

[54] **VIBRATORY CLEANER**
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 [51] Int. Cl. **B24b 31/06**
 [58] Field of Search **51/163, 7**

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[57] **ABSTRACT**

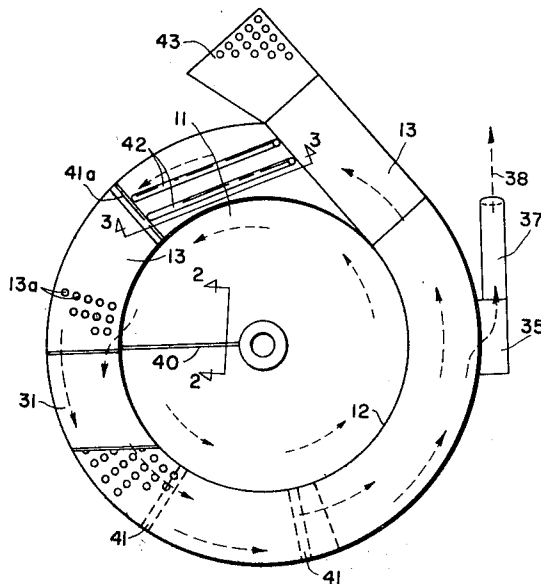
Apparatus and means are provided for cleaning pharmaceutical capsules by vibration in mixing contact with granular cleaning agent while moving the capsules away from the cleaning zone free of cleaning agent.

[56] **References Cited**

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10 Claims, 6 Drawing Figures



