May 15, 1951 J. F. LES VEAUX 2,552,565

AIR SWEPT ROTARY BEATER AND SEPARATOR WITH OVERSIZE-MATERIAL RETURN TUBE MEANS TO THE AIR INLET

Filed June 26, 1947 2 Sheets-Sheet 1

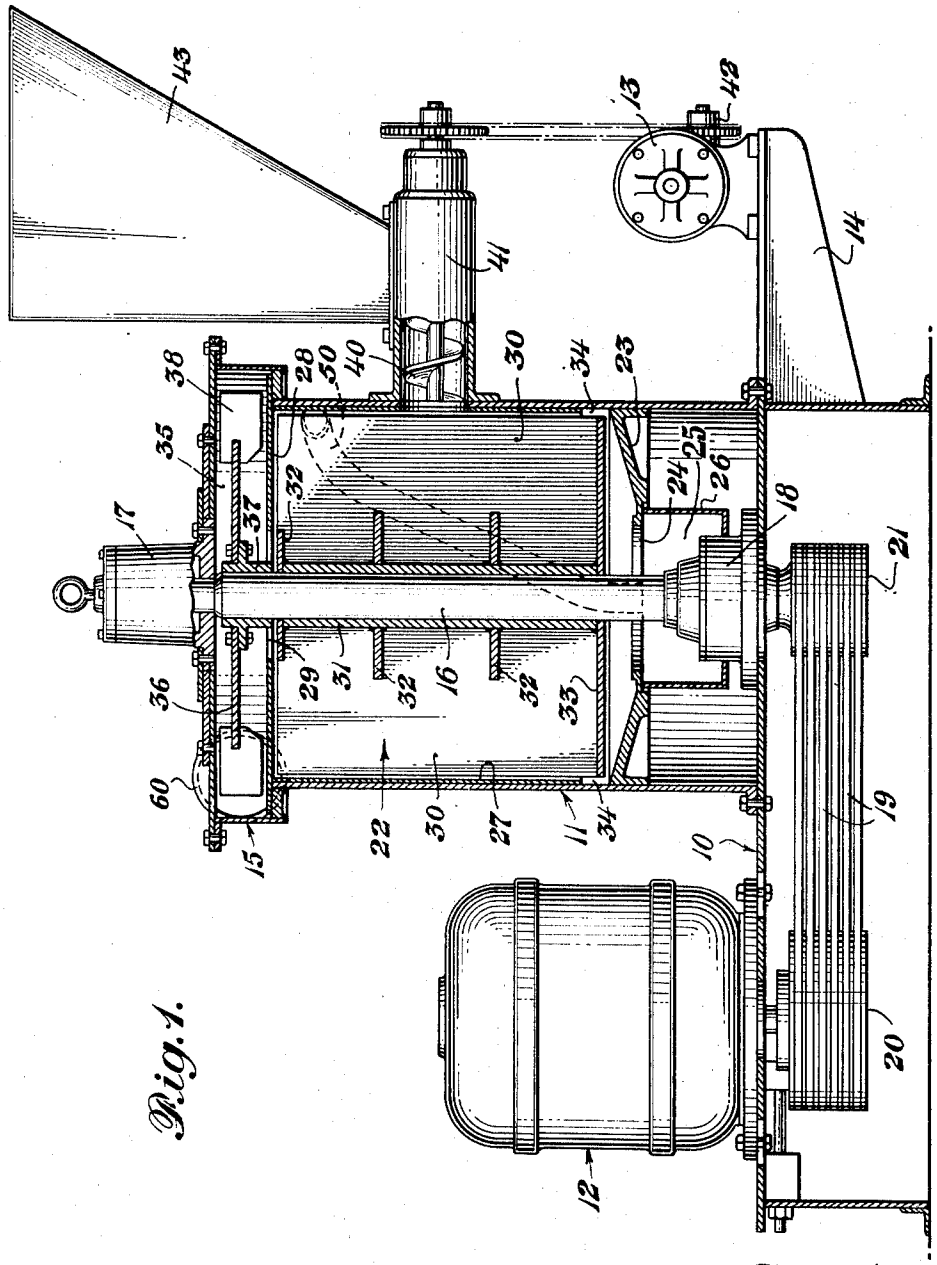


Fig. 1.

