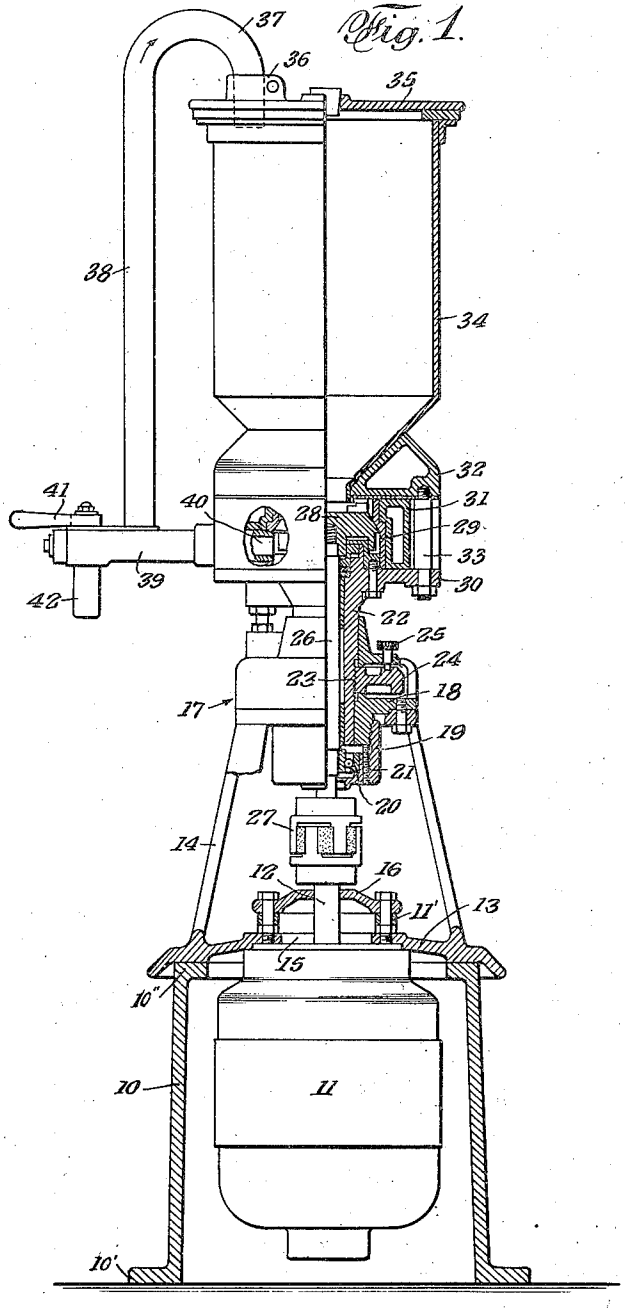
July 16, 1946. E. G. EPPENBACH ET AL 2,403,914

VERTICAL MILL

Filed April 7, 1942 2 Sheets-Sheet 1

Fig. 1.



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Fig. 2.

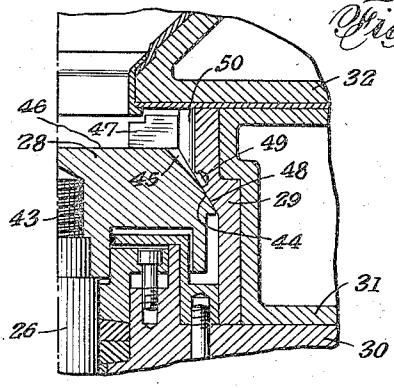


Fig. 3.

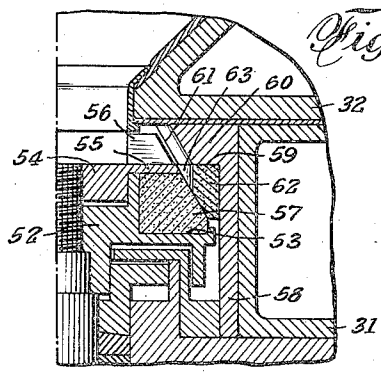


Fig. 4.

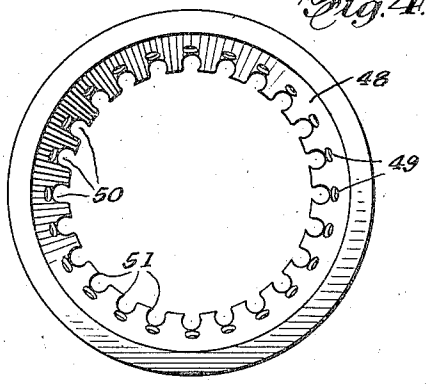


Fig. 5.

