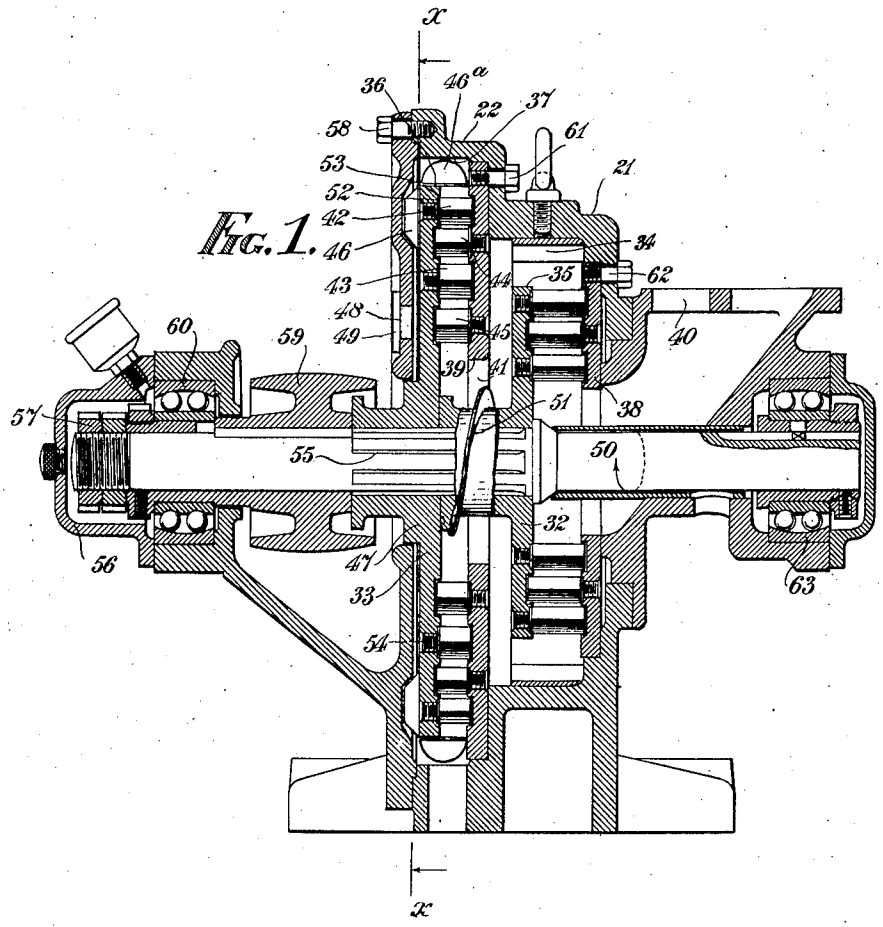
April 1, 1930. W. A. CLOUD 1,752,888

GRINDING, PULVERIZING, OR DISINTEGRATING MILL

Filed June 14, 1926 3 Sheets-Sheet 1

FIG. 1.



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GRINDING, PULVERIZING, OR DISINTEGRATING MILL

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Fig. 4.



Fig. 3.

