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3,324,902

METHOD OF FILLING CAPSULES

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2 Sheets-Sheet 1

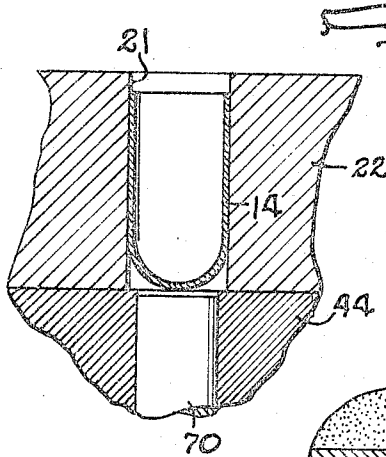
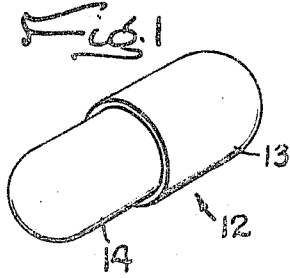


Fig. 3

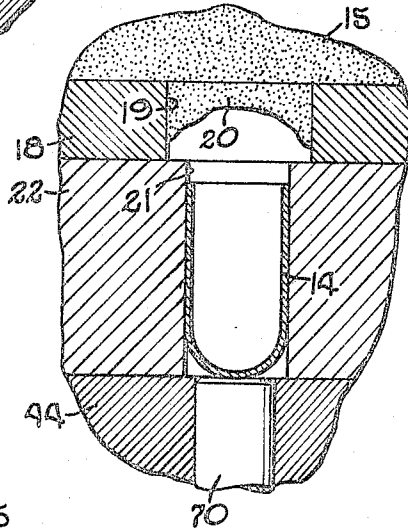


Fig. 4

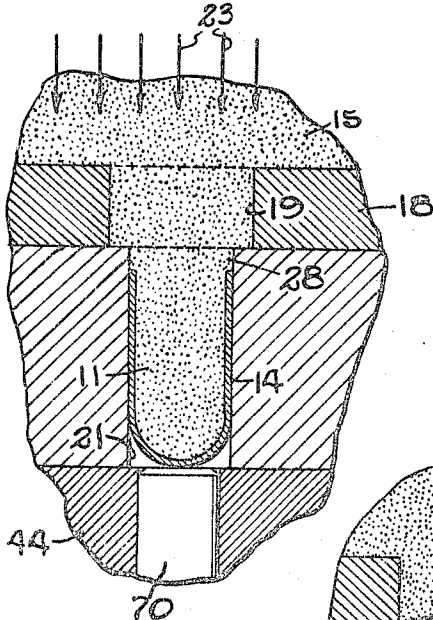


Fig. 5

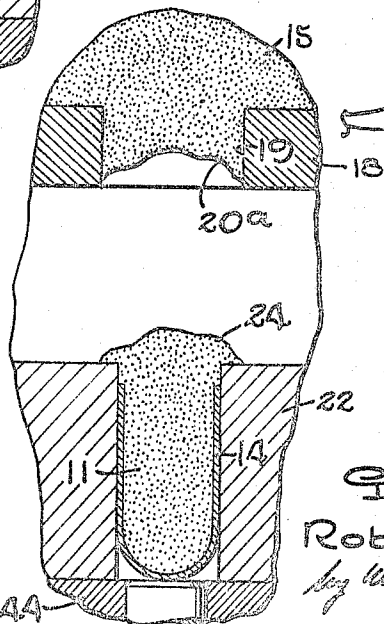
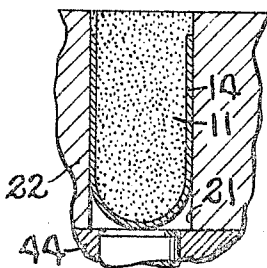


