United States Patent

Garland

[15] **3,693,320**

[45] **Sept. 26, 1972**

[54] **NOVEL CAPSULE FINISHING APPARATUS**

[72] Inventor: **Carl C. Garland,** 15700 Kentfield, Detroit, Mich. 48223

[22] Filed: **Nov. 9, 1970**

[21] Appl. No.: **88,053**

[52] **U.S. Cl.**.....**53/167,** 15/303, 134/25 R, 134/32, 209/115, 209/250

[51] **Int. Cl.**.....**B07b 7/04,** B08b 5/00

[58] **Field of Search**.....15/301, 302, 303; 53/167; 134/7, 25 R, 32, 37; 209/246, 250

[56] **References Cited**

UNITED STATES PATENTS

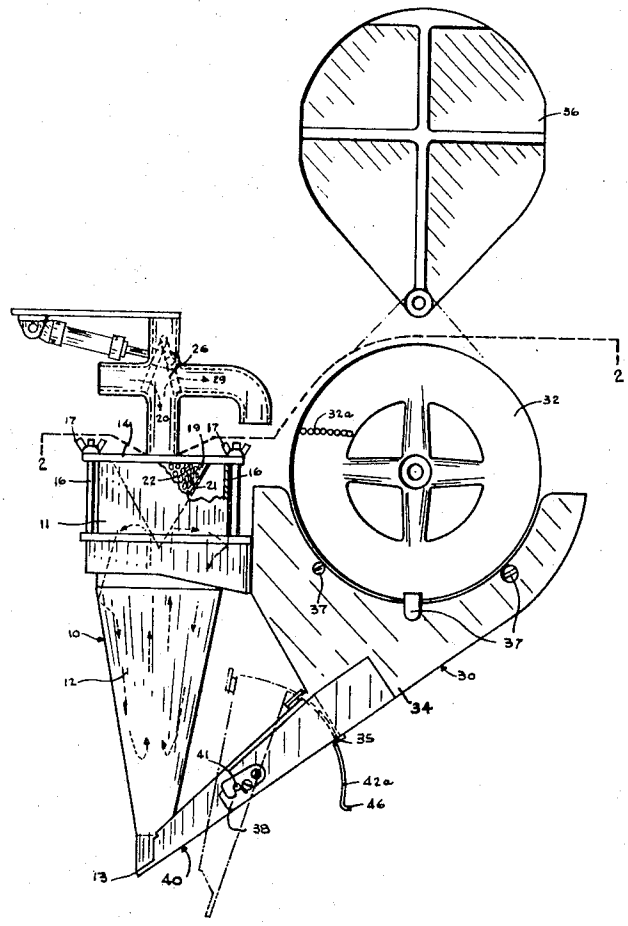
1,512,323	10/1924	Wallace	209/250 X
2,789,694	4/1957	Hills	209/250
3,592,689	7/1971	Chaplinski	134/7 X

Primary Examiner—Theron E. Condon
Assistant Examiner—Neil Abrams
Attorney—Robert R. Adams, David B. Ehrlinger, George M. Richards and Edward J. Gall

[57] **ABSTRACT**

Apparatus and means are provided for finishing pharmaceutical capsules under vacuum whereby any empty capsules present are disqualified and dust and other contamination are cleared from the surfaces of capsules, capsule filling machinery, etc.