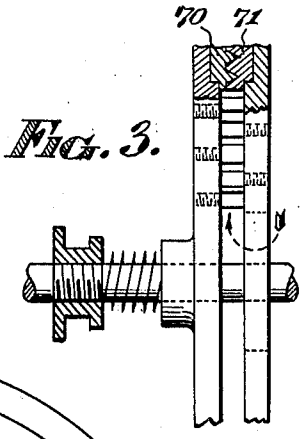
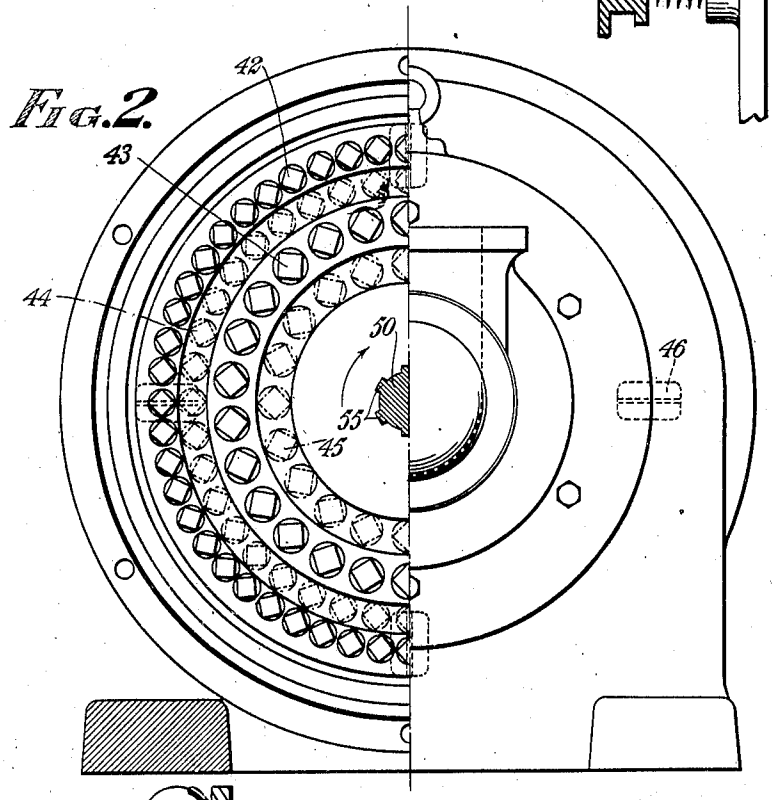


Fig. 2.



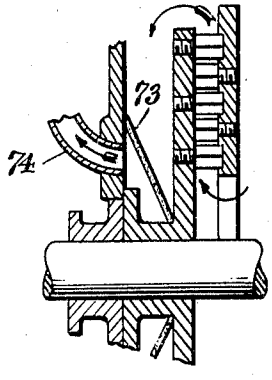


Fig. 5.

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GRINDING, PULVERIZING, OR DISINTEGRATING MILL

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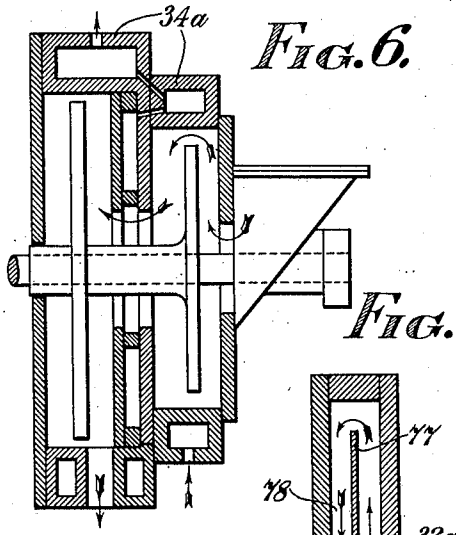


Fig. 6.

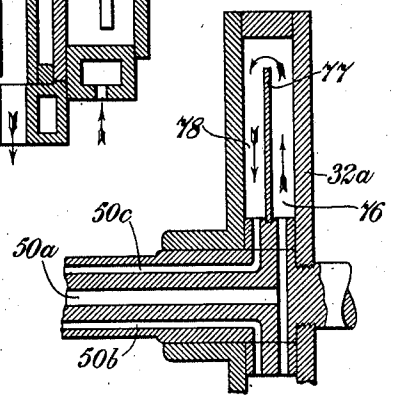


Fig. 7.

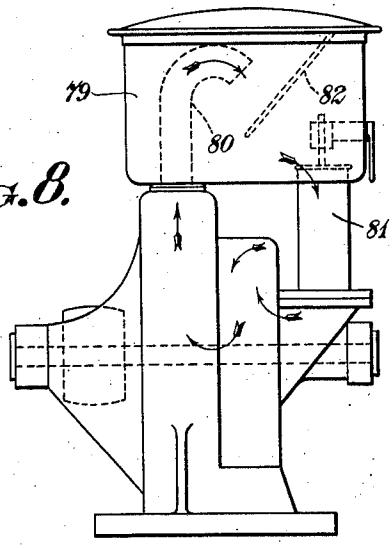


Fig. 8.

