United States Patent [19]

Stewart

[11] **3,718,164**

[45] **Feb. 27, 1973**

[54] POWDER FEEDING DEVICE

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[22] Filed: **Nov. 17, 1971**

[21] Appl. No.: **199,757**

Related U.S. Application Data

[63] Continuation of Ser. No. 880,030, Nov. 26, 1969, abandoned.

[52] **U.S. Cl.** **141/1,** 141/129, 141/238

[51] **Int. Cl.**.....**B65b 1/04,** B65b 3/04

[58] **Field of Search**.....141/129–191, 234–248

[56] **References Cited**

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[57] **ABSTRACT**

A device for feeding a measured volume of powder into a receiver without alteration of the bulk density and suited to high production rate.

7 Claims, 4 Drawing Figures

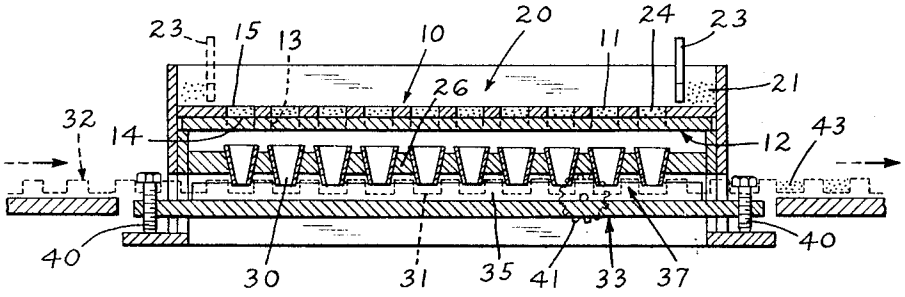


FIG. 1.

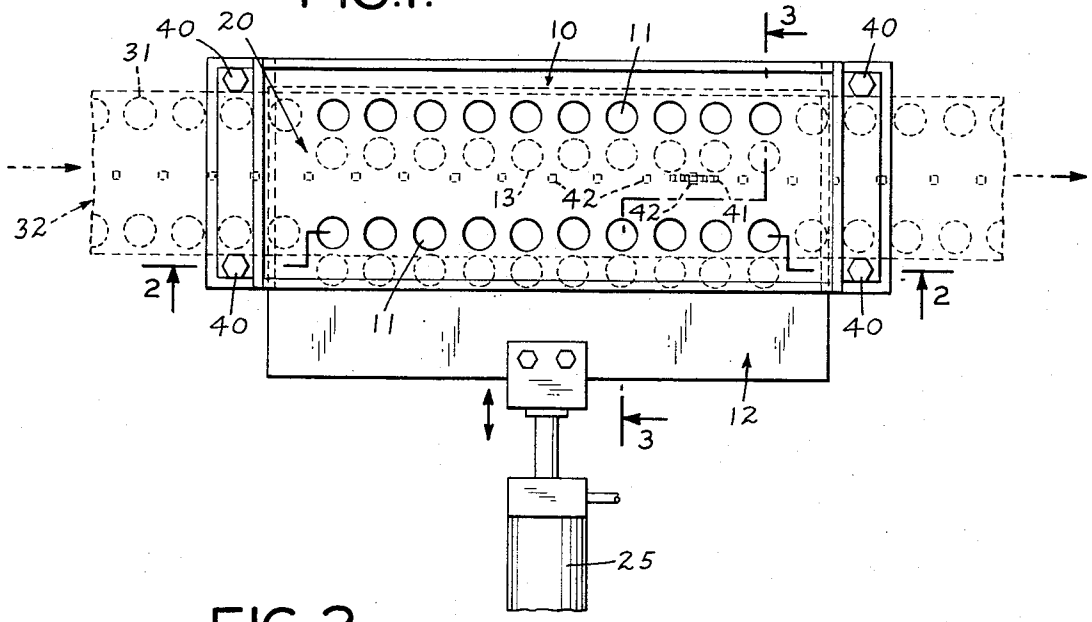


FIG. 2.