Fig. 6



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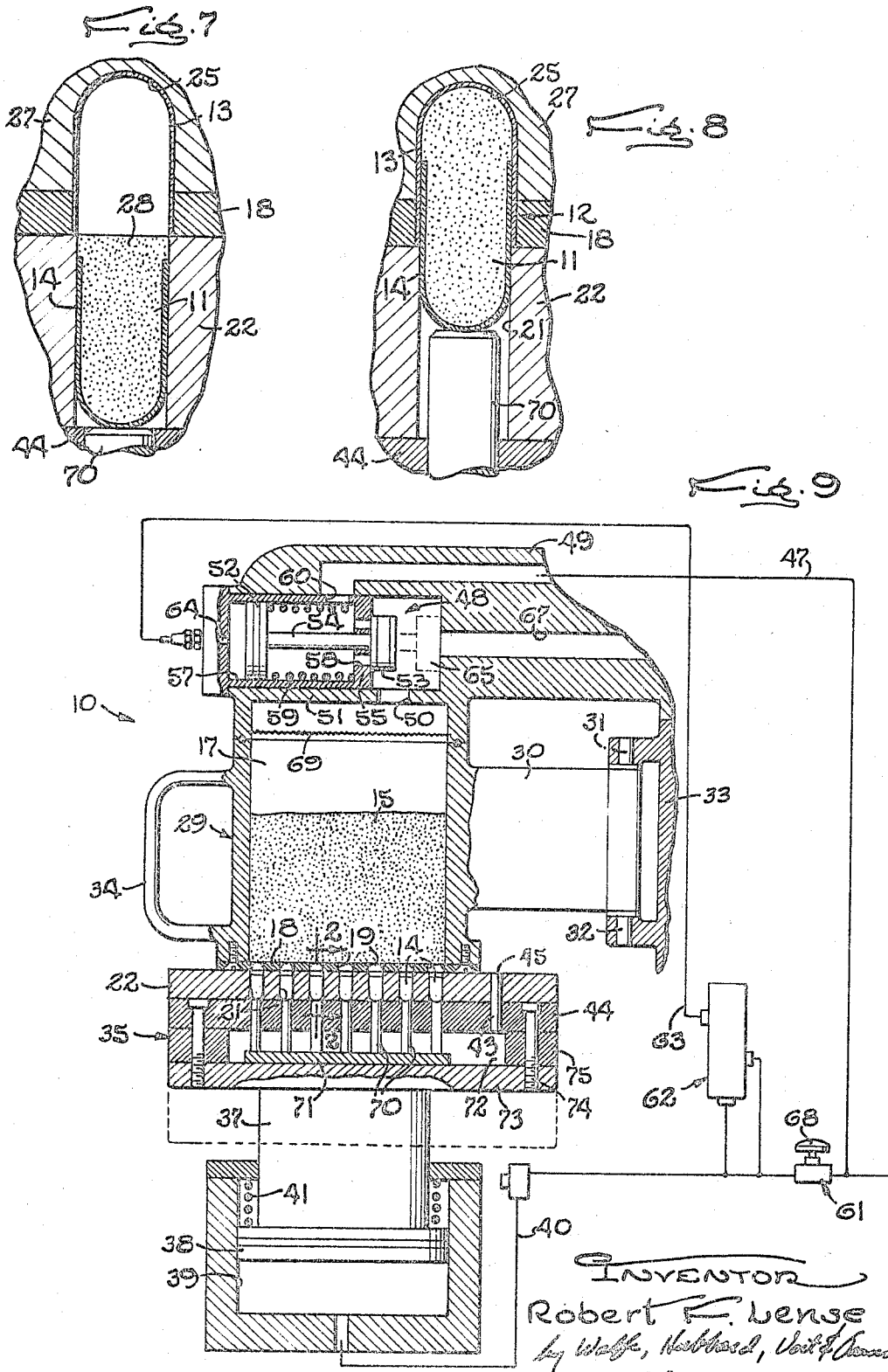
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METHOD OF FILLING CAPSULES

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2 Sheets-Sheet 2



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3,324,902

METHOD OF FILLING CAPSULES

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3 Claims. (Cl. 141-1)

This invention relates to a method for filling capsules and, more particularly, to the dispensing of measured amounts of powdered pharmaceutical compounds into open-ended capsule sections prior to the final assembly of the capsules.

