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ROTARY DRUM GRINDER AND PLURAL SEPARATOR CIRCUIT

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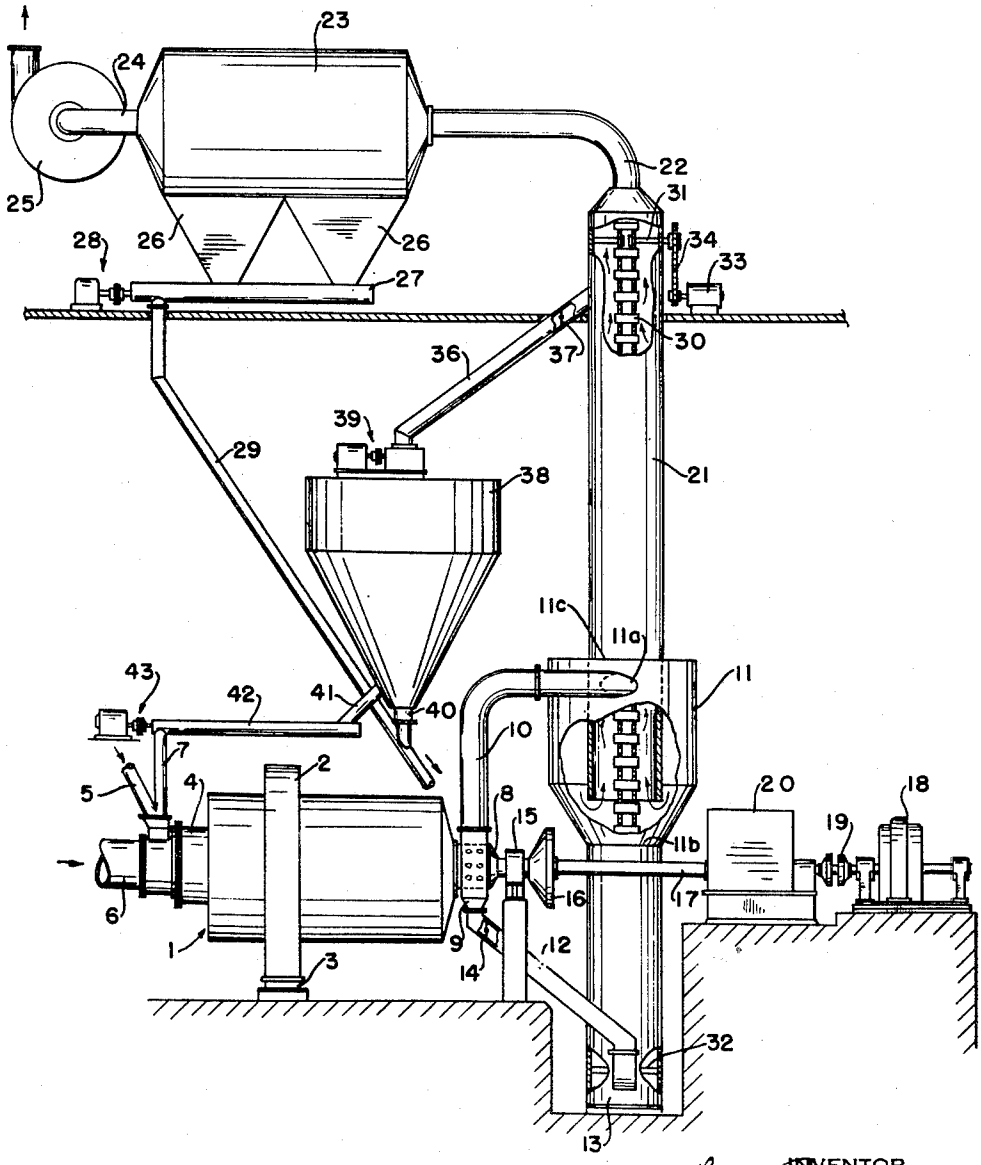

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ROTARY DRUM GRINDER AND PLURAL SEPARATOR CIRCUIT

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7 Claims. (Cl. 241—52)

This invention relates to a grinding apparatus and is concerned more particularly with a novel grinding installation, which includes an air-swept mill and means for separating coarse particles from the air stream, in which they are entrained and carried from the mill, and returning them to the mill for further grinding. The new installation offers advantages over prior similar installations, in that it is more compact and less expensive to construct, and the air, which is used for sweeping the mill and is ordinarily heated, is kept in contact with the material for a longer time and thus has a greater drying effect.

For a better understanding of the invention, reference may be made to the accompanying drawing, in which the single figure is an elevational view of one form of the new apparatus with parts broken away.

