Nov. 13, 1962 C. W. VOGT 3,063,477

METHOD AND APPARATUS FOR FILLING CONTAINERS

Filed Feb. 7, 1958 5 Sheets-Sheet 1

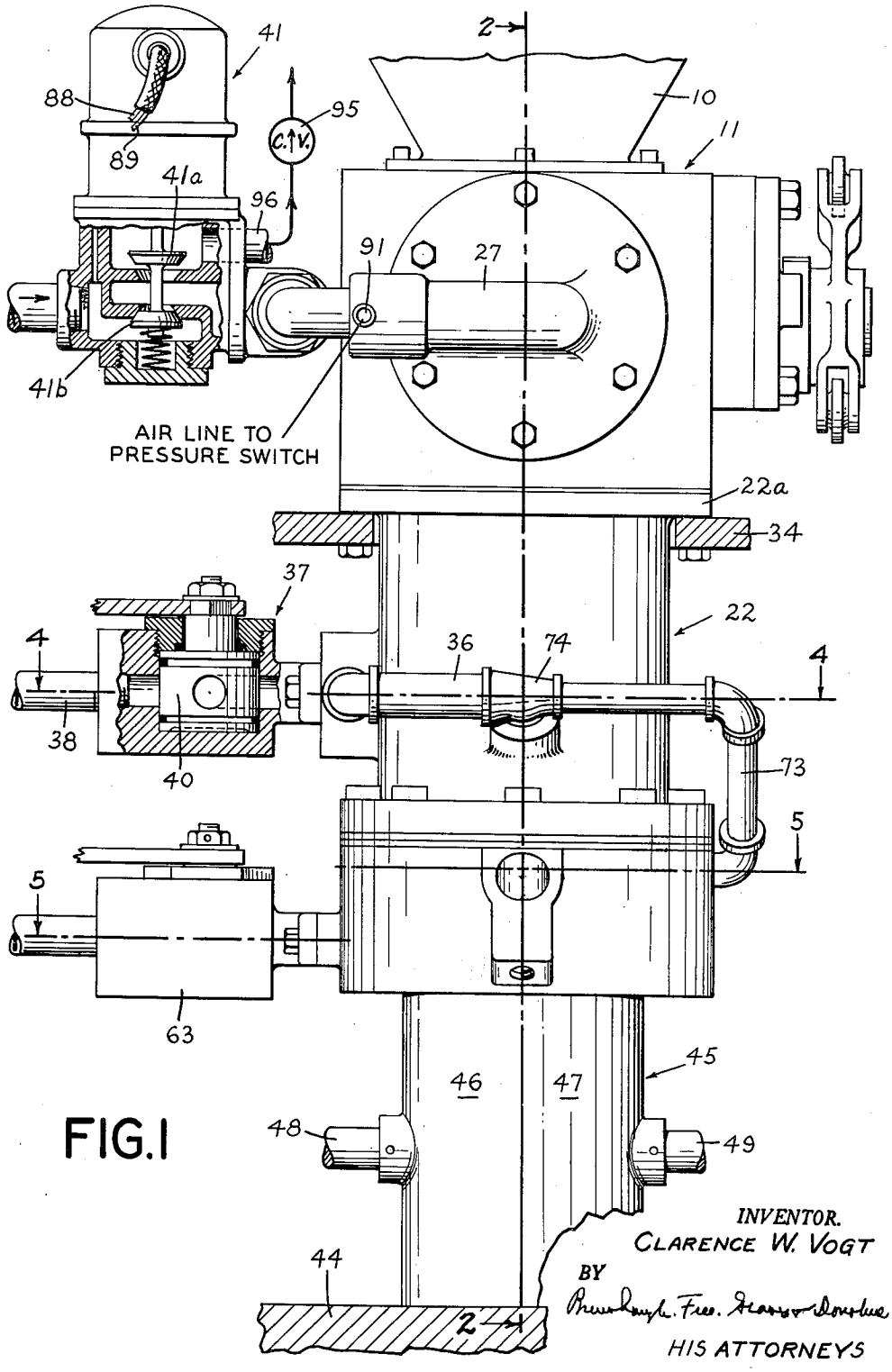

FIG.1

INVENTOR.
CLARENCE W. VOGT
BY
Rudolph, Free, Hanson & Douglas
HIS ATTORNEYS

Nov. 13, 1962 C. W. VOGT 3,063,477

METHOD AND APPARATUS FOR FILLING CONTAINERS

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FIG. 2

