June 8, 1965 B. M. CORDES 3,188,146

AUTOMATIC GRANULES DISPENSER

Filed Aug. 9, 1963 2 Sheets-Sheet 1

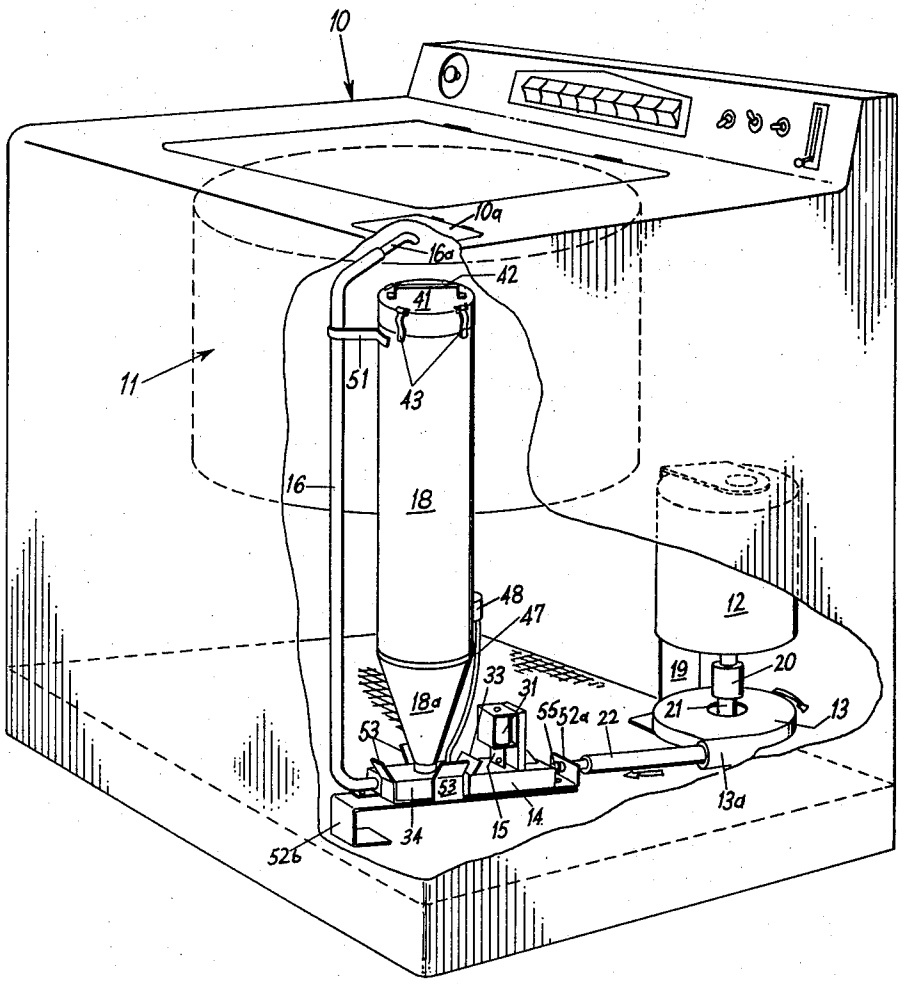


Fig. 1

INVENTOR.
BRANDON CORDES,

BY John V. Forman

ATTORNEY

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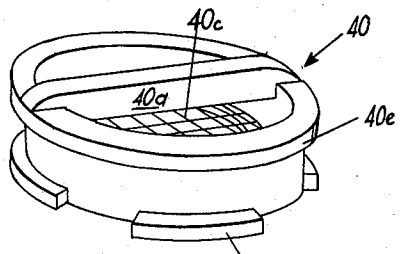
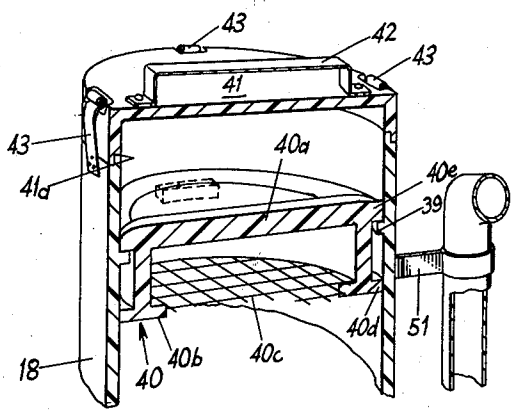