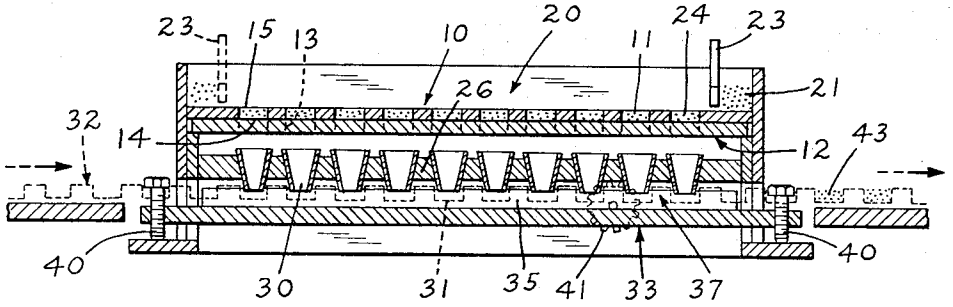


FIG. 3.

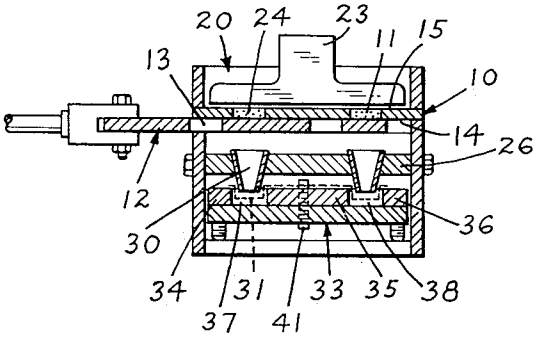
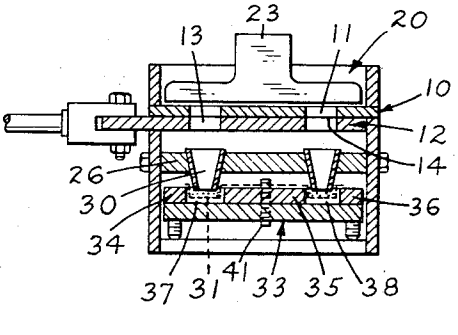


FIG. 4.



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POWDER FEEDING DEVICE

This is a continuation, of application Ser. No. 880,030, filed Nov. 26, 1969, now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to a device for feeding a measured volume of powder into a receiver and, in particular, to a volumetric powder feeding device which does not alter the bulk density of the powder being fed.

Introduction of a measured charge of powder into a receiver involves withdrawing a measured aliquot of the powder from a bulk supply and transferring it to the receiver. Various techniques and devices have been developed to make such transfer in commercial processes at high production rates, with an accurately measured and uniform volume being delivered in each instance. One example of such transfer is in the production of pharmaceutical capsules. Vacuum-pressure operated powder feeding devices are available in a variety of designs for this purpose. These devices are capable of metering the charge accurately but they change the bulk density and flow characteristics of the powder. Auger loaders, on the other hand, do not affect these characteristics of the powder, but they are incapable of metering the charge accurately. With increasing frequency, available powder feeding devices have been found to be incapable of meeting the requirements of special applications, such as the ability to charge a volume of powder without alteration of its bulk density. Devices available heretofore have not been able to transfer at a high production rate a uniform and accurately measured volume of powder without altering the bulk density characteristics thereof.

SUMMARY OF THE INVENTION

According to the instant invention, there is now provided a device for charging into a receiver a uniform and accurately measured volume of powder without alteration of the bulk density of the powder, which device is capable of filling the receivers at a high rate of production. This device comprises a horizontally disposed base plate having an upper feed surface and a lower surface, and a dispensing aperture extending therethrough with a volume equal to the volume of the powder to be charged into the receiver. Cooperating with the lower surface of the base plate is a means for alternately opening and sealing the lower extremity of the dispensing aperture. There are also provided a means for drawing the powder along the feed surface to introduce it into the dispensing aperture and means for adjusting the level of the introduced powder to the level of the feed surface. After introduction and adjustment of the level of the powder in the dispensing aperture, the lower extremity of the aperture is opened and the powder is charged into the receiver below without alteration of its bulk density characteristics.

