June 10, 1952 F. E. STIRN ET AL 2,600,367

CAPSULE DRYING AND BURNISHING METHOD

Filed April 30, 1948 2 SHEETS—SHEET 1

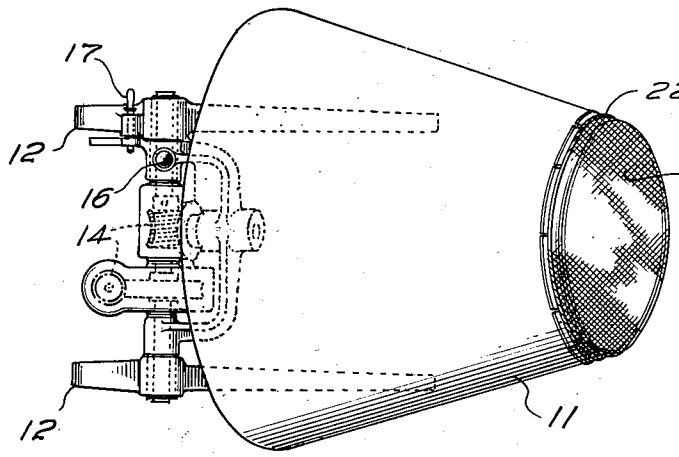


Fig. 1.

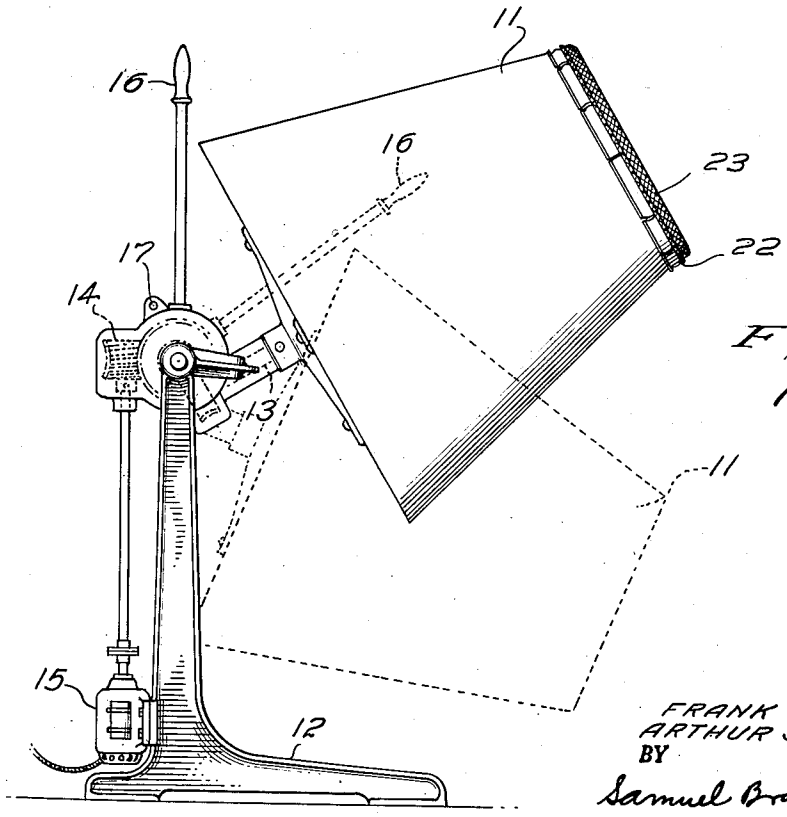


Fig. 2.

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Fig. 3.

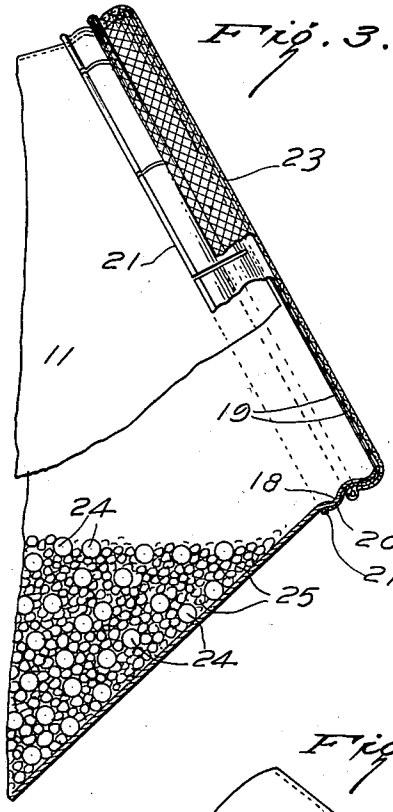


Fig. 4.