5 Claims, 7 Drawing Figures



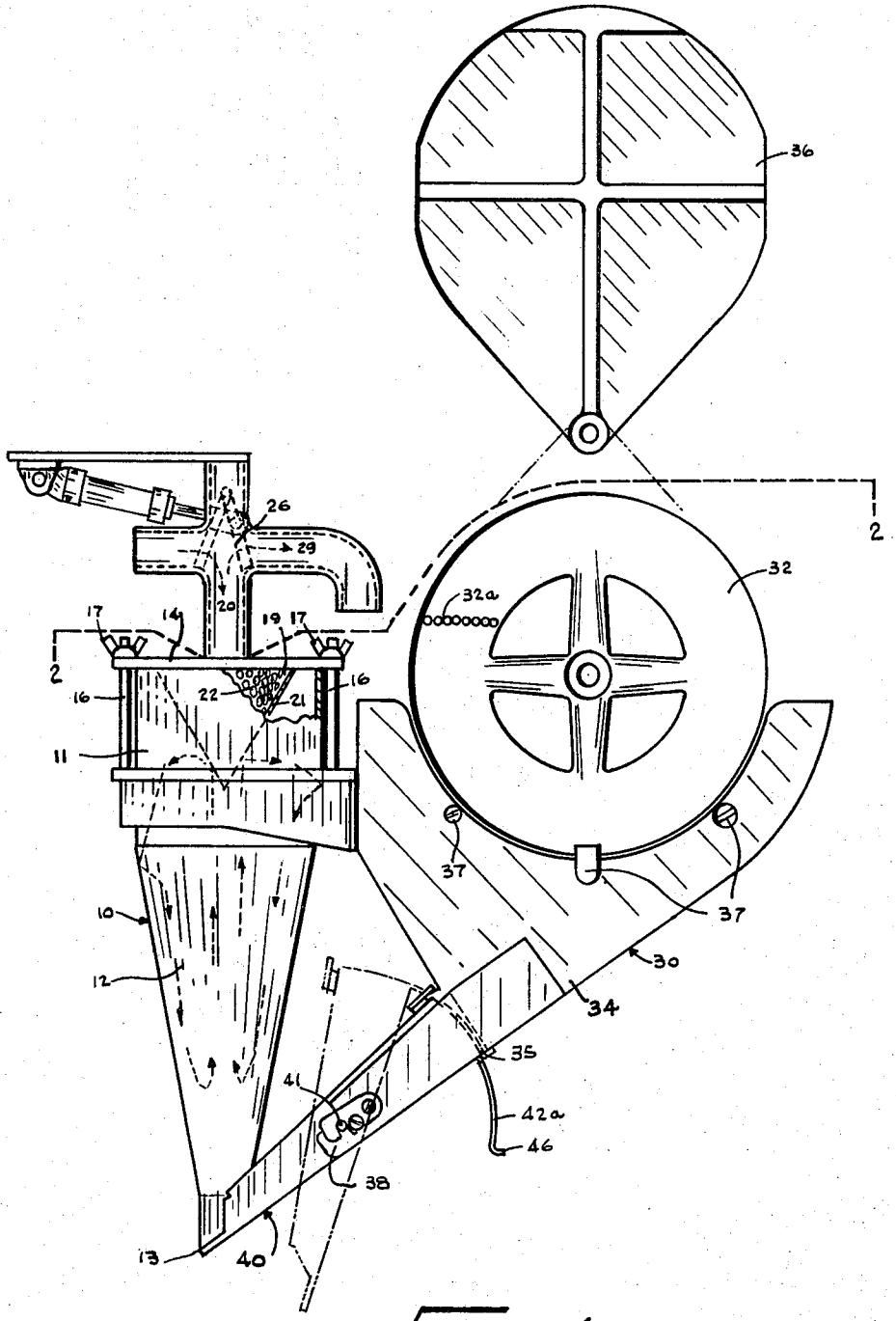


FIG 1

INVENTOR.
CARL C. GARLAND

BY

David B. Ehrlinger

ATTORNEY

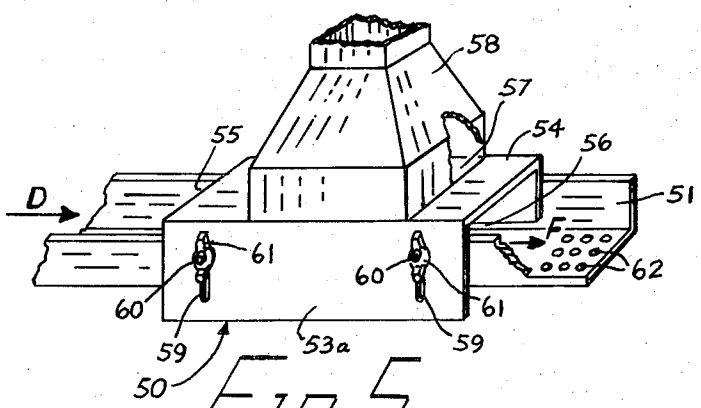


Fig. 5

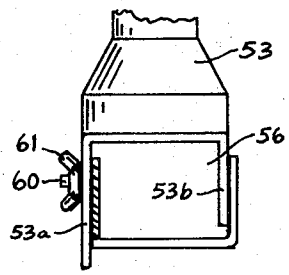


Fig. 6

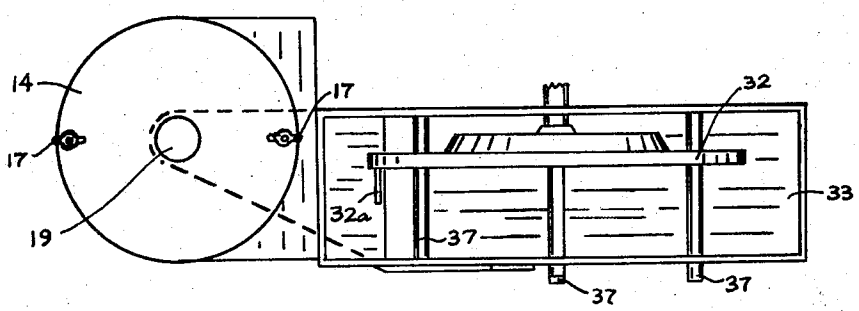


Fig. 2

INVENTOR.
CARL C. GARLAND
BY David B. Ehrlinger
ATTORNEY

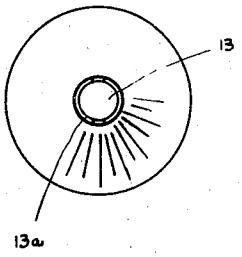


Fig 4

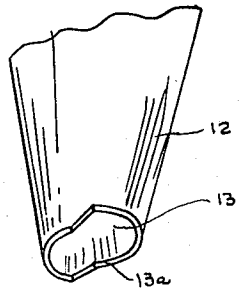


Fig 4a

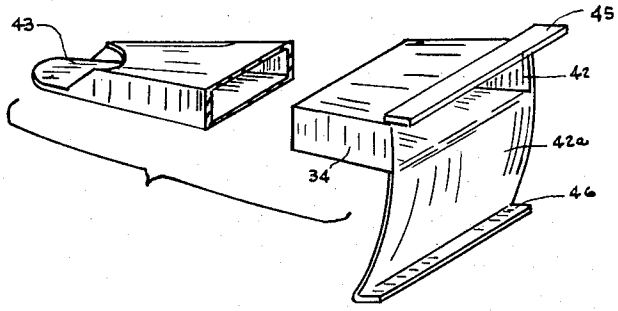


Fig 3

INVENTOR.
CARL C. GARLAND

BY
David B. Ehrlinger

ATTORNEY

NOVEL CAPSULE FINISHING APPARATUS

SUMMARY AND DETAILED DESCRIPTION

This invention relates to novel apparatus and means for finishing filled pharmaceutical capsules. More particularly, the invention relates to finishing apparatus for processing joined capsules in a vacuum to reject defective capsules and eliminate surface powders and the like.