Fig.6



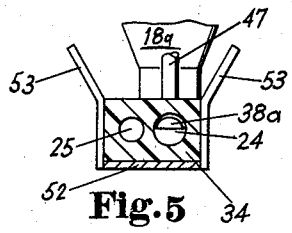


Fig.5

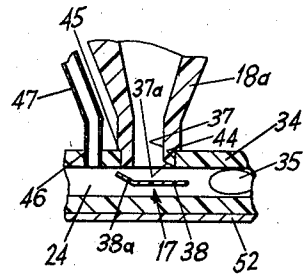


Fig.4

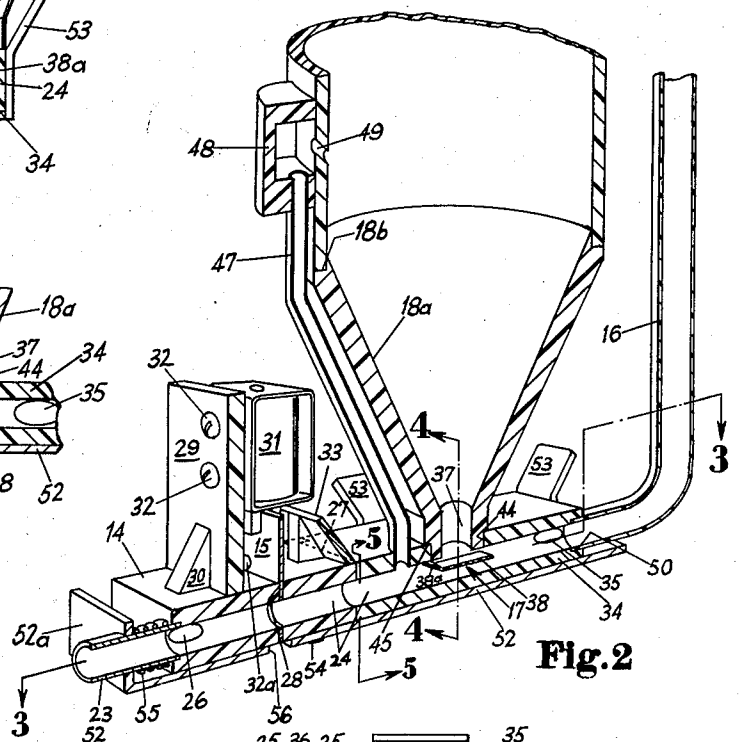


Fig.2

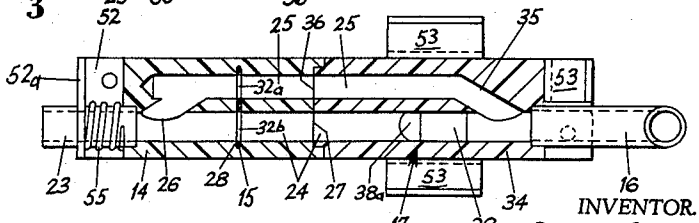


Fig.3

INVENTOR.
BRANDON CORDES,
BY John V. Forman
ATTORNEY

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AUTOMATIC GRANULES DISPENSER

Brandon M. Cordes, Wyoming, Ohio, assignor to The Procter & Gamble Company, Cincinnati, Ohio, a corporation of Ohio

Filed Aug. 9, 1963, Ser. No. 300,967
4 Claims. (Cl. 302—53)

This invention relates to a granules dispenser and more particularly to an automatic dispenser for granular washing products for use in connection with automatic washing machines and automatic dishwashers.

Many types of granules dispensers have been developed in the past for use with automatic washing equipment, but each such prior art device has failed to gain uniform commercial acceptance because of one or more shortcomings which deleteriously affect the operating characteristics or reliability of the unit. The most common fault, and one which is found in virtually every form of prior art granules dispenser, is the propensity of such devices to become clogged due to caking of the granules in the dispenser chamber and on the surfaces of many of the parts which comprise the device. Caking is caused by the high humidity conditions existing within the washer and is undesirable since such an occurrence obviously would cause an inaccurate measurement of charge and could cause the dipsenser to cease operating.

A second and extremely troublesome shortcoming found in the prior art dispensers of the kind contemplated is that most of such devices contain moving parts which contact the granules to be dispensed. This fact taken in conjunction with the incrustation problem mentioned above clearly demonstrates two significant factors opposing development of commercial interest in these devices.

Further shortcomings in the prior art include the lack of means by which the dispenser may be readily cleaned and the fact that most are expensive to fabricate and install on a washing machine.

It is one object of the present invention to obviate the above disadvantages.

It is another object of this invention to provide a new form of apparatus adapted to automatically dispense granular washing products from a storage reservoir into the washing chamber of an automatic washing or dishwashing machine at the proper time in the machine cycle and in predetermined amounts and which has no moving parts contacting the product to be dispensed.

