United States Patent

[11] 3,565,132

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[21] Appl. No. **800,880**
[22] Filed **Feb. 20, 1969**
[45] Patented **Feb. 23, 1971**
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[32] Priority **Feb. 22, 1968**
[33] **France**
[31] **140903**

[54] **APPARATUS FOR FILLING BOTTLES WITH A POWDER**
8 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **141/147,** 141/140, 141/149; 222/218, 222/305
[51] **Int. Cl.** **B65b 43/60**
[50] **Field of Search** ..... 141/131, 133, 135, 140, 144—149, 81 (Cursory); 198/62; 214/17.2; 222/168.5, 216, 218, 305, 307, 342, 367, 409

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ABSTRACT: The Specification describes an apparatus for filling bottles with powder, in which a turntable is formed, on its upper surface, with a number of radial grooves, which themselves are filled with powder from an oval section reservoir above a portion of the turntable. Cams cause doctor blades associated with each groove to rise, move inwardly, fall and then move outwardly to scrape the powder so that it falls via a funnel into a bottle moving round with the turntable.

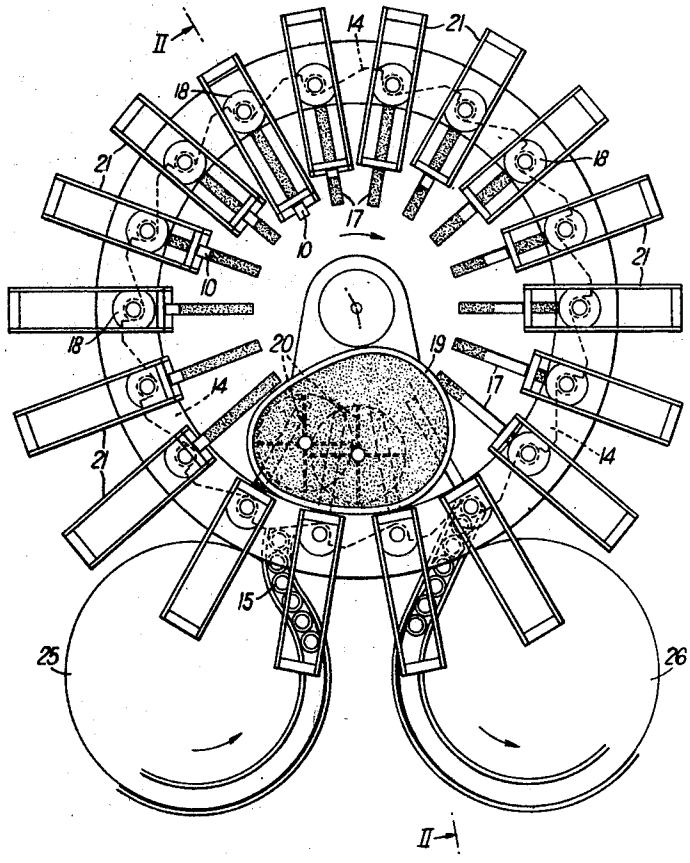

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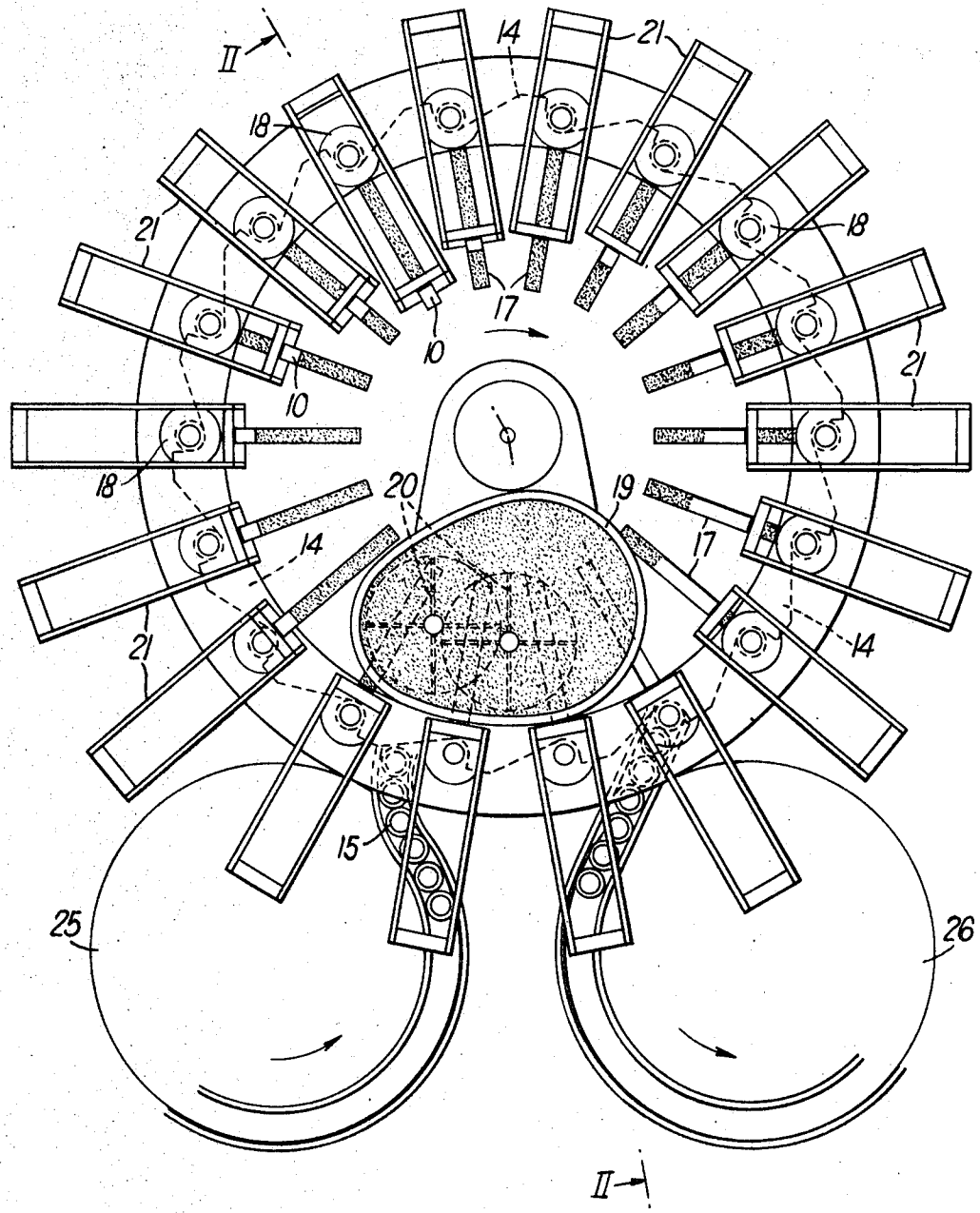
Fig. 1.