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Patented Apr. 1, 1930 1,752,888

UNITED STATES PATENT OFFICE

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GRINDING, PULVERIZING, OR DISINTEGRATING MILL

Application filed June 14, 1926, Serial No. 115,975, and in Great Britain July 20, 1925.

This invention relates to improvements in or connected with grinding, pulverizing or disintegrating mills, and has for its object to provide an improved mill or machine which will especially be suitable for grinding, pulverizing or disintegrating shellac, gums, resins, sulphur, coal and like friable materials which are detrimentally affected by heat and therefore have to be kept cool during the operation.

The invention will now be described, with reference to the accompanying drawings, in which,—

Figure 1 is a longitudinal sectional elevation of a grinding mill constructed in accordance with the invention, and

Figure 2 is an end elevation, the left half in section of the same;

Figure 3 is a detail view, partly in section, of a modification with co-operating rotary and stationary discs fitted with intermeshing rings at their peripheries, and

Figure 4 shows a portion of one of said rings;

Figure 5 is a detail sectional view of the machine provided with a sieve;

Figure 6 illustrates a further modfiication, the parts being jacketed, the figure being partly in section;

Figure 7 is a detail view in section and showing how one of the rotary discs is hollow, and

Figure 8 is an elevation of another modification.

Thus, in a suitable manner of carrying out the present invention the improved machine comprises one, two or more rotary discs or plates provided with a plurality of laterally or other projecting pins or their equivalents which are adapted to intermesh, or co-operate, with a plurality of laterally or other projecting pins or their equivalents provided on one, two or more stationary and co-operating discs or plates, the or each rotary disc being arranged to revolve in a vertical plane. The or each pair of opposing and co-operating rotary and stationary discs or plates constitutes a single element and each mill preferably comprises a plurality of such elements.

In the case of a machine being constructed with two or more compartments 21, 22, and so on, the rotary discs 32 and 33, Figures 1 and 2, are of smaller diameter than the interior of the compartments in which they revolve, and this arrangement is such that they leave spaces 34 between their peripheries 35 and 36 and the inside 37 of the outer casing for the passage of the material. Thus, after being ground, pulverized or disintegrated in the first compartment the material is expanded in said compartment into an expansion chamber or area which may be sufficiently large to reduce the pressure from that which was operating during the time the material was passing through the various rotary pins and stationary pins; this actually takes place in all the various compartments between the feed entrance and exit discharge. In other words, the volumetric area of each expansion chamber at the periphery and the back of a rotary disc should in no case be less than the total sectional area of the spaces taken up by all the pins on said rotary and stationary discs and the spaces left between the said pins. The object of said expansion chamber is to permit the pressure to drop below that created by the fast rotating rotary discs, and to allow the finely ground, pulverized or disintegrated material to pass over to the next rotary disc or to the discharge outlet of the machine, whilst the larger particles of the material are held back and passed through the next rotary disc in a more uniform condition, the said pins on said next rotary disc, and on the stationary disc co-operating with the same, producing a more uniform breaking up of said particles of material as they pass between the centre of the discs to the next expansion chamber surrounding, or disposed adjacent to, the peripheries of said discs.

The projecting pins or the like on each rotary disc 32 and 33 are preferably arranged in a number of concentric circular rows on one side or both sides thereof, as are also those on the other stationary and co-operating discs 38 and 39, so that the pins or their equivalents on one of the discs co-operate with the pins or their equivalents on the other disc. The material after passing outwardly be-