Briefly stated, in accordance with one aspect of this invention, the subject dispenser comprises a reservoir or hopper and a feed chamber. The hopper has an open outlet on the bottom communicating directly with the interior of the said feed chamber. The feed chamber has a feed control means therein to regulate the flow of product from the hopper and is located below the hopper outlet. The feed control means comprises a stationary support surface directly underlying the hopper bottom outlet and spaced therefrom to regulate the flow of product from the hopper and maintaining a substantially constant quantity of product in said feed chamber by action of the angle of repose of the product. The feed chamber has an air inlet end and a product discharge end. An air supply system provides a source of moving air and this system is placed in communication with the air inlet end of the feed chamber during the dispensing operation.

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which is regarded as the present invention, it is believed that the invention will be better understood from the following description taken in connection with the accompanying drawings in which:

FIGURE 1 is a perspective view of one embodiment of the present invention, partially cut away, illustrating the assembly of parts and the manner of connecting the device to and locating it in a top loading automatic washing machine;

FIGURE 2 is an enlarged sectional view in perspective of the metering and control portion of the automatic granules dispenser shown in FIGURE 1;

FIGURE 3 is a sectional plan view of the feed chamber block and slide gate block taken along the line 3—3 of FIGURE 2;

FIGURE 4 is a fragmentary sectional elevation view of the feed chamber, equalization tube and lower hopper cone taken along the line 4—4 of FIGURE 3;

FIGURE 5 is a sectional view of the feed chamber block taken along the line 5—5 of FIGURE 2; and

FIGURE 6 is a perspective of the strainer basket adapted for use with a device of the present invention.

Referring to the drawings, and particularly to FIGURE 1, the general arrangement of the parts constituting one embodiment of the present invention will now be described. Although the device is discussed hereinafter principally with reference to washing machines, the invention is equally applicable for use with automatic dishwashing machines or in connection with any other type of machine wherein a predetermined quantity of a granular product must be added in timed sequence with its operational cycle.

The illustration shows a top loading washing machine having a cabinet 10 within which a tub and rotatably mounted clothing basket is located, both being indicated generally at 11. Situated next to the tub and located between the outer surface of the tub and the inner surface of the washing machine cabinet 10 is a granules metering device. The granules metering device comprises a motor 12 adapted to drive a centrifugal fan 13 in order to produce a constant source of moving air at a pressure above atmospheric. The air from the centrifugal fan is directed into a slide gate block 14 within which it is selectively guided through a by-pass passageway directly to air-lift tube 16 or, alternatively, into a product feed passageway connected in parallel with the by-pass passageway, through a feed chamber contained therein and thence into the air-lift tube 16. The course which is taken by the air through the slide gate block 14 is dictated by the vertical position of slide gate 15 which directs and controls air flow through the device. Regardless of which path is taken through the slide gate block 14 the air which proceeds through the air-lift tube 16 is discharged through the nozzle 16*a* directed downwardly into the central portion of the rotatably mounted clothing basket.

If the slide gate 15 is selectively placed in position whereby the air being fed into the slide gate block 14 is caused to proceed through the product feed passageway, it will, as stated above, pass directly through a feed chamber 17 located beneath the cone of a product hopper or reservoir 18. The product hopper 18 is adapted to store a quantity of the granules or product intended to be dispensed by the unit. The base of the hopper is connected directly to the feed chamber 17 and product is fed to the feed chamber by means of gravity. Within the feed chamber the arrangement is such as to cause the product feeding from the hopper to form a pile of granules of constant size on a support surface by utilizing the angle of repose of the product being fed. The air passing through the feed chamber acts upon the pile of granules contained therein, picking up and carrying off (at a uniform rate) particles of the product, conveying the product up the lift tube 16 and directing the individual airborne granules downwardly into the clothing basket.

When the slide gate 15 is placed in a position whereby the air entering the slide gate block 14 is caused to enter the by-pass passageway, then no product will be fed during this period of operation. The purpose of using the by-pass is to prevent the accumulation of moisture in the passageways of the granules metering device. If no air flows through the air-lift tube during a substantial portion of the operative cycle of the machine, then some of the shortcomings associated with other product dispensers of this general type, i.e., caking of the granules in the dispenser chamber and the incrustation problem could arise.

The above briefly describes the arrangement of parts comprising the present invention, and now a more full description of each of the individual parts will be given. The motor 12 is suitably mounted within the cabinet enclosure by means such as the bracket 19 shown on FIGURE 1. Preferably, the motor 12 serves the purpose of providing power only to the automatic granules dispenser and is operative throughout the entire washing cycle of the machine so as to permit air to be flowing up the air-lift tube 16 at all times during the washing cycle. Alternatively, the washer drive motor can be utilized to provide the motive power for the fan in addition to its other functions in connection with the balance of the machine. In this case, however, and since the washer drive motor in most commercial washing machines does not operate throughout the entire cycle, there will be short periods during which no air will be forced by the fan through the air-lift tube 16. While this alternative arrangement is less desirable than the use of a motor driven during the entire washing cycle, it reduces the cost of the installation and has been found to be satisfactory so long as the motor is in operation at least about 80% of the washing cycle.

