United States Patent [19]

Henry

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[54] ROTARY VOLUMETRIC DISPENSING APPARATUS

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[52] **U.S. Cl.**.....**222/64**, 222/267

[51] **Int. Cl.**.....**G01f 11/00**

[58] **Field of Search**....222/352, 64, 55, 56, 170, 367, 222/346, 271, 308, 267, 163, 291, 254, 305, 370, 268, 168.5; 141/144, 145; 221/265, 241

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[57] **ABSTRACT**

A volumetric dispensing apparatus is disclosed wherein a dispensing head having a plurality of fill cavities formed around the periphery is mounted within an annular cavity housing concentric with the head and forming the outer peripheral side of the cavities. An inclined bottom is provided for each cavity and a lateral discharge opening in the housing allows sequential release of the measured batches from the fill cavities. Draft is provided along the side surfaces to provide an enlarged top fill opening and an enlarged lateral discharge side to prevent bridging of product and to promote clean release of the batch. The dispensing head is mounted on a column and is adapted for easy removal for cleaning. An annular collar supports the cavity bottoms for simultaneous adjustment by a central jackscrew device. A rotary wiper removes the loose material from the bottom of the cavity housing and deposits the same through a receiving opening. A product limiting fence extends across a bowl-type hopper mounted on the top of the dispensing head; said fence dividing the hopper into fill and discharge sections. Conveyor means is provided to feed product into the hopper at a fill point whereat the empty fill cavity emerges under the fence. A centrally located cone urges the product radially outward and handle means at the apex of the cone facilitates the dispensing head removal for cleaning. A control arrangement is provided for the feed conveyor whereby the speed of the conveyor is increased upon detecting a thinning out of product and decreased to a normal level upon detecting a proper level of product in the hopper. The detecting finger is mounted substantially at the midpoint between the fill point of the fill section and the wiping point to sense the approximate middle of the spiral wedge of product formed by rotation of the dispensing head.