tween the rows of pins or the like on the smaller rotary and stationary discs 32 and 38, partly by centrifugal force and also by means of a current of air drawn through the mill from the inlet 40 by the centrifugal action of the rotary discs, is then drawn by suction over the edge 35 of the first rotary disc 32 and inwards towards a central aperture 41 in the next stationary disc 39, then passing outwardly between the next pair of rotary and stationary discs 33 and 39, and so on if the machine is constructed with more than two pairs of rotary and stationary discs, until discharged from the machine by the outlet. The pins or their equivalents on the rotary and stationary discs are of square or other suitable cross-sectional shape having a plurality of sides which may be flat or fluted and of a number of angles, and are so arranged in relation to the paths in which the rotary pins move as to cause the material to be diverted or deflected from one pin to another and thereby effectively ground, pulverized or disintegrated. The radius or outward positions of the pins or their equivalents on each rotary disc may be on the increase from the inlet of the machine to the outlet thereof, and the spaces between the rotary discs and the stationary discs may be reduced as the diameters of the discs in their respective compartments increase. In a mill constructed of two or more compartments each containing a rotary disc, the discs, the compartments and the portions of the casing surrounding the discs all increase in size from the inlet of the mill to the outlet of same. The lengths of all the projecting pins or the like preferably decrease as the discs increase in diameter, and all the pins or the like may be set diamond fashion. The projecting pins or the like on each disc, when considered from the centre of the shaft to the periphery of said disc, preferably increase in number gradually in each compartment, thereby increasing the velocity of the material and at the same time packing up the material between the rotary and stationary pins or the like. The diameters of the pins or the like decrease on each rotary disc and stationary disc and from the centre of same to the periphery thereof, substantially as shown in Figure 2 of the drawings, in which the outer pins 42 of the rotary disc are of smaller diameter than the next inner pins 43, and, similarly, the outer pins 44 of the stationary disc are smaller in diameter than the inner pins or the like 45 of said stationary disc. Again, the spacing of the projecting pins or the like in each row decrease in clearance from the centre of the disc to the periphery thereof, and this is also the case with the clearances of spaces between the pins or the like in each row of the stationary discs or the rotary discs. Thus, the spacing of the projecting pins or the like from 45 to 42 decrease in distance from the inner pin, to the outer pin and the distance between the pins or the like in the row 42 are smaller than the pins or the like in the row 44, and so on.

Propeller blades 46 are attached to the back of the last rotary disc 33 so as to diminish pressure in the locality of the outlet from the machine of the boss 47 fitted to the said rotary disc, thereby obviating dust being ejected from the said outlet. An air inlet 48 is provided in the end plate of the casing and is fitted with a slide or the like 49. This air inlet would assist the blades 46. Alternatively, or in conjunction with, the propeller blades 46 a fan blade 51 is fitted on the main shaft 50 and between each pair of compartments which, on rotation, will throw the material from the centre of the machine outwardly to the sets of pins or the like on the rotary and stationary disc. Also, in conjunction with or without the propeller blades 46, is fitted at the periphery of the last rotary disc a number of fan blades 46^a which draw the material, and the current of air which carries it, to the outside of the rotary disc.

The projecting pins or their equivalents on each disc are provided with washers 52 which are received in recesses 53 formed in the discs, thus the better holding said pins or their equivalents upon said discs, and the pins or their equivalents are formed or provided with screw-threaded shanks 54 for engagement with similar holes tapped in the discs.

All of the rotary discs are preferably mounted on the one shaft 50 and are fixed in position by one or more splines 55 machined out of the shaft, thus forming one solid connection between the rotary discs and the shaft, said connection being free of all loose parts.

A machine consisting of two or more compartments may be so constructed that the entire working elements of the machine can be drawn out from the end of the latter containing the rotary disc 33 of largest diameter. Thus, in a preferred construction according to Figure 1, an end cap 56 is removed from around the adjacent end of the shaft 50, then two or more nuts 57 are removed from the end of the shaft, the bolts 58 securing in position the bracket or end plate, can be detached thus allowing the said end plate, a driving pulley 59 and an anti-friction bearing 60 at the end of the shaft to slide out of position on the shaft, the largest rotary disc 33 slidden out of position, the co-operating stationary disc 39 detached by screwing back bolts 61 or the like retaining it in position, the next rotary disc 32 removed, the stationary disc 38 co-operating therewith and secured in position by bolts 62 or the like detached and so on, the shaft being removed from an anti-friction bearing 63 provided at the other end.