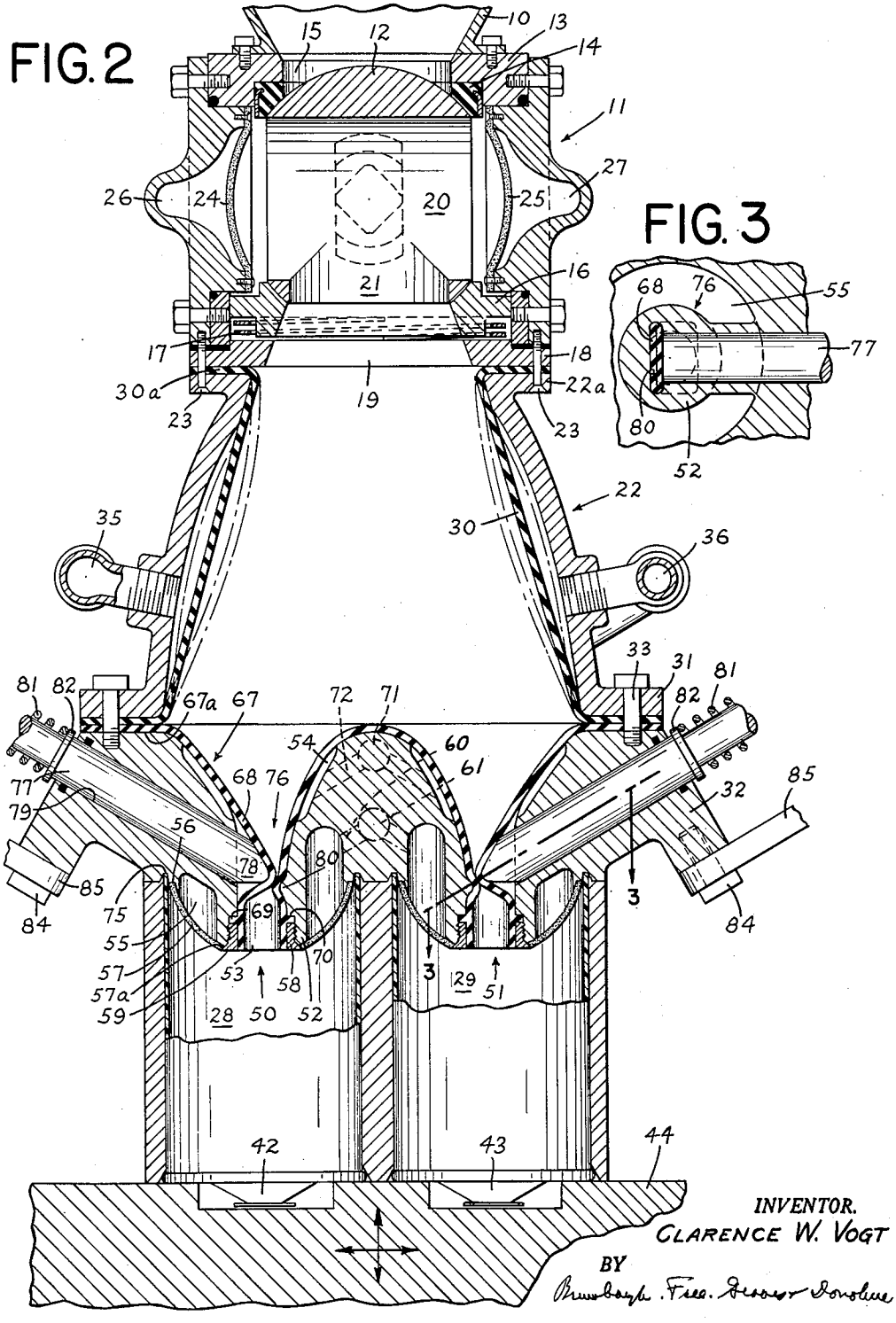

FIG. 3

INVENTOR.
CLARENCE W. VOGT
BY
Brumbaugh, Free, Graves & Donohue
HIS ATTORNEYS

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METHOD AND APPARATUS FOR FILLING CONTAINERS

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FIG. 4

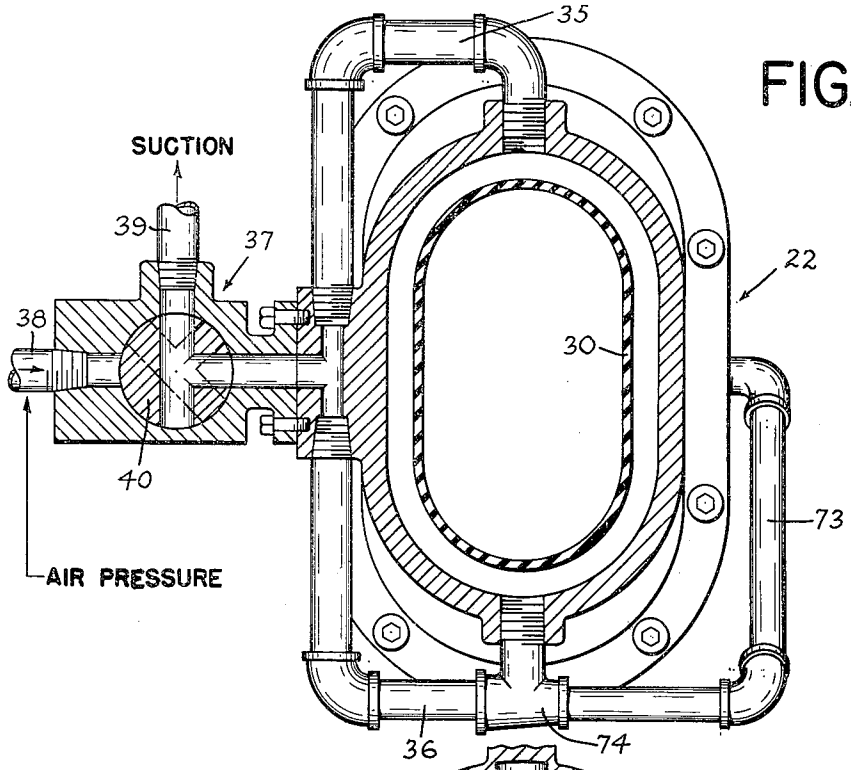
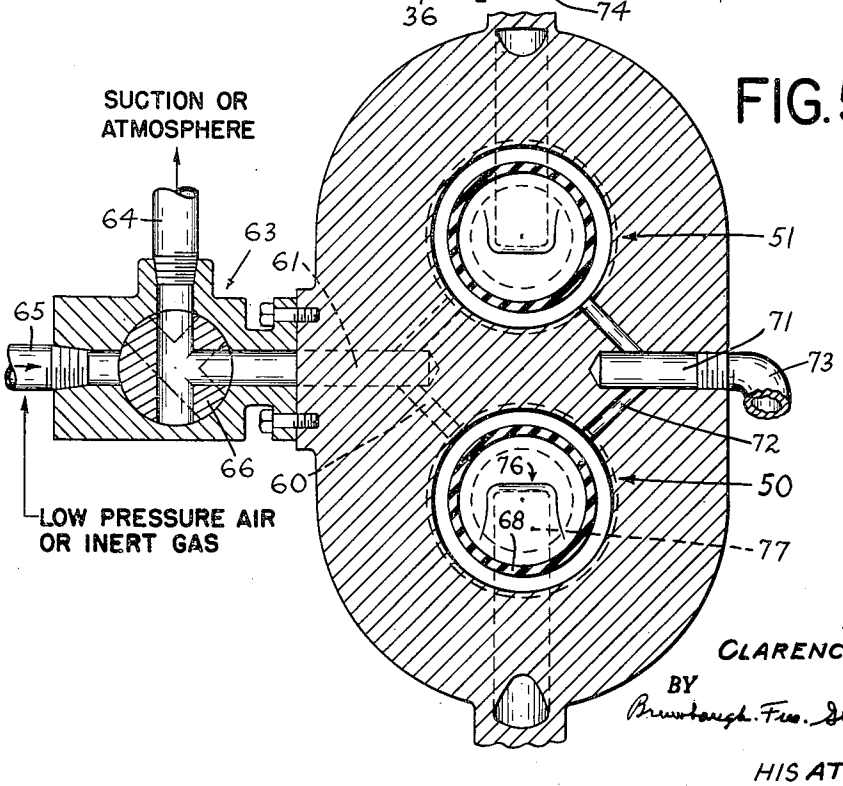