The general object of the present invention is to fill such sections quickly and accurately in an improved manner and with a simplified filling apparatus.

Another object is to force a measured amount of such powder directly into a capsule section from a body of the powder held in a filling head.

A more detailed object is to support the body of finely powdered material above an apertured plate and dispense the material intermittently through the plate directly into capsule sections in response to pressure impacts on the body of material.

Other objects and advantages of the present invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which

FIGURE 1 is a perspective view of a capsule of a type adapted to be filled in accordance with the present invention.

FIG. 2 is an enlarged fragmentary cross-sectional view taken along the line 2-2 of FIG. 9 and illustrating an initial step in the improved process.

FIGS. 3-8 are views similar to FIG. 2 but showing successive steps in the filling and assembly of capsules.

FIG. 9 is a fragmentary cross-sectional view taken in a vertical plane through a machine for practicing the improved process, together with a schematic diagram of the basic parts of a pneumatic system.

Shown in the drawings for purposes of illustration is an apparatus 10 (FIG. 9) for dispensing measured amounts 11 of finely powdered material into capsules 12 (FIG. 1) of a well-known type comprising two sections 13 and 14 of U-shaped cross-section adapted to be telescoped together in the manner shown in FIGS. 1 and 8 after one section 14 is filled with a quantity of the material. Such capsules usually are composed of gelatin and are used to enclose distasteful doses of pharmaceutical compounds to facilitate the swallowing of the compound.

The present invention takes advantage of the tendency of the particles in a packed body 15 of powdered material to adhere to each other in order to facilitate the rapid and accurate filling of capsule sections. In accordance with the invention, a body of such material is supported in a chamber 17 above a wall 18 of the chamber having at least one aperture 19 therein sufficiently small to hold the powder as a result of bridging of the aperture by the powder above the aperture. The capsule section 14 to be filled then is supported in a filling position below the apertured wall with the open end of the section adjacent and aligned with the aperture, and a momentary impact of pressure is applied to the body to jolt the latter toward the aperture, breaking the so-called bridge 20 and forcing a quantity of the powder into the capsule section. As the powder flows into the section, the air in the section is displaced upwardly therefrom through the aperture and into the body of powder in the chamber. After pressure impact is terminated, the filled capsule section is removed from the filling position, leaving another bridge of powder disposed across the aperture and effectively closing the latter.

The successive steps in the process are illustrated in

FIGS. 2 through 5. First, a capsule section 14 is inserted in a recess 21 in a support 22, herein called the fill plate, with the open end of the capsule section adjacent the upper end of the recess. Then the support is placed against the apertured wall 18, herein called the bridge plate, with the recess 21 aligned with the aperture 19 in the bridge plate. It will be seen in FIG. 3 that the body 15 of packed powder bridges the aperture at 20 and thus normally is held against movement through the aperture. The size of the aperture depends upon the nature of the material to be handled and the angle of repose of the material. With flour-like material, a 3/8 inch diameter hole is satisfactory.

With the capsule section 14 in place, a pressure impact (indicated by the arrows 23 in FIG. 4) is applied to the powder 15 above the bridge plate 18 to force the powder downwardly through the aperture 19 into the capsule section, the air in the section being displaced upwardly through the powder. Then the plates 18 and 22 are separated as shown in FIG. 5, leaving a new bridge 20^a across the aperture. Any excess powder left above the charge in the capsule section as at 24 in FIG. 5 simply is brushed away, either manually or automatically, to level the top of the charge and thereby insure uniform measurement of successive charges.

