Oct. 14, 1952 C. F. CARTER 2,613,864

APPARATUS FOR FILLING CONTAINERS

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FIG. 1

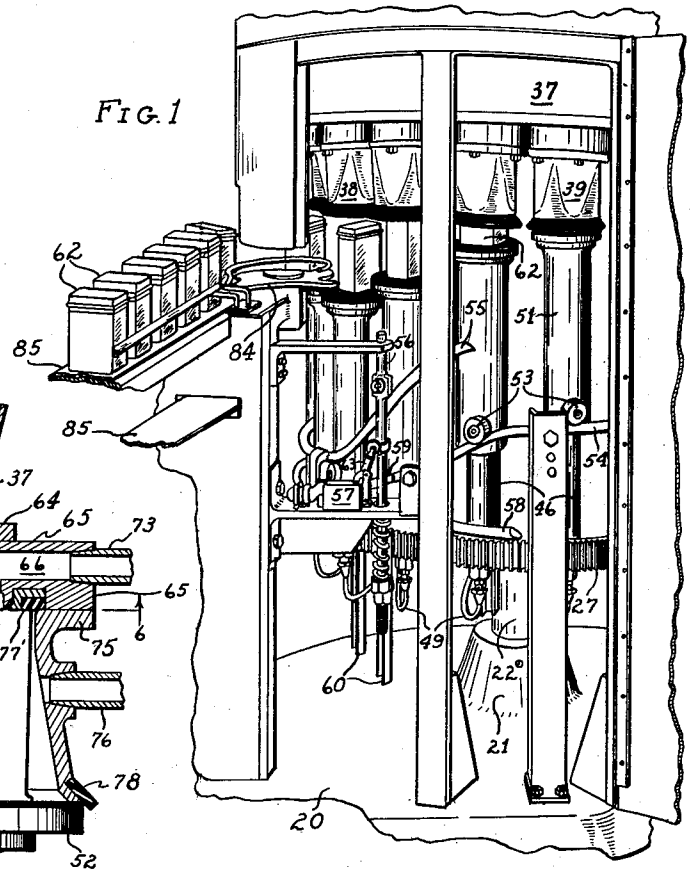


FIG. 5

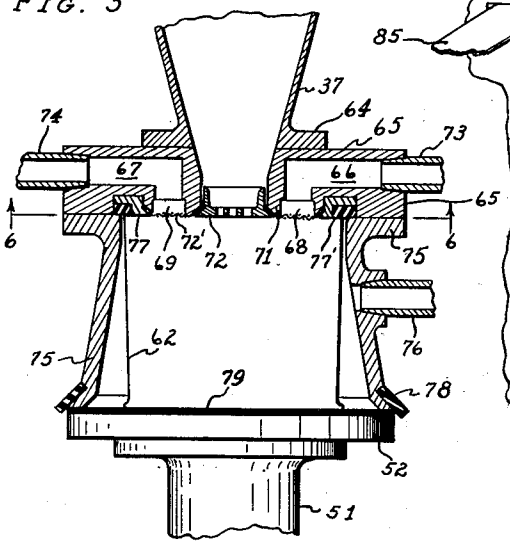
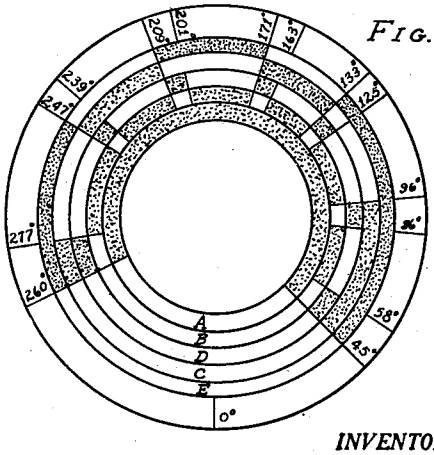