FIG. 5



INVENTOR.
CLARENCE W. VOGT
BY
Brumbaugh, Free, Graves & Donohue
HIS ATTORNEYS

Nov. 13, 1962 C. W. VOGT 3,063,477

METHOD AND APPARATUS FOR FILLING CONTAINERS

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FIG. 6

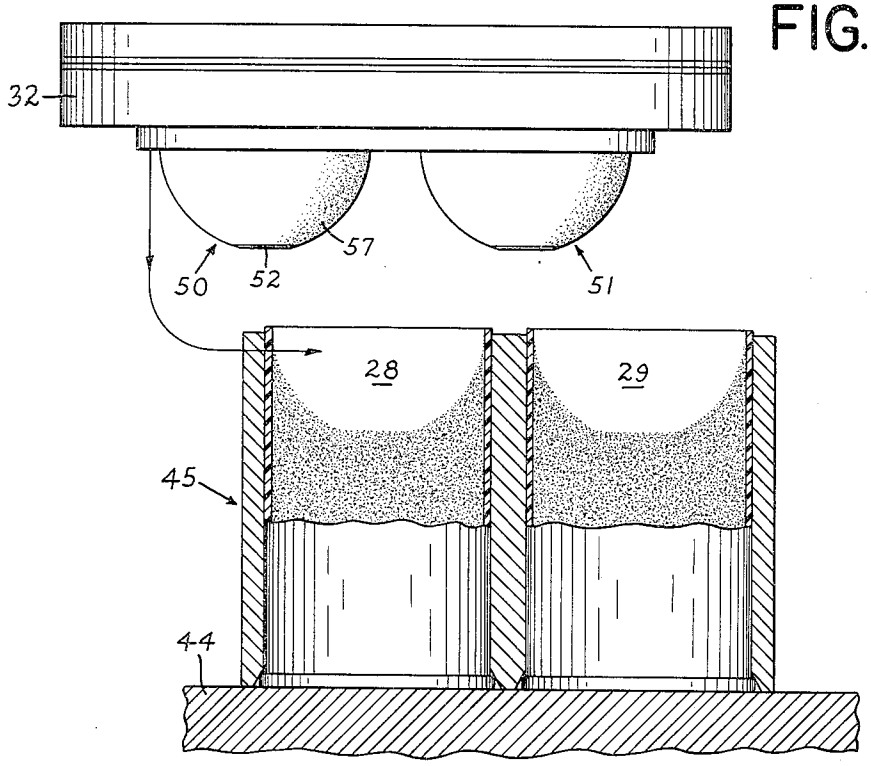
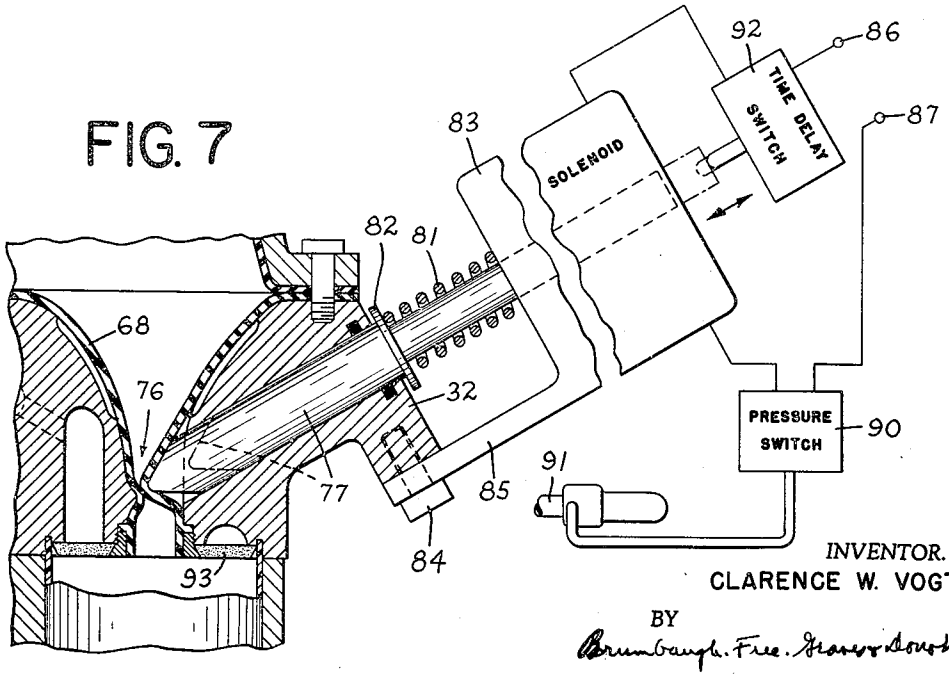


FIG. 7



INVENTOR.
CLARENCE W. VOGT

BY
Brumbaugh, Free, Graves & Donohue

HIS ATTORNEYS

Nov. 13, 1962 C. W. VOGT 3,063,477

METHOD AND APPARATUS FOR FILLING CONTAINERS

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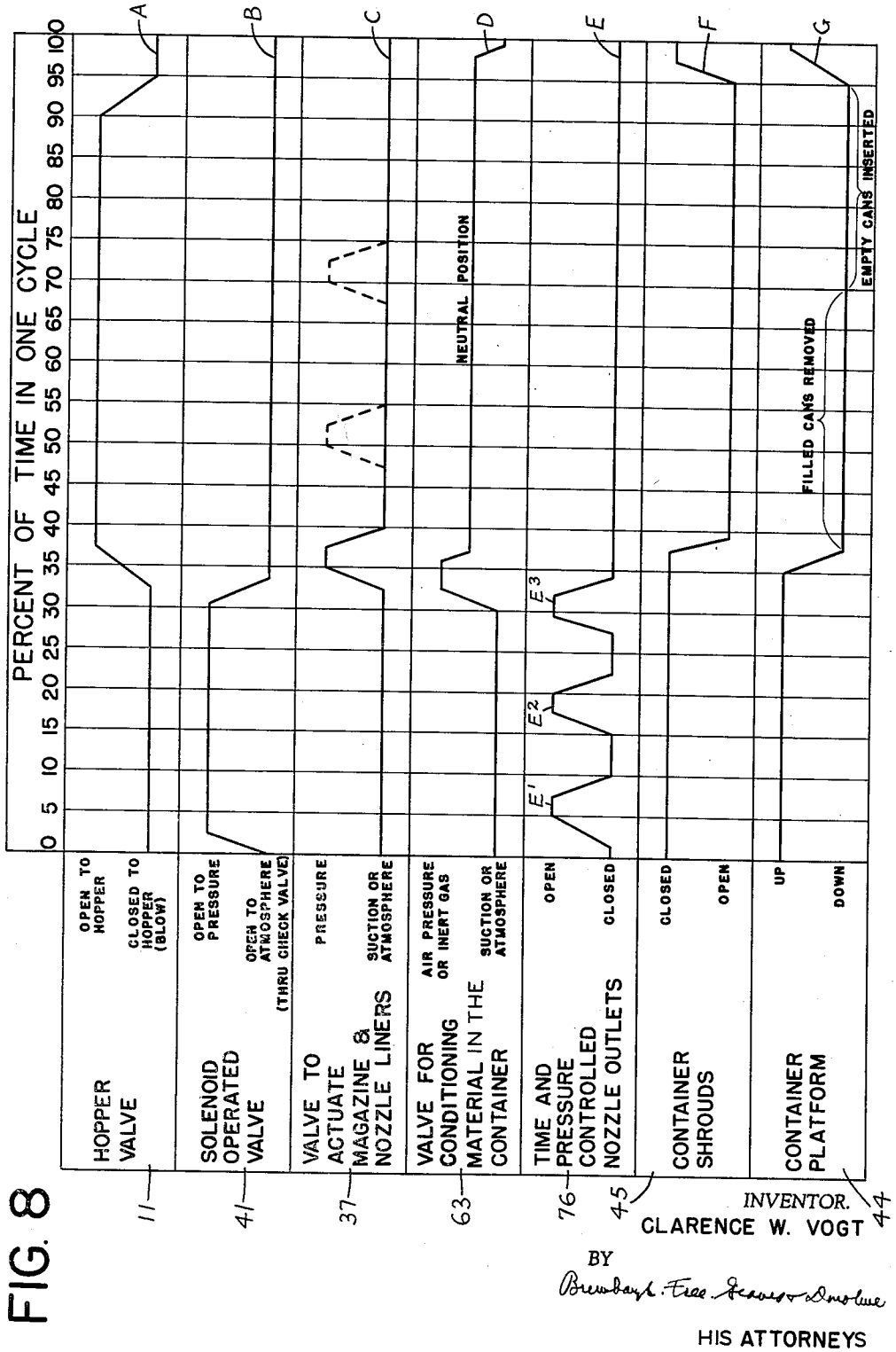

