

Nov. 13, 1951

W. MESSINGER

2,574,979

VERTICAL AXIS DISPERSION MILL WITH DRIVE MOTOR
SUPPORTED FROM CONICAL GRINDING HEAD

Filed March 14, 1949

2 SHEETS—SHEET 2

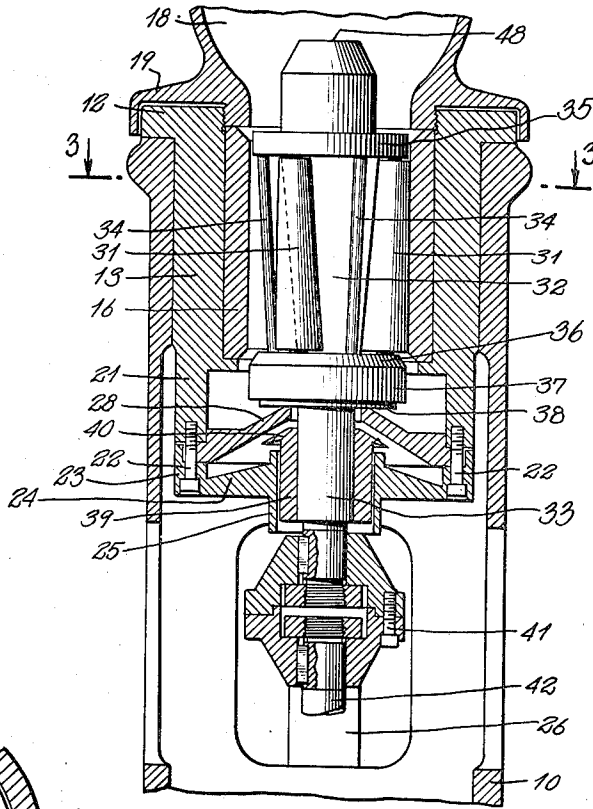


Fig. 2.

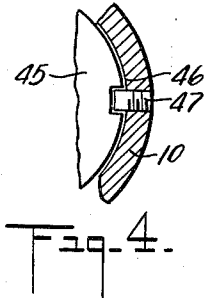


Fig. 4.

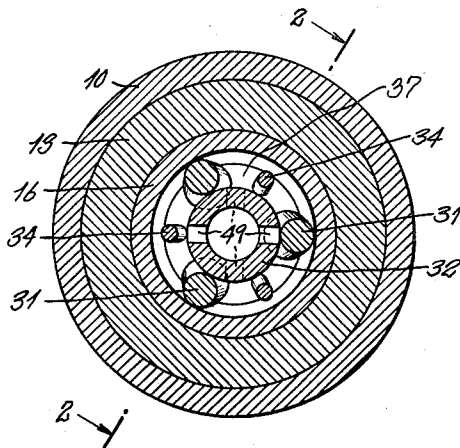


Fig. 3.

INVENTOR.
WILLIAM MESSINGER
BY
Campbell, Froumlough, Free & Graves
his ATTORNEYS

UNITED STATES PATENT OFFICE

2,574,979

VERTICAL AXIS DISPERSION MILL WITH DRIVE MOTOR SUPPORTED FROM CONI- CAL GRINDING HEAD

William Messinger, Philadelphia, Pa.

Application March 14, 1949, Serial No. 81,341

5 Claims. (Cl. 241-111)

1

The present invention relates to machines for preparing dispersions of a continuous fluid phase from dispersions of a discontinuous phase, either solid or liquid. More particularly, the invention embodies a mechanism for intimately dispersing solid particles, such as paint pigments, in liquid vehicles such as varnishes, oils and resins.

Yet another object of the invention is to provide a mechanism of the above character by means of which dispersions of the type above referred to may be homogenized, stabilized or refined.

There are various types of mills now in current use for preparing dispersions of the above character. These mills include ball mills, pebble mills and the like, and it is generally recognized that such mills are inefficient, not only in that they require excessive power, but also in the length of time required to bring about a desired degree of dispersion. It is also generally known that, in addition to the objectionable noise generated by these mills and to their relatively large size, much of the power required for their operation results in heating the dispersion rather than sub-dividing the pigments being milled.

In mills of the type using conventional rollers to accomplish the dispersion, the above described disadvantages of ball and pebble mills reappear, and in their operation many pigments must be passed through these roller mills repeatedly in order to be adequately dispersed in the vehicle. In the operation of colloid mills the output is low, or else the resulting dispersion is relatively coarse.

In order to overcome the foregoing disadvantages, the present invention provides a mill by means of which particle-size reduction and dispersion of substances are accomplished effectively, rapidly and efficiently. A mill constructed in accordance with the present invention is structurally compact and is characterized by relatively low power consumption, while at the same time, forming a desired dispersion in a single pass of the materials through the mill.