Heretofore the prior art has had the problem of keeping the filling room in good order and free of spillage. Another problem has been that of cleaning filled capsules so that excess material used for filling is completely removed from the capsule exterior in order that the same will have a pleasing appearance and will be free of the taste and order of the product. One method for cleaning capsules involves agitating the filled capsules in a bed of common salt. The cleaning action in this case is due to presence of moisture in the salt which serves to absorb or take up surface dust, leaving the capsule wall clean. While the prior art cleaning action is useful, the method is cumbersome to operate and it fails to disqualify or reject capsules which are not completely joined or are defective due to the presence of cracks or holes in the capsule wall. The prior art method also suffers from the disadvantage that unless done promptly after filling, the excess filling material may become permanently impregnated into the capsule wall or may absorb moisture which in turn may adversely affect the capsule wall.

It is therefore an object of the present invention to provide improved means for finishing and cleaning hard shell gelatin capsules filled with a granular or powdered material or other pharmaceutical fill.

It is another object of the invention to provide means for disqualifying defective capsules of the kind mentioned.

Another object is to provide controlled air cleaning means for finishing filled capsules.

Still another object is to provide means for ridding the filling area of excess dust, powder spillage, etc.

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

FIG. **1** is a side view of a cleaning assembly according to the invention;

FIG. **2** is a top view of the assembly taken on line **2**—**2** of FIG. **1** showing a vacuum chamber in combination with a filling chute for the chamber;

FIG. **3** is a detailed illustration of the filling chute;

FIGS. **4** and **4***a* are views of the vacuum chamber inlet;

FIG. **5** is a view, partly in section, of a shell remover according to the invention; and

FIG. **6** is an end view of the shell remover.

The preferred apparatus illustrated in FIG. **1** includes a vacuum chamber **10**, a filler housing **30**, and a transfer chute **40**. The chamber **10** has a cylindrical head **11** which merges with a conical or funnel-shaped body **12** having an access opening or orifice **13** at its lower end. The chamber **10** includes a flat circular top **14** with a central exhaust opening or port **15**. The top **14** is removably attached to the head **11** by any suitable means such as tie rods **16** and retaining wing nuts **17**. The underside of the top is provided with an integral conical screen or baffle **19** mounted under and

spanning the exhaust opening **15**. The baffle walls **21** are slanted symmetrically away from the center axis (preferably at an angle of about 30° to 50° from the vertical axis) and have an open mesh structure or evenly spaced perforations **22**. For convenience, the top **14** and baffle **19** are removable as a single unit so that the baffle walls **21** are directly exposed for cleaning. Mounted above and in communication with the exhaust port **15** is a conduit and T-valve **26** connected with a suitable vacuum source for exhausting air in the direction shown by arrow **29**. In one preferred embodiment, the source is a commercially available vacuum cleaner supplied under the name Toronado (rated at 5 H.P., Breuer Electric Mfg. Co., Chicago, Illinois, U.S.A.) and arranged to draw on a 1.5 inch flexible corrugated conduit; the exhaust port, body, and inlet **13** measure approximately 1.5, 6, and 1½inches, respectively. When the valve **26** is in the "open" position so that a vacuum is drawn on the chamber, air from the atmosphere is pulled into the chamber through inlet **13** and carried via body **12** upward through the head portion **11**, and out of the chamber through the baffle perforations and exit port **15**. A preferred feature of the chamber is the symmetrical funnel shape of the body which advantageously serves to provide a gradually decreasing linear velocity of air flow in the direction from the opening **13** to the head portion, which in turn facilitates the uniform vertically cyclic flow of capsules while being processed in the chamber. When the valve **26** is in the "off" position so that the vacuum source is cut off, atmospheric air enters in the direction shown by arrow **20** through the T-valve into the chamber.