FIG. 14



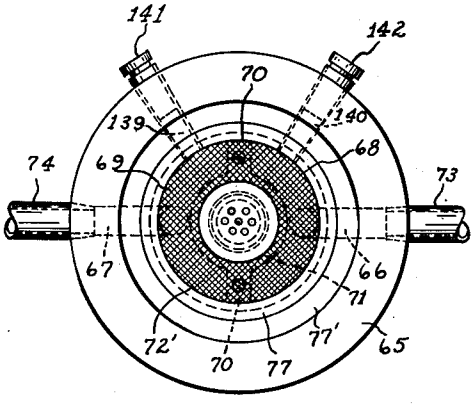


FIG. 6

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FIG. 2

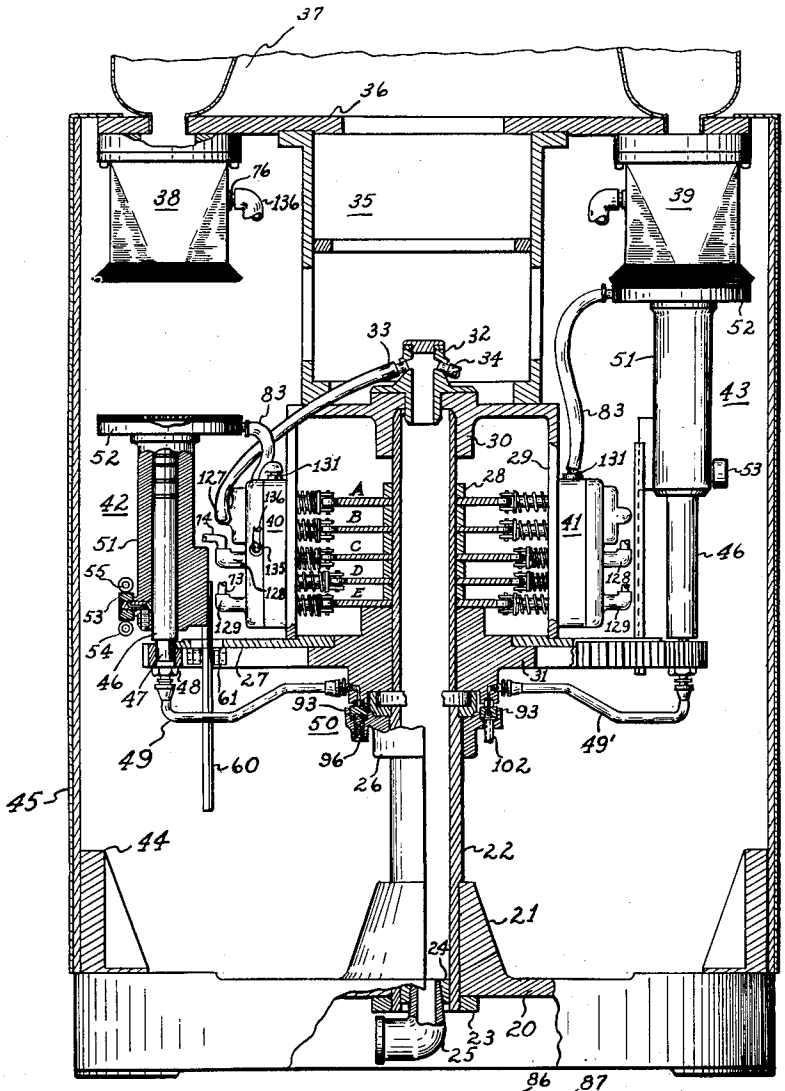
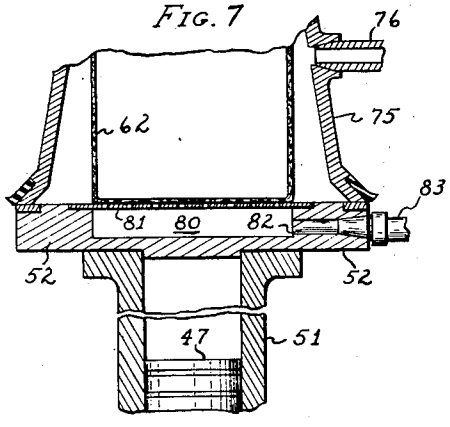


FIG. 7



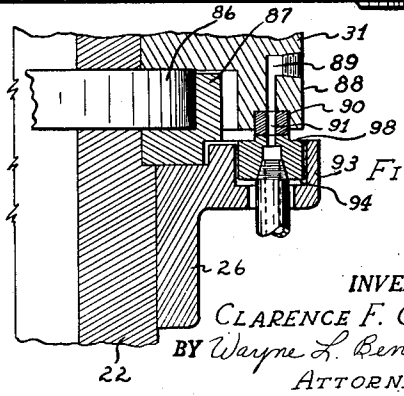


FIG. 8

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APPARATUS FOR FILLING CONTAINERS

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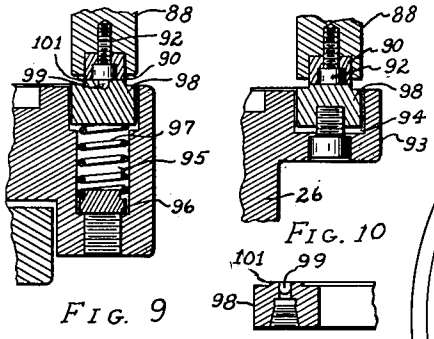


FIG. 9

FIG. 10

FIG. 11

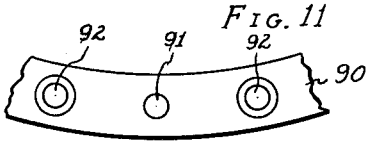
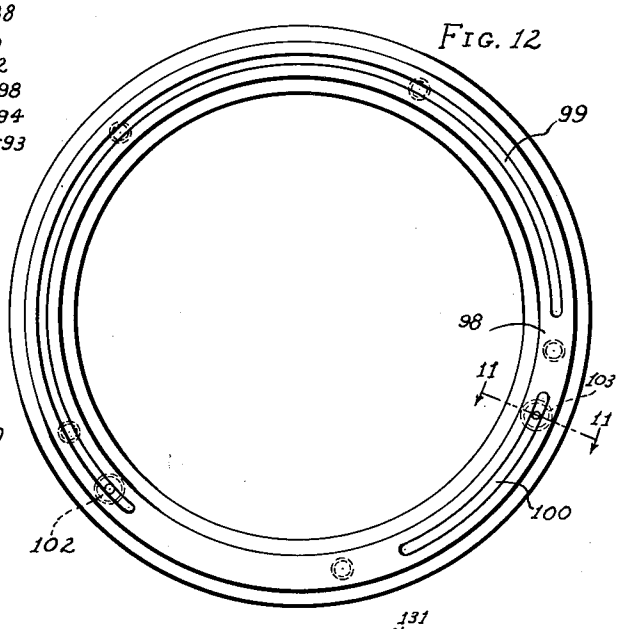