A further object of the present invention is to provide a mill of the above character, the milling components of which are so formed that particle-size reduction is accomplished surely and effectively regardless of the physical character of the product being ground or dispersed and regardless of the properties of the vehicle in which the particles are being dispersed, if the mill is used for preparing dispersions.

Other advantages of the invention will appear as it is described in greater detail in connection with the accompanying drawings, wherein:

2

Figure 1 is a view in vertical section, taken on a plane passing through the axis of a mill constructed in accordance with the present invention and showing the component parts of such mill;

Figure 2 is a partial view similar to Figure 1, but taken on the plane indicated by the arrows 2-2 of Figure 3;

Figure 3 is a view in horizontal section, taken on the line 3-3 of Figure 2 and looking in the direction of the arrows; and

Figure 4 is a partial view in horizontal section taken through the set screw 47 and showing a portion of the motor housing and frame.

Referring to the above drawings, the frame of a grinding or dispersing mill constructed in accordance with the present invention is illustrated at 10. This frame is formed to stand upon a supporting surface in an upright position, as illustrated in Figure 1. It is formed with an annular horizontal bearing surface 11 to which is secured the flange 12 of a cylindrical supporting sleeve 13 carried within the frame at the upper extremity thereof. Bolts 14 serve to secure the flange 12 to the frame 11. The sleeve 13 is formed with an inwardly extending flange 15 which supports a shell 16 which serves as an outer grinding surface in a manner to be described presently. The outer shell 16 may be secured in position by means of a top member 17 having a bowl or hopper 18 formed therein and into which the material (and vehicle, if the mill is operating as a dispersing mechanism) is fed. The top 17 is formed with a shield 19 to prevent the deposit and caking of material on the elements beneath the shield, the top 17 being threaded at 20 to the sleeve 13 so that it is seated against the shell 16.

At the lower extremity of the sleeve 13 a depending skirt 21 is formed, this skirt having secured thereto, by means of bolts 22, a ring 23. This ring is formed with inwardly extending arms 24 having, at their inner ends, a central collar 25, passages 24' thus being formed through which the ground material passes. Discharge tubes 26 are secured to the ring 23 and collar 25 to receive the material that has passed through the mill in the manner shortly to be described. Also secured to the stationary skirt 21 is the flange 27 of a spider 28, this spider being formed with apertures 29 through which the material or dispersion may pass in its travel to the passages 24' and into the discharge tubes 26. The spider 28 and skirt 21 form a discharge chamber 30 for receiving material that has passed through the grinding components to be described.

The grinding components of the mill include,

3

in addition to the inner cylindrical surface of the shell 16, a plurality of conical rollers 31 and a grinding head 32 having a conical surface and formed upon an arbor 33. The conical rollers 31 are secured in a cage by stay braces 34 which are secured to top and bottom end plates 35 and 36, respectively. The end plates and stay braces thus form a cage upon which the conical rollers 31 are mounted. The bottom plate 36 is formed with a downwardly extending skirt 37 within which a thrust bearing 38 is secured. The inner race of the thrust bearing is supported upon the spider 28, and thus it will be seen that the vertical resultant of the forces which pinch the conical rollers between the grinding head and shell 16 is carried by the spider 28, and thus upon the stationary sleeve 13.

Beneath the spider 28 there is secured to the arbor 33 a collar 39 having a flange 40 which projects outwardly and above the collar 25 to serve as a flinger to prevent the material or dispersion from flowing downwardly between the collars 25 and 39.

At the lower end of the arbor 33 there is provided a coupling 41 to which the drive shaft 42 of the rotor 43 of a suitable electric motor is secured. The stator 44 and housing 45 of the motor are received within and located by suitably formed surfaces 46 within the frame 10. Set screws 47 engage and anchor the housing 45 against rotation but permit vertical movement thereof.

The upper extremity of the grinding head 32 is formed with a chamber 48 into which material may flow from the hopper or cavity 18. Radial openings 49 at the bottom of the chamber 48 cause material therein to be thrown outwardly during operation, and the material being ground or dispersed is thus spattered over the rollers and distributed over the conical surface of the grinding head and other related grinding surfaces.

It will be seen that the direction of taper of the rollers 31 is reversed with respect to the direction of taper of the grinding head 32. The included angle of taper of the rollers is one-half that of the grinding head, enabling the assembly to fit into the cylindrical bore of the shell 16. The rollers thus have full elemental line contact with the tapered grinding head and with the cylindrical bore of the shell. In this fashion the effect of the weight of the motor, arbor and grinding head is to produce an enlarged resultant force which is impressed normal to the conical surface of the rollers and their engagement with the grinding head and the inner surface of the shell 16.