29 Claims, 7 Drawing Figures

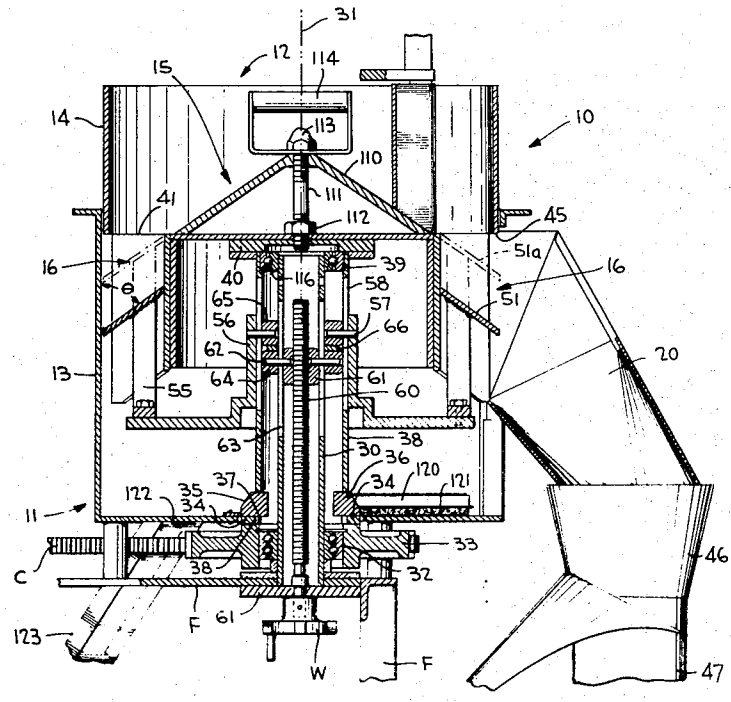

FIG. 1

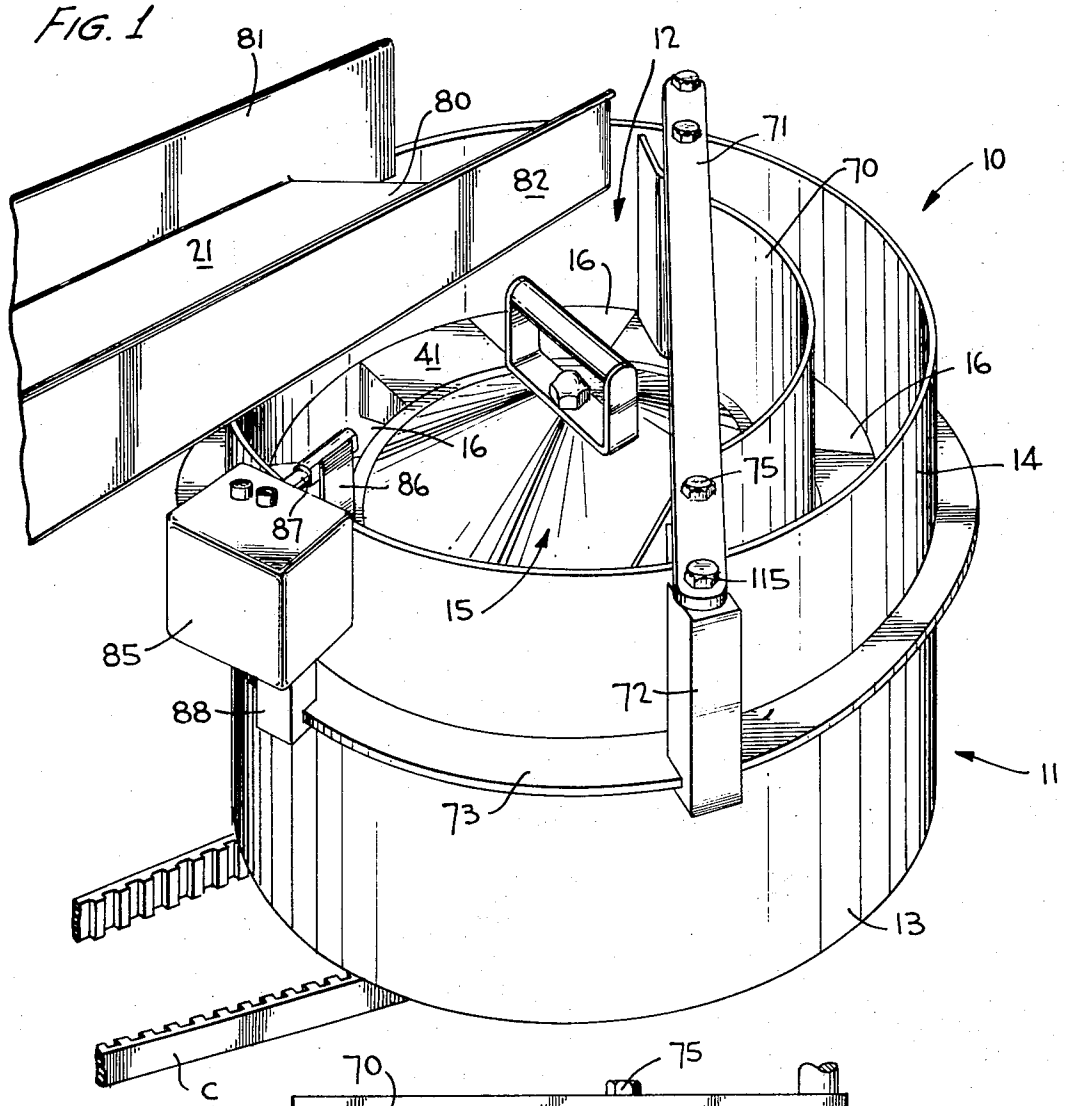

FIG. 4

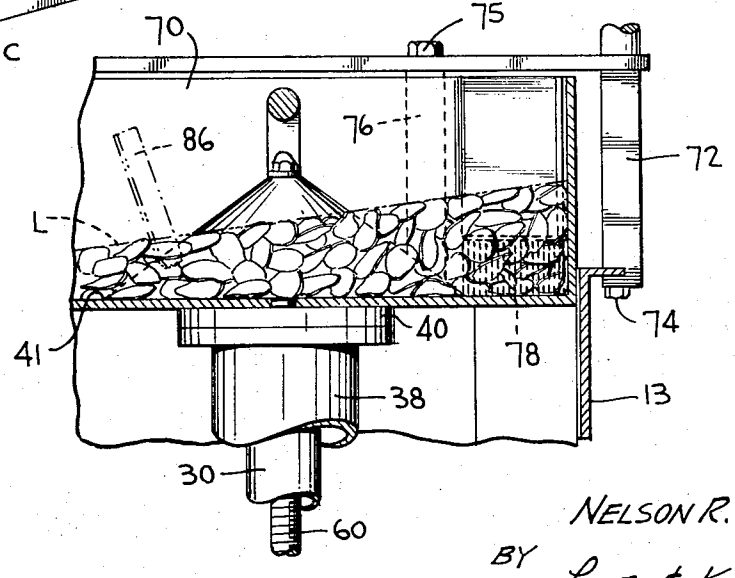

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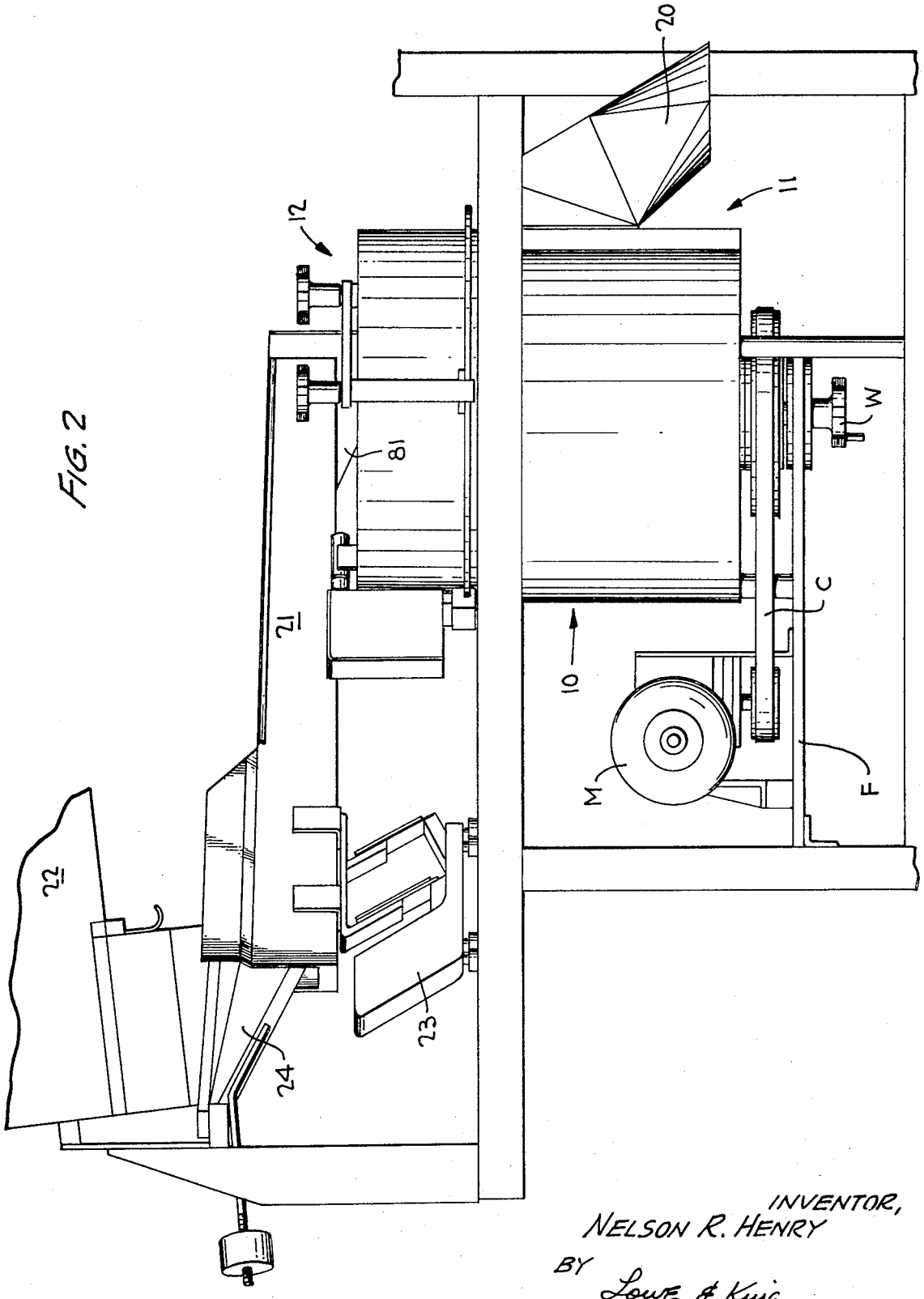
FIG. 2



