UNIVERS STATES PATENT OFFICE

2,656,162

TUMBLING MILL FEED MECHANISM


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6 Claims. (Cl. 259—14)

1. This invention relates to material mixing or blending devices for use in the various industries, and more particularly to improved means for feeding raw materials into such devices.

The invention contemplates improvements in the means for feeding raw materials into mixing or blending mills of the type comprising a rotatably mounted vessel for confining and tumbling dry or wet materials; and more specifically the invention contemplates improved means for feeding the raw materials into the mill through the trunnion bearing devices thereof.

An object of the present invention is to provide an improved feed mechanism of the character described; which mechanism employs an improved feed screw mounting and driving arrangement.

Another object of the invention is to provide a feed mechanism of the character described; which mechanism facilitates in improved manner disassembly and cleaning thereof intermediate of successive uses of the mill on different materials; thereby avoiding contamination of the feed materials.

Another object of the invention is to provide an improved feed mechanism of the character described which eliminates the need for feed screw bearing devices internally of the mechanism; thereby eliminating an otherwise difficult maintenance problem.

Another object of the invention is to provide in a mill of the character described an improved feed hopper and screw arrangement.

Other objects and advantages of the invention will appear from the specification hereinafter.

In the drawing:

Fig. 1 is a side elevation of a mixing or blending mill incorporating a material feeding arrangement of the present invention; the mill being illustrated by way of example as being generally of the type shown and described in U. S. Patent 2,514,126, but having a material feeding mechanism of the present invention incorporated therewith;

Fig. 2 is an end elevation of the mill of Fig. 1, showing one form of feed hopper supply means applicable thereto;

Fig. 3 is a fragmentary section, on an enlarged scale, taken along line III—III of Fig. 1;

Fig. 4 is a fragmentary top elevation, taken on an enlarged scale, of the feed mechanism support arrangement of Fig. 1;

Fig. 5 is a fragmentary section taken along line V—V of Fig. 4;

Fig. 6 is a fragmentary section taken along line VI—VI of Fig. 5; and

Fig. 7 is a fragmentary side elevational view, with portions broken away to show the interior, of another form of feed hopper and supply arrangement, in connection with a mill and feeding mechanism of the present invention.

The drawing illustrates by way of example, application of the present invention to a blending mill of the type illustrated in detail in U. S. Patent 2,514,126; but it will of course be understood that the present invention is applicable with equal facility to any other type of rotating vessel for blending or mixing or grinding materials. As shown in the drawing, the mill comprises a hollow container fabricated of two truncated cylinders so united as to provide a generally V-shaped hollow container 10 having access opening covers 12—12 and a material discharge spout and control valve unit 16. The mill is mounted to rotate upon trunnion bearings which are carried by pedestals 14—16; the trunnion bearing arrangement at the pedestal 16 comprising a truncated cylindrical bracket 17 fixed to the container 10 and having a stub shaft 18 extending therefrom and journaled within a bearing block 19 which is based upon the pedestal 15. A spur gear 20 is illustrated as being carried by the shaft 18 and meshes with a pinion 21 which is in turn driven by a motor 22 to provide the required rotation of the mill for material grinding or mixing or blending purposes, as explained in the patent previously referred to.

The trunnion bearing mechanism at the opposite end of the mill is especially designed to embody the feed mechanism of the present invention, and for that purpose the container 10 is provided with an integral truncated cylindrical bracket 24 (Figs. 1, 5) which extends horizontally and concentrically of the trunnion axis of the mill 16 and terminates in a grooved bearing ring 23. The ring 25 rests upon trunnion rollers 25 which are carried by suitable brackets 27 (Fig. 6) based upon the pedestal 15; and thus it will be appreciated that the mill 10 is mounted at one end by means of the trunnion bearing 19 and by the bearing ring and roller unit 25—26 at the other end thereof for rotation about a horizontal trunnion axis in response to operation of the motor 22.

As shown in Figs. 1—6, the material feed mechanism includes a generally cylindrical casing 30 which is rotatably mounted within longitudinally spaced bearing ring brackets 31—32; the cas-
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ing 30 having rollers 33 mounted in peripheral-ly spaced relation thereon by means of annu- lar mounting brackets 34 and axles 35. Thus, the rollers 33 are thereby arranged to run against the inside track portions of 31—32. The bracket 31 is based upon the ped- estal 15, and the bracket 32 is based upon a supple mental pedestal 36 (Figs. 1 and 5); and the parts are so dimensioned and arranged that one end of the casing 30 extends into the container bracket 24 in concentric inwardly spaced rela- tion therein. A dirt sealing gasket ring 38 (Figs. 5 and 6) of felt or the like is mounted therebe- tween by means of spaced retainer rings 39—39 (Fig. 5) and the retainer rings are carried upon support rods 40—41 (Figs. 5 and 6) which in turn are held in position by plates 41 extending from the ring 25. Furthermore, the retainer rings are biased toward one another by means of compres- sion springs 42 which are carried upon rods 43 in such manner as to continuously exert compres- sive force against the felt gasket 38 whereby the latter is at all times maintained in snug fit ting relation between the cylindrical shell pieces 24, 30, while at the same time freely per mitting relative rotation thereof.