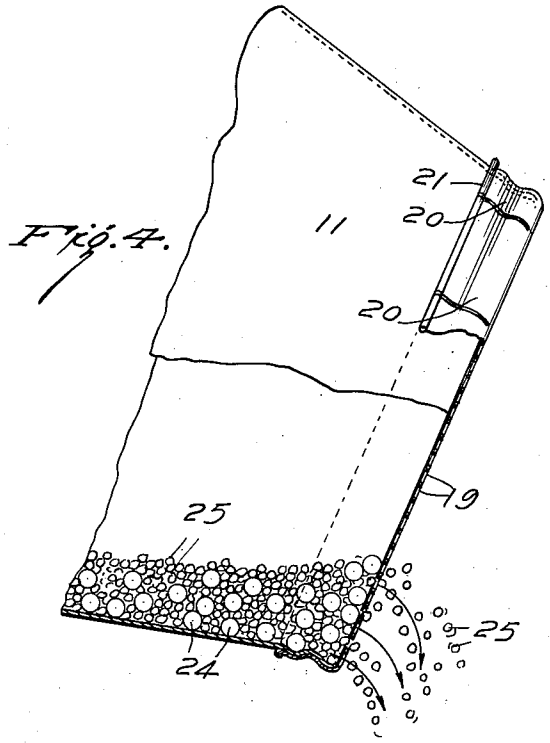


Fig. 5.

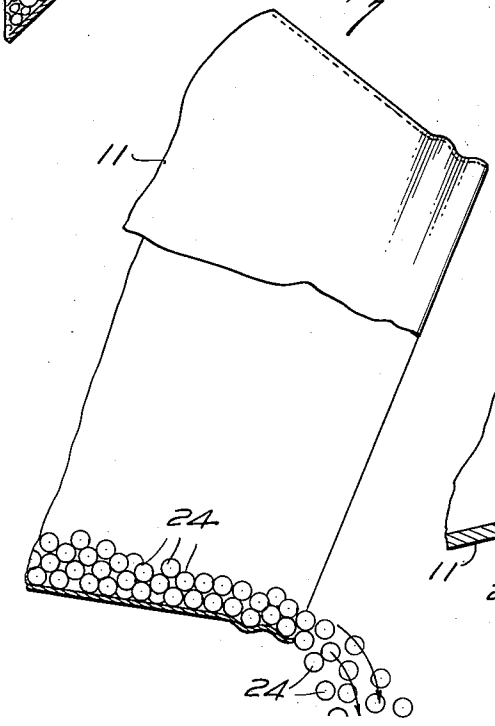
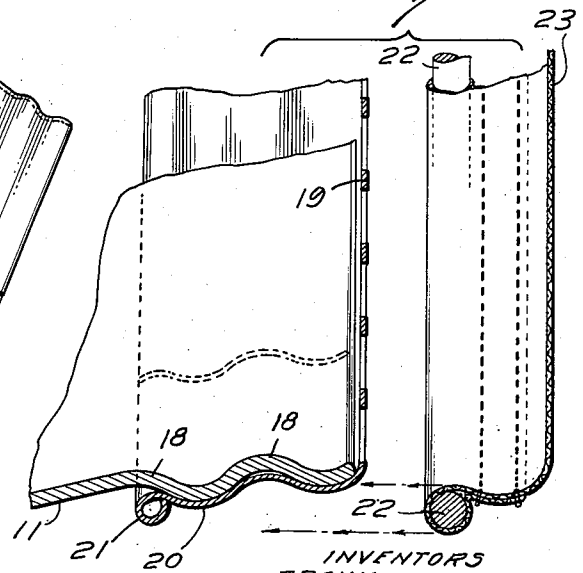


Fig. 6.