The housing **30** is adapted to be mounted by suitable bracket means around the filling apparatus. The apparatus may be any suitable capsule filling means having work positions where capsules are filled and joined and where there is a problem of dust removal, examples of such apparatus being Hofliger-Karg Type GKF700, Zanasi Model Z–25 and MG–2 Model G–36. The apparatus illustrated comprises conventional filler components of a Model 8 filler, Parke, Davis & Company, Detroit, Michigan, U.S.A. The latter has an ejector ring **32** and an ejector plate **36** arranged for pivoting to a position face-to-face in cooperation with parallel guide rods **37**. The space between the ring **32** and plate **36** is sufficient to accommodate placing the edges of the joining rings (not shown) onto the guide rods, in juxtaposition with the ring and plate. The ejector ring is power-driven to reciprocate axially back and forth by dwell foot-switch means under control of the operator, the shift in movement being sufficient (after the operator lines up the ejector fingers **32***a* with the joining ring channels) for the ejector fingers **32***a* to enter and then to be withdrawn from the channels. The housing **30** has an open top **33** and funnel-like bottom **34** with a drop-out opening **35** matching the mouth **42** of the transfer chute **40**. The housing **30** includes arms **38** at its lower end adapted for holding the transfer chute **40** in position. The ejector plate **36** is mounted, in conventional fashion, for rotation back and forth from the standby position (as illustrated) to the operating position (shown in dotted outline). The gate **26** and the chute **40** operate off shaft means power-driven by separate air pressure cylinders for synchronous rotation to

vacuum and transfer positions, respectively, whenever the ejector plate is placed in the standby position. By the same means, the gate and the chute are returned to their standby or holding positions whenever the ejector plate is pivoted to the operating position. Since delays often occur in the filling operation, the apparatus may optionally include automatic timing and control means for returning the gate and chute to their standby positions upon expiration of a predetermined time interval, e.g., after 1 minute has elapsed.

The transfer chute **40** is mounted by pivot shaft means **41** to rotate as indicated between the mentioned transfer position and the hold position shown in dotted outline. The upper end of the chute **40** has the mentioned open mouth **42** bounded on its lower margin by a holding surface **42***a*; the lower end has a discharge opening **43**. The mouth **42** and the holding surface **42***a* have dimensions matching the drop-out opening **35**. The discharge opening **43** is formed to provide a close fit with the inlet edges **13***a* of the lower end of the chamber. The chute has a transfer stop **45** and a holding stop **46** to constrain or limit the pivot movement between the transfer and holding positions.

While the invention contemplates the aforementioned means of emptying improperly joined or defective capsules, it also contemplates means for singling out, disqualifying and removing empty capsule shells and capsule parts, capsule fragments and the like. To this end, shell remover means **50** (Figs. **5** and **6** illustrating a preferred embodiment) is provided. The shell remover constitutes a tunnel overlying a conveyor **51** defining the path of travel of capsules. The tunnel includes a hoodpiece which has side walls **53***a* and **53***b*, a top **54**, an open entrance end **55**, and an open exit end **56**. Mounted on the top of the hoodpiece and extending upward from the periphery of an exhaust opening **57** is a chimney **58** arranged in communication with a vacuum source. The hoodpiece is removably mounted for vertically adjustable positioning upon the conveyor by means of the mounting slots **59**, threaded studs **60**, and wing nuts **61**. The bed or floor of the conveyor includes a uniform pattern of openings **62**, slots or the like arranged to provide passageway means for upward air flow particularly throughout the tunnel floor. The conveyor **51** is preferably a conventional air-driven vibratory chute or equivalent conveyor means. The configuration and dimensions of the tunnel can be varied to meet changing requirements such as the size and filled weight of capsule being processed. In one embodiment, for example, using No. 1 lactose-filled capsules at a flow rate of about 600 capsules per minute and operating with a vacuum equivalent to about 10–15 inches of water, the tunnel is about 1⅝ inch wide, the opening **57** is rectangular measuring 1⅝ by 2 inches, and is located about 2½ inches from the entrance opening **55** and 1⅜ inch from the exit opening. The height is adjustable within a range from about ¾ to 1¼ inch. The openings in the **1** conveyor floor within the tunnel are 0.156 inches in diameter spaced on 3/16 inch centers to provide about **60%** void in the surface.