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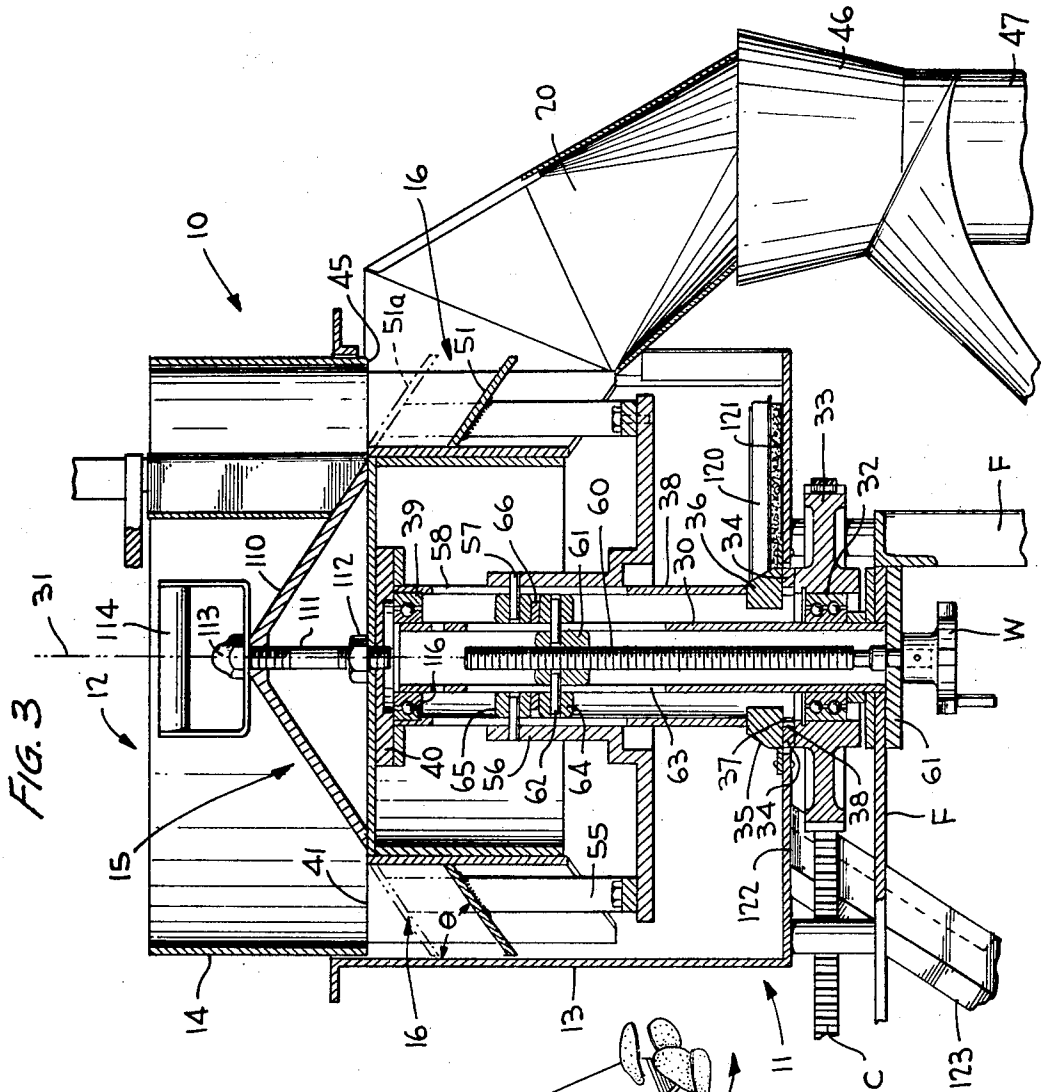

FIG. 3

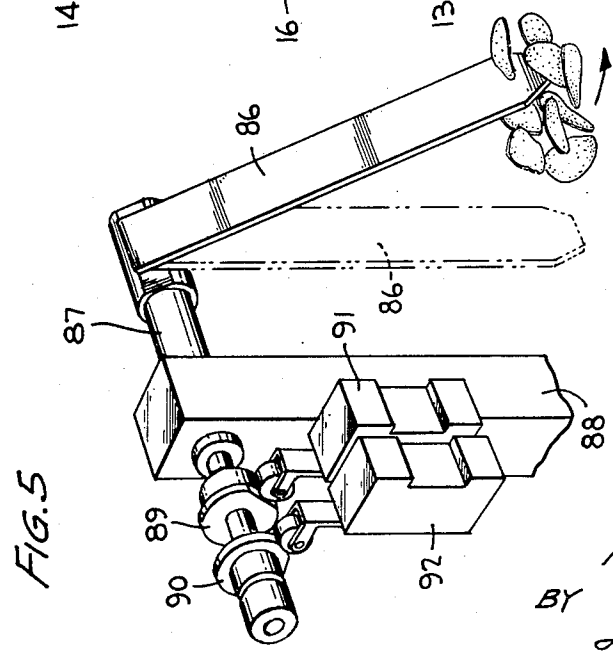

FIG. 5

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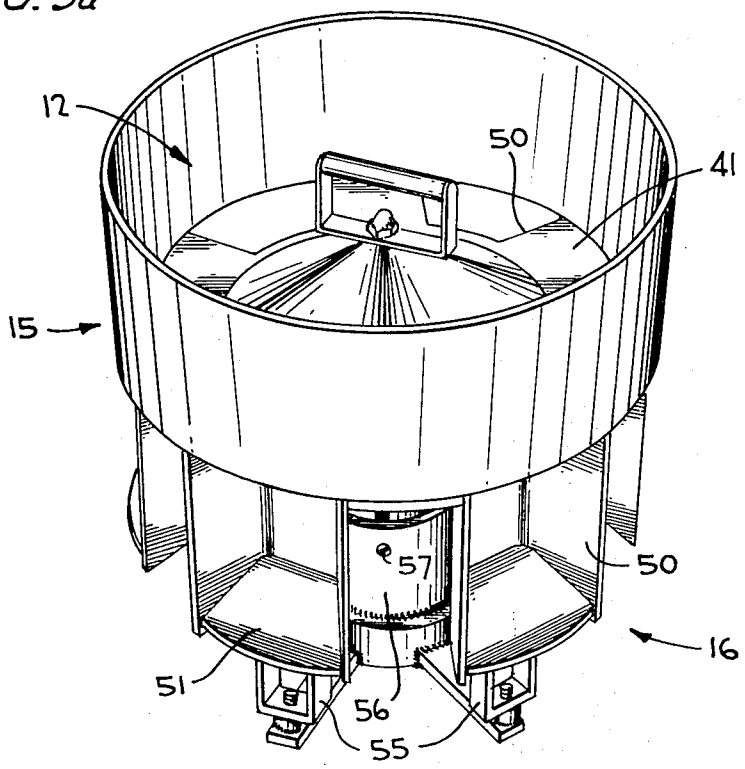
FIG. 3a



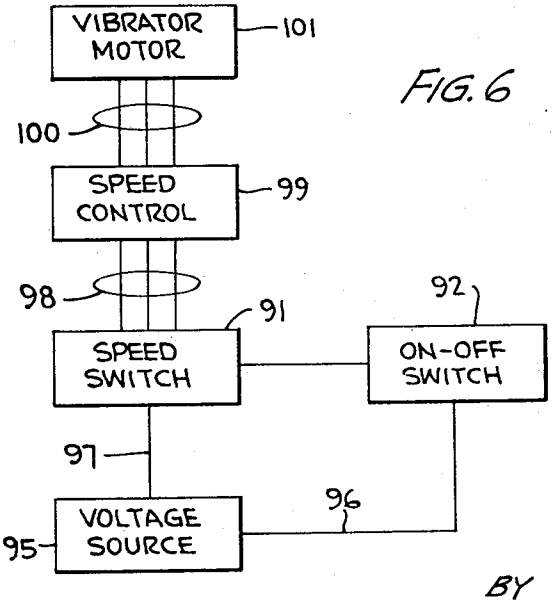


FIG. 6

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ROTARY VOLUMETRIC DISPENSING APPARATUS

The present invention relates to dispensing apparatus and, more particularly, to an apparatus for dispensing flowable solid product in volumetrically measured batches.

BACKGROUND OF THE INVENTION

In packaging machinery, the single most important function for obtaining maximum efficiency of the operation and maximum satisfaction of the ultimate custom of the package, is the rapid measurement of the product, whether liquid or flowable solid product, into an accurate quantity for each package. The quantity is usually determined by weight or volume of the product. Solid food products are normally sold in packages according to the weight of the contents. Heretofore, the majority of packaging machines for flowable solid products, especially of the food type, such as snack foods, candies, nuts, frozen vegetables, have been required to be weighed on a scale in order to get the requisite accuracy. However, to properly control the feeding conveyor for the weighing pan, sophisticated and relatively expensive electronic controls are needed. These controls are needed, for example, to properly regulate the flow of the product to a steady stream and to adjust the tare of the scale to compensate for a buildup of product residue. In addition to requiring expensive electronics, the weighing operation is considerably slower than the portion of the packaging machine forming the packages. In fact, with recent technological advances in package forming, the time gap between weighing and package forming has widened.