Inventor
John F. Les Veaux,

By A. S. McDaniel Attorney

May 15, 1951 J. F. LES VEAUX 2,552,565

AIR SWEPT ROTARY BEATER AND SEPARATOR WITH OVERSIZE-MATERIAL RETURN TUBE MEANS TO THE AIR INLET

Filed June 26, 1947 2 Sheets-Sheet 2

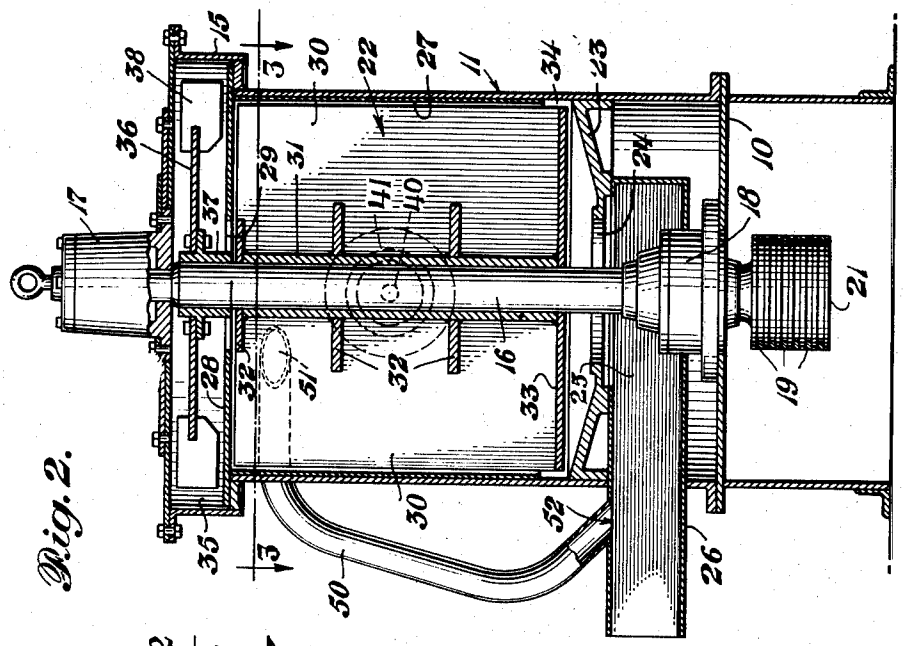


Fig. 2.

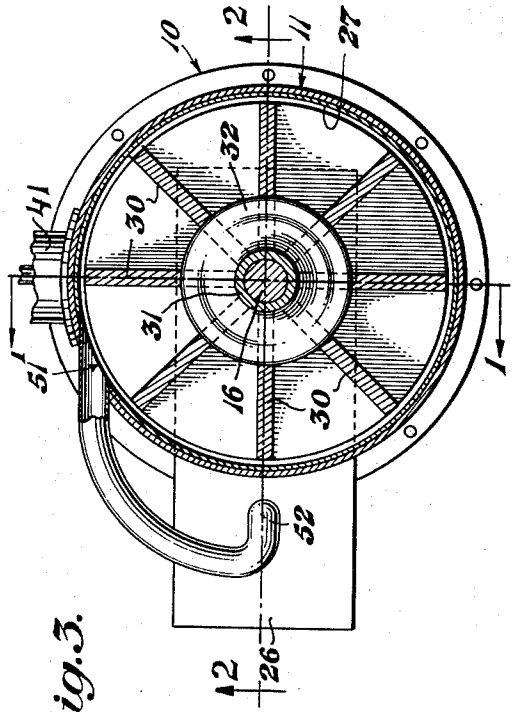


Fig. 3.