Rotary motion is transmitted from the shaft of the motor to the fan 13 by means such as the coupling 20 connected directly to the fan drive shaft 21. This causes the impeller of the fan to be rotated so as to result in the production of a moving stream of air at the discharge end thereof at a pressure slightly in excess of atmospheric. Satisfactory operation of the herein described embodiment (using the one-half inch product feed passageway later described, in connection with feeding of a leading high-sudsing detergent) has been accomplished when the fan was designed to discharge air having an average velocity pressure of about 0.46" of water at a velocity of 2700 feet per minute, the resulting quantity of air being about 3.7 cubic feet per minute. In further connection with the fan design, it has been found desirable for the shut-off static pressure at the fan discharge to amount to approximately 1" of water. The action of fans of this type are well known in the art and for this reason no further explanation thereof is necessary. Although the fan illustrated will draw air from the cabinet 10 interior, the design could be changed to draw air from a position outside the cabinet.

Connected to the discharge end 13*a* of the fan 13 is a cylindrical duct 22, preferably constructed of flexible material such as rubber tubing or the like. The duct 22 extends to and is telescoped over the tube 23 shown in FIGURE 2. The engagement between the duct 22 and the tube 23 may merely be by friction but must be such as to prevent the substantial loss of air therethrough. The downstream end of the tube 23 is telescoped within a counterbore at the inlet of the slide gate block 14. Preferably the slide gate block 14 and the tube 23 are constructed of plastic material and may be permanently united by means of a solvent or an adhesive so as to affix the tube 23 within the counterbore.

As shown most clearly in FIGURES 2 and 3, the inlet of the slide gate block 14 comprises a single passageway which is located on one side of the block 14. This passageway extends throughout the length of the slide gate block 14 and at points downstream of the slide gate 15 becomes the product feed passageway, identified by reference numeral 24. An additional passageway, by-pass 25, is provided in the block 14 and may be obtained by drilling the block 14 as shown, along a line parallel to the product feed passageway from the outlet end of the slide gate block 14 and to a depth shorter than the length of the block 14. Then, by means of the angular drilling pattern shown in FIGURE 3, a by-pass connecting passageway 26 may be formed. The outlet end of the slide gate block 14 is rabbeted as at 27, the rabbet extending vertically and including the full area of both the by-pass 25 and the product feed passageway 24.

Extending vertically through the central portion of the slide gate block 14 and intercepting the full area of both product feed passageway 24 and by-pass 25, is a transverse elongated narrow slot 28. A support bracket 29 is affixed to the top surface of the slide gate block 14 in a position parallel with and adjacent to the slot 28. The bracket 29 is reinforced by a gusset 30 so as to be held rigidly in a vertical position. The bracket and gusset are also preferably made of a plastic material and consequently may be united and mounted by adhesives or solvent action. Attached to one side of the bracket 29 is a solenoid 31 positioned in such a way as to have the vertically oriented plunger directly overlie the slot 28 in the slide gate block 14. The solenoid should be selected so that the length of "throw" or movement of the plunger when the device is energized will exceed the diameter of the by-pass 25 or product feed passageway 24, whichever is the larger, in order to permit the selective valving action mentioned above. This will be more fully explained hereinafter. The attachment to the bracket 29 may be by any suitable means such as by machine screws 32 (FIGURE 2) which extend through holes or slots in the bracket and enter threaded holes in the frame of the solenoid.

The slide gate 15 is affixed within a slot at the lower end of the plunger of the solenoid 31 by means of a cotter pin or the like, not shown on the drawings. The slide gate 15 has a width substantially the same as the width of the slot 28 and has a thickness such as to provide a snug sliding fit within the slot 28. Two ports, 32*a* and 32*b*, extend transversely through the slide gate 15. As shown in FIGURE 3, port 32*a* is in lateral alignment with the by-pass 25 and the port 32*b* is in lateral alignment with the product feed passageway 24. The ports 32*a* and 32*b* are offset from one another in a vertical direction (see FIGURE 2) and so positioned that at the extreme of movement of the plunger of the solenoid 31 in one direction, the port 32*b* is in exact alignment, vertically as well as laterally, with the product feed passageway. Because of the vertical offset mentioned above, the port 32*a* will be completely misaligned (no overlapping) with the by-pass 25 at this position and consequently, the by-pass 25 is blocked.