FIG. 13

FIG. 12



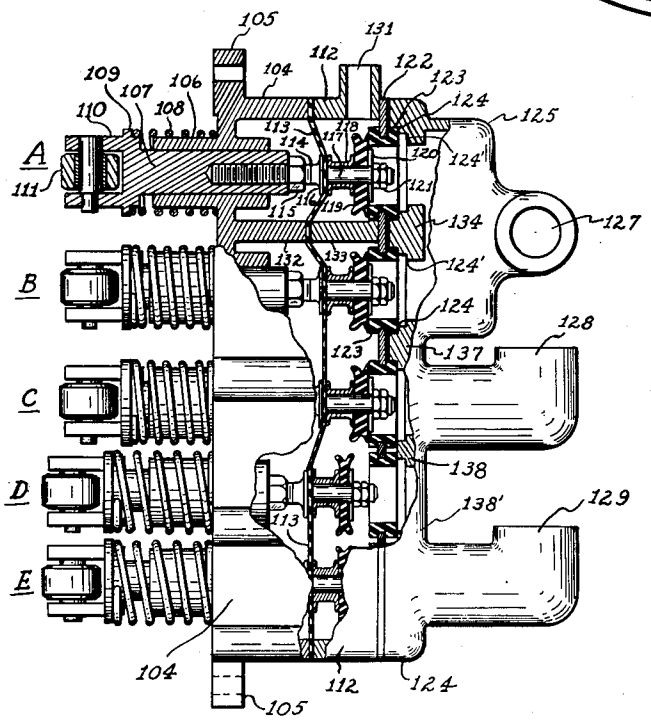


FIG. 3

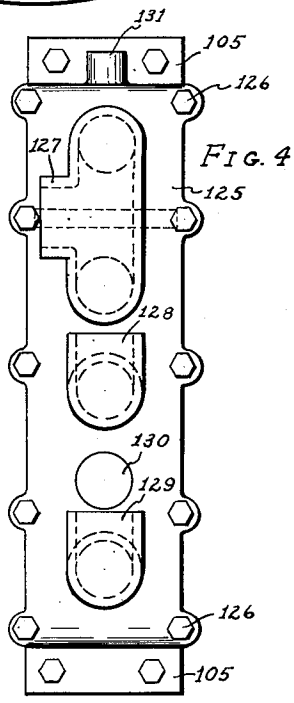


FIG. 4

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Patented Oct. 14, 1952

2,613,864

UNITED STATES PATENT OFFICE

2,613,864

APPARATUS FOR FILLING CONTAINERS

Clarence Freemont Carter, Danville, Ill.

Application January 5, 1948, Serial No. 593

11 Claims. (Cl. 226—98)

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This invention relates to a method and apparatus for filling containers such as cans, cartons, jars and other receptacles with powdered or granulated materials and particularly to a continuous automatic filling machine.

More particularly it relates to a valve mechanism for producing pulsating pressure within and around a container to be filled, said pulsating pressure being the means for filling and packing said containers.

It is an object of this invention to provide a method and apparatus for automatically and rapidly filling and packing a container with comminuted material of either fine or coarse particles to a prescribed and constant volume, weight and density.

It is a further object of the invention to provide a continuous rotary machine equipped with a plurality of container filling heads depending from a rotating hopper each of said filling heads being operatively connected with a multiple valving device to provide a predetermined series of pulsations, or variations in pressure, within and around said container in order to fill it.

In a broad aspect, the invention comprises a mechanism for producing pulsations, said mechanism comprising a valve or engine block comprising a plurality of cam actuated, spring impelled valves, said block being divided laterally into an upper and lower chamber by means of an elastic diaphragm, certain of said valves controlling ports communicably attached to a filling head on a filling machine, another of them controlling a port connectable through a duct to a source of vacuum, still another controlling a port communicating with the atmosphere, the latter two valves operating in conjunction with the first named valves to vary the pressure at the filling head between atmospheric and subatmospheric pressure.

Powder filling machines operating on the vacuum principle with or without added agitators, or packing devices such as augers, are relatively more rapid than the auger type. The multiple valving mechanism covered by the present invention is useful with machines either using vacuum only as a filling aid, or with the combined vacuum and auger machines.

The present device permits alternately evacuating a container and restoring it to atmospheric pressure while it is in filling relationship to a filling machine. It may be used with single or multiple head machines, generally requiring one of the devices for each filling head. The invention is particularly useful in connection to the

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divided head filling machines such as those described in my United States Patent 2,170,469. The device herein illustrated can be used in connection with a special means for positively removing containers from filling relationship to the filling head after it is full. It is particularly useful in connection with machines employing an evacuated shroud which surrounds a collapsible container such as paper bags or boxes, during the filling operation and which is used to equalize the pressure inside and outside the container.