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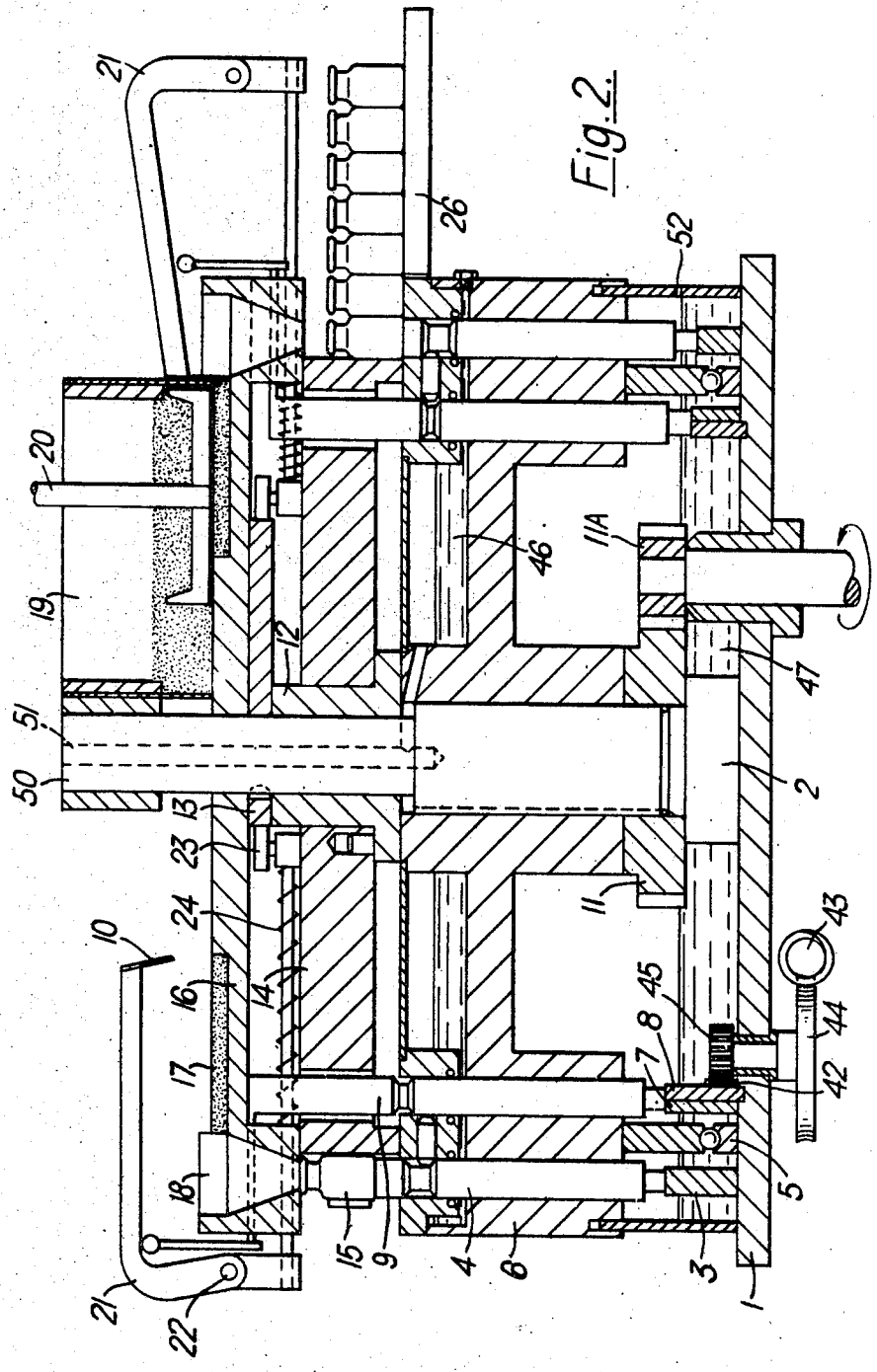

Fig. 2.

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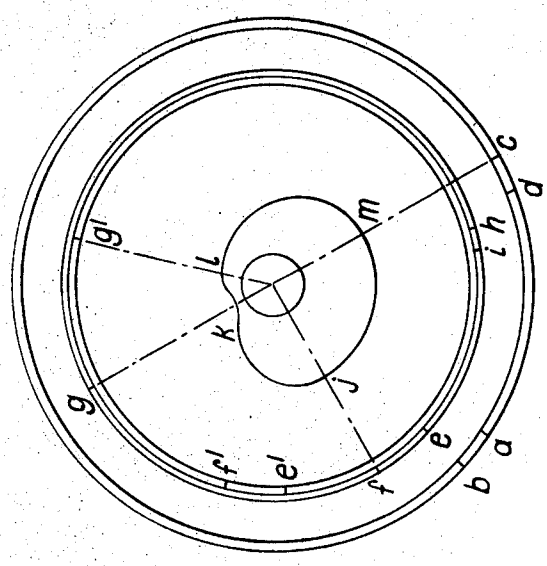

Fig. 3.

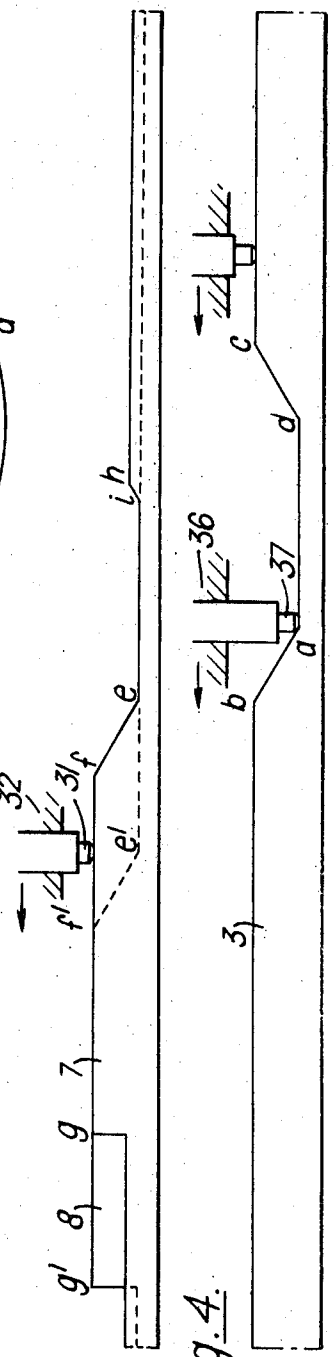

Fig. 4.

