particles of the material are prevented from entering by the restricting rib 46. The plates 36 keeps matter that has reached the rotary wind box from going into the non-rotary wind box. Further, entrance of matter through passage 41 may be retarded by continuing the flowing of fluid into the drum until oscillation has stopped. When operation of the mill is resumed, matter that may have entered the rotary wind box usually is blown back into the drum.

Although the invention has been described as primarily for introduction of air laterally into a rotary grinding drum, it is to be understood that it is adaptable for use also in injecting other suitable fluids into such mill drums.

Further, it is to be understood the term "wind box" is used for convenience to indicate any suitable members coacting as hereinbefore described with other members, and that limitation of the invention to use with gaseous fluid is not intended.

I claim:

A comminuting mill comprising a rotary drum, a wind box encircling the outside of and rotating with said drum having a radial face, circular concentric bearing members on said radial face, said radial face having an intake opening between said members, a partition dividing the interior of said box, a plate on said radial face extending between the circular concentric bearing members adjacent to said partition in the direction of

rotation, there being a passage extending from a part of said box adjacent to said plate to the interior of said drum, a non-rotating wind box, annular bearing members thereon in contact with those of said rotating box, there being an opening from said non-rotating box between its bearing members alignable with the opening of said rotating box, means holding said bearing members in contact, and means to force fluid into said non-rotating box.

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