FIG. 8

INVENTOR.
CLARENCE W. VOGT

BY
Brumbaugh, Free, Graves & Donohue

HIS ATTORNEYS

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3,063,477

METHOD AND APPARATUS FOR FILLING CONTAINERS

Clarence W. Vogt, Rte. 4, Weston, Conn.

Filed Feb. 7, 1958, Ser. No. 713,887

11 Claims. (Cl. 141—5)

This invention relates to methods and apparatus for filling containers and it relates particularly to improved methods and apparatus by means of which finely-divided, granular, pulverulent and other fluent materials can be introduced into cavities or containers of various types by the application of fluid pressure to the materials.

In accordance with the present invention, I have provided methods and apparatus by means of which finely-divided materials such as flour, core sand, cake and pie crust mixes, ground and granulated sugar, explosives and the like are introduced into a magazine and are forced from the magazine by means of gas under pressure into a cavity or container or a series of cavities or containers from which the gas in the container and entering with the materials is vented through selective filtering media to allow the containers to be charged with uniform weights and volumes of the material.

Also in accordance with the present invention, I have provided methods and apparatus by means of which such materials are compacted while being so charged in order to obtain such greater uniformity of weight-volume relationship, yet holding the compacted volume to less than that of the container. Thus the more accurate weights found obtainable by voiding all or a substantial portion of interstitial gas between particles of the product, are obtained and yet the product after complete closing of the container, with its partial, compact, charge, may be "fluffed" to facilitate its shake or squeeze dispensing. Also the amount of fluffing can be controlled to prevent its appearing to have been slack filled. By slack filling is meant providing a package with "head space" which to the ultimate consumer upon opening such container, is indicative of short measure of its original contents.

Moreover, the apparatus has provision for introduction of inert gas into the containers where desired or necessary in order to aid in protecting the material in the containers against oxidation or deterioration.

In blowing the material from the magazine of the filling apparatus, it has been found that the gas sometimes discharges the material from the zone or zones where the least friction occurs with the result that pockets or channels are formed in the material while the material adjacent the walls clings to the walls of the apparatus and remains within it.

One of the features of the present invention, is an improved means for dislodging the material from the walls of the magazine and also from the nozzles so that the material is fed substantially progressively from the magazine and bridging and clinging of the material in the apparatus is largely eliminated and channeling minimized.

Moreover, in accordance with the present invention, the apparatus is provided with means whereby the material introduced into the cavities or containers can be subjected to different pressures ranging from subatmospheric to superatmospheric to facilitate the removal of gas from the interstices between particles of the material thereby allowing it to be packed more densely and uniformly in the cavities or containers.

More particularly, according to the present invention, the magazine and filling nozzle or nozzles are provided with liners of flexible material and means is included for expanding and contracting the flexible liners to dislodge material which would normally tend to cling to the apparatus and assure a more uniform feeding of the material and filling of the containers.

For a better understanding of the present invention, reference may be had to the accompanying drawings in which:

FIGURE 1 is a side elevational view of a typical apparatus embodying the present invention with parts shown broken away in section in order to disclose details thereof;

FIGURE 2 is a view in vertical section taken on line 2—2 of FIGURE 1;

FIGURE 3 is a view in section taken on line 3—3 of FIGURE 2;

FIGURE 4 is a view in cross-section taken on line 4—4 of FIGURE 1;

FIGURE 5 is a view in cross-section taken on line 5—5 of FIGURE 1;

FIGURE 6 is an elevational view of a portion of the apparatus illustrating the filling nozzles and showing containers cooperating with the filling nozzles partly broken away and illustrating the motion of the containers relative to the nozzles;

FIGURE 7 is a view in vertical section through a modified form of filling nozzle for filling containers, the containers being broken away to disclose details of the nozzles; and

FIGURE 8 is a chart illustrating the operating cycle of apparatus of the type shown in FIGURE 1.

In filling containers of the type in which the contents are to be dispensed through a dispensing opening or nozzle at one end of the container by squeezing the flexible sidewalls of the container, such as the containers disclosed in my application Serial No. 697,111, filed November 18, 1957, it is desirable to fill the containers only partially. If the containers are filled completely with a compacted product, squeezing of the sidewalls tends to extrude the material and only small amounts thereof will be forced from the nozzle. Efficient and quick discharge of compacted material by shaking the container is not possible until a substantial part of the compacted material has been removed from the container, allowing free movement of the remainder. For that reason, the form of apparatus disclosed in FIGURES 1 to 6 is constructed and arranged to enable such partial filling of the containers with uniform quantities of material by weight and volume.