At the other extreme of movement of the plunger the port 32*a* is placed in direct alignment with the by-pass 25 and port 32*b* becomes misaligned with (thus blocking) product feed passageway 24 so as to result in the blockage of feed passageway 24. By such means the slide gate may be used to selectively open one of the said passageways while closing the other.

Desirably, the product feed passageway should be opened when the solenoid is in its energized position since the feeding portion of the cycle is substantially shorter in time than the balance of the cycle. Solenoid operation may be effected by means of the timer unit normally used in connection with automatic machines of the type described, by incorporating therein an appropriately designed cam and switch. Alternatively, a timer unit may be provided solely for the operation of the granules metering device. A separate timer would be most useful in connection with the installation of the automatic granules metering device on an existing machine or possibly where the periodic advance of the timer mechanism controlling

the balance of the operations of the automatic machine is not well adapted for use in connection with the timing of the cycle of the granules metering device. Another (and more important) advantage of using a separate timer is that it can readily be made adjustable with respect to the amount of product to be metered into the machine. For example, a separate timer for use in connection with controlling the operation of the present invention when placed on a washing machine can more easily be calibrated for alternative forms of product (such as high-sudsing and low-sudsing detergents) and for varying sizes of washloads being processed. In either case, however, the timer mechanism may be of any type well known in the art to effect a timed sequence of operations, the design of which is well within the skill of one of ordinary skill in the art. For this reason the details of the device are not described herein or shown on the drawings. The point of importance here is that a means must be provided to cause the solenoid 31 to be energized for a predetermined period of time at a fixed point in the washing cycle.

Attached to the top surface of the slide gate block 14 at the outlet end thereof is an inclined lead-in plate 33, the lower outside edge of which coincides with the rabbet 27. The purpose of the lead-in plate 33 is to facilitate the placement of the feed chamber block 34 contiguous to the outlet end of the slide gate block 14, as will be more fully understood from a later description.

The feed chamber block 34 contains extensions of the feed passageway 24 and the by-pass 25, and when in position next to the slide gate block 14 the like passageways align perfectly. The drill pattern of the passageways within the feed chamber block 34 is the approximate mirror image of that of slide gate block 14. In other words, the inlet side of the feed chamber block 34 contains the two parallel passageways 24 and 25, but these merge so as to become one passageway at a point close to the discharge end of the feed chamber block 34. The merging is done by means of an angle drilled by-pass connecting passageway 35, as shown in FIGURE 3.

A vertically extending rectangular projection 36, in the form of a tenon of substantially the same size as the rabbet 27 of slide gate block 14, is provided at the inlet side of the feed chamber block 34. The surfaces of the rabbet 27 and the projection 36 are such as to give a tight fit between the two parts in order to eliminate the possibility of air leakage through the joint.

At a point in the product feed passageway 24 intermediate the inlet end of feed chamber block 34 and the connecting passageway 35 and underlying the outlet 37 of the hopper 18 is a feed chamber 17. As shown most clearly in FIGURES 2 and 4, the feed chamber 17 may merely comprise a portion of the product feed passageway 24 within which is placed a feeder plate 38.

The feeder plate functions as a support shelf for the product being discharged through the hopper outlet 37. In the embodiment shown, the feeder plate 38 comprises a substantially horizontal, rectangular section directly underlying the outlet 37 and an upwardly extending angularly disposed tip 38*a*, the end of which is rounded (as shown in FIGURE 3) so as to fit close to the upper cylindrical surface of the passageway, thus blocking the major portion of airflow through the section of the passageway above the feeder plate 38. The horizontal portion of the feeder plate 38 extends full width across the passageway and is sealed to the product feed passageway 24 along its side edges. The upper portion of the tip 38*a* of the feeder plate 38 is preferably spaced from the interior of the product feed passageway 24 by about 1/16" and consequently a crescent-shaped gap is formed in the passageway therebetween.

The horizontal portion of the feeder plate 38 is spaced from the outlet 37 of the hopper a distance commensurate with the desired size of the pile of product which is to be subjected to the action of the air flow in the passageway. The angle of repose of the granules prevents excess product from flowing into the feed chamber to thereby block air flow therethrough. It has been found that using a product feed passageway of approximately 1/2" diameter and with a hopper outlet 37 of approximately the same diameter, the feeder plate 38 may be located 1/4" below the lip of the outlet 37.

The particular design of feeder plate described has been found to achieve the advantage of a slow, uniform product feed rate which may be accurately controlled so as to consistently dispense the required amount of product and at the same time permits the hopper outlet 37 diameter and the distance of the feeder plate from the outlet 37 to be large enough to feed large size granules. It has also been demonstrated that with the crescent-shaped gap described above, product will feed from all portions of the pile rather than from only the downstream side thereof—another factor tending to eliminate an agglomeration problem.

