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PULVERIZING MILL SEPARATOR, HAVING WHIZZER AND DIRECTIONAL VANES

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Fig. 2.

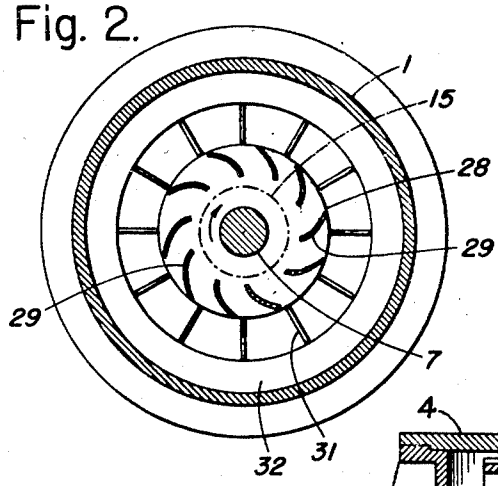

Fig. 1.

Fig. 2a.

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PULVERIZING MILL SEPARATOR, HAVING WHIZZER AND DIRECTIONAL VANES

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1 Claim. (Cl. 241—144)

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This invention relates to mills for pulverizing material and particularly to high speed mills for extremely fine grinding of material.

Pulverizing mills for extremely fine grinding of such materials as medium soft nonmetallics, chemicals and the like, may be of the type which employ a rotor having a multiplicity of hammers rotating at high speeds within a casing forming a grinding chamber. The material to be ground is delivered into the path of these hammers and is accelerated by the hammers to a high speed so that an attrition action is produced which causes the material to wear to a fine powder within the grinding chamber.

Spaced above the rotating hammers is a fan with its suction inlet adjacent the mill casing which creates a flow of air or gas upwardly through the mill casing and carries the sufficiently ground material entrained with the air out of the mill. Between the hammers and the fan and within the mill casing may be a whizzer or whizzers, which comprise a multiplicity of radial arms or blades rotatable about a shaft at very high speeds. The shaft supporting the whizzer blades may be a continuation of the shaft carrying the hammers. The whizzers act to increase the rotation of the dust laden air leaving the grinding zone and the resulting centrifugal force concentrates the insufficiently ground material adjacent the mill casing whence it returns to the grinding zone for further grinding.

Due to the high rotational speeds of the hammers and particularly the whizzer, and consequently the high rotational speed of the air at the fan inlet, it has been found that the fan is not effective and that a normal size fan provides an extremely low air flow which is objectionable.

It is an object of this invention to provide novel means for overcoming the above objections.

Figure 1 is a central vertical section through a high speed mill embodying the invention.

Figure 2 is a horizontal section taken on line 2—2 of Figure 1.

Figure 2a is a horizontal partial section also taken on line 2—2 of Figure 1, but showing a modification of the invention other than shown by Figure 2.

The apparatus comprises in general an outer cylindrical mill casing 1 provided with a liner 2, a fan chamber 3 in the upper portion of the casing, a top plate 4, a base structure 5 supporting the casing and a sub base 6 upon which said plate 5 rests. Within the casing is a rotary assembly comprising a shaft 7 mounted for rotation in top and bottom bearings 8 and 9 and extending

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through the axis of the casing. Upon shaft 7 there is mounted grinding element 10, a multiplicity of whizzer blades 11 and a fan 12, the latter being located within the fan chamber 3 of the casing 1. The shaft extends downwardly below the bearing 9 and is provided with a pulley 13 suitable for a multiple V-belt drive as shown.

Below the fan 12 the mill casing 1 is provided with an inwardly extending flange 14 having a central opening 15 through which the air from the mill passes to the fan 12. Within the base 5 there is provided an air inlet 16 and a conduit 17 through which air is admitted into the mill casing 1 below the grinding element 10. Air enters the mill through said inlet 16, passes upwardly through the casing around the grinding element 10, thence upwardly through the whizzers 11, thence through the fan intake 15 to the fan 12 to be discharged through an opening of the casing not shown.

A feeder 18 is provided and comprises a hopper 19 having a tube 20 extending through the wall of the mill casing 1 and a screw feed 21 whose shaft 22 extends through the hopper 19 and the bearing 23 to the sprocket wheel 24 by which shaft 22 is rotated (by driving means not shown). Upon rotation of the screw feed 21 the material to be pulverized is delivered into the casing 1 just above the grinding element 10.