It has been proposed to utilize volumetric dispensing apparatus for flowable solid product in high speed packaging machines to bring the measurement step up to par with the package forming operation. With many types of products having substantially regular pieces, such as certain frozen vegetables, candy and peanuts, volumetric feeding has been somewhat successful in the past in establishing batches with a constant number of pieces and thus with accurate weights. However, with other products, such as frozen vegetables with irregular pieces, corn chips and other snack foods and where accurate count and weight are required, success in volumetric dispensing has been sorely lacking. The previous devices of which I am aware, in addition to not giving accurate weights per batch, have suffered from such shortcomings as: (1) limitation to adjustment of the fill cavities or trap chambers by ratio of two to one, (2) tendency of product to bridge across the trap chamber, (3) tendency of the product to spread out when released rather than to remain in a compact batch form, (4) the inability to clean the apparatus by a simple procedure, and (5) lack of an arrangement to effectively control the product in the filling hopper to assure complete filling of the trap chambers.

OBJECTIVES OF THE INVENTION

Accordingly, it is one object of the present invention to provide a volumetric dispensing apparatus designed to alleviate the above-identified problems of prior attempts, and thereby to provide an improved volumetric dispensing apparatus capable of use with a wide variety of products on modern package forming equipment.

It is another object of the present invention to provide a volumetric dispensing apparatus including a rotary dispensing head having fill cavities or trap chambers that have enlarged top fill openings and enlarged lateral side discharge openings for quick fill and release of the batch of product, respectively, to provide increased efficiency of operation.

It is another object of the present invention to provide a dispensing head mounted on a vertical column or pedestal, which head may be easily removed for cleaning by simply lifting the head from the cavity housing.

It is still another object of the present invention to provide a system for adjustment of the fill cavities by vertical movement of the cavity bottoms over a wide range of adjustment and which cavity bottoms are inclined downwardly to assist in rapid batch discharge.

It is still another object of the present invention to provide a control for the feeder conveyor that deposits product into the fill hopper to maintain a substantially wedge-shaped layer of product in the hopper to assure against starving of the fill cavities.

BRIEF DESCRIPTION OF THE PREFERRED EMBODIMENT

The volumetric dispensing apparatus of the present invention comprises a rotary dispensing head having a plurality of fill cavities or trap chambers positioned around the periphery thereof with an annular cavity housing concentric with the dispensing head forming the outer peripheral side of the cavities. The dispensing head is preferably supported on a vertical support column or pedestal extending concentrically with the dispensing head and cavity housing. Drive means is provided to rotate the dispensing head relative to the housing to bring each cavity in sequence to a lateral discharge opening in said housing for releasing the batches one at a time, which batches in turn are deposited in the packages being formed. The adjustable bottom of each cavity is inclined downwardly and outwardly at an acute angle with respect to the housing. Thus, when the side discharge opening of the cavity is uncovered, the batch of product is rapidly discharged across the full outer peripheral side, and by sliding action of said product along the bottom and laterally away from the dispensing head. In addition, the cavity is provided with draft to not only provide an enlarged lateral discharge side for cleaner discharge, but also to provide an enlarged top fill opening for more efficient filling. This novel design of the fill cavity also assures against bridging of the product in the fill cavity, as has been a problem in the past, thus giving accurate weights in each batch.

An open, bowl-type hopper is positioned on top of the dispensing head. A product limiting fence extends transversely of the hopper in wiping relationship to the top fill openings of the cavities and thereby divides the hopper into fill and discharge sections. The feeder conveyor is positioned so as to release the incoming product directly over each fill cavity as it emerges under the fence from the discharge section. This arrangement gives maximum fill time for the trap chambers since the fill section extends around substantially 200° of the hopper and thereby permits sufficient time as the dispensing head rotates to complete the filling of each chamber.

At the bottom of the housing, the rotary drive means is provided with a quick-disconnect coupling for connecting the hub of the dispensing head for rotation thereof. At the top, the rotary bearing provided for lateral stabilization of the head merely slips over the top of the column, also for quick removal. The filling hopper is attached to the top of the dispensing head for rotation and removal therewith. Thus, when it is desired to clean the apparatus, all that needs to be done is detach the product limiting fence, and the control switch unit as will be discussed later, and then without a need to unscrew or uncouple any parts, simply raise the dispensing head from the cavity housing. As this is done, the cavity bottoms are released to their lowermost position and the interior of the cavity housing is completely exposed so that the entire apparatus may be cleaned with ease.

The cavity bottoms are adjustably supported by a support collar carried for rotation by the dispensing head. The collar is held in the properly adjusted position by a jackscrew device with a coupling, providing for relative rotation, interposed between. A rotating wiper is provided in the bottom of the cavity housing for removal of loose product to be discharged through a waste-receiving opening in the housing. A cone centrally located in the hopper directs the product radially outwardly and a convenient handle means is provided on top of the cone to allow simple and easy removal of the dispensing head as described above.

The feeder conveyor for filling product into the hopper is controlled between low and fast feed rates by a switch responsive to the position of a feeler finger extending into the hopper. The dispensing head upon rotation is designed to cause the product in the hopper to substantially assume the shape of a spiral wedge, said wedge extending from a minimum thickness at the fill point to a maximum thickness at the wiping point where the product backs up against the fence. In accordance with the invention, the sensing finger is positioned substantially at the midpoint of the spiral wedge whereby the wedge is maintained without thinning out adjacent the fill point that would tend to starve the cavities, and without overflowing at the wiping point. In operation, the conveyor is speeded up when the feeler finger is substantially in the vertical position indicating a need for additional product and is slowed down to a normal speed when the finger is pivoted more toward the horizontal indicating a proper amount of product in the hopper. A second control switch also responsive to the feeler finger is normally in the on position but moved to the off position to completely turn off the conveyor motor upon further pivoting of the finger toward a horizontal position thereby indicating an excess of product and that overflow of the hopper is imminent.