The invention is further understood by referring to the accompanying drawings.

Figure 1 is a side view in perspective of the container filling device, some parts being omitted.

Figure 2 is a side view largely in section, showing a lifting platform and shroud in filling position and another in position to receive an empty container.

Figure 3 is a side view partly in section of the valve mechanism which constitutes this invention.

Figure 4 is a plan view of the valving mechanism.

Figure 5 is a side view in section of one form of divided filling head, and a shroud, with a container in filling position.

Figure 6 is a plan view through lines 6—6 of the divided filling head shown in Figure 5.

Figure 7 is a side view in section of a form of vaccum lift plate and shroud showing a special lift plate constructed to aid in positive removal of a container from filling position.

Figures 8 to 13 inclusive are details of the air valve means used for operating the lifter plates.

Figure 14 is a diagrammatic representation of a preferred filling cycle representing the conditions existing within the container and shrouds at various stages of the filling operation and likewise diagrammatically representing a typical operation of the valving mechanism during the filling operation.

In the drawings is illustrated details of a multiple head filling machine having a base 20 and a centrally located flange 21 in which is set a stationary tubular support 22. The rotating hopper and filling mechanism is supported on support 22 as will be hereinafter described. Beneath base 20 and attached to support 22 is a flange 23 threaded on the support 22 which has a shoulder resting upon flange 21. A plug 24 is located in the tubular support and an elbow 25 is attached thereto communicating with the interior. The elbow serves as a means for connecting the filling machine to a source of vacuum. A flange 26 is

attached to support 22, and serves as a part of the air valving means for actuating the lift plates as will be hereinafter described. Resting on flange 26 and mounted for rotation around support 22 is the main driving gear 27 driven by any conventional power means, not shown, thereby actuating the filling mechanism. A multiple cam assembly 28 is mounted above the hub of gear 27, and is fixed by welding or other appropriate means to support 22. These cams serve to actuate the valves of each of the pulsator units when the machine is in operation. Mounted for rotation around support 22 and provided with appropriate sealing means to prevent leakage of air thereinto, is a cam housing 29 upon which the several valve units (designated as 40 and 41) are mounted by suitable means. The sealing means may comprise an annular boss 30 fitting over the end of the support 22. Housing 29 rests upon the gear 27 adjacent the hub 31. In sealing relationship with sleeve 30 is a distributing manifold 32 which has outlets 33 and 34 connected by means of flexible tubing to the vacuum side of multiple valve units 40 and 41 respectively. As many of these outlets are provided as there are valve units. The flexible tubes leading from the outlet to the connectors 127 are omitted for purpose of simplification. A hopper support 35 is mounted by suitable means on cam housing 29. The hopper base 36 rests upon and is attached by suitable means to hopper support 35 thereby supporting hopper 37. When gear 27 is driven, the cam housing 29 and hopper support 35 rotate around the support 22. Hopper 37 may suitably have a cone shaped inner member not illustrated in detail, from which depend the filling heads 38 and 39.

Mounted on the cam housing 29 are multiple valve units 40 and 41. These will be described later in greater detail. Also attached near the rim of the driving gear 27 are lift plates 42 and 43. These serve as a means for elevating the containers into filling position and of lowering them after they have been filled. They are preferably pneumatically operated. There are usually 8 to 12 or more filling units for individual containers on each filling machine of this type.

Around the base 20 is a flange 44 to which a shell 45 is fastened.

The lift plate mechanism 42 comprises a piston 46 mounted adjacent the rim of the driving gear 27 by any suitable rigid supporting means. As illustrated, the piston has a member 47 which fits into a hole in the rim of the driving gear and is threaded at the end to be fastened in place by nut 48. The piston is hollow in order to serve as a duct for air which passes through conduit 49 from the air valve assembly 50. Air is introduced or released through line 49. Fitted to the piston 46 is a cylinder 51. Appropriate piston rings on the piston serves to form an air tight seal between the cylinder walls and the piston and prevent escape of air into or out of the device except through line 49. When air is introduced through piston 46, it causes lift plate 52 to rise upwardly. In a like manner when the air pressure is released, the lift plate drops downwardly on the piston. The lift plate on the right hand side of Figure 2 is elevated into the position it occupies when the container is being filled which means that air pressure is being exerted through line 49'. In case of the lift plate on the left hand side of Figure 2, the air pressure has been released and the lift plate is lowered.