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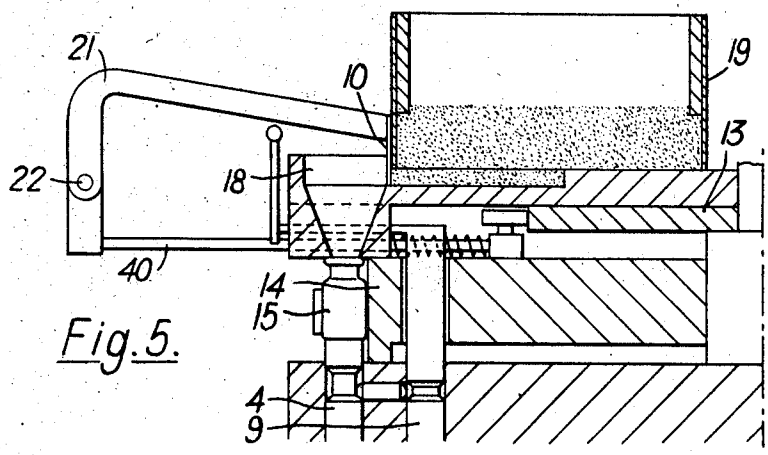

Fig. 5.

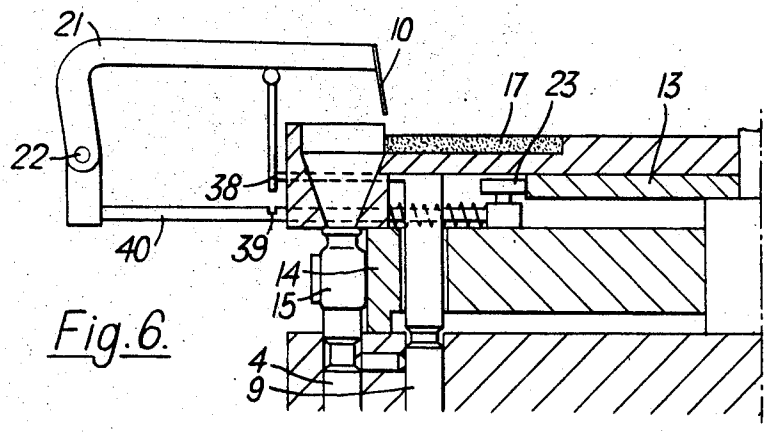

Fig. 6.

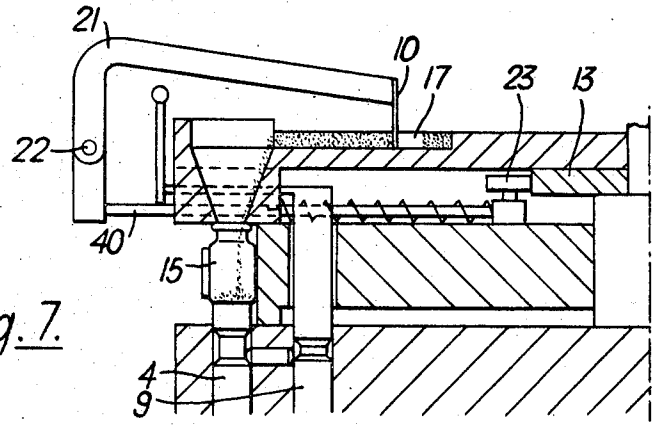

Fig. 7.