Still other objects and advantages of the present invention will become readily apparent to those skilled in this art from the following detailed description, wherein I have shown and described only the preferred embodiment of the invention, simply by way of illustration of the best mode contemplated by me of carrying out my invention. As will be realized, the invention is capable of other and different embodiments, and its several details are capable of modification in various obvious respects, all without departing from the invention. Accordingly, the drawings and description are to be regarded as illustrative in nature, and not as restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a preferred embodiment of the volumetric dispensing apparatus of the present invention;

FIG. 2 is a side view of the volumetric dispensing apparatus of FIG. 1 mounted in the framework of a packaging machine and including a showing of the feeder conveyor system for filling the hopper;

FIG. 3 is a cross-sectional view taken through the middle of the dispensing apparatus of FIG. 1;

FIG. 3A is a perspective view of the dispensing head removed for cleaning;

FIG. 4 is a cross-sectional view taken along line 4—4 of FIG. 1, showing the formation of a spiral wedge-shaped supply of product in the fill hopper;

FIG. 5 is a detailed view of the feeler finger and control switches for the feeder conveyor operated in conjunction with the level of product in the hopper; and

FIG. 6 is a schematic diagram of a control arrangement to assure maintenance of a proper level of product in the hopper.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT OF THE INVENTION

With reference now to FIG. 1, there is shown in a perspective view a volumetric dispensing apparatus **10** constructed in accordance with the principles of the present invention. As shown in this figure, and in FIG. 3, the dispensing apparatus **10** is divided into two major operating units consisting of a lower dispensing unit generally designated by the reference numeral **11**, and an upper bowl-like hopper unit, generally designated by the reference numeral **12**. The dispensing unit **11** is formed by and housed in an annular cavity housing **13** and the hopper **12** is formed by an annular wall **14**. Positioned inside the cavity housing **13** is a dispensing head, generally designated by the reference numeral **15**, as shown in FIGS. 3 and 3A. Positioned around the periphery of the head **15** is a plurality of fill cavities or trap chambers **16** that are designed in a particular way to give improved efficiency of operation through improved filling and discharge action, as will be explained presently.

The volumetric dispensing apparatus **10** is mounted on a frame F, which may be a portion of the framework of a conventional form and fill packaging machine; although it is to be understood that the invention is not to be limited to this type of packaging environment. Extending laterally from the volumetric dispensing apparatus **10** (see FIG. 3) is a discharge chute **20** to receive the measured batches of material being dispensed. Positioned above the hopper **12** is a secondary feeder conveyor or vibratory feeder pan **21** that serves to convey the product into the hopper **12** from an overhead storage bin or primary conveyor **22**. A power means in the form of a vibrating motor unit **23** carries the feeder pan **21** in the usual manner and sets on horizontal skirting of the framework. A conventional regulatory spade **24** controls the amount of product being fed from the primary conveyor **22** by operating a switch that controls the vibrating motor

(not shown) of the conveyor 22 in a conventional manner. Suffice it to say, that as the product is fed from the conveyor 22 to the entrance of the feeder pan 21 (left-hand end in FIG. 2), the spade 24 is positioned in accordance with the weight of the product, which positioning in turn controls the vibratory feeding action.

Referring once again now to FIG. 3, the frame F is shown to also serve as a support for a vertical support column 30, extending concentrically with the cavity housing 13 and the dispensing head 15. This column or pedestal 30 serves as a central support for the dispensing head 15 and allows the same to rotate about the central axis, designated by the reference numeral 31. To provide for such rotation, adjacent the base of the column 30 is located a double roller bearing 32 supporting a driving wheel 33 which is driven by a chain belt C. Fixed to the wheel 33 and supported thereby is a drive collar 34 and fixed to the top of said collar is a pair of spaced, upstanding keys 35, 36. As shown in FIG. 3, the drive collar 34 has an inner diameter less than the inner diameter of the drive wheel 33, thus providing an annular shoulder 37 on the top of the drive wheel 33, which is in turn adapted to receive the lower end of a hollow hub 38 of the dispensing head 15. The keys 35, 36 extend into open-ended slots in the bottom of the hub 38 and thus provide a driving relationship to said hub 38 by way of the drive collar 34. At the upper end of the hub 38, there is carried (by internal shoulder on the hub) a roller bearing 39 which spaces the hub 38 from the central column 30 and thus provides lateral stability for the dispensing head 15. The upper end of the hub 38 is secured to a central reinforcing plate assembly 40 of the head 15. An annular plate 41 (see FIGS. 1, 4 and 3A) forms the top of the dispensing head 15, or the bottom of the fill hopper 12. The annular wall 14 forming the hopper 12 is fixed to the outer periphery of the plate 41 so that the hopper rotates and is removable with the dispensing head 15 as a single unit.

It can now be seen that upon rotation of the drive wheel 33 in response to operation of motor M (FIG. 2) the dispensing head 15 is rotated in the counterclockwise direction as viewed in FIG. 1, so as to sequentially bring the fill cavities 16 into alignment with a lateral discharge opening 45 formed in the annular cavity housing 13 (see FIG. 3). When each cavity 16 is aligned with the opening 45, the measured batch of product held therein is released through the opening and projected laterally away from the head 15 and into the discharge chute 20. The batch immediately passes into fill tube 46 which discharges into the mouth of the formed packaging tube on the tube former 47. As mentioned above, the tube forming, settling of the product in the tube and the sealing of the tube, both longitudinally and transversely, are performed in a rapid fashion in modern machines. This requires the filling and discharging from the fill cavities 16 to be at a rapid rate and for which the dispensing head 15 and the fill cavities 16 are designed, as will now be described.

The design of the fill cavities 16 for allowing efficient filling and discharging can best be seen in FIG. 3A, in which the dispensing head 15 is shown removed from the housing 13. In this figure, it can be seen that the side surfaces 50 are formed so that the cavity has considerable draft. That is, the outer peripheral or open side of the cavity 16 is enlarged so as to provide a clean release of the batch during discharge through the lateral opening 45 in the cavity housing 13 (FIG. 3). The wide discharge opening design allows discharge of the batch as a whole with no restrictions that would cause "stringing out" of the product as it falls. With this arrangement, the top filling opening of the cavity 16 is also substantially enlarged to permit efficient accommodation of product with large and irregular pieces, such as corn chips, without bridging of the product.

An equally important design innovation in the cavities 16 is the inclined bottom 51. Specifically, the bottom 51 is slanted downwardly and outwardly at an acute angle with respect to the cavity housing 13, which angle is shown as angle θ on the left-hand side of FIG. 3. This angle θ is preferably within the range of 40°–60 which angle has been found to be advantageous in providing the cavities 16 with the fullness desired but without unduly restricted space at the juncture of the bottom 51 and the housing 13. The slanting bottom 51 also provides rapid discharge of the entire batch by gravitational sliding action of the bottom of the batch as it is laterally expelled as a whole from the fully open discharge side of the cavity. To improve the discharge characteristics and to limit loose residue buildup, the side surfaces 50 and the bottom 51 may be coated with Teflon or other type of low friction coating for this purpose.

According to another important aspect of the present invention, the bottom 51 is mounted for adjustment to vary the volume of the fill cavity 16. It is important to note that the ratio of volume change in the cavity 16 is on the order of 10:1, or about five times greater than the usual volumetric chamber that consists of interconnected telescoping tubes that discharge from the bottom. In other words, the volume wherein only the bottom 51 is moved vertically may be varied from an extreme upper position, shown by the dotted line outline 51a in FIG. 3, to a lowermost position wherein the volume is about ten times greater, as shown in FIG. 3A.

The mechanism by which the adjustment of the cavity bottoms 51 is made is of equal importance. Each bottom 51 is supported on a U-shaped standard 55 fixed to a spider-like support collar 56. The inside diameter of the collar 56 mates in siding engagement with the outer diameter of the rotating hub 38 and supporting pins 57 pass through longitudinal slots 58 in the hub 38 so that the support collar 56 is driven for rotation with the hub 38, and is capable of vertical sliding adjustment.