As shown in FIGS. 7 and 8, the second section 13 of the capsule is assembled on the filled section 14 by placing the second section over the recess 21 with its open end adjacent and in alignment with the section 14, and shifting the latter out of the recess into telescoped relation with the other section. The section 13 preferably is supported in an inverted position in a hole 25 in a carrier plate 27 with the open end of the capsule disposed outside and below the carrier plate to abut against the fill plate 22 around the recess 21. To obtain complete filling of the assembled capsule, the open end of the section 14 is disposed inside the fill plate and a substantial distance below the open end of the recess during the dispensing operation whereby the recess collects a quantity of powder at 28 somewhat greater than the volume of the section 14 alone (see FIG. 6). The excess then can fill the rounded end of the section 13 when the two sections are telescoped fully together.

The apparatus for filling the capsule sections 14 is shown in FIG. 9 and includes a hollow filling head 29 defining the chamber 17 for holding the body 15 of powder above the bridge plate 18 which forms the lower wall of the chamber. In this instance, the bridge plate is formed with a plurality of dispensing apertures 19 for simultaneously dispensing powder into an equal number of sections 14 held in recesses 21 in the fill plate 22 below the bridge plate. The head is suspended from one end of an arm 30 pivoted at its other end for back and forth lateral swinging movement about a vertical axis 31 defined by a pin 32 journaled on a portion 33 of the machine frame, and is provided with a handle 34 facilitating such swinging. Suitable stops (not shown) may be provided for alternately positioning the head in a dispensing position (FIG. 9) and a laterally spaced loading position (not shown) in which the supply of powder in the chamber may be replenished.

In the present instance, the fill plate 22 is supported on top of a table 35 disposed beneath the dispensing position of the head 29 and vertically movable relative to the machine frame between a lowered position in which the fill plate is spaced from the bridge plate 18 and a raised position shown in full in FIG. 9 in which the top of the fill plate is pressed into sealing engagement with the bridge plate. For this purpose, the table is mounted on the upper end of a rod 37 carried on a piston 38 guided for vertical sliding movement in a cylinder 39 beneath the table. When pressure fluid is admitted into the lower end of the cylinder through a line 40, the table is raised. When the pressure is relieved, a spring 41 compressed between the piston and the upper end

wall 42 of the cylinder returns the table to its lowered position indicated by the broken lines in FIG. 9. Two aligning pins 43 on the table top 44 project upwardly into holes 45 in the fill plate and thus support the fill plate in a preselected position in alinement with the bridge plate.

To produce the pressure impact on the body of powder 15 in the chamber 17, a blast of high pressure air is admitted into the upper end of the chamber above the body of powder. In this instance, air under pressure on the order of 125-150 p.s.i. is supplied to the chamber through a line 47 and a valve 48 stationarily supported over the dispensing position of the head on an arm 49 the outer end portion of which closes the pressure chamber 17 in the dispensing position. This valve controls the flow of air from the line 47 through a port 50 in the wall 51 forming the top of the chamber. Except for this port and the apertures 19 in the bridge plate 18, the chamber is air-tight.

The valve 48 is of the differential-pressure type and comprises a pair of different sized heads 52 and 53 on the opposite ends of a rod 54 extending through one end wall 55 of the valve body. The larger head 52 is fitted in the cylinder 57 forming the valve body and the smaller head 53 abuts against the wall 55 to cover a series of openings 58 therethrough. A spring 59 compressed between the larger head and the end wall 55 urges the heads into the position shown in FIG. 9 in which the valve is closed. Air under pressure is supplied to the interior of the cylinder, between the heads, through the line 47 and a port 60, and pilot pressure for operating the valve is supplied to the cylinder on the other side of the larger head through a manually operable start valve 61, a sequence valve 62 of well known construction, and a line 63 communicating with the cylinder through a port 64. Beyond the wall 55 is a chamber 65 communicating with the inlet port 50 and with an exhaust line 67 having an inlet alined with the smaller head 53 and normally spaced from the latter.