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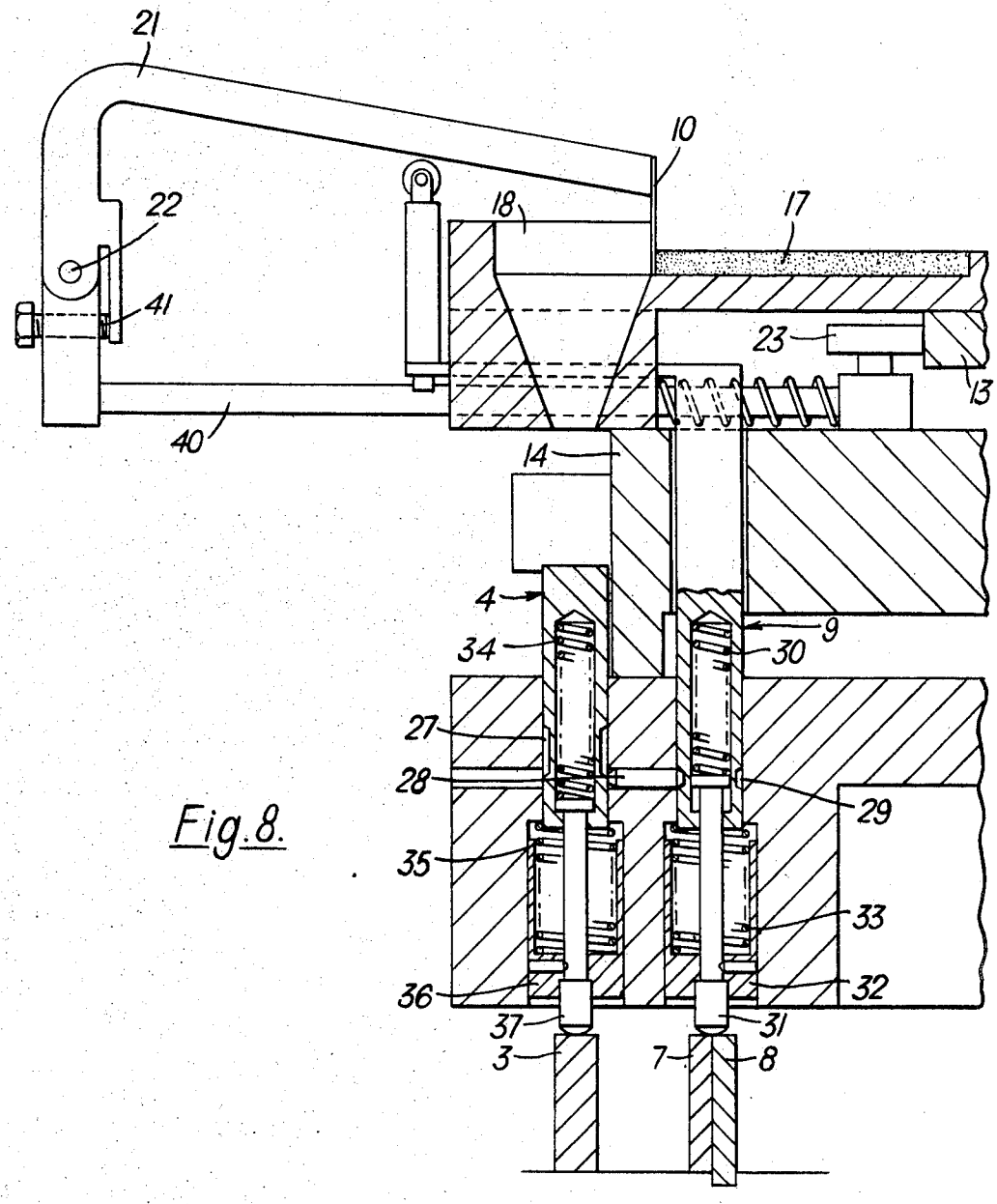

Fig. 8.

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APPARATUS FOR FILLING BOTTLES WITH A POWDER

The present invention relates to an apparatus for filling bottles with equal volumetric doses of powder.

The expression "powder" is intended to cover any product of fine particle size which has the physical appearance of a powder regardless of whether or not it possesses easy-flowing properties.

Numerous apparatuses for metering pulverulent products already exist; these use one of the following systems:

i. a metering screw, the speed of revolution which is regulated in accordance with the pitch of the helix;

ii. a tray in the vertical plane, comprising cells the bottom of which is alternately subjected to vacuum and then to a gas pressure in order to retain and then eject a certain dose of powder;

iii. a tray in which a curved channel is filled and of which a certain length is withdrawn in accordance with the desired dose, by means of discontinuously moving devices; and

iv. drawers of adjustable volume filled from a screw hopper, using a levelling device.

