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**TUBE MILL TRUNNION**

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4 Claims. (Cl. 241—54)

This invention relates to tube mills adapted to grind moist solid material while a hot drying gas is passed in contact with the material.

In a conventional form of tube mill, the inlet end of the mill casing is supported on a tubular trunnion through which both the material to be ground and the drying gas are introduced. It is also conventional in this type of apparatus to position a preliminary drying drum at the inlet end of the trunnion so as to effect contact between the moist solid material and the hot drying gas in the drum before they are both delivered to the trunnion and into the mill. The drying gas must be hot in order to achieve the required amount of drying without using such a large volume of gas, and hence high gas velocity, as to cause a large loss of fines from the mill. As a result, the hot drying gas has been found to heat the trunnion to such an extent as to cause lubrication difficulties in the trunnion supporting bearing.

I have now devised means for transferring the partially dried solid material from the preliminary drying drum to the interior of the trunnion while simultaneously confining a major portion of the hot drying gas to the axial portion of the trunnion where it causes only a minimum amount of heating of the trunnion. This device comprises a bell-mouth mounted within the preliminary drying drum with its small end communicating with a central opening in the end wall of the drum adjacent the inlet end of the trunnion. The bellmouth thus directs a major portion of the hot gases from the preliminary drying drum substantially axially through the trunnion. Baffles are mounted on the rearward surface of the bellmouth so that, upon rotation of the drum and bellmouth, the partially dried solid material within the drum is raised upwardly and is thence discharged onto the inner surface of the trunnion through additional openings surrounding the central opening in the drum end wall.

These and other novel features of the apparatus of my invention will be readily understood from the following description taken in conjunction with the drawings in which

FIG. 1 is a sectional elevation along the central axis of the mill; and

FIG. 2 is a cross-sectional view taken along the line 2—2 in FIG. 2.

The tube mill shown in FIG. 1 comprises a conventional casing 5 having a lining 6. The inlet end of the casing is provided with an end closure plate 7 which terminates in a hollow trunnion 8, both the plate 7 and the trunnion being provided with lining sections 9 and 10, respectively. The trunnion, and hence the inlet end of the mill casing, is supported for rotation on an annular bearing 11.

On the inlet end of the trunnion 8 there is mounted a conventional preliminary drying drum 12. The discharge end wall 13 of the drying drum adjacent the trunnion extends across the inlet end of the trunnion and is provided with a central opening 14 through which the hot drying gas is delivered in a stream along the axis of the trunnion. A plurality of additional openings 15 surround the central opening 14 and serve as charging ports for the solid material delivered to the interior of the trunnion 8. The opposite or inlet end of the preliminary

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drying drum 12 is provided with an annular wall 16 through which a hot gas inlet tube 17 projects. A delivery chute 18 for the moist solid material extends through the hot gas inlet tube 17 and into the inlet end of the preliminary drying drum. A plurality of lifting scoops 19 are attached to the inner surface of the drum near its inlet end and act to lift the moist solid material fed into the drum through the chute 18 and then let it fall through the inward flow of hot drying gas. The scoops 19 are advantageously skewed so as to impart a forward motion to the solid material and thus advance it toward the trunnion end of the drum.

The device of my invention for confining the flow of a major portion of the hot drying gas to the axial portion of the trunnion and for simultaneously raising the partially dried solid material from the drum into the interior of the trunnion comprises a bellmouth 20 mounted with its large end in contact with the inner periphery of the preliminary drying drum 12 and with its small end mounted adjacent the central opening 14 in the discharge end wall 13 of the drum. As can be seen in FIG. 2, the peripheral portion of the large end of the bellmouth 20 is provided with a plurality of notches 21 which permit the movement of the solid material along the bottom inner surface of the preliminary drying drum 12 from the inlet end toward the discharge end of the drum. The rearward surface of the bellmouth 20 has mounted thereon a plurality of scoop-like baffles 22 which extend inwardly from the periphery of the drum to the small end of the bellmouth and longitudinally from the rearward surface of the bellmouth to the drum discharge end wall 13. When the drum 12, the bellmouth 20 and the baffles 22 are rotated as a unit, the baffles scoop up partially dried solid material from the bottom of the drum, as shown in FIG. 2, and progressively move this material upwardly and inwardly along the rearward surface of the bellmouth and thence through the openings 15 in the discharge end wall 13 of the drum. The solid material thus delivered onto the interior surface of the trunnion flows progressively into the tube mill casing where its final drying and grinding are effected.

In operation of the tube mill embodying my invention, the mill, the trunnion and the preliminary drying drum are rotated as a single unit. Hot drying gas, such as hot air, is introduced through the tube 17 and the moist material to be ground is delivered through the chute 18. The lifting scoops 19 within the inlet end of the drum 12 lift the charged moist material and permit it to fall downwardly across the current of the incoming hot gas. The skewed position of the lifting scoops 19 and the action of the hot gas passing through the falling solid material advance the solid material through the peripheral notches 21 in the bellmouth and toward the discharge end wall 13 of the drum. The baffles 22 scoop up the partially dried material from the bottom of the drum 12 and discharge this material through the drum end wall openings 15 into the interior of the trunnion. The resulting layer of partially dried material covering the lower portion of the inner surface of the trunnion tends to insulate this portion of the trunnion from the hot drying gas. The major portion of the hot drying gas delivered to the preliminary drying drum is collected by the bellmouth 20 and is discharged through the central opening 14 in the discharge end wall of the drum in the form of a jet along the axis of the trunnion. The remainder of the hot drying gas flows through the peripheral notches 21 in the bellmouth and thence through the openings 15 along with the solid material charged into the interior of the trunnion. It will be appreciated, accordingly, that most of the hot gas is funneled into the central portion of the trunnion through which it passes at relatively high velocity so that the heat-

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ing effect of the hot gas on the walls of the trunnion is minimized.

I claim:

1. In a tube mill adapted to grind moist solid material while a hot gas is passed in contact with the material to effect drying thereof, the mill being provided with an inlet end and a discharge end and the inlet end of the mill being rotatably supported by a hollow trunnion through which the hot gas and the solid material are charged to the mill, the improvement which comprises a preliminary drying drum mounted on the inlet side of the trunnion, the preliminary drying drum being provided with an end wall extending over the inlet side of the trunnion and having a central opening and a plurality of surrounding openings all of which communicate with the interior of the trunnion, feed means for supplying the moist solid material and the hot gas to the preliminary drying drum, a bellmouth positioned within the preliminary drying drum with its small end communicating with the central opening of the drum end wall so as to direct a major portion of the hot gas from the preliminary drying drum substantially axially through the trunnion, and baffles mounted on the rearward surface of the bellmouth adapted upon rotation of the drum to raise moist solid

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material within the drum upwardly and through the drum end wall openings surrounding the central opening thereof and onto the inner surface of the trunnion.

2. In a tube mill as defined in claim 1, the improvement in which the baffles are scoop-like.

3. In a tube mill as defined in claim 1, the improvement in which the large end of the bellmouth engages the periphery of the drum and is provided with a plurality of notches extending inward from its periphery and each baffle extends from the periphery of the large end of the bellmouth to the small end thereof.

4. In a tube mill as defined in claim 1, the improvement in which the feed means for supplying the moist solid material is a chute discharging the material into the drum adjacent its inlet end, and a plurality of scoops are mounted on the inner surface of the drum in a circular series to raise the material and allow it to fall through the hot gas.

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