OPERATION

The operation of producing finished capsules with the means illustrated has what may be regarded as four steps: joining and ejecting, transferring the joined capsules to the vacuum chamber, cleaning the capsules while in the chamber, and collecting the cleaned capsules. Referring to these steps in detail, the joining rings (body ring with filled bodies and cap ring with empty caps) are manually transferred as a unit from the filling work station, placed on the guide rods **37** body ring first and adjusted face-to-face with the ejector ring so that the ejector fingers are in alignment with the joining ring channels. The ejector plate **36** is manually pivoted to the operating position (dotted outline, FIG. **1**) which pivoting action by the mentioned switch and pneumatic means causes the valve gate **26** and chute **40** to move to their holding positions whereby vacuum in the chamber is broken.

Next, the ejector ring fingers are advanced into the joining rings by the mentioned power means causing the capsules to be joined. The operator then causes the ejector ring to retract, at the same time advancing the joined rings manually in phase with the ejector ring so that the joined capsules are ejected. As the capsules eject, they fall into the housing **30** and slide by gravity towards the drop-out opening **35** where they are restrained by the holding surface **42***a* of the chute standing as it does in the position illustrated in dotted outline in FIG. **1**. In this position the valve **26** is in the vacuum off position illustrated. The operator then manually rotates the ejector plate **36** clockwise back to the standby position. This movement automatically causes the chute and the valve to return to the transfer and vacuum positions. When this happens the unloaded capsules in the lower end of the housing, no longer restrained by the holding surface **42***a*, freely slide through the chute **40** towards the discharge port **43**. At the same time a vacuum is suddenly drawn on the chamber which action serves to exhaust air through baffle **19** from the interior of the chamber. This, in turn, causes a suction effect on the capsules drawn through the discharge port **43** causing them to become airborne and to be pulled upwardly through the inlet opening **13** into the chamber **10**, first through the body **12** and then upward into the head **11**. In this area they move vertically upward in a line, impinge upon the slant walls **21** of the baffle and fall back as illustrated by the dotted arrows of FIG. **1**.

Meanwhile, the discharge opening **43** has been seated against the edges **13***a* of the inlet opening **13** so that the same is sealed. However, the seal purposely allows some air to enter which air serves to lift and move the capsules. As intended, the air is continuously being exhausted from the chamber, and correspondingly the capsules are in constant movement in the chamber, first rising and then falling back. As the capsules fall back they move against the oncoming flow of air. The air chamber pressure, however, is less than atmospheric since the inlet opening **13** restricts entry of air. In this way a sufficient vacuum is created in the chamber to cause the separation of any loose powder or particulate matter from the outer surfaces of each capsule. Such powder and foreign matter are carried upward through the low pressure air stream through the perforations **22** of the baffle and out of the chamber through the exhaust port. At the same time any capsules which are defective (with cracks or holes in the wall, poorly joined or otherwise subject to loss of the powder fill) are

caused by the vacuum cleaning action to become gradually emptied: the fill is slowly lost due to the continuing cleaning effect until nothing but the empty capsule shell remains.

The slant walls **21** of the baffle provide a useful agitation effect. In this regard, the capsules in the chamber are continuously cycled against the baffle walls **21** in turbulent fashion during the period of the cleaning cycle. As the capsules strike the baffle, they abruptly undergo a change of direction whereby surface dust is in effect shaken loose and carried straight on through the baffle by way of the perforations. After striking the baffle the capsules rebound and in the usual case move laterally and strike the chamber walls, the impact of which also has the effect of jarring surface dust loose. The mentioned impact actions serves not only to remove unwanted particulate matter but also to separate loosely joined or improperly joined capsules and it follows that these are emptied in due course, leaving the empty shells in the chamber. Advantageously, the vacuum action also has a useful cleaning effect outside the chamber in that dust-laden air at the filling work station tends to gravitate and move downward through housing **30** and chute **40**. By these means, throughout the operation, the environment is constantly being cleared of residual powder. Also, if desired, the operator can occasionally dust off the apparatus directly into the housing with the assurance that the unwanted dust will be purged automatically and carried away in the vacuum cycle.