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Patented June 10, 1952

2,600,367

UNITED STATES PATENT OFFICE

2,600,367

CAPSULE DRYING AND BURNISHING METHOD

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Application April 30, 1948, Serial No. 24,218

10 Claims. (Cl. 34—9)

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Our invention relates to a method and machine for the drying and burnishing or polishing of gelatin capsules, particularly sealed, soft gelatin capsules.

More particularly, it relates to the processes and machines involved in mechanically agitating soft gelatin capsules, preferably shortly after formation, with dehydrating materials, such as beads of silica gel until the capsules are sufficiently dry, separating the beads from the capsules, additionally coating or polishing the capsules as desired, and discharging the separated dried capsules as desired.

An important phase of our invention is the tumbling which tends to round out the capsules, particularly powder filled capsules, which may otherwise exhibit a tendency to remain lopsided, and which tends to prevent the bleeding of dye color if certain portions of the capsule are of a different surface color than other portions. It further tends to reduce the sticking of capsules to each other. The rapid and efficient drying of the capsules allows them to be filled with hydroscopic powders which would otherwise be spoiled by the absorption of moisture from the gelatin films before such moisture could be removed.

Further objects, advantages and meritorius features will appear from the following description, appended claims and accompanying drawings:

Figure 1 is a top view of a tumbling barrel suitable for the present invention.

Figure 2 is a side elevation of a tumbling barrel incorporating advantages of the present invention.

Figure 3 is a partially broken away elevation showing the beads and capsules in a tumbling barrel in operating position.

Figure 4 is a partially broken away elevation showing a screen in position over a barrel, in discharging position, whereby the drying beads are permitted to escape, but the capsules are retained.

Figure 5 shows the discharging of the finished capsules.

Figure 6 is a detail view showing the screen in position over the mouth of the barrel, and with a protective cloth adjacent, but not yet fastened over the mouth of the barrel.

According to the illustrated examples of the invention a tumbling barrel 11 is used as a container for the treatment of soft gelatin capsules 24, by tumbling with drying beads 25. The driving mechanism and frame assembly as well

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as the shape of the tumbling barrel may be in accordance with conventional practice. Standard candy coating machines, pill coating machines and tumbling barrels such as are used in the electroplating and metal burnishing arts may be used. For purposes of illustration a simple tumbling barrel is shown at 11, having a flat bottom and, a portion of a cone for the sides. As shown in Figures 1 and 2 the barrel 11 is supported by a frame 12 and the barrel itself is mounted on a rotatable shaft 13 which in turn is driven by suitable gearing 14 from the motor 15. Any convenient or suitable drive may be used. As shown the barrel may be tipped by means of a handle 16 from the operating position shown in full lines at Figure 2 to a discharge position as shown by the dotted lines at Figure 2. It is desirable that, as illustrated, the drive be independent of the position of the barrel so that the barrel may be rotated continually while in loading position or in discharging position or in any treating positions. As shown in Figure 1 a positioning pin 17 holds the barrel in a desired position during each portion of its operation. If large or heavy barrels are used it may be desirable that power operated elevator means may be used or that modifications be used in which the barrel is rotatable about its center of gravity, etc. Such conventional modifications of the barrel are well known to those skilled in the art and do not form a distinctive portion of this invention.

As an important feature of our invention, the mouth of the barrel is provided with attaching means whereby screen or covering members or both may be placed adjacent the mouth of the barrel and firmly retained thereon as may be desired. As a particular method of fastening, which may be readily modified, the mouth of the barrel is provided with grooves 18 in which clamping rings may be placed to position members. As clearly shown in Figure 6 a screen or perforated plate 19 is mounted in or made integral with a frame 20 which frame is slotted and has thereon a segmented peripheral bead 21 forming fingers which by spring action fit tightly in the grooves 18 whereby the screen 19 is held adjacent the mouth of the barrel. The screen may be held in this position while the barrel is being operated. Additionally there is provided a cover 23 which may be of metal or of a reasonably tightly woven cloth, or other impervious material. As shown in Figure 6 cloth is used for the cover and is fastened around an adjustable cover clamping band 22 by suitable

means, as for example by sewing. Other clamping means may be used. This cover, which is impervious to dust and moisture, may be either placed over the screen or over the mouth of the barrel direct, at the operator's choice. The cover prevents room moisture from slowing the drying of the capsules.