The hopper 18 may be constructed of any suitable material and may be any desirable configuration, but as shown is a cylindrical plastic structure having a conical base portion or lower end 18*a* leading to the outlet 37. The hopper 18 may comprise one or two pieces adhesively united as shown at joint 18*b*. The interior surface of the hopper 18 has several circumferentially spaced lugs 39 integrally molded therewith to provide supports for strainer basket 40, illustrated in FIGURES 2 and 6. The strainer basket 40 is a separate assembly adapted to be placed within the hopper 18 and is useful in preventing the introduction of agglomerated granules and foreign objects into the product supply maintained in the hopper.

The strainer basket is essentially spool-shaped with a handle 40*a* extending diametrically across the top of the basket and has an internally extending annular flange 40*b* at its lower side. The flange 40*b* has affixed thereto and extending completely across the internal opening of the strainer basket 40, a screen 40*c* of approximately #6 mesh and constructed of a material which is not reactive with the product to be dispensed. The outside diameters of the outwardly extending flanges of the spool-shaped strainer basket 40 are roughly the same size as the internal diameter of the hopper 18. The lower outside flange 40*d*, it will be noted, is notched in a number of locations corresponding to the spacing and size of the lugs 39 on the internal surface of the hopper 18. The strainer basket 40 is telescoped horizontally into the hopper 18 until the lower outside flange 40*d* of the unit contacts the lugs 39 whereupon the strainer basket 40 is rotated by means of the handle 40*a* until the notches on the lower flange 40*d* thereof align with the lugs 39. In this position the basket may be lowered until the lower surface of the top outside flange 40*d* contacts the lugs, thereby supporting the basket 40 within the hopper 18. It will be understood that when product is to be placed in the hopper the arrangement is such that it is subjected to the sifting action of the screen 40*c* before it can be fed.

A cover 41 equipped with a handle 42 is adapted to be placed over the top of the hopper 18, the two meeting in a tight joint 41*a*. A number of equally spaced chamfered indentations are cut out of the corner forming the intersection between the top surface of the cover 41 and its downwardly projecting wall. These chamfers are positioned to coact with radially inwardly urged spring clasps 43 attached to the outer top surface of the hopper 18. In use, the cover is placed on the hopper, rotated until the chamfers and clasps 43 line-up and pressed downwardly to form a seal at joint 41*a*. In the lowermost and tightest position of the cover 41 the spring clasps 43 enter and engage the chamfers in the cover 41, exerting a force component in a downward direction to maintain the cover in its closed condition. The joint 41*a* between the hopper 18 and the cover 41 should be such as to permit a slight buildup of pressure in the hopper. To remove the cover, it is merely forcefully lifted vertically while the hopper

is held stationary, the clasps 43 thereby being forced outwardly to release the cover. The cover may be removed while the balance of the dispenser remains in position in the washing machine, thus facilitating filling the hopper with product.

The lower end of the hopper, as shown in FIGURES 2 and 4, is stepped to permit it to be telescoped within a vertically disposed opening 44 extending from the top surface of the feed chamber block to the product feed passageway 24 extending therethrough. As pointed out previously, the outlet 37 of the hopper is located directly over the feed chamber 17. Thus formed, a shoulder 45 provides vertical support for the hopper and fixes its vertical position with respect to the feeder plate 28. The hopper is desirably permanently attached to the feed chamber block 34 by means of a solvent, suitable adhesive or the like. As shown in FIGURE 4, it may be desirable to form a radius 37*a* on at least the downstream side of the outlet 37 to provide added room for the occasional large granules which will be encountered.

Means is provided to substantially equalize pressures within the product hopper and the inlet end of the product feed passageway 24. Upstream of the feed chamber 17, and intermediate the feed chamber and the inlet of the feed chamber block 34, is a hole 46 which is drilled from the top surface of the feed chamber block 34 to the product feed passageway 24. The lower end of a pressure equalization tube 47 is inserted within and affixed to the hole 46 (FIGURE 4), the upper end extending into the interior of an equalization tube housing 48 which is closed on all sides, being sealed to the exterior surface of the product hopper 18. An inclined passageway 49 (FIGURE 2) extends upwardly from the interior of the hopper 18 to the interior of the equalization tube housing 48, thus permitting communication therebetween. So constructed, the conduit comprising the equalization tube 47, equalization tube housing 48 and the inclined passageway 49 permits air to flow directly between the hopper 18 and the inlet end of the product feed passageway 24 to thereby maintain essentially equal pressures in the two portions of the device. The passageway 49 is inclined in order to prevent the passage of granules from the hopper to the housing 48 and to eliminate the possibility of blocking the relatively restricted areas comprising the tube and passageway 49.