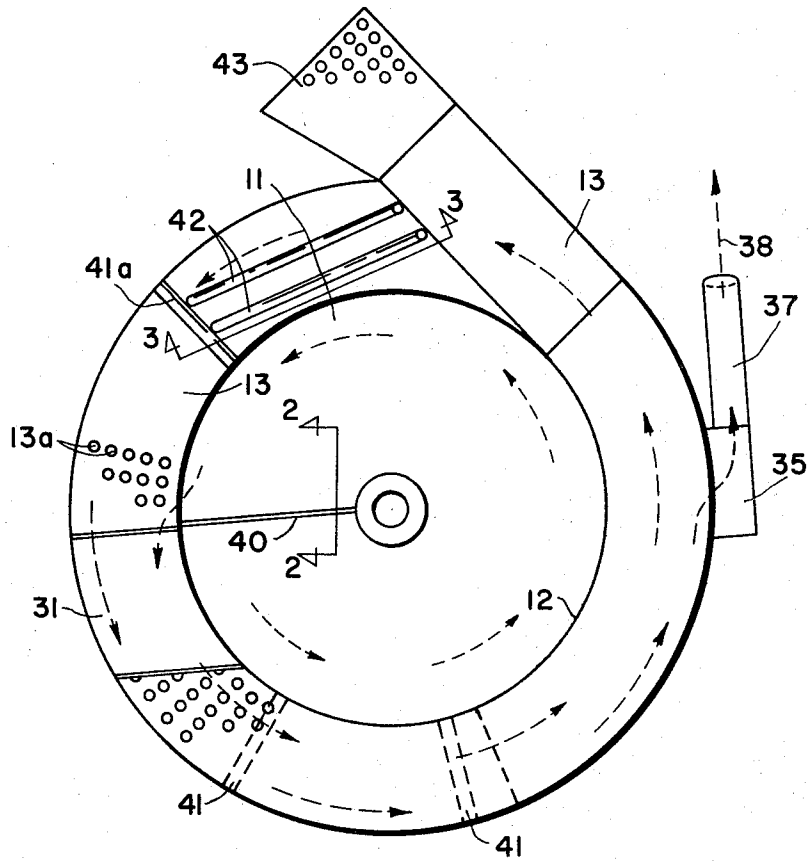


FIG - 1

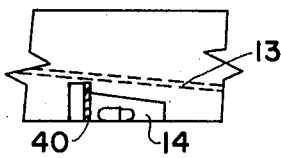


FIG - 2

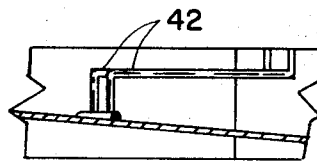


FIG - 3

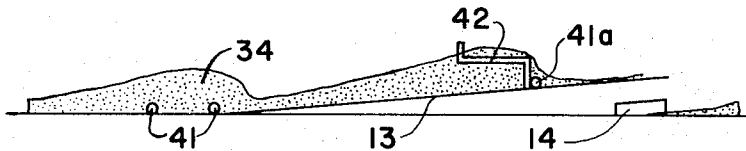


FIG - 4

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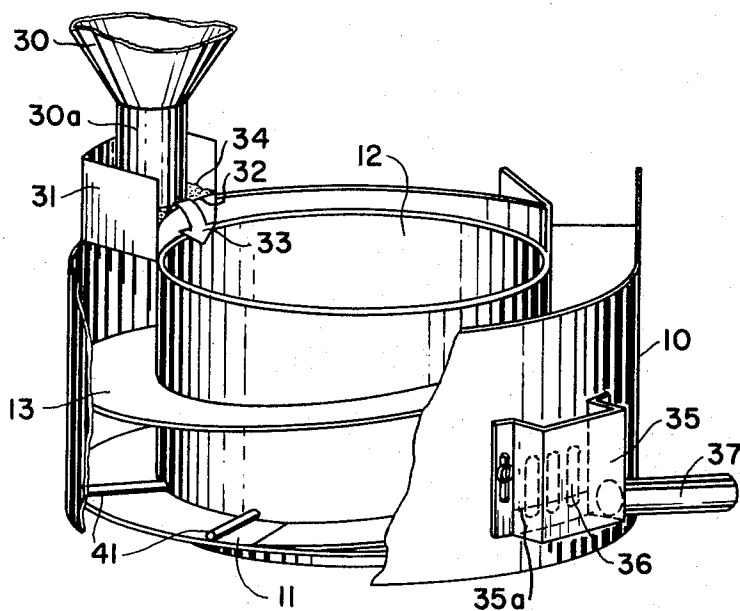


FIG - 5

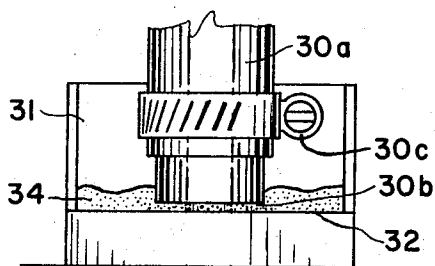


FIG - 6

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VIBRATORY CLEANER

SUMMARY AND DETAILED DESCRIPTION

This invention relates to novel apparatus and means for cleaning hard shell pharmaceutical capsules. More particularly, the invention concerns apparatus and means for cleaning capsules by vibration and mixing with granular cleaning agent, the apparatus including means for automatic supply and removal of cleaning agent.

Heretofore the art has employed feeder bowl means or mechanical vibrators for conveying small objects and for cleaning the same by batchwise addition and removal of cleaning agent. The prior art apparatus is, however, inconvenient to operate and in many cases inefficient.

It is therefore an object of the present invention to provide apparatus and means for conveying and cleaning pharmaceutical capsules and the like wherein the cleaning agent is automatically supplied and removed from the apparatus.

It is also an object of the invention to provide highly efficient means for cleaning and polishing filled capsules.

These and other objects, purposes and advantages of the invention will be seen from the following description with reference to the accompanying drawings in which:

FIG. 1 is a top view of a preferred cleaning apparatus according to the invention;

FIGS. 2 and 3 are views of the apparatus taken on lines 2—3 and 3—3 of FIG. 1;

FIG. 4 is an illustration of the changing profile of the layer or bed of cleaning agent along the path taken during the operation of the apparatus according to the invention;

FIG. 5 is a view in perspective of the apparatus; and

FIG. 6 is a side view of the means for controlling the supply of cleaning agent.

Referring to FIG. 1, the vibrator bowl 10 illustrated has a generally flat circular floor 11 around the central portion of which is a housing 12. Rising from the floor 11 around the edge of the housing 12 is a ramp 13 leading upward to the top of the bowl for delivery of capsules to the outside of the bowl. The art of vibratory feeding is highly developed and a wide variety of units are commercially available. One such commercially available feeder bowl unit which can be adapted for purposes of the invention is a Vibron feeder (Model No. PBD18A, Burger & Associates, Cleveland, Ohio, U.S.A.) capable of feeding about 600 No. 0 filled capsules per minute.