As shown in FIGURES 1 and 2, a suitable form of apparatus for filling flexible wall dispensing type containers includes a hopper **10** into which finely-divided materials such as pie and cake mixes, flour, powdered sugar, brown sugar or nonedible materials such as talcum powder and the like, can be introduced in any suitable way such as by means of a chute (not shown). Material from the hopper **10** is supplied to a hopper control valve **11** of the type more particularly disclosed in my copending application Serial No. 620,531 filed November 5, 1956, now Patent No. 2,985,340 issued May 23, 1961. Other types of hopper valves also may be used but the valve **11** illustrated is particularly satisfactory. As shown in FIGURE 2, the valve **11** includes a rotary ball member **12** mounted rotatably in the valve casing **13** and engaging a sealing gasket **14** surrounding a filling opening **15** between the casing **13** and the hopper **10**. A ring **16** engages the ball member **12** and is normally biased upwardly by means of a spring **17** thereby providing an effective seal between the gasket **14**, the ring **16** and the ball member **12**.

A retaining plate **18** provided with a central aperture **19** is detachably secured to the casing **13** to compress the spring **17** and also to enable the casing and the ball valve member **12** to be disassembled if necessary.

A transverse or diametrical passage **20** and a radial passage **21** are formed in the ball member **12**. By rotating the ball valve **12** either clockwise or counter-

clockwise from the position shown in FIGURE 2, the diametrical passage 20 can be aligned with the hopper 10 and a magazine 22 having an upper base 22*a* disposed below the valve 11 and secured to it by means of screws 23 or the like. In the position shown in FIGURE 2 the radial passage 21 communicates with the magazine 22 while the upper portion of the ball member 12 prevents communication between the hopper 10 and the magazine 22.

On opposite sides of the ball member 12 and carried by the casing 13 are a pair of semi-spherical porous plates 24 and 25 formed of sintered metal or other porous material. These plates overlie the inner ends of passages 26 and 27 by means of which gas under pressure can be blown into the casing 13 to discharge material in the passages 20 and 21 and the magazine 22 into the containers 28 and 29 disposed below the filling aperture. Gas is vented from the passages 20 and 21 and the magazine 22 through the porous filter plates 24 and 25, these plates serving to prevent the escape of the finely-divided material from the valve 11 or the magazine 22. Gas pressure in the apparatus must be relieved before the ball member is rotated from the position shown in FIG. 2 to the filling position permitting the finely-divided material to flow from the hopper 10 into the magazine. If the ball member 12 were moved to filling position with pressure remaining in the magazine, the finely-divided material would be blown out of the hopper 10.

With many materials, the charging and recharging of magazine 22 may be expedited by mounting an "auger" type mechanism with its lower end above the top of valve 11, arranged so that the auger (not shown) is rotated only when the valve is in open or partly open position.

As shown in FIGURES 2 and 4, the magazine 22 is of generally oval cross-section and has outwardly bowed downwardly diverging endwalls and generally flat sidewalls. The shape of the magazine illustrated enables two filling nozzles to be mounted on its lower end. If only one nozzle is mounted on the magazine or more than two nozzles are provided, the shape of the magazine can be modified appropriately.

To avoid channeling of the material during the filling of the containers 28 and 29 and also to prevent clinging of the material to the walls of the magazine, a sleeve-like liner 30 of resilient material such as molded rubber is disposed within the magazine 22. As shown, the liner 30 has its upper edge 30*a* clamped between the upper end of the magazine 22 and the retaining plate 18 while the lower end of the liner is clamped between a bottom flange 31 on the magazine and a nozzle plate 32 secured to the bottom of the magazine by means of screws 33 or the like. The apparatus, thus far described, is supported on a frame or platform 34 which engages the upper flange 22*a* of the magazine 22. Motion is imparted to the liner 30 by the pressure of the gas introduced through the hopper valve 11 and also by gas pressure between the liner 30 and the wall of the magazine 22. Thus, the magazine may be provided with a pair of pipe connections 35 and 36 communicating with the space between the magazine walls and the liner 30. These pipe connections 35 and 36, as shown in FIGURES 1 and 4 communicate with a rotary control valve 37 having an air pressure connection 38 and a connection 39 to a vacuum pump or other source of sub-atmospheric pressure or to atmosphere. Upon rotation of the rotary valve plug 40, the air pressure connection 38 or the suction or atmosphere connection 39 can be selectively connected to the pipe connections 35 and 36. In an intermediate or neutral position of the plug 40, the pipe connections 35 and 36 are disconnected from the air pressure connection 38 and the connection 39. The valve 37 may be timed to operate in synchronization with a solenoid valve 41 FIGURE 1, by means of which the air is admitted into the hopper valve 11 through the passages 26 and 27 and vented therefrom. When the ball member of the hopper valve 11 is in the closed or blowing position shown in FIGURE 2, the valve 41 will be energized to displace the valve plugs 41*a* and 41*b* downwardly from the position shown in FIGURE 1 to admit air into the hopper valve and magazine 22. At this time, the valve 37 will be in the position shown in FIGURE 4 so that the air between the liner 30 and the walls of the magazine 22 will be vented through the line 39 to atmosphere or withdrawn by means of a vacuum pump or the like to permit or cause the liner to expand against the walls of the magazine 22.

When air or gas is vented from the hopper valve 11 and magazine 22 through the valve 41 with the latter in the position shown in FIGURE 1, the valve 37 is rotated from the position shown in FIGURE 4 to connect the space between the liner 30 and the walls of the magazine 22 to the air pressure line 38 so that the liner is forced away from the walls of the magazine 22 to the inner dotted line position. If desired, and as explained in greater detail hereinafter, the valve 37 may be moved several times between its pressure and venting positions to cause inward and outward movement of the liner 30 to separate the material clinging thereto from the liner and also to force the material toward the center of the magazine thereby overcoming any tendency for channels to form in the material within the magazine.

The movements of liner 30 serve also to expedite the unbridging of material in the lower portion of hopper 10 and the drawing down or recharging of the material into the magazine 22. The kneading action produced by the liners also serves to prevent stratification of the material, when it consists of a mixture of components of different sizes and densities.

In filling flexible wall containers 28 and 29 of the type shown in FIGURES 2 and 6, particularly containers of the dispensing type, it is necessary to provide some means for preventing expansion of the containers by gas pressure during filling. To that end, the containers 28 and 29 with their dispensing nozzles or ends 42, 43 disposed downwardly and their open ends directly upwardly are carried by rotary, linearly movable or reciprocating support member 44. The support member 44, as indicated in FIGURES 4 and 6 is movable up and down and transversely as indicated by the arrows thereon so that the containers can be placed on the support 44 and moved underneath the filling apparatus where they are received in a split shroud 45 made up of two separable sections 46 and 47, each having a pair of semi-cylindrical cavities in it. The shroud sections 46 and 47 can be moved toward each other by means of the rods 48 and 49 which may be moved inwardly and outwardly by means of cams (not shown) or in any other suitable way to hold the containers securely therebetween.

