

[54] METHOD AND APPARATUS FOR FILLING TRAYS

[76] Inventor: **Borge Christian Andersen, Gullandsgade 35, Copenhagen, Denmark**

[22] Filed: **Aug. 10, 1970**

[21] Appl. No.: 62,599

[30] Foreign Application Priority Data

Aug. 8, 1969 Denmark.....4279/69

[52] U.S. Cl.141/12, 141/78, 198/59

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

[58] **Field of Search**.....141/12, 71-80,
141/129, 156-162; 198/220, 59

[56] **References Cited**
UNITED STATES PATENTS

354,634	12/1886	Grimm	141/12
868,605	10/1907	Heybach	141/12
2,010,220	8/1935	Cocks.....	141/78

Primary Examiner—Houston S. Bell, Jr.

Attorney—Ernest A. Greenside

[57] **ABSTRACT**

The invention relates to a method and apparatus for filling trays with discrete particulate material, particularly granulated freeze-drying goods. The method and apparatus are characterized in that the material is vibrated to fill the space between a tray for the material and cover plate for the tray.

6 Claims, 6 Drawing Figures

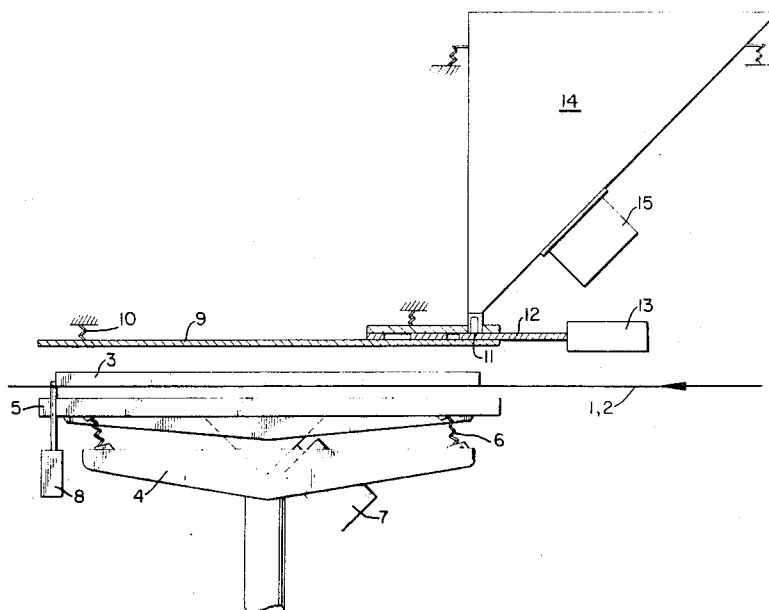


FIG. 3

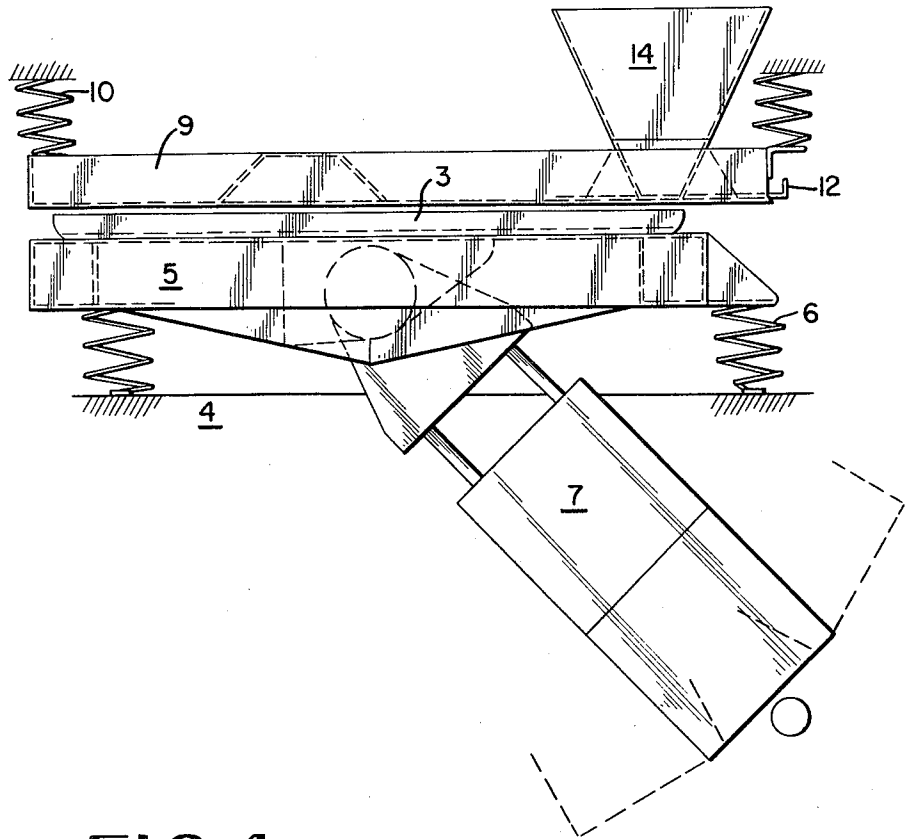


FIG. 4

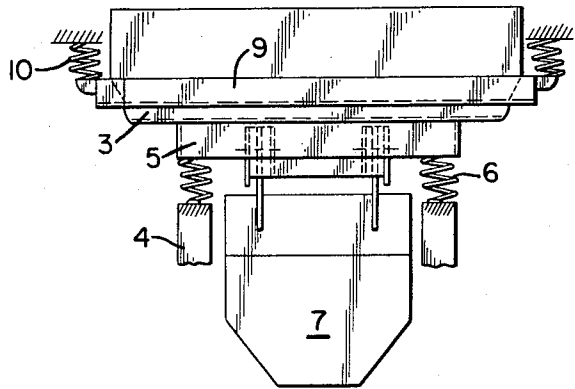


FIG.5

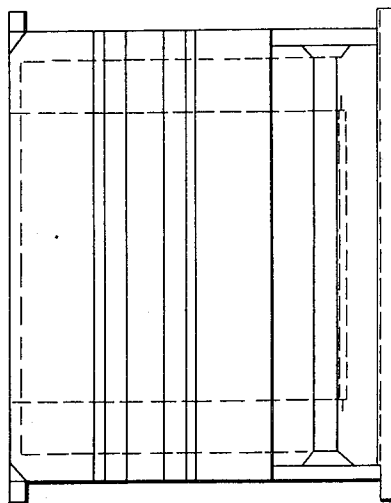
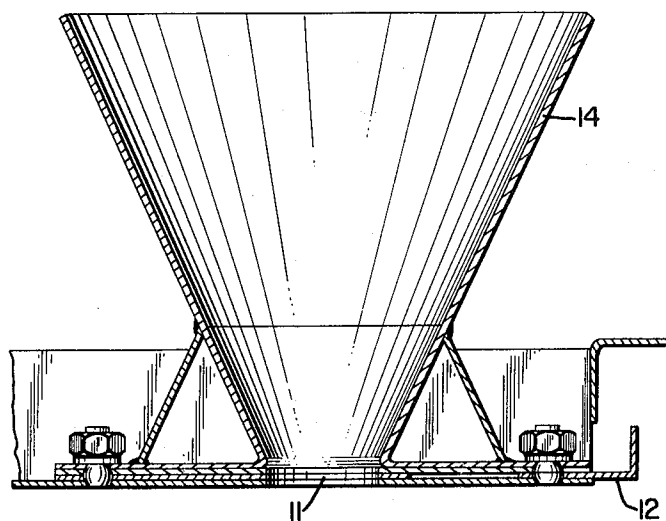


FIG.6



METHOD AND APPARATUS FOR FILLING TRAYS

The invention relates to a method for filling trays with discrete pieces of material, particularly granulated freeze-drying goods.

It is previously known to vibrate material with a view to obtaining a compact packing. With the previously known methods, however, it has not been possible to obtain a compact packing of the uppermost region of the particulate material, and therefore they are not suited for obtaining a compact packing of particulate material in a thin layer in trays.