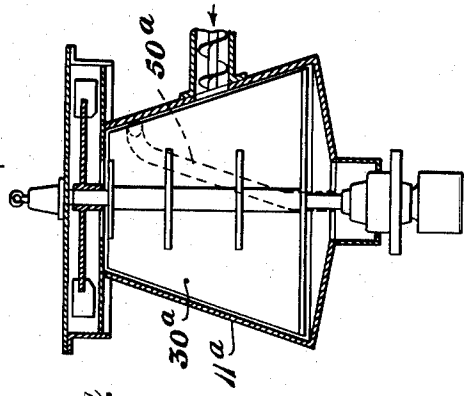


Fig. 4.

Inventor
John F. Les Veaux,

By A. S. McDonald Attorney

Patented May 15, 1951

2,552,565

UNITED STATES PATENT OFFICE

2,552,565

AIR SWEPT ROTARY BEATER AND SEPARATOR WITH OVERSIZE-MATERIAL RETURN TUBE MEANS TO THE AIR INLET

John F. Les Veaux, Middleport, N. Y., assignor to Food Machinery and Chemical Corporation, a corporation of Delaware

Application June 26, 1947, Serial No. 757,117

1 Claim. (Cl. 241—53)

1

The invention relates to improvements in pulverizing mills, and more particularly to improvements in mills of the pulverizing and classifying type disclosed in Patent No. 2,362,142, granted to H. G. Lykken et al., November 7, 1944. The general operation of the present device is similar to what is set forth in the above patent. Some defects have been found to be present in the operation of the machine disclosed in said patent, and the primary object of the present invention is accordingly to overcome such shortcomings and difficulties as have become apparent during the course of commercial operation.

In mills of this type, in which classification of the pulverized material is accomplished by drawing air through a forced vortex, fine material is drawn to the center of the vortex and discharged through an annular space at the top of the vortex. Coarse, unground material remains in the vortex and tends to accumulate there, which accumulation detracts from the grinding operation and reduces the flow of ground material through the mill, thereby reducing the capacity of the mill.

In order to overcome these difficulties the present invention contemplates the use of a tubular connection extending from the inner surface of the grinding chamber near the discharge end thereof to the air inlet of the grinding chamber. Since coarse particles will be drawn against the inside of the grinding chamber they will be discharged from the chamber and passed through said tubular connection to the inlet of the mill for further grinding. The size of the tube is just sufficient to discharge the coarse particles, which are largely thrown out by centrifugal force, and should not be large enough to draw an appreciable amount of air out of the grinding chamber, since this would tend to reverse the flow of fine material to the outside instead of to the inside of the vortex and would thereby discharge the fine material through the return tube instead of through the discharge outlet of the mill. Accordingly, the amount of air drawn off with the coarse material through the tube and recirculated to the air inlet of the mill comprises only a small percentage of the total air passing through the mill.

I am aware that fans have been employed for the purpose of exhausting dust-laden air and for collecting the dust by discharging the dust through a small opening in the periphery of the fan casing while the major portion of the air is discharged from a normal fan outlet so that the dust is collected and relatively pure air is discharged, but no construction is known to me in

2

which a return tube is employed in the arrangement set forth in the present disclosure.

The invention will be more readily understood by reference to the accompanying drawing and the following detailed description, in which are set forth by way of illustration certain specific embodiments of the inventive thought.

In the drawings:

Fig. 1 is a vertical sectional view of a grinding mill with parts shown in operation, the section being taken on line 1—1 of Fig. 3;

Fig. 2 is a vertical section through the grinding mill taken at right angles to the section shown in Fig. 1, parts being shown in elevation, the section being taken on line 2—2 of Fig. 3;

Fig. 3 is a horizontal section on the line 3—3 of Fig. 2; and

Fig. 4 is a diagrammatic section with parts omitted showing a modification in which the grinding chamber is of conical rather than cylindrical form.