It will be realized, of course, that other means could be used to serve the purpose of equalizing the pressures mentioned above, and that the described embodiment is but one illustration of a suitable such arrangement. The essential feature to be understood is that the equalization of pressures is necessary in order to assure proper operation of the dispensing device as a whole.

The single outlet of the feed chamber block 34 has a counterbore 50 formed therein to receive the lower end of the air-lift tube 16, preferably also constructed of a plastic substance and which is affixed to the feed chamber block by means of a suitable bonding agent. As shown, the air-lift tube 16 is bent in appropriate locations and is of sufficient length to permit the tube to extend inwardly over the top of the washer tub and basket 11. A discharge nozzle 16*a* is removably affixed to the end of the air-lift tube 16 and has a downwardly turned section pointing directly into the clothing basket of the machine. A strap 51 supports the upper portion of the air-lift tube 16, being connected to the outer surface of the hopper 18.

When it becomes necessary to gain access to the most critical portions of the dispensing unit, it will be seen that the feed chamber block 34, the air-lift tube 16, the closed hopper 18 and the smaller elements attached thereto may be handled as one integral structure, hereinafter referred to as "removable unit." The removable unit may be lifted intact from its position within the cabinet through the access door 10*a* shown in the cabinet 10 in FIGURE 1 by means of a handle which could be mounted on the side of hopper 18 (not shown) or by removing the cover 41, and pulling the unit outwardly utilizing handle 40*a* of strainer basket 40 when the lugs 39 and the notches of lower flange 40*d* are not in line. The ability to remove the bulk of the dispenser elements is advantageous for such purposes as cleaning when, and if, necessary.

A support plate 52 underlies the feed chamber block 34 and the slide gate block 14 and is equipped on the portion thereof adapted to support the feed chamber block with three friction catches 53 which extend upwardly and flare outwardly at the top. The main purpose of the catches 53 is to frictionally engage the side and end surfaces of the feed chamber block 34. However, there is an auxiliary function performed by the catches 53 since, as described above, the top portions thereof are inclined outwardly, providing a means to guide or funnel the removable unit into place when it is returned to service after removal. It will be noted from FIGURES 1 and 2 that the lead-in plate 33 will provide the proper funneling or guiding action on the fourth side, i.e., the in-feed side of the feed chamber block thereby permitting downward pressure to relocate the removable unit perfectly once it has been placed in the approximate position delineated by the upper portion of the friction catches 53 and the lead-in plate 33.

The side gate block 14 is slideably mounted on the support plate 52 by means of longitudinally extending slots in the plate 52 and machine screws 54 (FIGURE 2) extending therethrough and engaged in threaded holes in the bottom surface of the block 14. Thus, no vertical movement of the block 14 is permitted but longitudinal movement to an extent not exceeding the length of the slots is possible.

The end of the support plate 52 which is adjacent the slide gate block 14 is bent upwardly so as to form a vertical wall 52*a* and has a hole drilled therein through which freely extends tube 23. A compression spring 55 surrounds the portion of the tube 23 intermediate the interior of the wall 52*a* and the inlet end of the slide gate block 14. Consequently, the slide gate block 14 is urged outwardly to its full extent of movement in the direction of the feed chamber block 34. It is the resilient urging of the spring 55 which causes the removable unit to become locked in place once it has been pressed downwardly into position on the support plate 52. No other means of supporting the unit has been found necessary.

The support plate 52 may be mounted within the cabinet 10 by a bracket, such as 52*b* shown on FIGURE 1, secured thereto by means such as machine screws or the like. If the plunger of the solenoid 31 causes the slide gate 15 to extend downwardly past the bottom surface of the slide gate block 14 in its outermost position, then the support plate 52 will be slotted such as is shown at 56 (FIGURE 2) to permit the proper operation of the slide gate.

In operation, when the washing machine cycle commences it is preferable to have the timer controlling the granules dispenser cause the fan drive motor to simultaneously start. From this point, and for a short time thereafter, the solenoid will desirably be in its unenergized position, in which the air flowing from the fan into the slide gate block 14 will be shunted through the by-pass 25. This permits the by-passed air to flow through the air-lift tube and create a scavenging action therein to eliminate the possibility of moisture accumulating in the tube and to dry out any moisture which might have condensed therein. After a short period of time the timer causes the solenoid 31 to be actuated placing slide gate 15 in position whereby the hole 32*b* is in direct alignment with the product feed passageway 24, and the by-pass 25 is blocked. Due to this change in position all of the air discharged from the fan will be directed along the product feed passageway 24 through the feed chamber 17 in which granules are picked up and the airborne product discharged into the air-lift tube and through the

removable nozzle **16***a* into the washer. During this operation pressure from the product feed passageway **24** is transmitted directly to the hopper **18** by means of equalization tube **47**, preventing the improper intermittent feeding which would otherwise occur.