The bracket or end plate of the casing for supporting the driving end of the shaft 50, in cases where the machine is driven by a belt and pulley 59, is made in such a form as to be placed at any suitable angle by rotating said bracket or end plate to any suitable position. Thus, the bracket is bolted to the machine by bolts 58 and when it is desired, for instance, to rotate the bracket so as to change the drive of the pulley 59 from an overhead shaft to another shaft near the ground, said bolts 58 are removed, said bracket is turned and held in such position, and the bolts are screwed back.

A ring of pins 70, Figures 3 and 4, are fitted to the periphery of any rotary disc and adapted to mesh with and rub against a similar ring of pins 71 fitted on the corresponding stationary disc, said rings of pins being provided with interruptions 72 so as to allow the material to pass between said rings of pins.

A rotary screen 73, Figure 5, is provided, for instance, between the last compartment and the discharge outlet and set at an angle, so that the particles of material too large to pass through the mesh of the screen can be discharged from the machine through the outlet. The ordinary and required finely divided material passes outwardly from the machine through the rotary screen and through a separate discharge outlet 74.

The machine may be jacketed in one or more compartments for heating or cooling purposes such as by steam, water or air; see for instance Figure 6, in which the compartments are jacketed at 34^a. The or each rotary disc or stationary disc is made up in sections with intervening spaces for heating or cooling. For instance, the or each rotary disc 32^a, Figure 7, is formed hollow and is mounted on a shaft which is formed hollow at 50^b and 50^c, so that the steam, water or air passes along the shaft at 50^b to one side 76 of the interior of the disc, flows outwardly along the interior, passes around a divisional plate 77 and then flows backwardly on the other side 78 of the interior to the portions 50^c of the hollow shaft. Machines constructed on these principles are practically watertight and adapted for wet grinding, pulverizing or disintegrating in closed or open circuit with suitable discharge of the water at one or all of the compartments. In a suitable arrangement, shown in Figure 8, a closed tank 79 is provided at the top of the machine and is furnished with an inlet 80 from the larger compartment of the machine, with an outlet 81 to the smaller compartment, with a baffle plate 82, and with means whereby the fluid flows down the outlet 81, around the machine and upwardly through the inlet 80, whereby it is deflected or partially held up by the baffle plate and again enters the outlet 81, and its operation repeated.

For ease of transporting the machine from one place to another, each section of the latter is preferably a complete unit, mounted on one bed plate, and either in a horizontal or vertical position and at any suitable angle.

The machine is particularly adaptable, although not exclusively, to grinding, pulverizing or disintegrating fuel such as coal, it being found that lumps of coal enter the machine and then pass out through the discharge outlet in the form of a fine powder. The machine is also adaptable for use in grinding, pulverizing or disintegrating sulphur, sticky gums and the like, in that it maintains a cool temperature throughout the complete operation; in fact the material leaves the machine at a cooler temperature than when it enters the same, the centrifugal action of the rotary discs setting up a continuous current of air of high pressure, so that the material is not likely to get heated during the operation.

What I claim is:—

1. A grinding, pulverizing or disintegrating mill including cooperating pairs of disks, one disk of each pair being fixed and the other disk of each pair being rotary, cooperating pins on the disks of each pair for treating the material, propeller blades attached to one of the rotary disks, and a fan blade to assist in directing material from the center of the machine outwardly to said pins.

2. A grinding, pulverizing or disintegrating mill including successively arranged cooperating pairs of disks, one disk of each pair being fixed and the other disk of each pair being rotary, cooperating pins on the disks of each pair for treating the material, propeller blades secured to the back of the rotary disk of the final pair to diminish pressure in the locality of the outlet, and fan blades at the periphery of said rotary disk of the final pair.

3. A grinding, pulverizing or disintegrating mill including a casing, a shaft operating therein, a plurality of cooperating pairs of disks arranged in succession on said shaft, propeller blades carried by the rotary disk of the final pair, and an air inlet in the casing beyond the rotary disk of the final pair, said air inlet and propeller blades providing for diminishing pressure in the locality of the outlet of the casing to avoid ejectment of dust.

In testimony whereof I have hereunto signed my name.

WALTER AMELIUS CLOUD.