The grinding installation of the invention comprises a mill of the rotary drum type, such as a ball or tube mill, and the mill illustrated is a ball mill, the shell 1 of which has a tire 2 running on a slide shoe bearing on a support 3. At one end, the mill has an inlet 4, into which raw material to be ground is fed through a spout 5, and the air for sweeping the mill enters the inlet through a duct 6. The coarse particles or tailings from the separation operation, to which the mill output is subjected, are returned to the inlet through a spout 7. At the other end, the mill has an outlet trunnion 8, part of which is hollow and has openings for the escape of ground material and air and fine particles entrained therein. The hollow part of the trunnion is enclosed within a housing 9, from which the air and entrained fine materials are conducted by a duct 10 to the inlet 11*a* of a cyclone separator 11. The ground material leaves the bottom of the housing 9 and is conducted by a spout 12 to an inlet near the lower end of a lower casing 13. The spout contains a gravity or counter-weighted flap or other conventional air lock 14 to prevent the air leaving the mill from by-passing the separator 11. Beyond the hollow section, the trunnion 8 is supported in a guide bearing 15 and is connected through a membrane coupling 16 to a shaft 17 driven by a motor 18 through a coupling 19 and a speed reducer 20.

The lower casing 13 leads to the outlet 11*b* at the lower end of the cyclone separator, through which the solids are discharged. The separator has an outlet 11*c* for air at its top and an upper casing 21 leads upwardly from the air outlet. Preferably, the casing 21 extends downwardly into the separator a substantial distance so as to terminate well below the inlet 11*a* and thus improve the separating action. At its upper end, the upper casing has an outlet, from which a duct 22 leads to a dust collector 23, the air outlet of which is connected by a duct 24 to the inlet of a fan 25. The dust collector is provided with dust hoppers 26 discharging into a conveyor 27 with a conventional drive generally indicated at 28 and the dust is conducted from the conveyor through a spout 29.

An elevator 30 extends from the lower end of the lower casing 13 through the separator to the upper end of the upper casing 21. The elevator shown is of the bucket type and it includes an endless chain trained about pulleys on upper and lower shafts 31, 32 suitably supported within the upper and lower casings with the shaft 31 driven by a motor 33 through a chain 34. The upper casing has an outlet, through which the buckets of the elevator discharge, and the outlet is connected by a spout 36 containing a gravity or counter-weighted flap or other type of conventional air lock 37 to the inlet of an air-mechanical separating apparatus 38 with a conventional drive indicated at 39. The separating apparatus has an outlet 40 for fines at its lower end and, preferably, the outlet is connected to the spout 29, through which the dust is conducted from conveyor 27. At its lower end, the spout 29 delivers the combined separated fines and the dust to a point of final use or storage. The separator 38 has an outlet for a coarse fraction which is conducted from the outlet through a pipe 41 leading to a conveyor 42 with a conventional drive 43. The conveyor delivers the coarse fraction to the spout 7, by which the material is led into the mill through its inlet.

In the installation described, the air which has passed through the mill and carried away fine particles, passes through the separator and then travels up through the upper casing 21 to the top outlet thereof. The air is thus in contact with the material in the elevator from the lower part of the separator to the top of the upper casing 21. By utilizing the upper casing which encloses the elevator, as an air duct, it is unnecessary to provide both an elevator casing and a duct leading from the air outlet of the cyclone separator to the dust collector. Also, it is not necessary to provide a spout leading from the solids outlet of the cyclone separator to the lower part of the elevator casing. Two spouts of substantial length are thus eliminated in the new installation and, at the same time, improve drying of the material is obtained.

I claim:

1. The combination with a grinding mill of the rotary drum type having an inlet for admission of raw material to be ground and a stream of air for sweeping the mill, an outlet for air and entrained fines, and an outlet for ground material, of a separator having an inlet, a top outlet for air, and a bottom outlet for separated solids, a lower casing connected to the bottom outlet of the separator from below and having an inlet near its lower end, an upper casing leading upward from the air outlet of the separator and having an outlet for air and an outlet for material at its upper end, a connection between the material outlet of the mill and the inlet of the lower casing, a connection between the air outlet of the mill and the separator inlet, an elevator extending from the lower end of the lower casing through the lower casing, the separator, and the upper casing and discharging through the material outlet of the upper casing, and means connected to the material outlet of the upper casing and separating material discharged through said outlet into coarse and fine fractions.

2. The combination of claim 1, in which the lower end of the upper casing extends into the separator and terminates substantially below the inlet.

3. The combination of claim 1, which includes means receiving the coarse fraction from the separating means and introducing the fraction into the mill with the raw material to be ground.

4. The combination of claim 1, in which the elevator includes an endless chain carrying buckets.

5. The combination of claim 1, which includes a fan connected to the air outlet of the upper casing and causing a stream of air to flow through the mill, the connection between the air outlet of the mill and the separator, the separator, and the upper casing.

6. The combination of claim 1, which includes dust collecting means connected to the air outlet of the upper casing and having an outlet for collected particles and a duct connected to the dust collector particles outlet for conducting the particles for combination with the fine fraction from the separating means.

7. The combination of claim 6, which includes a duct which conducts the fine fraction from the separating means and is joined by the duct conducting particles from the dust collector.

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