On each of the pistons is a roller 53 which is used in connection with a safety arrangement and to provide positive means by which each of the lifter plates will be lowered at the end of the filling cycle. Referring to Figure 1, the rotation of the machine is in a clock-wise direction. Cam tracks 54 and 55 are provided at the part of the machine where the lifter plates are being lowered. As a rule, roller 53 will rest on cam track 54 and the cylinder 51 drops of its own weight and the weight of the filled container. In certain instances however, the lifter plate may be held up, in which case the roller 53 strikes the cam track 55 which rests against upright bar 56 which in turn is in contact with the actuating arm 63 of a micro-switch 57. The slightest movement of bar 55 throws the micro-switch and stops the machine. The bar 54 extends only part way around the interior of the machine. In the event that the piston 51 should drop before it is supposed to and the roller 53 were thereby under cam bar 54, another cam bar 58 is attached to bar 56. The roller striking bar 58 causes the lower part of bar 56 to move operating the switch and stopping the machine before damage can be done. Bar 54 is hinged at 59 so that the piston can be raised manually sufficiently for the roller to be put back on track 54. The part of the machine illustrated in Figure 1 is that approaching the end or unloading part of the cycle. On the opposite or loading side of the machine, which is substantially a mirror image of the part illustrated, the cam track corresponding to 55 serves to prevent the cylinder 51 from rising too rapidly when air pressure is applied thereby damaging the shrouds or the lifter plates. The continuation of track 54 on the opposite side of the machine starts the cylinder 51 in its upward movement thus preventing its sticking at the bottom, which might result if only air pressure were used.

Since the cylinder 51 rests and moves freely on the piston 46 there is a tendency for it to turn. This is overcome by providing a channel iron 60 attached to the inside of the piston 51 and passing downward through a guide 61 located adjacent the rim of gear 27. This guide may suitably comprise rollers to reduce friction and permit free action.

A suitable filling head and shroud arrangement is illustrated in Figures 5 and 6. Other such heads are shown in my United States Patents 2,170,469 and 2,360,198. Referring to the figures, the filling head depends from the hopper 37 and is attached thereto by flange 64. The body 65 of the filling head is provided with a pair of ducts 66 and 67 leading to filling head divisions 68 and 69, these being divided by extensions 70 of the annular throat piece 71. A screen retaining member 72 fits into the opening from the hopper 37 and is preferably countersunk to fit flush and at the same time to retain the screen 72' centrally. The outer periphery of the screen is held in place by the ring 77 which fits into an appropriate groove in member 65. These members 72 and 77 may be held in place by suitable means such as machine screws or the like, not shown. The ducts 66 and 67 are provided with flexible connectors 73 and 74 leading to ports 128 and 129, the actual connection being omitted for purposes of simplification, but being apparent by reference particularly to Figures 5 and 2. Member 72 may have a number of openings to permit passage of powder into the container, or may have a single opening, depending on the size of the opening,

the type of powder being handled, and the like.

Attached to the body 65 by any suitable means such as cap screws, studs or the like, is a shroud 75 preferably bell-shaped and having a connection 76 which is connected to the pulsator unit to equalize the pressure inside and outside the container. A gasket 77' lies in member 65 and when the container 62 is raised into filling position, the top is thrust against the resilient gasket. When flexible containers such as cardboard boxes, bags, and the like, are filled, an arrangement such as is shown in my co-pending applications Serial Numbers 698,605, now Patent #2,513,143, issued June 27, 1950, and 698,606, filed September 23, 1946, now abandoned, may be used. The bell-shaped shroud 75 flares at the bottom end and may have a resilient skirt 78 of rubber or the like, cooperating with a flat rubber gasket 79 on the lifter plate 52, to make a vacuum tight seal while the device is in filling position.

A preferred form of lift plate is shown in Figure 7. The lift plate 52 in this case is provided with a vacuum chamber 80 which is a recess in plate 52. A perforated plate 81 covers the vacuum chamber 80, the perforations being arranged in a pattern to lie within the outlines of the bottom of container 62. A duct 82 is provided by drilling a hole from the outside of the lift plate 52 into chamber 80 and inserting a connector 83 which is attached by resilient tube to port 131 of the pulsator. In this way chamber 80 is evacuated whenever valve A is open. Since the container rests flush over the perforations, the suction thus created holds it fast to the lift plate 52 and the container is withdrawn from the filling head by a positive action, and is held on the lift plate until slid off by the action of star wheel 84, the movement of which is synchronized with the rotation of the machine so that the arms catch the containers and slide them off the plate 52 onto a conveyor belt 85. A similar device may be used at the inlet or loading side of the machine to position the containers on the lifter platforms before they are elevated into filling relationship.

The air valve by which the lifter plates are actuated is generally designated by the numeral 50 and is constructed as follows: A collar or casting 26 is rigidly attached by suitable means to tubular support 22. This comprises a thrust bearing assembly 86—87 of conventional design. Gear 27 is mounted for rotation on the thrust bearing. Hub 31 having a flange 88 has an L shaped passage 89 tapped for connecting lines 49 and 49' leading to the pneumatic lifter plates. There is a similar device for each filling head on the machine. The passage 89 is L shaped and leads to a channel in the lower face of flange 88 into which a metal ring 90 is set. This ring has a number of spaced ports 91 drilled therein, one for each lift plate in the machine, and making connection with the vertical openings 89 in the flange 88. The ring is also provided with countersunk screws 92 (Fig. 10) for attaching it to the flange 88. Member 26 attached to tubular support 22 has an outwardly projecting flange 92 in which there is an annular groove 94. At intervals in the flange directly beneath this groove and communicating with it are cut wells 95 containing a guide 96 and a spring 97 urging a ring 98 upwardly into contact with ring 90. The ring 98 has grooves 99 and 100 cut in boss 101, the face of which is the same width as ring 90 which rests upon it. A connection is made with a source of compressed air at 102 in fitting 26. On the opposite side of fitting 26 is an outlet hole 103

open to the atmosphere. Air enters through inlet 102 and passes into the groove 99. When a port 91, communicating with one of the lift plates, coincides with groove 99, air passes through line 49' and through the piston 46 into the cylinder 51 causing the lift plate 52 to rise. When the port of the lift plate corresponds with groove 100, the air within the cylinder 51 is released through port 103 to the atmosphere and permits the lifter plate to fall, lowering the container. The blank spaces between the grooves 99 and 100 form a seal.