The apparatus, according to the invention (FIGS. 5 and 6), is arranged for supplying the housing with granular or particulate cleaning agent 34 from a suitable supply hopper 30 by way of a trap 31 mounted on the top edge of the housing 12. In one preferred embodiment, the hopper having a capacity of 30 pounds includes means for shaking the hopper in the form of an air-driven vibrator (Vibrolator, Model UCV, size 19, Martin Engineering Co., Neponset, Illinois, U.S.A.) center mounted on the hopper sidewall. Cleaning agent contained in the supply hopper 30 is loaded by gravity through a circular throat 30a downward to an opening formed in a telescopically fitting delivery sleeve 30b which is in direct contact with a bed of cleaning agent 34 filling a lower portion of the trap 31 to a height within the trap defined by the threshold 32. The position of the delivery sleeve 30b in the throat 30a, as illustrated in FIG. 6, is adjustable in a preferred form by clamp means 30c for variation of clearance above the threshold 32. By these means or other suitable means the flow of cleaning agent delivered over threshold in the direction of arrow 33 into the housing can be regulated. As will be recognized, the flow can be varied within wide limits and in a typical case, for example, with a work flow of 600 capsules per minute, the flow rate conveniently is about 8–10 pounds per hour. Table salt is commonly used as a cleaning agent and other materials may also be used such as stearates, talc, silicones, cornstarch and the like. The feeder bowl itself and the associated apparatus are preferably fabricated with stainless steel, the construction permitting periodic dismantling and washing.

Referring to FIG. 1, the floor area within the housing 12 is generally circular being partly divided by the housing baffle 40 which is adjacent an exit opening or doorway 14, as illustrated in FIG. 2. The floor 11 extends through the doorway 14 to a passageway leading counter-clockwise around the outside of the housing wall. Mounted on the floor within the passageway is a barrier 41 preferably in the form of a rod or strip at floor level disposed across the path of transit through the passageway. In a preferred form the barrier 41 comprises two or more strips spaced apart to increase the extent of their baffle effect.

The floor continues to a point beyond the baffle 41 at which point it merges with the ramp 13. The ramp serves gradually to convey the capsules both up and away from the bowl floor 11 and from the area of the baffle. The ramp continues, in a substantially constant slope, to a point where the passageway is uncovered or open at the top. At this point in a preferred embodiment a second baffle 41a is located in combination with which retaining bars 42 are provided for controlling conveyed material held back by the baffle 41a. Continuing upward along the ramp a point in the path is reached above doorway 14 where the conveying surface of the ramp, instead of being imperforate, is purposely apertured throughout the remainder of the ramp with an evenly spaced distribution of holes 13a of size sufficient for the surface to support capsules but larger than the grains or particles of cleaning agent so that the latter particles reaching this portion of the ramp will begin to be sifted through the conveying surface. In a preferred embodiment, the holes are 0.156 inch in diameter first distributed apart on ¼ inch centers for a short distance to a point preceding the front of baffle 41 (on the floor below) and then distributed on 3/16 inch centers (about 63 percent average void in the surface) to the end of the ramp.

For selective removal of spent cleaning agent from the bowl, the apparatus of the invention includes discharge means comprising a discharge reservoir 35, adjustably and removably mounted on the outer wall of the bowl. The reservoir in use is located flush upon the wall in a position enclosing a discharge opening 36 in the wall at the level of the ramp 13. The reservoir is self-unloading by means of a side-mounted discharge tube 37.

OPERATION

To operate the apparatus the capsules to be processed and cleaned are dropped or placed into the housing in any suitable way either singly or in batches. Conveniently, the loading of the bowl can take place immediately after the capsules are filled as part of the same production operation. The supply hopper 30 is filled with cleaning agent in sufficient quantity to maintain cleaning for an indefinite period. At the same time the flow is adjusted for steady operation at a constant rate sufficient to establish and maintain the presence of cleaning agent on the floor 11 and at the baffles 41 and 41a. The vibrator means is set in motion to cause the capsules and the cleaning agent to be agitated within the housing so that complete contact of the capsules and cleaning agent is maintained. By the means employed the capsules and cleaning agent are caused to flow in circular fashion, as illustrated in FIG. 1, in the direction of the dotted arrows and to contact baffle 40 which serves to guide the flow out of the housing by way of the opening 14 (FIG. 2).

The capsules and cleaning agent then move, still in counter-clockwise direction, along the outer passage to the area of the baffles 41. As illustrated in FIG. 4, the capsules and cleaning agent in this area tend to be held back by the baffles and so are built up in a relatively thick bed through which the capsules are caused to be moved so that they are subjected to cleansing, polishing and scrubbing action on all sides. The mentioned buildup is caused not only by the continuous input through the doorway 14 but also by the constant sifting of cleaning agent from above through the overhead portion of the ramp. The cleaning agent serves to pick up any powder