As so arranged, both the screen and the cover are removed from the barrel, and the barrel is elevated to a position such as that shown in Figure 3 for loading. After the barrel is loaded it may be run with no cover on the mouth, with the cover on the mouth or with both the cover and screen on the mouth. The cover and the screen may be left on while the barrel is dropped to the discharging position or preferably, the cover may be removed and the screen left on whereby when the barrel is dropped to the discharge position with the power on and rotated, all particles smaller than the screen mesh will escape through the screen and drop into a suitable receptacle while the portions of the charge which are larger than the screen mesh will be separated and retained in the screened barrel.

The particular method of using screens as shown in this invention renders particularly convenient the separation of the finished capsules from the drying and/or burnishing materials and fines.

As an illustration of the particular process to be used, soft gelatin capsules may be formed by enclosing between suitable portions of gelatin sheets and sealing together around the periphery any suitable material. A suitable machine for the production of such capsules is described in our co-pending application, Serial No. 16,554, filed March 23, 1948. As discharged from the capsule forming machine the capsules are comparatively sticky and soft. In the past there has been difficulty with such capsules sticking to each other or becoming lopsided or mashed from their own weight, and the contents were loaded in such a fashion that the capsules were lopsided as formed. These asymmetric conditions are particularly apt to occur when a dry powder is used as the fill, as disclosed in the above mentioned co-pending application. Additionally, difficulty is had if different colored gelatins are used or if portions of the gelatin are dyed different colors during their manufacture as the colors will tend to bleed to the adjacent capsules if allowed to remain in contact at rest. Therefore it is considered desirable that the capsules as formed be discharged from the forming machine immediately into the tumbling barrel which is kept in rotation while being loaded.

As shown in Figure 3 the barrel may be partially filled with a tumbling mass. It has been found particularly convenient to use what are known as "sova-beads." These beads are described in "Synthetic Bead Catalysts," R. W. Porter, Chemical and Metallurgical Engineering, 53; No. 4, 94 to 98 and 138 to 41 (April 1946). These beads are silica gel; which are formed in small beads which are comparatively round. The beads are dried, as in an oven, so that they will absorb considerable moisture. The beads were originally developed as a catalyst carrier but proved to be useful for our present purposes.

For ready separation it is necessary that the beads be of a different size than the capsules so that they may be separated by a screen. For purposes of convenience the beads are best used smaller than the capsules, as the smaller beads give a better burnishing effect and additionally any fines or broken beads will be discharged through the screen, whereas if the capsules are smallest and discharged through the screen there is always the possibility that broken beads would remain with the capsules.

It is possible to place the capsules in the tumbling barrel first and the beads later, but there is more danger of the capsules sticking to each other if this is done. It is generally desirable that a suitable mass of beads be placed in the tumbling barrel, and the capsules allowed to fall into the barrel as formed and rotated until the tumbling barrel is fully loaded. The barrel may then be removed, an additional similar barrel placed in position, permitting continuous operation of the capsule forming machine, and the removed barrel tumbled for a sufficient period of time to remove moisture from the gelatin films and form a sufficiently dried gelatin capsule. Normally a period of from 2 to 3 hours at room temperature is adequate. During this process it is usually desirable that a cover be placed on the barrel so that moisture and dust from the room can not get into the barrel, and similarly dust can not escape from the barrel.

At the end of the tumbling time the cover is removed and the screen secured. A mesh of such size is used that the capsules are retained in the barrel and the sova-beads and fines are passed by the screen. The barrel is lowered to the discharge position, and rotated, permitting the discharge of the beads and fines until all of the beads and fines have escaped through the screen. (If desired, the barrel may then be elevated to its normal operating position, burnishing material such as sawdust or bran added and the capsules burnished.) A coating material, such as a silicone plastic in a suitable solvent, sugar, shellac, or other material as desired may be then used. This protective coating may be of a moisture-proof material to prevent reabsorption of moisture. The barrel is rotated is accordance with conventional pharmaceutical practice until the capsules are adequately coated. The capsules are then discharged to a suitable container.

It will be found that the sova-beads have a tendency to leave a pastel egg-shell type of finish on the capsule which may be desired. If a high polish is desired bran or sawdust will remove any dust and give a particularly shiny capsule. The finish coating may be used for the particular purposes; it is not always essential.