The object of the invention is to devise a method as stated by means of which there may be obtained a compact packing of particulate material in a thin layer with even thickness in the trays. This is of particularly great importance when filling trays with granulated freeze-drying goods as thereby there is obtained a shorter heat transmission path and a better heat transmission during the subsequent freeze-drying process. As the transmission of heat into the material normally is the limiting factor for the freeze-drying process, this will considerably reduce the processing times and thereby afford a more economical process. Furthermore, a more uniform product is obtained by means of the freeze-drying process because the material is packed with a uniform degree of compactness.

The characterizing features of the method according to the invention are that the material is vibrated so as to fill out the space between the tray and a covering plate for the tray. It has turned out that a compact and uniform packing is obtained thereby.

The material may, according to the invention, be filled into tray along a lateral edge of the tray, and it may be subjected to transport vibration in a direction towards the opposite side of the tray, the filling process being continued until the tray is full up to the covering plate. The transport vibration is preferably carried out so intensely that the filling of the entire space between the tray's bottom and the covering plate takes place from the lateral edge opposite the filling place. Thereby there is obtained a rapid and uniform filling, and the method is suited for being executed entirely automatically.

The covering plate may, according to the invention, be maintained at a substantially constant distance from the tray's bottom. Thereby there will be formed a layer with a certain (constant) thickness every time.

The covering plate may, according to the invention, be spring loaded in a direction towards the tray's bottom. Thereby the covering plate can participate in the vibrations in an advantageous manner.

The vibrations may, according to the invention, be applied to the tray's bottom. Thereby an advantageously compact packing of the material is obtained.

Furthermore, the invention relates to an apparatus for carrying out the method, and the characterizing features of the apparatus are that it has a substantially horizontal support for a tray, members to exert transport vibrations on the bottom of the tray, a covering plate that is spring loaded downwards, a filling slit at one side of the tray and the covering plate, and a filling funnel arranged above the filling slit. Rapid, compact and uniform filling of a tray may be carried out by means of such apparatus.

The support may, according to the invention, consist of two parallel conveyor bands. Thereby trays may rapidly and easily be transported to and from a filling station where the vibration members act on the tray between the two conveyor bands, preferably through a table which can be moved up and down to lift a tray from the conveyor bands for filling and thereafter for lowering same down on these for being carried away.

The apparatus may, according to the invention, have a tray stop with a sensing means to be struck by a tray, and a slide gate arranged at the bottom of the filling funnel, the sensing means operating said gate in the opening direction. The sensing means may also operate the said table. Hereby an automatic operation of the apparatus may be obtained.

Two embodiments of an apparatus according to the invention are shown in the drawings, wherein

FIG. 1 schematically shows a vertical longitudinal section through an apparatus according to one embodiment,

FIG. 2 parts of the apparatus shown in FIG. 1, seen from above,

FIG. 3 a schematic lateral view of a second embodiment of the apparatus,

FIG. 4 same, seen in the longitudinal direction,

FIG. 5 same, seen from above, and

FIG. 6 a filling funnel and a slide gate for the apparatus shown in FIGS. 3-5, seen in a longitudinal section through the apparatus.

The apparatus shown in FIGS. 1 and 2 has two parallel conveyor bands for conveying rectangular trays 3 having a plane bottom plate and a circumferential lateral wall. The apparatus has a vibrator table with a lower portion 4, which by means of a mechanism, not shown, may be moved from a lower end position to an upper end position and back again, and an upper portion 5 which is supported by the lower portion 4 by means of obliquely arranged compression springs 6. The vibrator table 4, 5 is arranged between the two conveyor bands 1 and 2. On the upper portion 5 there is arranged a vibrator 7 which is designed to make the upper portion 5 perform oblique vibrations. The apparatus has a tray stop 8 to stop a tray 3 carried by the conveyor bands 1 and 2 in a position above the vibrator table 4, 5.

Above the vibrator table 4, 5 there is arranged a covering plate 9 which is loaded downwards by compression springs 10. In that end of the covering plate 9 which is arranged opposite the tray stop 8 there is made a filling slit 11 which is arranged near the end edge in question of the tray 3. Above the slit 11 there is arranged a slide gate 12 with a moving mechanism 13, and above that there is arranged a filling funnel 14 with a vibrator 15.