To provide for this adjustable movement, I have selected a jackscrew 60 mounted inside of the support column 30 and held in position by the frame F; the jackscrew 60 being operable in response to the turning of crank wheel W which is accessible from underneath the dispensing apparatus 10, as shown in FIG. 2. Threadably carried by the jackscrew 60 is a positioning nut 61, the outer periphery being in sliding engagement with the interior of the column 30. The nut 61 carries radially extending support pins 62 that extend through longitudinal slots 63 in the column 30 so that the pins are held against rotation, but adjustable in the direction of the central axis 31. A first support ring 64 is carried by the pins 62, which ring 64 is held in a level horizontal plane by means of its captive relationship between the stationary column 30 and the rotating hub 38. The

first ring 64 is, of course, also held against rotation since it is mounted on the pins 62 carried by the nut 61. A second ring 65 is positioned above the ring 64 and serves to carry the pins 57, and thus in turn carries the support collar 56 and the cavity bottoms 51. As will be remembered, these latter-mentioned parts rotate and accordingly the ring 65 rotates relative to the ring 64. Positioned between the two rings 64, 65 is a low friction thrust washer 66.

In operation, upon turning the crank wheel W, the nut 61, ring 64, thrust washer 66 and ring 65 move for adjustment of the cavity bottoms 51 into any position desired. Since there is a capability of relative rotation between the rings 64, 65 at all times, adjustment of the cavity bottoms 51 may be made even during the operation of the dispensing apparatus 10. It will be realized that the mechanism provided is compact and designed with simplicity in mind. Also, the parts on the dispensing head 15 are so designed to be positioned as close as possible to the central rotational axis 31 whereby the rotational mass is held to a minimum.

The hopper 12 is divided into a fill section, at the left-hand side of FIG. 1, and a discharge section at the right-hand side of FIG. 1. This division is accomplished by an upstanding fence 70 that extends transversely across the hopper 12, as best shown in this FIG. 1. The fence 70 is suspended in wiping engagement with the plate 41 forming the floor of the hopper 12 by a bridge 71 that extends over the top of said hopper. The ends of the bridge 71 are supported on posts 72 which are in turn attached to an annular rim 73 by a groove and lock bolt combination 74, as shown in FIG. 4. Suspension bolts 75 are threaded into enlarged portions 76 on the back side of the fence 70 (see FIG. 4) to hold the same in the required wiping position. Preferably, a wiping brush 78 may be provided along the lower edge of the fence 70, over the annular plate 41 and in the wiping position over the top of the cavities 16 (see FIG. 4). This brush has sufficient resiliency to allow product already trapped in the fill cavity 16 to pass underneath the fence 70 without excessive crushing or breakage. However, the bristles of the brush 78 have sufficient stiffness to brush off the excess from each batch to prevent overfilling of the cavities.

A suitable embodiment of the dispensing head 15 is one wherein six cavities 16 are provided around the periphery thereof. Preferably, the fill section of the hopper 12 is approximately twice as large as the discharge section. In other words, as shown in FIG. 1, the fill section extends over approximately 200°–260° of the circular hopper 12 whereas the discharge section is approximately 100°–160° thereof. With six fill cavities 16, this means that four are positioned at any one time in the fill section, whereas two are positioned in the discharge section. Since the dispensing head rotates in the counterclockwise direction as viewed in FIG. 1 and the feeder pan 21 discharges over the first cavity 16 that has emerged from under the fence 70, it will be realized the maximum fill time is gained for each cavity 16. Normally, the product dropping from the fill pan 21 is concentrated into the first cavity 16 at the fill point (adjacent the fence 70). If required, completion of the filling of each cavity is obtained as the hopper 12 rotates the additional approximately 220 degrees to the wiping point at the opposite end of the fence 70.

Additional features of the apparatus of the present invention tend to insure complete filling of each cavity 16 and thus to give accurate batch measurement. In this respect, the feeder pan 21 is provided with a discharge lip 80 that extends obliquely to the longitudinal axis of the pan 21. One side of the feeder pan 21, side 81, is positioned so as to extend substantially tangentially to the hopper wall 14. The inside wall 82 extends forward beyond the end of the wall 81 and terminates just short of the wall 14. As shown in FIG. 1, the bottom of the feeder pan 21 adjacent the inside wall 82 extends further so that the discharge lip discharges the product and directs the same toward the wall 14 of the hopper and directly into the first-appearing cavity 16 as previously pointed out. It will be noted that this arrangement further insures that the maximum fill time is allowed for each cavity 16 and that the surplus product around the remaining extent of the fill section is effective to top off each cavity to obtain a full load.

Advantageously, the surplus product in the hopper is in a substantial spiral wedge shape extending from a minimum thickness at the fill point (where the cavity 16 first emerges under the fence) to a maximum thickness at the wiping point (where the filled cavities move under the brush 78 into the discharge section). This approximate spiral wedge shape of the surplus product in the hopper is outlined in rough form in FIG. 4 with the imaginary line L representing the top of the surplus supply.

In order to keep this supply at the proper level, a sensor control unit 85 (FIG. 1) having a feeler finger 86 is positioned along the fill section of the hopper 12, as best shown in FIG. 1. The finger 86 is pivotally mounted by a control shaft 87 supported on a support post 88 (see FIG. 5, also). The post 88 is suitably attached to the rim 73 by any suitable means, such as the groove and locking bolt combination shown. The control shaft 87 has fixedly mounted thereon a pair of control cams 89, 90, each having a single depressed section to operate the control arms of speed control and on-off microswitches 91, 92, respectively.

A schematic diagram of the control circuit including the microswitches 91, 92 is shown in FIG. 6. A voltage source 95 is connected by lead 96 through the microswitch 92 to the microswitch 91. A second lead 97 completes the circuit to the microswitch 91, which is a three-pole switch, as represented by the leads 98. These leads are in turn connected to a conventional two-position speed control 99 that is wired through leads 100 to control vibrator motor 101 of the vibrator unit 23 for feeder pan 21.

Now, assuming a normal condition in the fill hopper 12, with the surplus supply in substantially a spiral wedge shape, as represented by the line L in FIG. 4, the feeler finger 86 will be positioned in the tilted, full line position of FIGS. 4 and 5. The recess of the cam 89 is thus positioned so as to place the speed control microswitch 91 in proper condition to operate the speed control 99 in the low or normal range. As long as the surplus supply remains substantially as shown assuring filling of the cavities 16, the feeler finger 86 remains in this position and the speed of the feeder pan 21 will remain in a normal steady flow. In the event that the supply in the hopper 12 is diminished by outside conditions, the feeler finger will be allowed to return to the

vertical position under the force of gravity whereby the cam **89** is rotated (in the clockwise direction as viewed from the left in FIG. **5**) to switch the microswitch **91** to the fast position and thereby activate the speed control **99** to the fast mode. The feed through the feeder pan **21** is immediately increased, the spade **24** causes an increase in feed from the main hopper **22** and the supply in the hopper **12** is soon brought back to normal, the finger **86** is pivoted from the vertical position back to the tilted, full-line position, thereby switching the feed back to normal. If the surplus supply in the hopper **12** should happen to increase by an excessive amount, for example where the feeder pan **21** is maintained in the fast mode through a greater number of cycles than usual, then the finger **86** will be lifted an additional amount toward the horizontal whereupon the recess on cam **90** is operative to switch the on-off microswitch **92** to the "off" position and thereby disable the circuit all together resulting in a shutdown of the vibrator unit **23** to prevent an overflow.