In operation, the arbor is rotated at a relatively high speed, and there results an operation under which each particle passing through the machine is subjected to a great number of impacts and an enormous crushing force before it can descend vertically and reach the discharge cavity 30. It will be observed that since the conical rollers have their tapers inclined oppositely to that of the grinding head, there cannot be pure rolling motion between these elements. The largest diameter of the grinding head drives the smallest diameter of the rollers and conversely, the smallest diameter of the grinding head drives the largest diameter of the rollers. Inasmuch as the rollers are rigid and the inclination of their axes is fixed by the roller cage, there can only be one transverse plane upon which pure rolling motion can take place. It may be assumed that

4

this plane is intermediate the length of the conical surfaces. Thus, in all other positions along the rollers, the percentage of sliding with respect to rolling motion increases as the respective positions advance toward either end of the rollers. As a result, there is not only rolling contact, but there is, in effect, a smearing, sliding, scrubbing and shearing action upon the material passing through the grinding components, and it is this action that forms the intimate dispersion and the effective particle-size reduction previously referred to.

From the foregoing it will be seen that the parts of the mill are few in number and simple in construction, so that they may be readily assembled and dismantled for the purpose of cleaning, maintaining and repairing. Because of this, it is a relatively simple matter to use the mill for different products without causing contamination of later processed products.

While the invention has been described with specific reference to the accompanying drawings, it is not to be limited save as defined in the appended claims.

I claim:

1. Apparatus for reducing the particle size of materials comprising a supporting frame, a stator mounted in the frame and having a substantially vertical inner cylindrical grinding surface, a plurality of conical rollers in the stator with their smaller ends uppermost, means to support the rollers in grinding relation to the cylindrical surface, a central rotatable conical grinding member engaging the rollers and having its smaller end lowermost, a shaft extending downwardly from the control member, a motor having a casing, a rotor in the casing fixed to the shaft, the motor being supported by the shaft and urging the central member downwardly to force the rollers out toward the cylindrical surface, and means in the frame restraining the motor casing against rotation.

2. Apparatus, according to claim 1, wherein the included angle of taper of the rollers is one-half the included angle of taper of the central member, and the direction of taper of the central member is opposite to that of the rollers.

3. Apparatus for reducing the particle size of material comprising a cylindrical shell, means supporting the shell with its axis vertical, a plurality of conical rollers, a cage supporting the rollers with their smaller ends uppermost, for relative rotation about their axes and for bodily movement around the axis of the shell, the rollers being movable radially in the cage into engagement with the interior surface of the shell, means supporting the rollers against downward movement out of the shell, a central rotatable conical member engaging the rollers and exerting downward force on the member to urge the rollers outwardly, the central member having its smaller end extending downwardly, the tapers of the rollers and the conical member being complementary and their diameters being sufficiently great to restrain the conical member against downward movement of the shell, an arbor depending from the central member, and a motor carried by the arbor.

4. Apparatus, according to claim 3, wherein the central member is formed with an axial chamber and at least one radial duct extending to the outer surface of the member to receive material to be reduced and deliver it to the surfaces of the rollers.

5. An apparatus for reducing the particle size

5

of materials, comprising a frame, a hollow annular shell having an inner continuous grinding surface mounted near the top of the frame with its axis substantially vertical, a frusto-conical central member substantially concentric with the inner surface of the shell, the central member having its larger diameter end uppermost, a plurality of frusto-conical rollers interposed between the shell and the central member, means supporting the rollers against downward movement out of the shell, the tapers of the rollers and their inclination relative to the axis of the shell disposing their inner surfaces complementally to the central member to support it against movement out of the shell in a downward direction, and the weight of the central member urging the rollers outwardly against the shell, an electric motor having a rotatable drive shaft mounted in the frame below the shell and freely movable up and down in the frame, means retaining the motor against bodily rotation in the frame, and means connecting the drive shaft to the frusto-conical mem-

5

10

15

20

6

ber to rotate it and suspend the motor from the central member to urge the latter downwardly.
WILLIAM MESSINGER.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
232,419	Smith	Sept. 21, 1880
739,492	Groves	Sept. 22, 1903
1,444,485	Thomas	Feb. 6, 1923
1,750,088	Bragard	Mar. 11, 1930
1,774,464	Wood	Aug. 26, 1930
1,960,708	Loomis	May 29, 1934
2,204,140	Langbein	June 11, 1940
2,428,415	Eppenbach et al.	Oct. 7, 1947
2,464,733	Traylor	Mar. 15, 1949

FOREIGN PATENTS

Number	Country	Date
205,481	Germany	Jan. 6, 1909