Inasmuch as shake or squeeze type dispensing containers should not be compact filled completely, the nozzles 50 and 51 of the filling apparatus are constructed to prevent the containers 28 and 29 from being filled completely. Inasmuch as the nozzles 50 and 51 are identical, only one of them will be described. As shown in FIGURES 2 and 6, the nozzle 50 is a part of the nozzle plate 32 and includes a tubular tip 52 extending below the bottom of the plate 32. A central passage 53 in the tip is joined to an upwardly flaring or generally conical recess 54 into which the material from the magazine 22 is discharged. An annular recess 55 in the bottom of the plate 32 extends around the nozzle tip 52 thus forming a hollow chamber adjacent thereto. Overlying the annular recess 55 and extending from the end of the tip 52 to an annular supporting shoulder 56 on the nozzle plate is a dome-like filtering member 57 formed of porous material, such as porous sintered metal and having a central opening 57*a*. The filter member 57 is clamped to the nozzle tip by means of a threaded collar 58 having a tapered flange 59 at its outer end engaging the edge of the open-

ing 57*a*. The collar 58 is screwed into the end of the nozzle tip. The filter member 57 serves to permit escape of air from the container 23 as it is being filled with the finely-divided material and also admits gas such as inert gas into the container 28 to prevent deterioration of the contents of the container. To that end, the annular recess 55 is connected by means of a branch passage 60 to a bore 61 formed in the nozzle plate 32 which is connected to a rotary valve member 63 (FIGURES 1 and 5) by means of which air may be vented to atmosphere or withdrawn through the connection 64 to atmosphere or a vacuum pump. Low pressure air or inert gas is supplied to the valve 63 by means of a pipe 65. The rotary valve plug 66 of the valve 63 can be turned in timed relation to the operation of the solenoid valve 41 and the linear control valve 37 to discharge gas from the container during filling or to supply gas to the container as will be described in greater detail hereinafter.

Inasmuch as some materials also have a tendency to bridge in the nozzle passage 53 and the recess 54, they have a flexible or resilient liner 67 mounted therein. The liner 67 is formed of molded rubber or the like and has a peripheral flange 67*a* disposed and gripped between the lower end of the magazine 22 and the upper periphery of the nozzle plate 32. Generally conical sleeve portions 68 are disposed in the recess 54 and the passage 53 and the lower ends of these portions are provided with a peripheral flange 69 which is gripped between the collar 58 and an annular shoulder 70 in the nozzle tip. The portion of the liner 67 between the flange 67*a* and the flange 69 is flexible and can be moved inwardly and outwardly by means of gas pressure in the mgazine 22 and gas pressure between the liner 67 and the nozzle plate 32. As shown in FIGURES 2 and 4, a bore 71 is provided in the mid-portion of the nozzle plate 32 and is connected by means of a branch passage 72 to the space behind or outwardly of the liner 67. The bore 71 is connected by means of pipes 73 and a T-coupling 74 to the pipe connection 36 so that the liners 30 and 67 expand and contract together under the control of the valve 37. It will be understood that gas under pressure can be introduced behind the liners 30 and 67 so that they are normally deflected inwardly and by placing the valve 37 in its neutral position, the liners may be expanded or contracted solely by change in the pressure in the magazine 22.

As shown in FIGURE 2, the undersurface of the nozzle plate 32 is provided with an annular groove 75 which receives the upper edge of the container 28 so that the open end is sealed against the escape of air or the finely-divided material during the filling of the container. Air can escape or gas can enter the open end of the container only through the filter member 57 when the containers are in the position shown in FIGURE 2.

In order to enable the filling of the containers 28 and 29 with compacted material and also to allow the introduction of inert gas without back flow of such gas through the nozzles and the magazine 22, a control valve mechanism is provided for opening and closing the nozzles during the operation of the filling apparatus. As shown in FIGURES 2 and 7, a suitable form of control valve 76 may include a plunger 77 having a wedge-shaped inner end 78, the plunger being mounted for reciprocation in a bore 79 in the nozzle plate 32 extending inwardly and downwardly and intersecting the passage 53 in the nozzle tip. The wedge end of the plunger engages the liner portion 68 and forces it inwardly against the opposite side thereof thereby squeezing the opposite sides of the liner together, as shown in FIGURE 3, to prevent escape of material therethrough. A straight-edged rib 80 is formed in the nozzle tip to assure substantially line contact of the opposite sides of the liner. As best shown in FIGURE 7, the plunger 77 is normally urged in a direction to pinch the walls of the liner 68 together by means of a spring 81 engaging a collar or flange 82 on the plunger at its inner end and the end of a solenoid coil 83. The coil 83 is mounted on the nozzle plate 32 by means of one or more mounting screws 84 engaging an arm 85 of the casing of the coil 83. When the coil 83 is energized, the plunger is retracted to the dotted line division shown in FIGURE 7, thereby enabling the sleeve-like portion 68 of the liner 67 to expand and the finely-divided material to flow through it from the magazine to the container. Inasmuch as it is desirable to retract the plunger 77 only when gas pressure is supplied to the magazine 22, the solenoid coil is connected to terminals 86 and 87 which are connected to the leads 88 and 89 of the solenoid valve 41. As a further control for the plunger 77, a pressure responsive switch 90 is interposed between the terminal 87 and the solenoid coil and is actuated by gas pressure in a coupling 91 which is connected to the passage 27 of the control valve, as shown in FIGURE 1. So long as a predetermined pressure exists in the magazine 22, the pressure switch 90 will be closed, but if the pressure drops below a predetermined value, the pressure switch 90 will open and the coil 83 will be de-energized to close the nozzle valve, even though the solenoid valve 41 may still be energized. It will be understood that the terminals 86 and 87 of the coil 83 need not be interconnected with the solenoid valve 41, and retraction of the plunger 77 can be controlled entirely by the pressure in the magazine 22 and control valve 11. In addition to the control afforded by the pressure switch, a time-delay switch or interrupter 92 is interposed between the terminal 86 and the coil 83 so that the circuit therethrough may be interrupted and completed several times during a short period of time during the filling operation, thereby opening and closing the nozzle valves 76 repeatedly during the filling operation. In this way, a drop in pressure in the magazine due to discharge of material therefrom is substantially avoided and filling of the containers under more uniform pressure conditions is obtained. The time-delay or interrupter switch 92 may be of any conventional type, such as thermostatically or dash-pot controlled, to produce reciprocation of the plunger 77 between its open and closed positions.

The nozzle structure shown in FIGURES 2 and 6 is susceptible to considerable modification. For example, the dome-shaped filter member may be conical or frusto-conical or the like and it may extend much farther into the container 28 if, for example, it is desired to leave a large cavity in the compacted material in the container. The provision of a large cavity may be desirable, for example, when it is desired to place a separate container for another material in the container 28 before closing it, and it enables several different materials to be introduced into the same container with or without a separator between them. This can be accomplished by passing the container successively to several different filling machines having nozzles of progressively decreasing displacements. When it is desired to fill a container completely, the filter member can be modified as shown in FIGURE 7, wherein the filter member 93 is in the form of an annular plate formed of porous metal or the like. The operation of the nozzle, regardless of its shape and the shape of the porous filter member thereon, is the same during the filling operation.