Referring to Figures 3 and 4, the pulsator device will now be described. This device comprises a base casting 104 equipped with flanges 105 for mounting the pulsator on housing 29. A journal 106 is provided for the plunger 107. A compression spring 108 fits over the external portion of journal 106, resting against shoulder 109 on the bottom of plunger 107, and against the body of casting 104. The end of plunger 107 forms a yoke 110 in which is mounted a roller 111. Plunger 107 extends through the journal 106 into the interior of casting 104.

A second casting 112 is designed to fit upon casting 104 and be held together by conventional means. A resilient diaphragm 113 which is preferably made of rubber or some other elastomer, forms a partition between castings 104 and 110, dividing them into two chambers. This has the advantage that the fit between journal 106 and plunger 107 need not be vacuum tight. A valve stem 114 is adjustably attached to plunger 107, and is provided with sealing means whereby the valve stem extends through the resilient diaphragm without possibility of leakage of gas from one compartment to the other. As illustrated there is a lock nut 115 on the threaded end of the valve stem. Thus the length of the stem may be adjusted and locked into place. The stem 114 is provided with a shoulder 116 upon which the diaphragm 113 rests, the stem passing through a hole in the rubber diaphragm into the vacuum chamber formed by casting 112. A spool 118 with both ends flanged is slipped over stem 117 and rests against the diaphragm opposite shoulder 116. A resilient valve head 119 which is preferably made of rubber cast in the form illustrated, is next placed on the valve stem 117 resting against the upper flange of spool 118. A washer 120 and lock nuts 121 complete the valve assembly. When the lock nuts 121 are drawn down, the washer 120 compressing the resilient valve head 119 against the spool 118 and in turn forces the lower part of the spool against the rubber diaphragm 113 so that a gas tight seal is formed.

Several variations of valve seat assemblies may be employed but a preferred one is illustrated. Another variation is shown in my co-pending application 550,001, now Patent #2,538,441, issued January 16, 1951, of which this application is a continuation-in-part. A plate 122 contains appropriately located openings corresponding to each of the valve heads. A valve seat 123 of rubber or other suitable material is provided with a circumferential groove which fits over the plate 122 holding it in position. The casting 125 is relieved to form a shoulder 124 against which the seat 123 rests. It is further relieved at 124' to provide a space for the resilient member 123 to bulge upward slightly when the valve head seats against the seat 123. The casting 125 contains the outlet ports to which is made the connections leading to the various parts of the filling appa-

ratus. The castings 104 and 112, plate 122, and casting 125 are assembled by conventional means, such as cap screws 126.

A vacuum inlet 127 is provided and attached by means of an appropriate resilient duct or tube to outlet 34 of the distributing head 32 mounted on support 22. An outlet port 128 connects with line 74, duct 67 and screened head 69. Outlet 129 leads to connector 73, duct 66 and screened head 68. These actual connections are not shown for purposes of simplification but are apparent from the drawings. In the top of member 125 is an opening 130 to the atmosphere. A duct 131 extends from one end of casting 112, connecting with the vacuum chamber of lift plate 52 by means of flexible connection 83.

The valve unit operates in a chamber formed by partitions 132, 133 and 134 in castings 104, 112 and 125 respectively. When the valve unit A is open, vacuum is applied to the lift plate, the suction holding the container firmly in place. The valve is closed only when the filled container is being slid from the lift plate as above described. When the vacuum lift plate is not used, the valve A and the chamber formed by the partitions, as described, are omitted from the device as is shown in my co-pending application Serial Number 550,001 above referred to.

An outlet 135 (see Fig. 2) from the upper chamber of the pulsator unit is connected by means of flexible duct 136 to the shroud at the connection 76. Thus when the valve B is open, the shroud will be evacuated, and when valve B is closed and valve D is open, the shroud will be restored to atmospheric pressure. In this way the same pressure exists in the shroud and within the container at all times. The vacuum inlet 127 is so constructed that vacuum is supplied to both compartments.

Lateral partitions 137 and 139 and 138' separate the valve ports controlled by valves B, C, D and E from each other. In this way vacuum can be drawn through either port 128 or 129 or both by operation of valve B, and either valve C, or E, or both. The pressure can be restored to atmospheric by closing valve B and opening valve D, at the same time leaving valves C and E open.

The cams 28 upon which operate the valves by contact of the rollers therewith, are constructed so that the valves can be opened and closed according to a predetermined plan, such as that diagrammatically illustrated in Figure 14. Each of the circles containing the shading represents a valve and each of the shaded or unshaded areas represents a valve position, the unshaded portions representing the valves in closed position, i. e., a high spot on the cam, and the shaded portions representing the valves as open, that is, a low-spot on the cam.