All these different machines effect the transfer of the dose into a receptacle which is stationary at the filling point, and are dependent on complex alternating movements which limit the rate of output even if the weights of the items executing the alternating movement are reduced to the minumum.

French Pat. specification No. 1,288,765 has described a continuously moving machine comprising a tray of adjustable cells which are filled by levelling and from which the powder is ejected by the action of a piston. This type of machine allows much higher rates of filling to be achieved than the machines of the preceding type. It has however been observed that in the case of pulverulent products which are sticky or which clump together irregularities in the filling of the cells and difficulties in transferring the powder can be observed, so that even this machine does not prove entirely satisfactory.

According to the present invention, there is provided an apparatus for filling bottles with a powder, such apparatus comprising a turntable rotatable about a vertical axis, and having a plurality of radially extending grooves, in the upper surface of the turntable; powder supply means above the turntable so that powder can be fed to the grooves; a plurality of bottle location means below, and rotatable with the turntable, each of the location means being in communication with one of the grooves so that the powder can leave the grooves and fall into the bottles; a doctor blade associated with each of the grooves; vertical drive means for the doctor blades to move the doctor blades into and out of the grooves; radial drive means for the doctor blades to move the doctor blades radially with respect to the grooves; means for supplying bottles to the location means; means for withdrawing bottles from the location means and means for rotating the turntable.

In order that the invention may more readily be understood, the following description is given, merely by way of example, reference being made to the accompanying drawings, in which:

FIG. 1 is a plan view of one embodiment of apparatus according to the invention;

FIG. 2 is a section along the line II–II of the apparatus of FIG. 1;

FIG. 3 is a schematic plan view of the four cams of the apparatus of FIG. 1;

FIG. 4 is a development of the two doctor blade lifting cams shown in FIG. 3;

FIGS. 5 to 7 are fragmentary sectional views, similar to a part of FIG. 2, showing three different positions of one of the doctor blades; and

FIG. 8 is a fragmentary sectional view, to a larger scale, showing the operation of the push rods associated with the annular cams.

Referring first to FIG. 2, a base 1 has mounted thereon, at its center a vertical shaft 2, and concentric therewith annular cams 3, 7 and 8. Also mounted on the base 1, between cams 3 and 7 concentric to the shaft 2, is a circular roller track 5. The vertical shaft 2 is keyed to a pinion 11, driven by a second pinion 11A, and also to a turret 6, rotatable on the track 5, the turret 6, together with a hub 12, a tray 14 and an upper plate 16 forming a turntable. Coaxially mounted above the shaft 2 is a stationary vertical shaft 50, carrying a cam 13, and a powder reservoir 19, provided with rotatable stirrers 20.

The upper plate 16 is formed with a plurality of radially extending grooves 17, located immediately below the reservoir 19, which, it will be noted from FIG. 1 is of oval cross section as viewed in plan.

Each of the grooves 17 cooperate with a funnel 18, below which may be mounted a bottle 15, carried on the upper end of a push rod 4 which is caused to rise and fall by the cam 3. Each of the radial grooves 17 has associated therewith a doctor blade 10 mounted on an arm 21 rockable about a pivot 22, and axially slidable together with a guide rod 40 which is provided with a cam follower roller 23 which is urged against the stationary cam 13 by a spring 24. Rise and fall of the doctor blade arm 21 is effected by means of a push rod 9 which slides at its lower end in a part 32, and is reciprocated by a cam follower 31 which cooperates with the cams 7 and 8.

As can be seen from FIG. 1 a rotary feed table 25 supplies the bottles 15 to the turntable in which they are located in notches formed in the tray 14 below the funnels 18; the bottles are removed at a rotary takeoff table 26.

Cam 8 can be moved concentrically relative to cam 7 by means of an annular rack 42 cooperating with a pinion 45, driven by a wormwheel 44 and a worm 43. Lubrication for all the moving parts is supplied by a duct 51 in the stationary vertical shaft 50, oil flowing into an upper sump 46 above the turret 6, and around the push rods 4 and 9 to a lower reservoir 47, from which it flows outwardly through an aperture 52 to be recycled by a pump (not shown) to the duct 51.