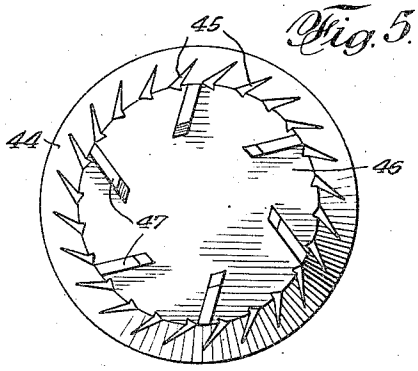
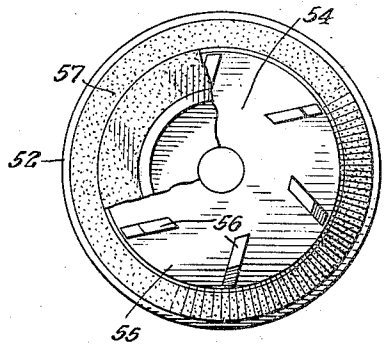


Fig. 6.



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UNITED STATES PATENT OFFICE

2,403,914

VERTICAL MILL

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Application April 7, 1942, Serial No. 437,979

1 Claim. (Cl. 241—285)

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This invention relates to grinding devices or mills in general, and particularly to what may be termed a vertical mill. While the device is primarily intended to operate vertically, it may be placed and operated in any other desired position. The device is adapted for finely grinding or milling either dry or fluid matter, but is preferably used for material suspended in fluids. It is especially adapted for handling dietary or medical substances, such as serum, and for bringing these substances to any desired colloidal state.

Its prime object is to provide a compact, relatively simple and accurately operating and finely adjustable device of this type, which may be readily disassembled and re-assembled for sterilization purposes, and wherein means are provided for not only milling substances and discharging them in their milled state from the device, but whereby a sustained and continuous milling operation, for any desired period, may be provided until the required fineness of the milled matter is reached.

The foregoing and still further important objects and advantages of the present invention will become more fully apparent from the ensuing description in connection with the accompanying drawings, wherein:

Fig. 1 illustrates an elevation of the device in its presently preferred form, shown partially in section;

Fig. 2 illustrates an enlarged partial detail view of the grinding or milling mechanism;

Fig. 3 is a similar illustration of a modified form of the grinding or milling arrangement;

Fig. 4 is a bottom view of a portion of the stator in one of its forms used with the grinder shown in Fig. 2;

Fig. 5 is a top view of a rotor such as employed in the construction shown in Fig. 2; and

Fig. 6 illustrates a top view of a rotor such as employed in the construction shown in Fig. 3.

In Fig. 1 of the drawings there is illustrated a vertical mill structure in accordance with the present invention. It broadly consists of four major parts, that is, a base portion, an open mill-supporting portion, the mill and the hopper.

The base portion comprises a hollow, relatively spacious base 10 provided with an outwardly extending bottom or floor flange 10' and an inwardly directed upper or supporting flange 10'' at the top of the base. The base, although preferably placed upon the floor, may be mounted and secured at any desired position by means of bolts, not shown, passing through flange 10'.

The upper end of the base is open to permit

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the insertion or the removal of motor 11 located within the base interior. Extending upwards from the motor is a vertical shaft 12. Abutting and associated with upper flange 10'' of the base is a substantially dish-shaped element 13 forming the support for an upwardly converging open frame work or structure 14. Dished element or support 13 overhangs the body of the base. At the center of the support is an opening 15, motor 11 being suspended from the peripheral flange of that opening into hollow base 10. Spaced from support 13 and covering motor 11 and opening 15 and overhanging the latter is an upwardly dished, concentrically disposed centrally apertured drip guard 16, designed to effectively prevent liquid or moisture from entering the base and damaging the motor. It will be observed that motor shaft 12 passes centrally through opening 15 and through drip guard 16.

Secured to and supported by the reduced upper end of open frame structure 14 is a combination journaling and adjusting member 17, consisting of a hub member 18 with which is associated a threaded adjustable cup 19, accommodating shaft bearing 20. Cup 19 may be set in its adjusted position in respect to hub 18 by set screws 21. Within hub 18 is lodged and guided a sleeve 22, which is threaded externally at 23 and is engaged by an internally threaded and calibrated index ring 24, by means of which ring sleeve 22 may be adjusted in upward or downward directions. Sleeve 22 may be held in its adjusted position by means of set screw 25 engaging ring 24.

Within sleeve 22 and journaled in bearings 20 is rotor shaft 26. The latter is joined with shaft 12 of motor 11 by means of coupling 27, accessibly located within frame 14. Secured to shaft 26 is rotor 28, forming a part of the grinder or mill unit of the device. Rotor 28 is exchangeable. The stator of the mill is indicated at 29 and also comprises an exchangeable member or insert, which is supported by the broadened upper or flanged end 30 of sleeve 22, and which broadened end forms the bottom of the mill casing, which houses the grinder unit. It will be seen that the casing is provided with a water jacket 31, whereby the casing, and therefore the grinder unit, may be readily cooled or held at any desired temperature required for the matter to be treated within the device.

Above jacket 31 is a jacketed top member 32, held together with flange 30 of sleeve 22 by means of spacer bolts 33. Supported by upper jacket structure 32 is a hopper 34, provided with a cover 35, which may be completely closed if so desired.