With the table 35 in its lowered position and the dispensing head 29 in its dispensing position above a fill plate 22 on top of the table, the filling operation is initiated by pressing the operator 68 of the start valve 61 thereby to admit air to the sequence valve 62 and thence to the lower end of the cylinder 39 to raise the table until the fill plate is pressed against the bridge plate 18. When the pressure builds up to a predetermined level in the cylinder, the sequence valve automatically directs pressurized air through the line 63 to the port 64 to overcome the closing force exerted on the head 52 by the spring 59 and the pressure inside the cylinder 57 thereby to shift both valve heads to the right. During such movement, the head 53 first uncovers the openings 58 in the wall 55 and then almost immediately covers the exhaust line 67 so that a blast of high pressure air from the line 47 is directed through the port 50 into the pressure chamber 17 to jolt or hammer the body of powder and fill the capsule sections 14 through the apertures 19.

The sequence valve 62 then cuts off the air supply to the pilot line 63 so that the valve 48 closes the openings 58, and also cuts off the air to the cylinder 39 to lower the table 35. As the valve closes the air supply to the chamber 17, it also reopens the exhaust line 67 so that the pressure in the chamber is relieved. A filter screen 69 catches any powder that may be entrained in the reverse flow of air. With the fill plate 22 spaced from the bridge plate 18, the head 29 may be swung out of the dispensing position so that the excess powder can be brushed from the top of the fill plate, and the carrier plate 27 with the capsule sections 13 therein can be positioned over the fill plate in the manner shown in FIG. 7 for the final assembly. The carrier plate, of course, is formed with a pattern of holes 25 the same as the pattern

of recesses 21 in the fill plate 22 to hold one section 13 over each filled section 14.

Herein, the bottom of each recess 21 in the fill plate 22 is formed by the end of a knock-out pin 70 projecting upwardly through the plate forming the table top 44 and supported on a carrier 71 disposed in the hollow interior 72 of the table and movable toward and away from the fill plate to shift the pins 70 upwardly through the recesses 21 after the carrier plate 27 has been positioned over the fill plate. The knock-out pin carrier 71 normally rests on a base plate 73 bolted at 74 to the top plate 44 but spaced from the underside of the latter by bars 75 as shown in FIG. 9. Thus, the pins are positioned to eject the filled sections 14 from their recesses and press them into the waiting sections 13 as shown in FIG. 8. The knock-out pins may be actuated either automatically or by a suitable manual operator (not shown) for raising the carrier 71.

I claim as my invention:

1. The method of dispensing powdered material into capsule sections each having an open end and a closed end, said method comprising the steps of, supporting a body of the material in a pressure chamber having a lower wall with a plurality of dispensing apertures therein sufficiently small to hold the material as a result of bridging of the apertures by the material when the latter is undisturbed, supporting a plurality of capsule sections beneath said apertures with the open ends of the sections positioned to receive material through the apertures, admitting a blast of gas under pressure to said chamber above said material and thereby jolting the material to break the bridging of said apertures and force material through the latter into the capsule sections, terminating said blast, and then removing the capsule sections from beneath said apertures.

2. The method of dispensing powdered material into a capsule having an open end and a closed end, said method comprising the steps of, supporting a body of the material in a pressure chamber having a bottom wall with a dispensing aperture therein sufficiently small to hold the material as a result of bridging of the aperture by the material, supporting the capsule section in a filling position outside said wall with the open end of the section closely adjacent and alined with said aperture, applying a momentary blast of high-pressure gas to said material to force a quantity of material through said aperture and into the capsule section while air in the section is displaced through said open end and the material therein, and, after said blast has terminated, removing the capsule section from said filling position.

3. The method of dispensing powdered material into a capsule section having an open end and a closed end, said method comprising the steps of, supporting a body of the material in a chamber having a wall with a dispensing aperture therein sufficiently small to hold the material as a result of bridging of the aperture by the material, supporting the capsule section in a filling position outside said wall with the open end of the capsule adjacent and alined with said aperture, applying a pressure impact to said body of material to jolt the latter and force a quantity of material through said aperture and into the capsule section while the air in the section is displaced through said open end, and removing the capsule section from said filling position after termination of said impact.

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