As shown the mechanism constituting the grinding mill is mounted upon a suitable base 10 which supports a cylindrical housing or casing 11 for the grinding mechanism, and at a point suitably spaced therefrom is mounted a motor 12 which serves to actuate the grinding mechanism of the mill. A small motor 13 designed to actuate the feed screw for introducing the material to be ground into the mill is shown as mounted upon a bracket 14 extending laterally from the base.

At the top of the cylindrical casing 11 is mounted a fan casing 15. A main drive shaft 16 is centrally mounted with reference to the mill casing 11 and fan casing 15 and is provided with suitable upper and lower bearings 17 and 18 located at the top of the fan casing and on the base 10, respectively. The main shaft 16 is adapted to be driven from the motor 12 by any suitable means, as, for example, V-belts 19 and pulleys 20 and 21 carried by the motor shaft and main driving shaft respectively.

A grinding chamber 22 is provided within the cylindrical casing 11 and has a downwardly inclined bottom portion 23 carried by the casing 11 and having a central air inlet opening 24 formed therein surrounding the drive shaft 16. An air chamber 25 is provided below the inclined bottom member 23 having a lateral passage or intake box 26, herein shown as rectangular in cross section. The grinding chamber 22 is provided with a hardened liner 27 fitting within the outer casing 11. At the top of the chamber there is provided a plate 28 which divides the grinding chamber from the fan chamber included within

the casing 15. The plate 28 is provided with a central opening 29 to permit communication between the grinding chamber and the fan chamber, this opening being formed concentric with the drive shaft 16.

A pulverizing rotor is mounted within the grinding chamber 22 and comprises a plurality of radial blades 30, herein shown as mounted upon a hub 31 secured to the driving shaft 16. A plurality of disks 32 of less diameter than the rotor itself are secured to the blades and welded to the hub 31. These disks are to reinforce the blades. A bottom disk 33 of greater diameter than the disks 32 and extending to the periphery of the radial blades 30 is secured to the bottoms of such blades and is spaced slightly from the inclined bottom 23 of the grinding chamber to allow air to enter the grinding chamber from the inlet 24 through a peripheral space 34.

The fan casing 15 encloses a fan chamber 35 within which is mounted a fan runner comprising a ring 36 secured to a hub 37 mounted on the drive shaft 16 and equipped with radial blades 38. The fan casing may be provided with a discharge outlet 60 similar to that shown in Fig. 3 of Patent No. 2,362,142.

The material to be treated is supplied to the grinding chamber by means of a feed screw 40 mounted in a housing 41 communicating through an opening in the chamber wall interior of the grinding chamber. The housing 41 is suitably secured to the cylindrical wall 11 of the grinding chamber.

The feed screw 40 may be driven through any suitable means, as, for example, a variable speed drive 42 from the motor 13. A feed hopper 43 supplies the material to the feed screw 40.

The above described mechanism may be of known construction and as shown is similar in many respects to what is disclosed in Patent No. 2,362,142, although it will be obvious that the invention is not limited to such details of construction.

In accordance with the present invention a recirculation tube 50 is provided connecting the interior of the grinding chamber 22 with the top of the inlet box 26. To accommodate such tube an oval shaped opening 51 is provided in the upper portion of the casing wall 11 and the liner 23, and an opening 52 is provided in the top of the lateral inlet box 26.

The axis of the tube 50 is substantially tangential to the cylindrical casing 11 and at its other end the tube joins the intake box at an acute angle in the direction of air flow.