The instant device is suited to filling receivers at a high rate of production by providing a plurality of dispensing apertures in the base plate and opening and closing means, powder drawing means, and level adjusting means cooperatively associated therewith.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the instant invention, reference is made to the accompanying drawings, wherein:

FIG. **1** is a top plan view of a powder feeding device of the instant invention with the doctoring blade not shown and the sliding plate in the closed position;

FIG. **2** is a sectional view of the embodiment of FIG. **1** along **2**—**2** with the doctoring blade shown;

FIG. **3** is a sectional view of the embodiment of FIG. **1** along **3**—**3** with the sliding plate in the closed position; and

FIG. **4** is a sectional view of the embodiment of FIG. **1** along **3**—**3** with the sliding plate in the open position.

DETAILED DESCRIPTION OF THE INVENTION

The powder feeding device of the instant invention enables one to charge a measured volume of powder into a receiver accurately, uniformly and without alteration of the bulk density characteristics of the powder. It is also suited to charging a large number of receivers simultaneously and is capable of production rates far in excess of volumetric powder feeding devices available heretofore, especially those which do not alter bulk density during the charging process. With reference to FIG. **1** wherein is illustrated a top plan view of a preferred embodiment of the instant device, there is provided a horizontally disposed base plate **10** through which a plurality of dispensing apertures **11** extend. The volume of apertures **11** equals the volume of powder to be charged. Mounted beneath base plate **10** is sliding plate **12**, which is in sealing engagement with lower surface **14** of base plate **10**. Associated with each dispensing aperture **11** is a passage **13** extending through sliding plate **12**, such that when sliding plate **12** is in the closed position (as illustrated in FIGS. **1**–**3**), passages **13** are each misaligned with their associated dispensing aperture **11** and when sliding plate **12** is in the open position (as illustrated in FIG. **4**) passages **13** are each aligned with their associated dispensing aperture **11**. With reference to FIG. **2**, sliding plate **12** engages the lower surface **14** of base plate **10** so as to seal the lower extremity of dispensing apertures **11** when in the closed position. The powder to be charged is maintained at one end of hopper **20** of which plate **10** forms the base. With sliding plate **12** in the closed position, powder **21** is drawn along the upper feed surface **15** of base plate **10** by means of doctoring blade **23** (which is actuated by reciprocating means not shown). Charges of powder **24** are thereby introduced into dispensing apertures **11** and made level with feed surface **21**. Sliding plate **12** is then moved to the open position, as illustrated in FIG. **4**, by hydraulic cylinder **25** so that passages **13** become aligned with their associated dispensing apertures **11** and the aliquots of powder are introduced through funnels **30** into the receivers **31** waiting below. The bulk density characteristics of the powder as introduced into the receivers do not vary substantially from those of the powder in the hopper.

Funnels **30**, interposed on fixed mounting plate **26** between the dispensing aperture in the base plate and the receiver, are included in a preferred embodiment of the instant invention to serve as a conduit for the powder being charged from the dispensing apertures **11**

into receivers 31. With the lower extremity of the funnels engaging the open neck of the awaiting receivers, funnels 30 thereby form a seal with receivers 31 and ensure delivery of the full amount of the measured volume of powder to receivers 31 and minimize contamination and impurities in the final product. It has been found that interposition of the funnel between the base plate and receiver does not affect the bulk density characteristics of the powder.

In practicing the instant invention, it is advantageous to provide receivers 31 as a plurality of properly positioned preformed blisters in an endless strip 32 of material such as polyethylene, polyvinyl chloride, sheet metal, etc. This strip 32 rests beneath funnels 30 on supporting member 33 which, in the illustrated embodiment, preferably consists of three individual supports 34, 35 and 36, positioned to form longitudinal channels 37 and 38 for the respective rows of receivers 31. Supporting member 33 is provided with leveling screws 40 to adjust its position with respect to funnels 30.

Between each cycle of the powder feeding operation, strip 32 is advanced by means of sprocket 41 engaging sprocket holes 42 to bring a new set of unfilled receivers into position beneath funnels 30 and to advance the previously filled receivers 43 out of the powder feeding device for further operations. Sprocket 41 is intermittently rotated by means not shown in timed relation with the operating cycle. If necessary, funnels 30 are disengaged from receivers 31 prior to advancing strip 32 and are then reengaged for the next cycle.

A variety of means can be provided for alternately opening and closing the lower extremity of the dispensing apertures, e.g., individual gates for each aperture mounted on the lower surface of the base plate, or a sliding plate as illustrated in the accompanying drawing. The latter means is especially preferred due to its suitability to increased production rates by increasing the number of passages therethrough corresponding to the increased number of dispensing apertures.