A material feed screw 45 is mounted within the casing 30 by means of mount devices con necting with opposite stub shaft end portions of the feed screw. Thus, at one end the feed screw shaft is bored longitudinally to receive in slip fitting relation therein a knob portion 46 extending from a bracket 47 which is fixed to the inner surface of the container bracket 24, as indicated at 48. The knob portion 46 carries a radially ex tensing pin 49 which slip-fits into a longitudinal keyway portion 50 of the feed screw shaft; thus it will be appreciated that when the feed screw is slip-fitted at its inner end upon the knob 46 with the keyway 55 embracing the knob pin 49, the feed screw will be thereby connected to rotate within the casing 30 coincident with rotation of the mill 10. At its opposite end the feed screw 45 is provided with an extending shaft portion 52, the outer end of which is conically bored to pro vide a bearing seat for a jack screw 54. The screw 54 is mounted in screw threaded relation through a gland 55 which is in turn mounted upon an end plate 57 by means of screws 68; and the end plate 57 is in turn mounted upon the end of the casing 30 by means of screws 58. Thus, the end plate 57 and the gland 55 constitute a bearing support for one end of the feed screw 45 while the jack screw 54 operates as a thrust bearing to maintain the feed screw in keyed connection with the bracket 47 which revolves with the vessel 10. A lock nut 60 is provided on the jack screw 54 for locking the latter in any adjusted position, and suitable packing rings 61 are provided interiorly of the gland 55 for dust-sealing the junction of the feed screw shaft 52 with the end plate 51. Thus, it will be appreciated that the feed screw 45 is mounted to rotate within the casing 30 while being keyed to the bracket 47 which revolves with the vessel 10. It is a particular feature and ad vantage of the arrangement of the invention that whenever the mill operation is converted from one material to another, the feed screw device is merely removable from the casing 30 by simply first removing the end plate 57 and then with drawing the feed screw bodily in endwise direc tion through the opening thus provided. This re moval of the feed screw then leaves the casing 30 in completely open and uninterrupted condition, whereby it may be readily cleaned of all materials previously operated upon prior to loading of the machine with a different kind of material. This feature is of course of particular advantage when ever there is a possibility of a new material to be operated upon by the materials previously processed, such as when working with materials of chemical nature, or pigments, or other finely prepared materials. The feed screw is then readily replaced by simply slipping it endwise back through the casing 30 until the kno wbow 46 thereof engages the pin 49, whereupon re placement of the end plate 57 completes the re assembly of the feed screw unit.

As illustrated in Figs. 1—5, the feed casing 30 is provided with a lateral opening 53 through which is fited one end of a box-like hopper structure 66; the hopper structure being connected rigidly to the cylindrical casing 30 at the position of the opening 65. Thus, as shown in Figs. 1 and 2, the hopper 66 is then adapted to be lowered to a position wherein it is set upon the floor in front of the blending mill and at one end thereof so that the hopper may be conveniently loaded with feed ma- terial such as by dumping barrels or sacks of feed material thereto. Then, the hopper 66 may be lifted and rotated with the casing 30 as to the broken line position thereof shown in Fig. 2, so that the feed materials within the hopper will then tend to slide downwardly and feed in through the opening 55 and into the casing 30. The feed material will then be acted upon by the feed screw 45 to be transported thereby from within the cas ing 30 into the interior of the mill 10.

This material feeding action is of course due to rotation of the feed screw 45 relative to the casing 30 as provided for by the keyed connection of the feed screw with the bracket 47, thereby dispensing with need of a separate driving mechanism for the feed screw 45. On the other hand, it will of course be appreciated that if for any reason it is provided to a separate power supply means for the feed screw 45, any such arrange ment may be readily made by simply connecting a suitable power source to the motor in a suit able manner. As shown in Fig. 2, the hopper 66 may be conveniently handled if desired by means of some power hoist device terminating in a pull cable 67 and connecting through a bale 68 to the hopper 66.

It is another particular feature and advantage of the present invention that the construction of the material feed mechanism thereof eliminates need for provision of any relatively moving bear ing parts for support of the feed screw device within spaces normally occupied by the feed ma- terials. Thus, difficulties customary to mainten ance of mechanisms of the type wherein rela- tively moving bearing parts are within access of abrasive feed materials, is eliminated. This is because there is no relative motion between the knob bearing 46 and the inner end of the feed screw shaft, and because the end thrust bearing of the screw 54 against the feed screw shaft is ext ernally of the packing gasket 61.

Fig. 7 illustrates an alternate feed material sup ply arrangement wherein the feed screw enclos ing casing 30 is stationarily mounted, as for example by welding or bolting to the casing frame struc ture from the pedestal structures. In this case the casing 30 is provided with a feed opening 72 in its upper surface, and a stationary supply hopper 74 is stationarily mounted upon the opening 72.