The operation of the device is as follows: The motor 12 drives the main shaft 16 and radial blades 30 at a high rate of speed. The fan runner within the casing 15 also revolves at a high rate of speed and draws air through the inlet box 26 and the inlet 24 into the grinding chamber 22, from which it is passed out through the discharge opening 29 into the fan chamber within the casing 15. The discharge outlet 60 from the fan may be connected to a suitable dust collector (not shown) for recovery of the ground material. The material to be ground is placed in the hopper 43 and fed through the walls 11 and 27 of the grinding chamber 22 by means of the feed screw 40. The rapidly rotating blades 30 of the rotor pulverize the material and create a forced vortex so that the material is drawn by centrifugal force against the inner wall of the grinding chamber and is rapidly whirled around. The material which has been sufficiently pulverized and is therefore capable of being drawn radially inward against centrifugal force is discharged through the opening 29 into the fan housing 15 and is thence discharged through the opening 16 into the dust collector (not shown). If the mill is operated at high capacity too great a quantity of coarse particles may accumulate within the grinding chamber, and this condition tends to prevent the flow of finely pulverized particles through the mill unless means are provided for progressing the coarse particles longitudinally through the cylinder. According to the preferred embodiment of my invention the tube 50 is provided for this purpose. The coarse particles which are whirling around against the inner wall of the grinding chamber 22 are discharged by centrifugal force together with a certain amount of air blast into the tube 50 and the particles are returned with the inlet air through the intake box 26 into the chamber 22 for further grinding. This arrangement insures a definite flow of dust upwardly through the mill and allows the finely ground particles to be discharged, thus increasing the capacity of the mill and improving the classification. All material within the mill tends to be drawn upwardly through the mill, which results in a mixture of coarse and fine material at the top of the mill. By returning the coarse material to the bottom of the mill it will pass through a region relatively free of fine material where there is less cushioning effect from the finer material. Greater attrition and faster grinding result, which also increases the mill capacity.

A modification of the invention is shown in Fig. 4, in which the parts may be similar to what has been set forth in the previously described embodiment except that the wall 11a of the grinding chamber is frusto-conical in form, being inclined inwardly and upwardly from the base, and the radial blades 30a are similarly inclined in order to fit within the grinding chamber. This conical arrangement of the walls tends to force the coarse material downwardly and retain such material in the lower part of the mill, where it can be more effectively ground since the fine material will be drawn by the air to the upper part of the mill and discharged from the outlet of the fan casing. A return pipe 50a similar to the pipe 50 in the previously described embodiment of the invention may be employed if desired in connection with the conical walled grinding chamber, although this return pipe is of less importance in the case of a conical walled chamber than in the case of a chamber having cylindrical walls.

Further modifications and variations in detail may be resorted to without departing from the spirit of the invention, as will be apparent to those skilled in the art.

I claim:

In an attrition grinding mill, an upright chamber having walls of circular cross section, a pulverizing rotor concentrically mounted in the grinding chamber, said chamber having aligned axial air inlet and outlet openings at the bottom and top thereof respectively, an air intake chamber located below the air intake opening and having a laterally extending intake passage communicating therewith, means for supplying material to be ground to the grinding chamber and communicating with said chamber through a lateral opening intermediate the ends thereof, means for actuating said grinding rotor at a high rate of speed for grinding said material, means for mov-

ing air axially through the mill comprising a fan located above the grinding chamber and communicating therewith through the grinding chamber outlet opening, and a conduit leading from a hole in the peripheral wall of the chamber near the upper end thereof to the laterally extending intake passage, whereby coarse particles are withdrawn from the inside of the chamber and are passed to the inlet of the chamber for regrinding.

JOHN F. LES VEAUX.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
677,702	Russell et al.	July 2, 1901
960,893	Gore	June 7, 1910
1,427,322	Pomeroy	Aug. 29, 1922
2,200,822	Crites	May 14, 1940
2,294,921	Lykken	Sept. 8, 1942
2,329,208	Lykken	Sept. 14, 1943
2,354,312	Harlow	July 25, 1944
2,362,142	Lykken	Nov. 7, 1944
2,399,051	Maxson	Apr. 23, 1946

FOREIGN PATENTS

Number	Country	Date
274,278	Great Britain	July 21, 1927
351,291	Great Britain	June 25, 1931