The oval cross section of the powder reservoir includes a semicircle, of which the diameter corresponds essentially to the free space between the outer diameter of the stationary vertical shaft 50, and a circle which is tangent to the inner periphery of each of the funnels 18. At its outer periphery the cross section continues by an arc of $2 \times_n 360°$ (n being the number of grooves in the plate 16) of this tangential circle to the inner periphery of the funnels 18. At the downstream side a further circular portion joins this arc with a symmetrically disposed circular arc. The stirrers are of the anchor sweeping type and rotate in opposite senses at the same speed. This speed can be adjusted depending on the powders employed and preferably possess inclined blades so as not to lift the powder up.

The lower lip of the reservoir is parallel to the upper plate 16, only leaving minimum play between the lower lip and the plane surface of the plate 16. The reservoir is fed to a constant level by a conventional device (not shown).

As can be seen in greater detail in FIG. 8, the form of the push rods is such as to provide an upper portion formed with an annular groove 27, and a lower portion 36. The two portions each include springs 34 and 35, the spring 34 abutting on the upper end of the cam follower rod 37, while the upper end of the spring 35 abuts on the lower end of the upper portion 4.

Similarly, the push rod 9 has two springs 30 and 33 disposed in an upper portion 9 and the lower portion 32, an annular groove 29 being formed in the upper part 9. As can be seen from FIGS. 5 to 7, the outer portion of the rod 40 is formed with a recess 39 which cooperates with a claw 38 on the push rod controlling raising and lowering of the arm 21.

In operation of this machine, bottles are continuously fed into the notches on the tray 14 by rotary table 25. Each bottle locates itself in the notch at the moment when the corresponding groove 17, which is going to provide it with a dose of powder, has been filled (FIG. 5). When the doctor blade 10 is in the position of FIG. 5, the bottle 15 is supported under the corresponding funnel 18 by the push rod 4 which has risen during the rotation of the turntable as a result of the ramp *ab* of the cam 3 (FIGS. 3 and 4). As the rotation continues, the

push rod 9 is lifted by the ramp *ef* of the cam 7 and pushes the arm 21 vertically, thereby lifting the doctor blade 10 (FIG. 6).

The point of the cam 13 which corresponds to *f* of cam 7 (FIGS. 3 and 4) is the point *j*. As the turntable rotates to the location *k*, the cam follower 23 moves inwardly, under the action of the spring 24 and displaces the doctor blade 10, which is in its raised position, radially inwardly. At *k*, the doctor blade is vertically above the radially inner end of the groove 17 and as the rotation continues, the cam followers 23, moving from the position *k* to the position *i* moves the doctor blade radially outwardly. On arriving at the point *g* on the cam 8, the cam follower 33 and therewith the push rod 9 drops abruptly, the doctor blade descending sharply into the groove 17. As the rotation continues from point *l* to point *m*, the cam 13 pushes the follower 23 and the doctor blade radially outwardly, and the dose of powder drops into the bottle 15 through the funnel 18 (FIG. 7). The doctor blade 10 remains in the lower position of FIG. 5, while the cam follower 23 passes through the circular section *mj* of the cam 13, which corresponds to the filling of the grooves 17, by passing under the powder reservoir 19.

Rotation of the turntable continues, and the filled bottle is lowered again by the push rod 4, which follow the ramp *cd* of the cam 3 (FIGS. 3 and 4) to the level of the upper face of the turret 6, and is removed on the rotary table 26.

By making the push rods telescopic, as shown in FIG. 8, the push rod 9 and the doctor blade 10 are not operated when no bottle is present. If no bottle is present, the push rod 4 will continue to rise above the position illustrated in FIGS. 5 to 7 and will rise to the position shown in FIG. 8, in which a finger 28 is urged to the right, as the left-hand end of it rides out of the groove 27 and is forced into the groove 29 in the push rod 9. This prevents lifting of the upper end of the rod 9 when the cams 7 and 8 cause rising of the followup portion 21. The spring 34 serves normally to urge a bottle in position, and the spring 35 pushes the follower 37 against the cam 3 via the lower portion 36.