The feeler finger **86** is positioned at approximately the midpoint of the fill section of the hopper **12** for an important reason. The feeler finger **86** cannot be placed too close to the wiping point of the fence **70** since the higher backup at the fence would cause a premature shutdown of the vibrator unit **23** and thus a starving of the hopper at the fill point at the opposite end of the fence **70**. Conversely, if the finger **86** is positioned too far toward the thin portion of the wedge, that is at the fill point, then insufficient surplus supply is provided to top off the cavities **16**. Positioning the finger **86** at approximately 100°–160° counterclockwise around the circular hopper **12** from the fill point, maintains the spiral wedge of supply to prevent starving and overflowing in a unique manner.

The supply in the hopper is constantly urged toward the outer periphery of the hopper floor **41** and into the cavities **16** by a centrally located cone member **110**. Excess product backup at the wiping point is occasionally allowed to continue along the front of fence **70** to reenter the supply at the initial fill point.

The cone **110** is mounted on the head **15** by a stud **111** that is threadly engaged with the reinforcement plate assembly **40** and locked into position by lock nut **112**. A cap nut **113** attaches a handle **114** on the top of the cone **110** to assist in removal of the dispensing head **15**, as will now be described.

When it is desired to clean the dispensing apparatus **10**, the feeder pan **21** is pivoted away from its position over the hopper **12**. This is easily accomplished since the vibrator unit **23** that supports the feeder pan **21** is merely resting on the horizontal skirting or platform of the framework, as can be seen in FIG. **2**. The control unit **85** and the fence **70** are removed from over the hopper **12**. Then without removing any separate parts and without requiring any tools, the dispensing head **15** is simply lifted from its supported position within the housing **13** (compare FIGS. **3** and **3A**.). The bearing **39** is removed with the hub **38** because of shoulder **116** and the slots in the bottom of the hub **38** allow the lower end of the hub **38** to be removed.

As shown in FIG. **3A**, when the dispensing head **15** has been removed, the cavity bottoms **51** are lowered to their lowermost position to allow ease of cleaning of the complete cavities **16**. This is so since upon upward movement of the head **15**, the ring **65** allows the support collar **56** to drop until the pins **57** are caught at the bottom of the longitudinal slots **58**. Furthermore, with the dispensing head **15** completely removed, the full interior of the cavity housing **13** can be reached with ease for cleaning.

In order to maintain the bottom of the cavity housing **13** free from buildup of foreign particles and loose pieces of product that may escape the cavities along the sliding interface between the head **15** and the housing **13** during operation of the packaging machine, a wiper arm **120** with a wiper element **121** is attached to the drive collar **34** by any suitable means (not shown). Thus, upon rotation of the drive collar **34**, the wiper **120** is effective to remove the loose product. The wiper has a negative or trailing rake angle so that upon rotation the particles will be urged toward the outer periphery of the housing **13** and then deposited through a receiving opening **122** in the bottom of the housing **13** adjacent the outer periphery thereof. From here, the particles fall into a chute **123** for disposal.

The drive motor M preferably includes an electrically operated clutch and brake (not shown) so that the dispensing head **15** rotates in an intermittent fashion. Suitable control means for operating the motor M in synchronism with the package forming apparatus may be provided. That is to say that the clutch and brake may be of the conventional type wherein the drive wheel **33** is effectively rotated through a certain arcuate increment (in the present case, through 60°) in response to a cycle initiation switch mounted on the packaging machine and operated during each packaging cycle. The clutch is released and the brake operated in synchronism in response to a suitable stop cam mounted on the output shaft of the motor M at the end of each cycle. In other words, the stop cam operates a stop microswitch, which in turn properly deactivates the clutch and activates the brake after each 60° interval. In one embodiment, the radius of the cam may be selected so as to require two stop codes or indentations on the cam per revolution in order to obtain the 60° spacing between the stops of the dispensing head.

In view of the foregoing description of the invention and the attendant advantages of the preferred embodiment, it can be seen that an efficient volumetric dispensing apparatus **10** has been provided wherein the rapid and accurate filling and discharge operation is obtained as required by modern-day packaging machinery. The fill cavities **16** are advantageously designed to prevent bridging of product and to allow clean release of the batch as a whole through the enlarged discharge side of the cavity. The entire dispensing head **15** may be removed with a minimum of effort for cleaning. During operation, the feeler finger **86** is operative through two microswitches **91**, **92** to maintain a proper wedge-shaped supply of product in the hopper **12**.

In this disclosure, there is shown and described only the preferred embodiment of the invention, but, as aforementioned, it is to be understood that the invention is capable of use in various other combinations and environments and is capable of changes or modifications within the scope of the inventive concept as expressed herein.

I claim:

1. A volumetric dispensing apparatus for measured batch discharge of flowable solid product comprising a frame, a vertical support column on said frame, an annular cavity housing concentric with said column, a removable concentric dispensing head supported by said column with the outer periphery in juxtaposition with said housing, a plurality of fill cavities of substantially equal size formed around the periphery of said head, said housing serving to form the outer peripheral side of said cavities, an inclined bottom for each of said cavities slanted downwardly and outwardly at an acute angle with respect to said housing, common means cooperating with said support column for adjusting the vertical position of the bottom to simultaneously vary the volume of each cavity, means for filling said cavities through the top, a lateral discharge opening in said housing for releasing the batch held in one of the cavities at a time, means for relatively rotating said head with respect to said housing to sequentially align said cavities with said opening, whereby measured batches are sequentially released through said opening by sliding action of said product along said bottom and laterally away from said head.

2. The volumetric dispensing apparatus of claim 1 wherein each cavity is provided with draft along the side surfaces to provide an enlarged top fill opening and enlarged lateral discharge side, whereby bridging of product is avoided and clean release of the batch during discharge is attained.

3. The volumetric dispensing apparatus of claim 1 wherein said filling means comprises a hopper above said dispensing head for receipt of said product, a product limiting fence extending across said hopper in wiping relationship to the top fill openings of said cavities, said wiper serving to divide the hopper into fill and discharge sections, and conveyor means for feeding product to said fill section.

4. The volumetric dispensing apparatus of claim 3 wherein said conveyor means includes means to release said product substantially directly above each fill cavity in turn as it emerges from under said fence into the fill section, whereby maximum fill time is gained.

5. The volumetric dispensing apparatus of claim 4 wherein said conveyor means comprises an elongated feeder pan, means for vibrating said pan, and said release means includes a discharge lip substantially above the emerging fill cavity in the fill section.

6. The volumetric dispensing apparatus of claim 3 wherein is further provided brush means for wiping the top fill openings as they enter the discharge section, said brush means having sufficient resiliency to prevent crushing of said product in the top of said cavity.

7. The volumetric dispensing apparatus of claim 5 wherein one side of said feeder pan extends substantially tangentially to the outer wall of said annular hopper, said discharge lip extends obliquely to the longitudinal axis of said feeder pan, said pan being longer on the side toward the center of said hopper, whereby to direct said product toward said outer wall and concentrated into said fill cavity.