Then, any suitable means for supply of the hopper 14 may be employed, such as an overhead conveyor or other continuous or periodic supply
means. The feed screw 45 is mounted within the casing 39 in the identical manner described heretofore and illustrated in FIG. 5, and it will be appreciated that, coincident with rotation of the mill 10, the keyed connection thereof with the feed screw 45 will cause the latter to rotate so as to displace feed material from within the hopper 74 into the interior of the casing 10. Then, incidental to maintenance or conversion of the mill to operations upon different materials, the feed screw may be removed for cleaning or other maintenance purposes by simply removing the end plate 51 as explained hereinafore and then withdrawing the feed screw as described.

Although only a few forms of the invention have been described and shown in detail, it will be apparent to those skilled in the art that the invention is not so limited but that various changes may be made therein without departing from the spirit of the invention or the scope of the appended claims.

We claim:

1. An apparatus of the character described comprising a rotatably mounted vessel for confining and tumbling masses of material, said vessel being supported by trunnion members projecting outwardly from opposite sides of said vessel, one of said trunnion members comprising a cylindrical bracket integral with said vessel and terminating in a bearing ring engaging roller supports, a material feeding device comprising a generally cylindrical casing extending through said bearing ring and cylindrical bracket and having an open inner end for discharge therefrom of material into the interior of said vessel, said cylindrical casing being mounted independently of said cylindrical bracket and said vessel, a detachable end plate carried by the outer end of said casing and an end thrust bearing mounted thereon, means for introducing feed material into said casing, intermediate of the ends thereof, a feed screw device disposed within said casing and having extending shaft portions at its opposite ends, one of said shaft portions extending through the open inner end of said casing and engaging in keyed relation with a bracket fixed to said vessel for rotation therewith, the other shaft portion of said feed screw engaging said end thrust bearing on said end plate for maintenance of the keyed connection between said feed screw and said vessel bracket, whereby said end plate may be detached from said casing and said feed screw then withdrawn therefrom for cleaning purposes.

2. An apparatus of the character described comprising a rotatably mounted vessel for confining and tumbling masses of material, said vessel being supported at one side by a hollow bearing device at one end thereof, a material feeding device comprising a casing having a closed outer end and an open inner end extending through said bearing device for discharge thereof of material into the interior of said vessel, the outer closed end portion of said casing being detachable therefrom, means for introducing feed material into said casing, a feed screw device disposed within said casing and having a shaft portion extending through the open inner end of said casing and engaging in keyed relation with a bracket fixed to said vessel for rotation therewith, whereby said outer closed end portion may be detached from said casing and said feed screw then withdrawn for cleaning purposes.

3. An apparatus of the character described comprising a rotatably mounted vessel for confining and tumbling masses of material, said vessel being supported at one end by a hollow trunnion bearing extending outwardly therefrom, a material feeding device comprising a tubing extending through said bearing for discharge of material into the interior of said vessel, said tubing having a detachable outer end portion mounting thereon an end thrust bearing and an open inner end, means for introducing feed material into said tubing, a material feed device disposed within said tubing and having extending bearing portions at its opposite ends, one of said bearing portions extending through and engaging the open inner end of said casing and into the interior of said vessel and engaging in keyed relation with a bracket fixed to said vessel for rotation therewith, the other bearing portion of said feed device engaging said end thrust bearing for maintenance of the keyed connection between said feed device and said vessel bracket.

4. An apparatus of the character described comprising a vessel for processing material, said vessel being supported for rotation by trunnion bearings including a hollow bearing device at one end thereof, a material feeding device comprising a casing having a closed outer end and an open inner end extending through said bearing device for discharge thereof of material into the interior of said vessel, the outer closed end portion of said casing being detachable therefrom, means for introducing feed material into said casing, a feed screw device disposed within said casing and having a shaft portion extending through the open inner end of said casing and engaging in keyed relation with a bracket fixed to said vessel for rotation therewith, whereby said outer closed end portion may be detached from said casing and said feed screw then withdrawn for cleaning purposes.

5. An apparatus of the character described comprising a rotatably mounted vessel for confining and tumbling masses of material, said vessel being supported by substantially horizontally disposed trunnion members including a hollow trunnion bearing at one end thereof, a material feeding device comprising a tubing extending through said bearing for discharge of material into the interior of said vessel, said tubing being mounted to rotate relative to said vessel, said tubing having a detachable outer end portion mounting thereon an end thrust bearing, means for introducing feed material into said tubing, a material feed screw device disposed within said tubing and having a bearing portion engaging said end thrust bearing, and means driving said feed screw.

6. An apparatus of the character described comprising a rotatably mounted V-shaped vessel for confining and tumbling masses of material, said vessel being supported by trunnion members including a hollow trunnion bearing at one end thereof, a material feeding device comprising a tubing extending through said bearing for discharge of material into the interior of said vessel.
vessel, said tubing being mounted to rotate relative to said vessel, said tubing having a detachable outer end portion mounting thereon an end thrust bearing and an open inner end, means for introducing feed material into said tubing, a material feed screw device disposed within said tubing and having extending shaft portions at its opposite ends, one of said shaft portions extending through the open inner end of said casing and into the interior of said vessel and engaging in keyed relation with said vessel for rotation therewith, the other shaft portion of said feed screw device engaging said end thrust bearing for maintenance of the keyed connection between said feed screw device and said vessel.

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