In the past it has been the custom to discharge capsules into a starch or other powder to keep them from sticking to each other, or into a dehydrating liquid such as acetone so that they may be dried without handling. These conventional processes are much slower than that disclosed in this invention and are not nearly as satisfactory particularly for powder filled capsules in which tumbling is useful to assure that the capsules are formed to a symmetrical shape.

As a modification of our invention, the capsules may be placed in a coating pan or tumbler and the drying beads placed in contact therewith so that the drying takes place while the beads are stationary rather than while being tumbled. Such drying, while a marked improvement over the prier processes, is generally not as convenient nor as satisfactory for large scale operations, as it does not result in as uniform a product.

In operation in accordance with our invention it is generally desirable that the tumbling barrel

be only part filled so that it may be rotated without a cover thereon without the contents spilling out. Such tumbling is conventional and the amount of charge in the barrel normally is not critical.

The ratio of quantity of beads to capsules may be varied over wide limitations without in any way deleteriously affecting the process. For best burnishing effect however, it is generally desirable that the volume of beads be not markedly less than the volume of capsules which are added. If more than twice the volume of beads is used in relationship to the volume of capsules, an uneconomically large barrel is necessary, and larger quantities of material must be handled, although it speeds up the rate of drying, and under some circumstances is expedient.

The sova-beads after having been used may be regenerated by placing them in a drying oven at a sufficiently high temperature to drive off moisture. Angular slica gel, alumina, or other dehydrating materials may be used provided that they are sufficiently non-toxic, and that they may be readily separated from the capsules. Toxic drying agents may be used if the filled capsules are for other than human or animal consumption.

Having thus described certain commercially important embodiments thereof and explained the operation, as our invention, we claim:

1. The process of drying and shaping soft gelatin capsules which comprises intermixing while agitating soft gelatin capsules and beads of substantially dry silica gel, at about room temperature.

2. The process of drying and shaping soft gelatin capsules which comprises agitating such soft gelatin capsules with smaller discrete particles of a non-toxic drying agent, at about room temperature for about 2 to 3 hours.

3. The process of drying and shaping soft gelatin capsules which comprises adding such capsules as formed, while moist, to an agitated bed of silica gel beads, thereby intermixing and continuing agitation of the intermixed beads and capsules at about room temperature until the capsules are substantially dry.

4. The process of drying and shaping soft gelatin capsules which comprises the steps of intermixing while agitating moist, soft gelatin capsules and substantially dry silica gel beads, agitating at about room temperature until the capsules are substantially dry, and screening off the beads and fines.

5. The process of drying and shaping soft gelatin capsules which comprises tumbling moist soft gelatin capsules at about room temperaure in a substantially dry atmosphere with solid beads.

6. The process of drying and shaping dry, soft gelatin capsules containing a moisture sensitive fill which includes the steps of forming capsules filed with such moisture sensitive material, immediately thereafter agitating such formed capsules with substantially dry silica gel beads at about room temperature whereby the moisture is extracted from the gelatin of the capsules before it has time to deleteriously affect the contents of the capsules, and screening to separate said capsules from said drying material.

7. The process of drying and shaping soft gelatin capsules containing a moisture sensitive material which comprises forming capsules filled with such moisture sensitive material, from moist gelatin sheets, immediately thereafter agitating such capsules with a solid drying agent at about room temperature for a sufficient time to substantially remove the moisture before the moisture sensitive material is deleteriously affected, separating said drying agent from said capsules and coating said dried capsules with a moisture resistant surface coating.

8. The process of drying and shaping multiple colored soft gelatin capsules which comprises intermixing such capsules as formed with discrete particles of a solid drying agent and agitating such agent and such capsules at about room temperature whereby moisture is removed from the capsule material without permitting such capsules to remain in contact with each other a sufficiently long time for the colors to bleed.

9. A method of drying and shaping soft gelatin capsules which comprises adding such capsules to an agitated tumbling mass of substantially dry silica gel, agitating at about room temperature until such capsules are substantially dry while protecting such capsules from dust and ambient moisture, and screening such capsules from the drying material.

10. The process of drying and shaping soft gelatin capsules which comprises forming asymmetric soft gelatin capsules, immediately thereafter transferring said capsules to tumbling means and tumbling said capsules at about room temperature in a substantially dry atmosphere until the capsules are symmetrically shaped and sufficiently dry to withstand subsequent handling without deformation.

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