The springs 108 are under compression hence the normal position of the valves is open. When the valve roller strikes a high spot on the cam track, the valve is closed. The circles are lettered to correspond to the valve units illustrated in Figure 3. The zero point represents the approximate point at which the empty container is placed in position on the lift plate. The filled container is removed between about 260° and the 0° point. The machine as illustrated operates in a counter-clockwise direction.

It should be borne in mind that each one of the lift plates and filling heads has one of the pulsator or multiple valve units controlling it. The operation is described in terms of a single unit although the usual filling machine may have 4, 6, 8, 12 or more such individual units associated with a single hopper.

Refer to Figures 14 and 3, particularly. At 0° point the pressure within the container is atmospheric. As the hopper rotates from 0° to 45° the container is placed in position on the lift plate and air is introduced through the air valve 50 in a manner previously described, causing the lift plate to rise, putting the container in the filling position illustrated in Figure 5 and on the right hand side of Figure 2. The cam tracks controlling the valves are all high, engaging the rollers, so that all of the valves are closed. At approximately 45° of revolution, valves A, D, C and E are opened because of low points in the respective cam tracks. Vacuum valve B remains closed at this point but because valve A is open, the vacuum chamber 80 is under suction and the container is held against the lift plate. At approximately 58° the relief valve D is closed and the vacuum valve B is opened. Since valves C and E, to each side of the filling head, are open, the pressure within the container is reduced as the air is withdrawn therefrom. Port 135 to the shroud is open at all times, hence the shroud is simultaneously evacuated and the pressure inside and outside the container is equal. The container continues to be held firmly in position. At about 86° of revolution the vacuum valve B is closed and the relief valve D is opened for a space of about 10° of revolution. Since valves C and E are still open the air rushes back through lines 73 and 74, and screened heads 68 and 69, clearing the screen and restoring the pressure within container 62 to atmospheric. Due to the fact that the shroud is connected through line 76 to port 135, the pressure outside of the container is simultaneously restored to atmospheric. At about 96° the vacuum valve B again opens while simultaneously valve D to the relief line and valve C to one side of the filling head, close. Since valve E to the other side of the filling head is still open, air is withdrawn through that side of the filling head. Due to the lowered pressure within the container, the material is drawn from hopper 37 through filling throat. This operation is continuous until about 125° of revolutions at which time the vacuum valve is again momentarily closed, the relief valve D opened. Due to the fact that valve C is still closed and valve E is still open, air rushes from the atmosphere back through the side of the filling head controlled by valve E and clears the powder from it. At about 133° valve E is closed, the relief valve is closed and the vacuum valve B and valve C are opened. At 163° valve B controlling the vacuum to this compartment is closed, the relief valve D is opened and since valve C is still open it permits air to rush back through the other side of the filling head clearing that screen. At about 171° the vacuum valve B is again opened, the relief valve D closed, valve C is closed and valve E is opened to evacuate the opposite side of the filling head. This continues to about 201° at which point valve B is closed, valve D is opened and the air rushes back through open valve E clearing the screen. At 209° the relief valve D is closed as is valve E and vacuum valve B and control valve C are opened. At about 239° valve B is closed, valve D is opened and the screen of the side of the filling head controlled by the valve C is cleaned by the back rush of air. At 247° the relief valve D and valve C are closed, vacuum valve B and valve E are opened and held open to about

277° at which point the vacuum valve B is closed and both relief valve D and valve C are opened permitting air to rush back through both filling heads to clean the screens. This continues to about 260°. Valve A has been open from 45° to 260°. At 260° all of the valves are closed. Due to the fact that there is no way provided for relieving the vacuum in the compartment controlling line 131, the container is held against the perforated plate but the vacuum continues to exist in compartment 80. This lasts sufficiently long for connection to be made through the relief port in ring 98 by which the lift plate drops, lowering the container from filling position and out of the shroud 75. One arm of the star wheel 84 then pushes or slides the container off of the perforated plate. The vacuum is broken as soon as one or more of the perforations becomes exposed.

The cycle just described is repeated for each filling head during each rotation of the hopper.

It is advantageous in certain instances to provide air ducts 139 and 140 provided with plugs 141 and 142 (see Fig. 6). By removing these plugs and applying an air hose from a source of compressed air, it is possible to more thoroughly clean the screened filling head when this becomes necessary, as it does from time to time due to the accumulation of coarser particles that stick in the screen.

The preferred embodiment of the device has been described but should not be construed as limited exactly to the device illustrated and described.

I claim as my invention:

1. A filling machine comprising a support, a hopper mounted thereon for rotation, a plurality of filling heads depending from said hopper, ducts connecting each of said filling heads with a pulsator; said pulsator comprising a hollow engine block having a plurality of ports, a plurality of valves mounted for reciprocation therein controlling said ports, a resilient diaphragm dividing said block laterally into separate chambers, the stems of said valves extending through said diaphragm, means maintaining said diaphragm in gas-tight relationship with said block, means forming a gas-tight seal between said diaphragm and said valve stems whereby no gas can pass from one of the chambers to the other but normal reciprocating action of the valves is permitted, means for connecting said ducts with said ports; means for mounting said pulsator on said support, means whereby one of said ports is connectable with a source of vacuum, another of said ports communicating with the atmosphere, timing cams mounted on said support engaging the stems of said valves thereby reciprocating them when said hopper is rotated, container lifters corresponding to said filling heads whereby a container to be filled is placed in filling relationship with said filling head, means for positioning a container on said container lifters and means for removing filled containers therefrom.