By means of the jacket in member 32 the contents of the hopper may be kept at any desired temperature. The top of the hopper is provided with an inlet 36 into which is removably placed the end of the goose neck 37 forming the upper portion of conduit 38, joined at its lower end with outlet pipe 39. The latter is connected at 40 with the grinder unit, and its discharge is controlled by valve 41. This valve may be so placed that it either provides a direct discharge from the grinder unit through its hollow structure 42, or that it closes outlet pipe 39 to provide circulation of the matter being milled through pipe 38 to the top of hopper 34 and back into the grinder.

Referring now to Figs. 2, 4 and 5, these detail figures clearly show the construction of the grinder or mill unit. Rotor shaft 26 is off-set and threaded at 43 for the reception of rotor 23, which is shown in plan view in Fig. 5. This form of a rotor has a conical work surface 44, in which are provided wedge-shaped, inclined recesses 45, terminating with their broadened ends at the normally horizontal top surface 46 of the rotor. From this top surface extend vertical vanes or blades 47, which are positioned tangentially to a theoretical inner circle. Recesses 45 and the peripheral faces of vanes 47 are provided with sharp cutting edges.

Stator 29, which forms an annular insert within the water jacketed portion 31 of the grinder housing, is provided with an internally conical work surface 48, corresponding to and adapted to cooperate with conical work surface 44 of the rotor. Within work surface 48 are provided recesses 49, and adjacent to these recesses are flutes 50 extending vertically through the upper portion of the stator. These flutes have sharp cutting edges, indicated at 51 in Fig. 4, which cooperate with the working or peripheral edges of rotor vanes 47. These vanes are adapted to function both as turbine blades as well as precutting instrumentalities in conjunction with flutes 50, which latter also serves as feeders for the material to be milled, in that they guide it towards the adjacent milling surfaces of the rotor and the stator.

In the modified form of the grinder or milling unit shown in Figs. 3 and 6, the rotor consists of a lower, bodily immovable member 52, provided with a recess formation 53 and an adjustable top member 54 provided with a flange 55. Extending vertically from the flat upper surface of member 54 are tangential vanes 56. Between lower members 52 and flange 55 of the upper member is securely held an abrasive element 57, provided with an outer conical work surface, which forms a continuation of the outer tapered face of flange 55 and the tapered peripheral surfaces of vanes 56.

The stator in this construction comprises an annulus 58, provided with a recess 59, and a head 60 provided with an internally conical work face, which latter is provided with inclined flutes 61. Within recess 59 is lodged an exchangeable abrasive element 62, preferably provided with recesses 63, which form continuations of flutes 61.

In either of the constructions shown in Figs. 2, 4 and 5 and Figs. 3 and 6, the work surfaces, whether conical or cylindrical or both, of the grinder stator and rotor conform with one another in their respective contours in such a manner as to provide precise cooperation between one another. In both constructions the rotor is not bodily adjustable, whereas the stator may be moved for adjustment in respect to the rotor through the arrangement of sleeve 22 and index ring 24, which latter may be fixed in any position to hold the stator in its adjusted place. In this manner a very minute adjustment is possible between the grinding or work surfaces of the rotor and stator, and any wear of these surfaces may be readily compensated by simply moving the indexed adjusting ring 24 to the desired setting.

Although the illustration in Fig. 1 indicates a device primarily intended for use in vertical position, and although the device is called a vertical mill, the grinding mechanism, as well as the motive source, will operate in any other desired position, provided the hopper is suitably located to function in conjunction with the grinder in such other position.

While specific details are illustrated in the drawings, it is readily evident that in the employment of the device for various matter to be milled, modifications and improvements may have to be incorporated, and we therefore reserve for ourselves the right to make changes and improvements in our invention, without departing from the scope thereof, as expressed in the annexed claim.

We claim:

In a colloidal mill, a hollow base having an upper flange arranged to provide a central opening at the top of the base, an open frame structure mounted upon the upper base flange and comprising a dished frame-supporting element overhanging the base and an upwardly tapering open framework connected to the dished element, said dished element having a central opening, a motor with an upwardly extending vertical shaft suspended from the dished element and concentrically aligned in the hollow base with the central opening, an upwardly dished centrally apertured stationary drip guard concentrically aligned with the shaft and spaced above and overhanging the central opening, and attachment means between the drip guard and the frame supporting element for preventing liquid or moisture from entering the base and damaging the motor, the shaft of the motor extending through and above the drip guard, a mill unit surmounted by a feed hopper supported upon the top of the frame structure and including a vertically adjustable disk centrally coupled to a vertically downwardly extending shaft, the lower end of the mill shaft being shouldered to form a shaft portion of reduced diameter, a ball bearing unit mounted about the reduced shaft portion with the inner race contacting the shaft shoulder, a bearing cup vertically adjustably mounted within and to the top of the open frame structure and supporting the outer race of the ball bearing unit, a coupling disposed directly above the drip guard and directly below the bearing cup, and operatively connecting the upwardly extending motor shaft and the downwardly extending mill shaft, the bearing cup and coupling being readily accessible due to their location with respect to the open frame work.

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