The grinding element 10 comprises a multiplicity of spaced apart discs 25 mounted on the shaft 7 to rotate therewith, the discs 25 having a multiplicity of concentrically spaced holes adjacent their periphery, which holes receive pins 26. A multiplicity of hammers 27 are mounted between said discs and are provided with bearings for rotation about the pins 26. When rotating with mill shaft 7 the hammers are held by centrifugal force in a radial position with respect to the shaft 7.

In accordance with my invention (and for a purpose presently to become evident), a plate 28 having a hole through which shaft 7 extends is spaced from the bottom side of the inwardly extending flange 14 of the mill casing 1; this plate 28 is concentrically placed with respect to the axis of the shaft 7 and to the inlet 15 of the fan 12; and a multiplicity of deflecting vanes 29 are mounted between the plate 28 and the flange 15 so that any material laden air passing from the mill to the fan inlet must pass in a generally horizontal direction between the spaced deflector vanes. Obviously these deflector vanes 29 may preferably be curved as shown in Fig. 2, or may be straight radial vanes as shown in Fig. 2a.

The complete mill further utilizes whizzers 11 mounted on the shaft 7 between the grinding element 10 and the fan 12. Each whizzer 11 comprises a central disc or plate 30 which is concentric with and extends normal of the shaft 7 and has a plurality of narrow plates or vanes 31 mounted upon it which project radially outward toward the wall of the lining 2 of the mill casing 1. Cooperating with each whizzer 11 is an annular deflector 32 carried by the lining 2 of the casing 1. This stationary deflector comprises an upwardly and inwardly extending conical shell 33 which overlaps the outer end portions of the blades 31. The beveled ends of the vanes rotate in close proximity to the conical shell 33.

Any insufficiently ground material will be thrown by the rotating blades 31 radially against the lower conical surface 33 of deflectors 32 and thence delivered downwardly into the grinding zone for additional treatment; moreover, any insufficiently ground material being moved by centrifugal force to the space adjacent the lining 2 of the mill casing 1 and above the deflectors 32 will accumulate upon the top surface of said deflectors and eventually overflow the inner edge thereof and fall between the blades back into the grinding zone for further treatment.

Due to the high rotational speeds of the hammers 27 and particularly the whizzers 11 (typical speeds by shaft 7 are about 6000 R. P. M. for an 18 inch diameter mill and about 3500 R. P. M. for a 35 inch diameter mill), and consequently the high rotational speed of the air in the zone between the whizzers 11 and the fan inlet 15, it has been found that the fan 12 is not effective and that a normal size fan provides an extremely low air flow which objectionably interferes with the efficient operation of the mill.

According to the invention I overcome the foregoing objection by providing the deflecting vanes 29 intermediate plate 28 and flange 14 and there surrounding the inlet 15 of the fan 12. These vanes convert the high speed rotational flow of the dust laden air within the mill casing above the whizzers 11 into a substantially radial flow into the fan inlet 15. By maintaining the periphery of the vanes 29 in close proximity to the top flange 14 of the mill casing 1 and centrally thereof, the desirable high speed rotational flow of the dust laden air in the zone between the whizzers 11 and the plate 28 is not disturbed so that there is no interference with the efficient centrifugal classification in said zone of the insufficiently ground material from the sufficiently ground material.

While the preferred embodiment of my invention has been shown and described, it will be understood that changes in construction, combination and arrangement of parts may be made without departing from the spirit and scope of the invention as claimed.

What I claim is:

In combination with the casing of a pulverizing mill having an inlet in one end and an outlet in the other end, a fan located within said casing and adjacent said outlet to draw gas into said casing through said inlet and discharge a mixture of gas and pulverized material from said casing through said outlet, a whizzer separator located concentrically with respect to said fan on the inlet side thereof and remote therefrom and serving to cause a rotative vortical motion of said gaseous mixture inside said casing at high speed, and stationary vanes adjacent to the inlet of said fan intermediate that inlet and said whizzer separator and remote from the whizzer to arrest said rotative motion of said gaseous mixture before entrance thereof into said fan, said vanes being circumferentially spaced with respect to the axis of said fan inlet and being curved with the inner ends adjacent the inlet opening arranged radially thereto and the opposite outer ends arranged substantially tangential to the flow direction of the entering gaseous mixture.

JOE CRITES.

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