While the exact theory regarding the feeding operation of the device is not known, it is believed that the device functions in the following manner. As the air flows through the feed chamber **17** the feeder plate **38** with its angularly disposed tip **38***a* partially blocks the passageway causing a Venturi effect to occur. Thus, the pressure of the air flowing under the feeder plate **38** is reduced proportionally with the increase in velocity therethrough. Consequently, at the downstream end of the feeder plate **38** the pressure will be somewhat reduced in comparison with the pressure existing in the hopper itself and with the pressure of the air flowing over the crescent-shaped gap at the top of the end **38***a* of the feeder plate. Consequently, the granules are pushed from the downstream end of feed plate **38** and picked up by the moving stream of air, remaining airborne through the lift-tube and until discharged into the washer.

After operation of the solenoid for a period of time sufficient to cause the discharge into the washer of the correct amount of the product, the timer causes deenergization of the solenoid to occur and the slide gate **15** is automatically returned to a position wherein the product feed passageway **24** is blocked and the by-pass **25** opens. Thenceforth, and for the balance of the cycle during which the motor **12** is in operation, air flows from the fan through the by-pass and out the air-lift tube and discharge nozzle without feeding granules. Such tends to keep the air-lift tube and discharge nozzle clean of moisture and the positive pressure contained therein is sufficient to prevent humid air or steam from the washwater entering the nozzle, eliminating the possibility of condensation later occurring.

Many modifications of the above invention may be used and it is not intended to hereby limit it to the particular embodiments shown or described. The terms used in describing the invention are used in their descriptive sense and not as terms of limitation, it being intended that all equivalents thereof be included in the scope of the appended claims. For example, as used herein, the term "granular" is also intended to cover any other form of product existing as discrete particles, such as flakes, powder, particles or the like.

What is claimed is:

1. A dispenser for granular materials having in combination:

(A) an enclosed hopper for temporary storage of a quantity of the product to be dispensed, said hopper having an open bottom outlet;

(B) an enclosed product feed chamber below and in communication with the hopper outlet and having incorporated therein feed control means to regulate the flow of product from the hopper;

(C) said feed control means comprising a stationary granules support surface directly underlying said bottom outlet, said granules support surface being spaced from said bottom outlet and from underlying portions of said feed chamber, said spacing serving to regulate the flow of product from the hopper and maintaining a substantially constant quantity of product in said feed chamber by action of the angle of repose of the product to be dispensed,

(D) said product feed chamber having an air inlet end and a product discharge end,

(E) an air supply system providing a source for a moving stream of air and means to place said air supply system in communication with said air inlet end of said product feed chamber only during a predetermined period of time in which the dispensing operation occurs, said period commencing at a fixed point in the cycle of an automatically controlled machine,

(F) a by-pass passageway connected in parallel with said product feed chamber and providing direct communication between the product discharge end of said product feed chamber and said air supply system during the portion of the timed cycle other than that during which dispensing occurs, and

(G) a pressure equalization passageway interconnecting the interior of said enclosed hopper with the air inlet end of said product feed chamber whereby such equalization occurs during said predetermined period.

2. The dispenser of claim **1** in which said air supply system is operative during at least about 80% of said timed cycle.

3. An enclosed dispenser for granular materials, comprising:

(A) a hopper for temporary storage of the product to be dispensed, said hopper having an open outlet at its lower end;

(B) an enclosed product feed chamber directly underlying and in communication with the hopper outlet and having feed control means therein to regulate the flow of product from the hopper and to maintain a substantially constant quantity of product in the feed chamber; said feed chamber having an inlet end and a discharge end;

(C) a pressure equalization passageway interconnecting the interior of said enclosed hopper with the inlet end of the feed chamber;

(D) a by-pass passageway connected in parallel with said feed chamber, said by-pass passageway being provided with an inlet end and having a discharge end communicating with the discharge end of said feed chamber;

(E) an air supply system providing a source for a moving stream of air, and

(F) means for selectively directing and controlling the flow of air from said air supply system to the inlet end of said feed chamber and to the inlet end of said by-pass, said means permitting such flow to the inlet end of the by-pass while blocking such flow to the inlet end of the feed chamber.

4. The dispenser of claim **3** in which said means for selectively directing and controlling the flow of air operates to substantially block air flow to said by-pass and permit air flow to the inlet end of said feed chamber during a predetermined portion of the timed cycle of an automatically controlled machine, and to substantially block air flow to said inlet end of said feed chamber and to permit air flow to the inlet end of said by-pass during substantially the entirety of the balance of said timed cycle.

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SAMUEL F. COLEMAN, *Primary Examiner.*

ANDRES H. NIELSEN, *Examiner.*