In some instances, as, for example, when measured charges are to be prepared of material which is semi-form-retaining when in a compacted condition, the container itself may be omitted and the cavities in the shrouds 45 may be used to receive the material. If desired, the shrouds themselves can be formed of a filtering material, such as porous, sintered metal so that a very large area is provided for the escape of air during the filling operation.

The filling cycle and operation of the apparatus will be better understood by reference to FIGURE 8 which discloses graphically a typical filling cycle. The elements referred to in the chart are identified by the corresponding reference characters. The chart lines A, B, C, D, E,

F and G correspond, respectively, to the operation of the hopper valve **11**, the solenoid operated valve **41**, the liner actuating valve **37**, the valve **63** for conditioning the material in the containers, the valve **76** for controlling the nozzle outlet, the container shroud **45**, and the container platform **44**. Referring to the line A, it will be seen that during the 37% of a cycle as indicated by the line A, the hopper valve **11** is in a closed position, that is, in the position shown in FIGURE 2. Blowing (admission of air through valve **41**), chart line B, occurs during about 25% of the cycle while the hopper valve **11** is closed. Also, the valve **37** is in a position to connect the space behind the liners **30** and **67** to atmosphere or suction and the valve **63** is in a vent position to permit gas to escape or be withdrawn from the containers through the filter members in the nozzles **50** and **51**. Also, the container shroud **45** is closed and the container support **44** is in its "up" position for filling the containers. Also, the nozzle valves **76** (chart line E) are open or may be opened and closed several times as indicated by the peaks E^1, E^2, and E^3.

At the end of the blowing operation, chart line B, the solenoid operated valve **41** is opened to atmosphere so that air can escape from the control valve **11** and the magazine **22**, and the valves **76** in the nozzles move to closed position. Also, as indicated by line D, valve **63** is operated so that air or inert gas may be introduced into the containers after filling and during the early part of the downward movement of the containers as indicated by chart line G. The valve **63** then moves to a neutral position in which gas flow through the valve **63** is prevented during the magazine-filling operation. As indicated by lines F and G, platform **44** moves downwardly and the shroud **45** opens to permit the containers **28** and **29** to be removed and empty containers substituted.

Referring back to line A, following the blowing operation, the hopper valve **11** is rotated to connect the magazine **22** to the hopper **10** to recharge the magazine with finely-divided material. Also, at the same time, the valve **37** is operated to admit pressure behind the liners **30** and **67** to force them inwardly and dislodge material clinging to the liners or bridging across the nozzle and magazine. As shown by the dotted line peaks on line C, gas may be vented from and admitted into the space behind the liners repeatedly to cause them to vibrate and thereby facilitate dislodging of the clinging material. Inward movement of the liners breaks up any bridges in the material, fills any channels in the material produced by the passage of air therethrough and causes a mixing and kneading of the material to prevent stratification or separation of components of different sizes and densities. Outward movement of the liners **30** and **67** also aids in recharging the magazine **22** for the reason that it creates a reduced pressure in the magazine which aids in drawing material from the hopper **10**. To prevent air from entering the control valve and magazine through the solenoid valve **41** during recharging of the magazine and preventing the development of reduced pressure therein, a check valve **95** (FIGURE 1) is interposed in the air vent pipe **96** of the valve **41**. Similar but less positive movement of the liners can be obtained by introducing gas under pressure behind the liners and moving the valve **37** to its neutral position. The gas behind the liners forces them inwardly while the pressure in the magazine and nozzle forces them outwardly.

Line A shows that over 50% of the cycle is available for recharging the hopper, for removing the filled containers and inserting empty containers as indicated by chart line G, for moving the shrouds **45** inwardly and outwardly, and for moving the liners **30** and **67**. It will be apparent, therefore, that sufficient time is available during the cycle for replenishing the material in the control valve **11** and magazine **22** during the non-blowing portion of the cycle and for removal of filled containers and replacement with empty containers. The operations such as vacuumizing and filling the containers with inert gas can take place without interference with the filling of the magazine **22** inasmuch as the nozzle valves **76** isolate the containers from the magazine **22**.

The filled containers may be closed and sealed in any conventional manner depending on the type of container or liner contained within the cavities. Certain types of containers may be closed by spinning end or bottom discs over the lips of the can. Other containers may be closed with "blister" or "bubble" pressure or vacuum-formed films. Then, in lieu of the inert gas, a premium or "prize" may be inserted in these closed cavities, and thereafter the cavity reclosed over the inserted material with another similar film or any other desired closure. In any event, after being charged with its desired contents, the filling openings are closed whether the particular container be jars, bottles, cans, cups, cartons, bags, liners, etc.

Elimination of air from the contents of the container or cavity during filling and subsequent filling of the head space in the container with inert gas has marked advantages in enhancing the freshness of the contents of the container or cavity, as compared with a vacuum-filled container. When a vacuum-filled container is opened, air rushes into the container and fills the interstices in the contents of the container so that oxidation can occur throughout the contents.

In containers of the kind disclosed herein, when a part of the contents of the container is shaken or squeezed out, only the same volume of air enters the container as the volume of the discharged contents and this air is not distributed throughout the contents of the container so that oxidation does not occur throughout the container.

The containers described above have been indicated as being of the flexible wall type, but other containers such as cans having rigid walls and the like or cavities having porous or non-porous walls may also be filled by means of the filling apparatus. Moreover, while the apparatus is illustrated as having two filling nozzles, only one or more than two nozzles may be provided. Therefore, it will be apparent that the form of the invention described herein is susceptible to considerable variation in its structure and operation and accordingly, the forms of the invention described should be considered as illustrative of the invention and not as limiting the scope of the following claims.

I claim:

1. An apparatus for filling containers comprising a magazine for receiving moldable material, means for introducing said moldable material into said magazine, at least one nozzle secured to said magazine having a hollow chamber therein and a passage therethrough communicating with said magazine, said chamber having an opening adjacent to said passage, a filter member on said nozzle covering said opening, a support for a member having a cavity therein, said support and nozzle being relatively movable to bring said cavity-containing member into sealing engagement with said nozzle and to position said nozzle in the interior of said cavity-containing member to reduce the capacity of said cavity therein, means for applying gas at superatmospheric pressure to said material in said magazine to discharge some of said material through said passage into said cavity and for relieving said magazine of said gas pressure, means for venting gas from said chamber to enable gas to escape from said cavity through said filter member while retaining said material in said cavity, means for supplying gas to said chamber for flow through said filter member into said cavity and means for closing said passage while gas is being supplied to said cavity.