It is also preferred to provide a doctoring blade engaging the feed surface of the base plate as the means for drawing powder therealong and for adjusting the level of the powder in the dispensing apertures. By this single operation in combination with movement of the sliding plate between the open and closed positions, the instant device is able to deliver simultaneously to a great number of receivers the specified volume of powder without altering its bulk density.

It is a feature of the instant invention that it provides a method of feeding powder which is suited to either manual, semi-automated or fully automated operation and permits varied rate of operation without loss of efficiency. Additionally it is possible to expand the capacity of the powder feeding device as desired by increasing the number of dispensing apertures in the base plate. In contrast with other powder feeding devices, this expansion of capacity requires no increase in number of parts, either stationary or moving, nor any increase in complexity of operation.

What is claimed is:

1. A powder feeding device for simultaneously charging a measured volume of powder to a plurality of receivers at a high rate of production without alteration of the bulk density thereof which comprises:

a horizontally-disposed base plate having an upper feed surface and a lower surface, and a plurality of dispensing apertures extending therethrough, the volume of each of said apertures being equal to the volume of powder to be charged to each receiver;

a second plate mounted parallel to and in sealing engagement with the lower surface of said base plate, said second plate being slidable between an open and closed position and having a plurality of passages extending therethrough associated with said dispensing apertures, each of said passages being in alignment with its associated dispensing aperture in the open position and in misalignment therewith in the closed position;

a doctoring blade engaging said upper feed surface and movable therealong over the dispensing apertures;

a plurality of funnels associated with said dispensing apertures and mounted beneath said second plate, each of said funnels being interposed between its associated dispensing aperture and the receiver to be charged therefrom; and

a plurality of preformed blisters, formed in a movable endless strip, to provide a plurality of said receivers disposed beneath said funnels to remove said measured volume of powder.

2. The powder feeding device of claim 1 wherein said endless strip is advanced by a sprocket which engages sprocket holes provided on said endless strip.

3. The powder feeding device of claim 2 wherein said base plate has a longitudinal direction and a transverse direction, wherein said second plate is slidable across the transverse direction of said base plate and wherein said strip is movable in said longitudinal direction of said base plate.

4. The powder feeding device of claim 2 wherein said dispensing apertures are arranged in rows extending in a first direction along said base plate and extending therethrough, wherein said second plate is slidable in a direction transverse to said first direction and wherein said strip is movable in said first direction to advance said receivers towards said funnels for removal of said powder and to withdraw said receivers in said first direction after charging of said receivers.

5. The powder feeding device of claim 4 wherein said movable endless strip is supported by supporting means which comprise spaced individual supports positioned to form channels, extending in said first direction, for respective rows of receivers provided in said strip, and wherein adjusting means are provided to adjust the position of said supporting means with respect to said funnels.

6. A method of simultaneously charging a measured volume of powder from a base plate into a plurality of receivers at a high rate of production without altering the bulk density thereof, said base plate having an upper feed surface and a plurality of dispensing apertures extending therethrough, each of said apertures having a volume equal to the volume of powder to be charged, which method comprises:

sealing the lower extremity of each of said apertures;

drawing the powder over the feed surface of said base plate to introduce the powder into said aper-

tures and simultaneously adjusting the level of introduced powder to the level of said feed surface;

advancing a movable endless strip provided with a plurality of preformed blisters defining said receivers beneath said apertures;

opening the lower extremity of said apertures;

funneling the powder in each of said apertures into said receivers to be charged; and

removing said charged receivers from beneath said apertures by advancing said endless strip.

7. The method of claim 6 further comprising intermittently moving said endless strip in a longitudinal direction to position unfilled receivers beneath said apertures and intermittently moving said strip in said longitudinal direction after filling said unfilled receivers to remove said charged receivers and simultaneously advance a plurality of unfilled receivers to a position beneath said apertures, and wherein the lower extremity of said apertures is sealed by moving a sealing means in a first direction transverse to said longitudinal direction, and wherein the lower extremity of said apertures is opened by moving said sealing means in a direction opposite to said first direction and transverse to said longitudinal direction.

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