8. A volumetric dispensing apparatus for measured batch discharge of flowable solid product comprising a frame, a vertical support column mounted on said frame, an annular cavity housing concentric with said column, each of said cavities includes an inclined bottom slanted downwardly and outwardly at an acute angle with respect to said housing, means for adjusting the vertical position of the bottom of each cavity to vary the volume of the same, said means for adjusting including a common member connected to said bottoms and cooperating with said support column for simultaneous adjustment of all cavities, a removable concentric dispensing head supported by said column with the outer periphery in juxtaposition with said housing, a plurality of fill cavities of substantially equal size formed around the periphery of said head, said housing serving to form the outer peripheral side of said cavities, a lateral discharge opening in said housing, a hub for said dispensing head for rotatably supporting the same on said column, rotary drive means positioned adjacent said annular housing for said head for sequentially aligning said cavities with said opening to release the measured batches, and means for detachably connecting said hub to said column for support and to said rotary drive means, whereby said dispensing head may be removed as a whole from said annular housing for cleaning.

9. The volumetric dispensing apparatus of claim 8 wherein said connecting means includes bearing means between the column and said hub at the top to provide stability to said dispensing head, and wherein said drive means includes a drive collar, a driving wheel for supporting said collar, key means fixed to said collar and fitting into slots in said hub for imparting drive motion to said hub and thereby to said dispensing head, whereby said dispensing head may be lifted free of said drive means, said column and said annular housing by only lifting said dispensing head.

10. The volumetric dispensing apparatus of claim 9 further providing a mounting shoulder on said driving wheel, the end of said hub fitting within said collar and resting on said shoulder.

11. The volumetric dispensing apparatus of claim 8 wherein is further provided a bowl-type hopper on said dispensing head, said hopper including an annular outer wall fixed to said head and being rotatable and removable therewith.

12. The volumetric dispensing apparatus of claim 11 wherein is further provided a product limiting fence extending transversely across said hopper and dividing the same into fill and discharge sections, and means for suspending said fence with the lower edge in wiping engagement with said dispensing head whereby said product is retained in said fill section.

13. The volumetric dispensing apparatus of claim 12 wherein said means for supporting said fence includes an annular rim mounted on said annular cavity housing, support posts attached to said rim on opposite sides of said hopper, a bridge member extending above said hopper and supported on said posts, and means for attaching said fence to said bridge member for support.

14. The volumetric dispensing apparatus of claim 8 wherein is further provided a cone centrally located on the top of said dispensing head to urge the product radially outwardly into said fill cavities.

15. The volumetric dispensing apparatus of claim 14 wherein is provided handle means at the apex of said cone member for grasping of said dispensing head for removal as a whole from said annular cavity housing for cleaning.

16. The volumetric dispensing apparatus of claim 8 wherein said means for adjusting the bottom of each cavity further includes an adjustable jackscrew within said column, a traveling nut on said jackscrew for varying the vertical position upon rotation of said screw, said common member includes a common support collar around said hub for the cavity bottoms, and means to provide relative rotation between said nut and said support collar to allow rotation of said dispensing head.

17. The volumetric dispensing apparatus of claim 16 wherein said interconnection means includes an annular ring extending around said column inside said hub and attached to said nut for vertical adjustment, and a second ring extending around said column inside said hub and fixed to said support collar, said second ring being rotatably supported on top of said first ring.

18. The volumetric dispensing apparatus of claim 17 wherein is further provided a low friction thrust washer held captive between said first and second rings to permit ease of rotation of said dispensing head.

19. The volumetric dispensing apparatus of claim 16 wherein is provided pin means extending from said second ring to said support collar, and elongated slots in said hub extending in the direction of adjustment receiving said pin means and being operative to impart rotation from said hub to said support collar.

20. The volumetric dispensing apparatus of claim 19 wherein the slots in said hub are sufficiently long to permit full adjustment of said cavity bottoms, said pin means being movable to the bottom of said slots under the weight of gravity of said support collar and said bottoms upon removal of said dispensing head, whereby said support collar and said bottoms are extended to the lower limit of said cavities to expedite cleaning.

21. The volumetric dispensing apparatus of claim 16 wherein said support collar includes radial arms extending outwardly therefrom, upstanding posts on said arms connected to individual ones of said cavity bottoms, whereby adjustment of said collar simultaneously effects equal adjustment of all of said cavity bottoms.

22. The volumetric dispensing apparatus of claim 8 wherein is further provided a rotary wiper extending along the bottom of said cavity housing and having a negative rake angle to pick up excess product and loose material as said head rotates and direct the same toward the outer periphery of said housing, and a peripheral opening in the bottom of said housing for receiving the excess product and loose material collected by said rotating wiper to thereby prevent buildup of product in said housing.

23. A volumetric dispensing apparatus for measured batch discharge of flowable solid product comprising an open bowl-type hopper, a rotary dispensing head supporting said hopper and including a plurality of fill cavities formed around the periphery, an annular cavity housing concentric with said dispensing head and serving to form the outer peripheral side of said cavities, product limiting fence means for dividing said hopper into fill and discharge sections, conveyor means for feeding product into said hopper to fill the cavities with product to form the batches, power means for said conveyor, control means for said power means for changing the speed of said conveyor, finger means extending down into said hopper to operate said control means in response to the level of product resting in said hopper, means for rotating said dispensing head to cause the product in said hopper to substantially assume a spiral wedge, said wedge extending from a minimum thickness at the fill point of said fill section to a maximum thickness at the wiping point where the fence levels the top of each fill cavity, said finger means being positioned substantially at the midpoint of said spiral wedge whereby said wedge is maintained without thin spots adjacent the fill point and without overflowing at the wiping point.

24. The volumetric dispensing apparatus and conveyor combination claimed in claim 23 wherein said control means includes switch means for operating said conveyor on at least two selected speeds, said conveyor being speeded up when said finger is in a substantially vertical position indicating a tendency of product to thin out and said conveyor being slowed down when said finger is pivoted toward the horizontal indicating the proper amount of product in said hopper.

25. The volumetric dispensing apparatus and feeding conveyor claimed in claim 24 wherein is further provided an on-off switch means responsive to the movement of said finger, said switch normally being in the "on" position and switched to the "off" position in response to a further pivoting of said finger toward a horizontal position indicating an excess of product in said hopper.

26. A volumetric dispensing head for measured batch discharge of flowable solid product for use with a companion base comprising an annular plate forming the top of said head, a plurality of cavities of substantially equal size formed around said plate having top fill openings in said plate, said cavities having the full outer peripheral side open for discharge, and an adjustable bottom for each cavity, said bottoms slanting outwardly for full discharge by sliding action of said product and means for adjusting said bottoms to vary the capacity of said cavities including a common member for simultaneous adjustment of all cavities, said discharge head including said common member being removable as a unit from said base to facilitate cleaning.

27. The head of claim 26 wherein is further provided a bowl-type hopper on said dispensing head, said hopper including an annular outer wall fixed to said head and being rotatable and removable therewith.

28. The head of claim 26 wherein each cavity is provided with draft along the side surfaces to provide an enlarged top fill opening and enlarged lateral discharge side, whereby bridging of product is avoided and clean release of the batch during discharge is attained.

29. The discharge head of claim 26 wherein said common member is free to move to the lowermost cavity forming position when said head is disengaged from said base.

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