2. The apparatus set forth in claim 1 in which said opening is annular and substantially concentric with said passage, and said filter member is a hollow shell overlying said opening and extending outwardly beyond the

edge, said shell having an aperture in the center thereof concentric with said passage.

3. The apparatus set forth in claim 1 comprising a resilient sleeve in said nozzle passage and forming the outer periphery thereof, and means for expanding and contracting said sleeve to prevent said material from bridging across said passage.

4. An apparatus for filling cavities with moldable materials comprising a magazine having a material inlet thereto, an inlet control valve for opening and closing said material inlet, a nozzle secured to said magazine in spaced relation to said inlet control valve, a cavity support, said support and said nozzle being relatively movable to introduce said nozzle into the open end of said cavity, means adjacent to said nozzle for engaging the periphery of the cavity in substantially gas-tight relation, valve means for introducing gas under superatmospheric pressure into said magazine while said material inlet is closed to discharge moldable material from said magazine into said cavity through said nozzle, said valve means also being operable for venting gas from said magazine, a valve in said nozzle, means for opening and closing said valve, a chamber in said nozzle having an opening disposed within the area bounded by the means for engaging the periphery of said cavity, a selective filter member covering said opening, and means for venting gas from and introducing gas into said chamber to enable gas to escape from and gas to be introduced into said cavity, said means for opening and closing said nozzle valve maintaining the nozzle valve closed while gas is being introduced into said chamber and cavity.

5. The apparatus set forth in claim 4 in which said filter member is a hollow shell-like member having a centrally-located opening concentric with said nozzle and comprising means for securing said filter member to said nozzle.

6. An apparatus for filling cavities with moldable materials comprising a magazine having a material inlet thereto, an inlet controlled valve for opening and closing said material inlet, a nozzle secured to said magazine in spaced relation to said inlet, a support for a container having therein a cavity with an open end, said support and said nozzle being relatively movable to introduce said nozzle into the open end of said cavity, means adjacent to said nozzle for engaging the container around the open end of the cavity in substantially gas-tight relation, valve means for introducing gas under superatmospheric pressure into said magazine while said material inlet is closed to discharge moldable material from said magazine into said cavity through said nozzle, means for venting gas from said magazine, an openable and closable valve in said nozzle for permitting and preventing discharge of material through said nozzle, means for opening and closing said valve, a chamber in said nozzle having an opening exposed within the area bounded by the means for engaging the container around the periphery of said cavity, a selective filter member covering said opening, means for discharging gas from and introducing gas into said chamber to enable gas to escape from said cavity and to be introduced into it, sleeve-like liners in said magazine and said nozzle, and means for contracting and expanding said liners for preventing channeling and bridging of the finely divided material therein.

7. An apparatus for filling cavities with moldable materials comprising a magazine having a material inlet thereto, an inlet control valve for opening and closing said material inlet, a nozzle secured to said magazine in spaced relation to said inlet control valve, a support for a container having therein a cavity with an open end, said support and said nozzle being relatively movable to introduce said nozzle into the open end of said cavity, means adjacent to said nozzle for engaging the container around the periphery of the open end of the cavity in substantially gas-tight relation, valve means for introducing gas under superatmospheric pressure into said magazine while said material inlet is closed to discharge moldable material from said magazine into said cavity through said nozzle, means for venting gas from said magazine, a flexible tubular liner in said nozzle, a plunger movable to a first position engaging one side of said liner and constricting it to prevent flow of material through said liner and to a second position enabling expansion of said liner to allow material to flow through said liner, means responsive to gas pressure supplied to said magazine for moving said plunger from said first position to said second position, a chamber in said nozzle having an opening disposed within the area bounded by the means for engaging the container around the periphery of said cavity, a selective filter member covering said opening and means for discharging gas from and introducing gas into said chamber to enable gas to escape from and gas to be introduced into said cavity.

8. The apparatus set forth in claim 7 comprising means for moving said plunger between said first and second positions, repeatedly, while gas is vented from said magazine.

9. A method of filling open mouth containers with fluent, finely divided material, comprising introducing a dome-like filter member the predominant portion of which comprises a gas permeable filter wall into the open mouth of a container to occupy a substantial part of the space within the container and reduce its capacity, forcing material through a passageway extending through said filter member into said container by means of gas under superatmospheric pressure to fill the container and form a cavity in the material therein having a shape complemental to said filter member, venting gas through said filter member while said material is being forced into said container, removing said filter member from the open mouth of the container and closing said container while retaining said cavity in said material.

10. An apparatus for filling cavities with fluent, finely-divided materials comprising a magazine having a material inlet thereto, an inlet control valve for opening and closing said material inlet, a nozzle secured to said magazine in spaced relation to said inlet control valve, a support for a cavity containing member, means for moving said support and said nozzle relatively to introduce said nozzle into the open end of said cavity containing member, means extending around and spaced radially from said nozzle for engaging the periphery of the cavity containing member in substantially gas-tight relation, valve means for introducing gas under superatmospheric pressure into said magazine while said material inlet is closed to discharge material from said magazine into said cavity containing member through said magazine into said cavity containing member through said nozzle, a valve in said nozzle, means for opening and closing said valve, a chamber in said nozzle having an opening within the area bounded by the means for engaging the periphery of said container, a hollow dome-like filter member covering the opening in said chamber and projecting beyond the means for engaging the periphery of said cavity for insertion in said cavity to occupy a substantial part of the space in said cavity and prevent complete filling thereof, the predominant external surface portion of said dome-like filter member comprising a gas permeable filter wall, said filter member having an opening therein coaxial with said nozzle, means for securing said filter member to said nozzle in a position overlying said chamber, and with the nozzle disposed in said opening and means for venting gas from said chamber to enable gas to escape from said cavity.

11. An apparatus for filling cavity-containing members comprising a magazine for receiving fluent pulverulent material, means for introducing said fluent material into said magazine, a hollow dome-like member, the interior thereof being provided with a vent, the predominant external surface portion of which member is gas permeable, said member being provided with an aperture communi-

cating with said magazine, a support for a cavity-containing member, said support and said dome-like member being relatively movable for positioning said cavity-containing member and said dome-like member in sealing engagement one with the other and with said dome-like member in the interior of said cavity containing member thereby reducing the fillable volume of the cavity containing member, and means for supplying gas at superatmospheric pressure to said magazine whereby the supplied gas discharges fluent pulverulent material from the magazine through said aperture into said cavity containing member and gas entrained with the discharged material is simultaneously vented through said vent from

the cavity containing member while said material is retained therein.

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