The vacuum cycle continues until the operator activates the ejector plate to the down position (or until the mentioned automatic timer means bypasses the operation and terminates the vacuum cycle) at which time the valve gate **26** and chute **40** are phased into the unload position. When this occurs the vacuum is broken and air enters the chamber via the inlet opening and valve (in the direction of arrow **20**). With the loss of the vacuum in the chamber the capsules, now clean, fall by gravity action downward through the access opening into a suitable collector, conveyor, or the like.

Capsules processed in the cleaner **10** or other work station are according to the invention transferred directly or indirectly to the shell remover means **50** (arrow D, FIG. 5) along the path of the conveyor **51**. For simplicity, the conveyor is a rigid trough constructed of stainless steel or other suitable material, operating as part of a vibratory feed bowl. The path of travel of filled capsules passes through the tunnel under vacuum to the exit end of the conveyor (arrow F, Fig. 5). The construction of the tunnel is such that the air flow to the chimney **58** from the exit end **56** is greater than the air flow from the entrance end **55** thereby creating a back pressure or air curtain inside the tunnel at the exit end. Empty capsules, therefore, and capsule shell parts moving with the filled capsules are according to the invention unable to pass the tunnel because of the selective exhaust effect and back pressure. In this regard, the shells entering the tunnel either are sucked up directly into the chimney **58** or are rebuffed by the air curtain at the exit end **56** and carried back to the chimney where the shells are removed by vacuum for salvage. The exhaust action is enhanced by the aperturing **62** in the conveyor which serves in the tunnel area to facilitate getting the shells airborne and separated from the filled capsules. The shell removing effect is highly efficient. It is not unusual, for example, that a capsule shell will enter the tunnel, pass the chimney and move up to the exit end at which point it will suddenly, as if meeting a solid surface, bounce back and up to the chimney **58**. The strength of the exhaust action and back pressure can be varied, depending on requirements of capsule size, capsule weight, etc., by adjusting the relative position of the hoodpiece **52**. The entrance and exit openings of the tunnels in this way can be separately changed. Other equivalent means for modifying the differential air flow will be satisfactory.

While the invention in capsule handling systems 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 be interpreted to cover both the invention particularly described and any such variation.

I claim:

1. Apparatus for finishing pharmaceutical capsules comprising:

a vertically disposed chamber;

means for introducing capsules into the chamber;

vacuum means for moving an air stream through the chamber in a vertical direction to cause capsules in the chamber to become airborne therein above the bottom of the chamber and to be lifted and tumbled in the air stream;

baffle means above the airborne capsules adapted to pass the air stream and to confine the capsules within the chamber; and

outlet means for removing capsules from the chamber, the capsule introducing means comprising an open-ended chute, the chute being pivotable to a transfer position with one end of the chute in cooperative relation with the outlet means for transfer of articles therebetween.

2. An apparatus according to claim **1** wherein the outlet means is an opening located at the bottom of the chamber.

3. An apparatus according to claim **1** in combination with means for filling and joining capsules, the latter means including housing means in communication with an open end of the chute while in the transfer position whereby joined capsules collected in the housing can be transferred from the housing via the chute to the chamber.

4. An apparatus according to claim **2** in combination with control means for interrupting the air stream whereby capsules located in the chamber lack support and are discharged from the chamber via the opening in the bottom of the chamber.

5. An apparatus according to claim **1** wherein the baffle means includes perforate walls slanted away from the vertical at an angle sufficient to cause capsules moving upwardly to rebound toward side walls of the chamber.

* * * * *