from the capsule exterior and to improve the appearance of the capsule surface. An important feature is that due to the stationary baffling within the confined space an active bed of cleaning material is established substantially filling the passageway so that advancing capsules must pass directly through the bed. Beyond the area of the baffles 41 the bed becomes relatively thin. It moves onto the ramp 13 and is carried past the discharge opening 36 to the area of the second baffle 41a. In this area a second bed of material builds up and fills the passageway. In a preferred embodiment, however, the location of the terminal edge of the bed is limited by the presence of holes 13a in the ramp. In other words, the bed is kept back of the line of apertures 13a. This also has the advantage of providing means not only for augmenting the supply of cleaning agent to the first-mentioned cleaning bed located below the ramp on the underlying floor but also for returning cleaning agent to the floor at a strategic point so that it can eventually be discharged. For purposes of cleaning, according to the invention, various configurations and arrangements of one or more cleaning beds can be employed. In general, it is preferred to have at least two such beds in series. In a case where the passageway is open at the top so that the bed is exposed, as illustrated in FIG. 1, horizontal retaining rods or bars 42 or other retaining means should be used to keep capsules from escaping at the top.

The cleaning agent passing onto the perforated portion of the ramp is screened out or sifted, as indicated, leaving the processed capsules on the ramp where they move in a steady stream to the end of the ramp for delivery at the exit 43 into a suitable receiver. The cleaning agent meanwhile falls to the floor where it contacts capsules entering the housing opening 14 and merges with the capsules into the bed established by the floor baffles 41. In this way, the sifted cleaning material is launched on a course which repeats its previous path around the outer passageway of the bowl. However, with each cycle the material tends to move closer and closer to the outer wall. Since the cleaning agent on continued exposure picks up foreign material, powder, moisture, etc., and becomes spent with use, it is important for purposes of the invention to selectively recycle fresh and partly used cleaning agent and to remove the same prior to overexposure. The same is accomplished by means of the discharge opening 36 and reservoir 35 located along the circumference of the bowl. Whereas the opening 36 is too small to accommodate entry by a capsule moving along the circumference, it does permit the granular cleaning agent to pass and to be collected in the reservoir for discharge from the exit tube 37. For convenience, the flow capacity through opening 36 and tube 37 is in excess of operating requirements and the actual rate of flow is selected by adjusting the extent of blockage by the reservoir threshold 35a at the discharge opening.

While the invention in vibratory cleaner means has been described in considerable detail in the foregoing specification, it will be realized by those skilled in the art that wide variation can be made in such detail within the spirit of the invention claimed below; it is intended that the claims which follow be

interpreted to cover both the invention particularly described and any such variation.

I claim:

1. A capsule cleaner comprising a vibratory feeder bowl including a floor and a circular ramp leading from the floor upward around the bowl edges for conveying capsules and particulate capsule cleaning agent on a path following the ramp to a point of exit at an upper edge of the bowl,
- control means for supplying the cleaning agent to a distribution point in the bowl for mixing with capsules in the bowl,
- the ramp comprising an extensive transversely flat conveying surface with spaced apertures therein of size sufficient to support the capsules but larger than the cleaning agent whereby reusable cleaning agent conveyed with capsules from the floor onto the ramp is sifted through the conveying surface and returned for further mixing with capsules in the bowl,
- an outer wall standing upright from the outer circumference of the ramp adapted to confine materials centrifugally moving to the outer edge of the ramp,
- and discharge aperture means located in the wall for access to the centrifugally moving materials but too small to accommodate entry by a capsule whereby spent cleaning agent at the circumference of the ramp is selectively removed.
2. A capsule cleaner according to claim 1 including baffle means adapted to cause the cleaning agent conveyed with capsules to build up locally in the form of a bed sufficiently large to cover a plurality of capsules in which bed capsules are subjected to a scrubbing action.
3. A capsule cleaner according to claim 2 wherein the baffle means includes at least one barrier strip disposed across the path of cleaning agent conveyed in the bowl.
4. A capsule cleaner according to claim 2 wherein the baffle means is located on a portion of the ramp open at the top and includes at least one barrier strip disposed across the path of cleaning agent conveyed on the ramp.
5. A capsule cleaner according to claim 3 wherein the baffle means is located for buildup of cleaning agent in a confined space underneath a portion of the ramp.
6. A capsule cleaner according to claim 4 wherein the ramp surface below the barrier strip is imperforate.
7. A capsule cleaner according to claim 6 wherein the ramp surface at a predetermined distance above the barrier strip is apertured whereby the length and height of the bed built up by the barrier strip is limited.
8. A capsule cleaner according to claim 7 including means for retaining capsules within the bed built up behind the baffle means.
9. A capsule cleaner according to claim 8 where the retaining means includes horizontal bars.
10. A capsule cleaner according to claim 1 where the discharge aperture means is adjustable.

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