The tray stop 8 is movable between the shown tray stop position and a position, not shown, in which the tray 3 can pass by. Furthermore, it is provided with a sensing means, e.g. a small electric switch, to sense the carrying forward of a tray 3 against it. The sensing means may advantageously be designed to activate the mechanism mentioned for lifting the vibrator table 4, 5 when a tray strikes it. Thereby the upper edge of the tray 3 is brought into resilient abutment against the covering plate 9. The sensing means may furthermore advantageously be designed to activate the vibrator 7,

which, however, possibly may be operative all the time while the apparatus is operative, and to activate the mechanism 13 for opening the slide gate 12. Thereby the granulated freeze-drying goods in the funnel 14 will trickle down into the tray 3 where it by means of the oblique vibrations is led in the direction towards the tray edge near the tray stop 8. At this point the goods cannot go any further and it will accumulate up against the edge of the tray and will abut the covering plate 9. The tray 3 is filled in this manner from the edge mentioned and progressing towards the opposite end edge at the slit 11. When the tray thus has been filled with goods which is deposited uniformly compact from the bottom of the tray to the covering plate, the slide gate 12 is closed, the vibrator table 4, 5 is lowered so that the tray 3 again will rest on the conveyor bands 1 and 2, and the tray stop is brought into the position mentioned in which it allows passage of the tray. The tray 3 will then be carried away by the conveyor bands 1 and 2, to the left in FIGS. 1 and 2. These operations may possibly be controlled by a timer mechanism which is activated by the sensing means.

The apparatus shown in FIGS. 3-6 corresponds substantially to the apparatus shown in FIGS. 1 and 2. The springs 6 are vertical in this case. The vibrator 7 can be set in different angular positions as indicated by dotted lines, whereby there may be obtained an adjustment of the relation between the transporting effect and the compacting effect of the vibrations.

The shown and described embodiments are only to be considered by way of example, as different variations are conceivable within the scope of the invention. The compacting may possibly take place under the forward transport of the trays, a number of plates 5 with vibrator being moved forward by an endless conveyor. The vibrator 15 on the funnel 14 may be replaced by or be supplemented by mixer means which are arranged in the funnel. In the embodiments shown the covering plate 9 presses against the upper edge of the tray 3. However, an embodiment is conceivable in which the covering plate is designed to fit down into the tray, being a tight fit with the inner side of the circumferential wall. In this case the trays may possibly be carried forward in filled condition and with a moderately

even surface to the vibrator apparatus where the covering plate 9 is lowered into the tray, and the vibrator is started. Thereby the material will compact, and the covering plate will sink slightly corresponding to the compaction.

What I claim is:

1. A method for filling a tray with discrete particles, particularly granulated freeze-dried materials, characterized in that the material is charged into a tray along one side edge of the tray and that the material is subjected to transport vibration in a direction towards the opposite side of the tray, the charging of said particles being continued until the tray is substantially full to the covering plate from said other side to said one side of said tray.

2. A method according to claim 1, characterized in that the covering plate is maintained at a substantially constant distance from the tray's bottom.

3. A method according to claim 1, characterized in that the covering plate is spring loaded in a direction towards the bottom of the tray.

4. A method according to claim 1, characterized in that the vibrations are applied to the tray's bottom.

5. An apparatus for filling a tray with discrete particles, particularly granulated freeze-dried materials, comprising a tray, a substantially horizontal support for said tray, a covering plate spaced from and above said tray when said tray is predeterminedly positioned on said support and being downwardly spring urged toward said tray, a discrete particle material filling slit at one side of the tray and the covering plate, a charging funnel above the filling slit for charging said material into said tray along one side edge thereof, means for subjecting said material to transport vibrations in a direction toward the opposite side of the tray, a tray stop with a sensing means adapted to be engaged by said tray, and a slide gate at the bottom of the charging funnel, the sensing means operating said gate in the opening direction until said tray is substantially full to the covering plate from said other side to said one side thereof.

6. An apparatus according to claim 5, characterized in that the support consists of two parallel conveyor bands.

* * * * *

50

55

60

65