While passing through the circular section *mj* of the cam 13, the push rod 9, actuated by the ramp *hi* of the cam 7 descends and reaches the lower position, so that the claw 38 engages in the notch 39 of the guide rod 40, thereby preventing radial movement of the doctor blade, which is controlled by the cam 13. Thus no metering can take place if there is no bottle to be filled. The relative rotation between the cam 8 and cam 7 can be effected by rotation of the worm 43. Thus the travel length of the doctor blade in the groove can be varied which allows the desired dose to be regulated when the apparatus is stopped and even for corrections to be made while it is running. Since the doses of powder are determined by the volume of the groove, it is possible to have one or more interchangeable and easily detachable upper plates 16, having different groove sections and allowing a whole range of doses to be metered. The grooves may be of rectangular, semicircular or other cross section, with the doctor blades having a corresponding tip. Preferably, however, the grooves are of a rectangular section of which the depth is essentially half the width. Furthermore, the tray 14 can also be interchangeable with other trays having different notches for the bottles of different height and diameter.

In one prototype machine which was made, the base 1 was made of sheet steel and the shaft 2 of steel, while the turret 6 and hub 12 were made of cast iron. The tray 14 was made of an aluminum alloy sold under the trade name "Duraluminium," but it could equally be made of plastic. The cams 3, 7, 8 and 13 and the rods 31 and 37 were made of a steel, the cams and the lower ends of the rods being case hardened, while the upper plate 16, the push rods 4 and 9 and the doctor blade assemblies were made of stainless steel, except the guides 32 and 36 which were made of bronze. The grooves 17 were mirror polished.

The prototype machine was made with a 500-millimetre diameter turret containing 18 filling positions, and it was found that a rate of 360 bottles per minute, using a powder which had a tendency to cake, no problems arose. With this machine two upper plates with rectangular section grooves were provided. One had 18 grooves with a width of 16 millimetres and a depth of 8 millimeters while the second had 18 grooves with a width of 10 millimetres and a depth of 6 millimetres. The length of the grooves machined in the two trays was 60 millimetres, and the maximum amount of powder withdrawn was 5 ml. in the case of the first tray and 3 ml. in the case of the second tray. The volumes used for measuring can range from 5 ml. to 0 in the case of the first tray and 3 ml. to 0 in the case of the second tray. At the rate indicated above, doses were obtained with an error of plus or minus 1 percent by weight, depending on the physical properties of the powder, of which the apparent densities ranged from 0.2 to 0.6. This machine was particularly well adapted to high speed and filling at high speed small quantities of powders which had a tendency to stick and cake.

I claim:

1. An apparatus for filling bottles with a powder, said apparatus comprising in combination:
   a. a turntable rotatable about a vertical axis;
   b. an upper surface to said turntable;
   c. means defining a plurality of radially extending grooves in the upper surface of said turntable;
   d. powder-supply means above said turntable, effective to feed powder to said grooves;
   e. a plurality of bottle location means below, and rotatable with said turntable, each of said location means being in communication with one of said grooves whereby said powder may leave said grooves and fall into said bottles;
   f. a doctor blade associated with each of said grooves;
   g. vertical drive means for said doctor blades effective to move said doctor blades vertically into and out of said grooves;
   h. radial drive means for said doctor blades effective to move said doctor blades radially with respect to said grooves;
   i. means for supplying bottles to said location means;
   j. means for withdrawing bottles from said location means; and
   k. means for rotating said turntable.

2. An apparatus as claimed in claim 1, wherein a funnel is associated with each groove, effective to feed powder from said grooves to said bottles.

3. An apparatus as claimed in claim 2, wherein the powder supply means comprises a reservoir situated above said turntable and means defining an aperture in communication with said grooves.

4. An apparatus as claimed in claim 3, wherein the plan cross section of the reservoir is oval, the wall of the reservoir remote from the center of rotation of the turntable being arcuate and tangential to at least two of said funnels.

5. An apparatus as claimed in claim 4 and further comprising a stirrer in said reservoir.

6. An apparatus as claimed in claim 1, wherein said radial drive means comprises a stationary cam mounted on said vertical axis.

7. An apparatus as claimed in claim 1 wherein said vertical drive means comprises an annular cam concentric with the axis of said turntable.

8. An apparatus according to claim 7 wherein the annular cam comprises two concentric annular cams, one of said cams being stationary and the other being rotatable and adjacent to said stationary cam, whereby rotation of said rotatable cams is effective to vary the point in the rotation of the turntable at which the said doctor blade enters said groove.