2. A filling machine comprising a support, a hopper mounted thereon for rotation, a plurality of filling heads depending from said hopper, ducts connecting each of said filling heads with a pulsator; said pulsator comprising an engine block having a plurality of ports, a plurality of reciprocable valves mounted therein to control said ports, a resilient diaphragm dividing said block laterally in a gas-tight manner into separate chambers, the stems of said valves passing through said diaphragm, means for forming a gas-tight seal between said valve stems and said diaphragm,

said seal means permitting normal reciprocating action of said valves; means connecting said ducts with said ports; means for mounting said pulsator on said support, means whereby one of said ports is connectable with a source of vacuum, another of said ports communicating with the atmosphere, timing cams engaging the stems of said valves thereby reciprocating them when said hopper is rotated, means for placing a container to be filled in filling engagement with said filling heads and means for disengaging the container when full.

3. The apparatus of claim 2 wherein the valves comprise resilient valve heads and the valve seats around said ports are of resilient material.

4. The apparatus of claim 2 further characterized in that valves comprise resilient self-cleaning valve heads.

5. A filling machine comprising a support, a hopper mounted thereon for rotation, a plurality of filling heads depending from said hopper, a plurality of pulsators, ducts connecting each of said filling heads with a pulsator; said pulsator comprising a hollow engine block having a plurality of valve ports, a plurality of valves controlling said ports mounted for reciprocation in said block, each of said valves comprising a resilient valve head, a valve stem and a roller, spring valve-actuating means, said roller and spring means being external of said block and adapted to reciprocate said valve when operatively engaging a timing cam, a resilient diaphragm dividing said block laterally into chambers, means maintaining said diaphragm in gas-tight relationship with said block, means forming a gas-tight seal with said diaphragm and said valve stems which extend therethrough; journal bearings in said block wherein said valve stems are journalled, said bearings being in one of said chambers and the valve ports opening from the other chamber; means for mounting said pulsator on said support, means whereby one of said ports is connectable with a source of vacuum, another of said ports communicating with the atmosphere, timing cams mounted on said support engaging the stems of said valves thereby reciprocating them when said hopper is rotated; means for engaging a container to be filled in filling relationship with said filling heads and means for disengaging said containers when full.

6. A filling machine comprising a support, a hopper mounted thereon for rotation, a plurality of filling heads depending from said hopper, a plurality of pulsators, ducts connecting each of said filling heads with a pulsator, said pulsator comprising a hollow engine block, said block comprising a bearing casting having a plurality of journal bearings therein, a second casting attachable thereto and a top casting having a plurality of ports therein; a plurality of valves mounted for reciprocation in said block, the valve stems being journalled in said bearings and extending through said bearing casting; means mounted on said valve stems externally of said bearing casting and engageable with timing cams, means external of said casting urging the valves toward an open position, a resilient self-cleaning valve head attached to said valve stem, a resilient diaphragm, means to clamp said diaphragm in gas-tight relationship between said bearing castings and said second casting to form a lateral gas-tight separation between the two castings, means forming a gas-tight seal between the diaphragm and the valve stems which extend through said diaphragm, means for attaching the top casting to

the second casting thereby forming a chamber controlled by said ports and valves, timing cams mounted on said support engaging the stems of said valves thereby reciprocating them when said hopper is rotated; means for placing a container to be filled in filling relationship with said filling heads and means for disengaging the container when full.

7. A filling machine comprising a support, a hopper mounted thereon for rotation, a plurality of filling heads depending from said hopper, said filling heads comprising container receiving hoods, ducts connecting each of said filling heads with a pulsator, a duct connecting said hood with said pulsator, said pulsator comprising a hollow engine block having a plurality of ports, a plurality of valves mounted for reciprocation therein controlling said ports, a resilient diaphragm dividing said block laterally into separate chambers, the stems of said valves extending through said diaphragm, means maintaining said diaphragm in gas-tight relationship with said block, means forming a gas-tight seal between said diaphragm and said valve stems whereby no gas can pass from one of said chambers to the other but normal reciprocating action of the valves is permitted; a vertical partition separating one of said ports and valve associated therewith from the remaining valves and ports, the portion of the chamber formed by said partition being connected by the second-mentioned duct to said hood, means connecting the last named port and one of the other ports with a source of vacuum, another of said ports communicating with the atmosphere, timing cams mounted on said support engaging the stems of said valves thereby reciprocating them when said hopper is rotated, container lifters corresponding to said filling heads whereby a container to be filled is placed in filling relationship therewith inside said hood, said lifter comprising means for closing said hood when the container is in filling position, and means for disengaging the filled containers.

8. The apparatus of claim 6 wherein said ports comprise a resilient valve seat.

9. The apparatus of claim 6 wherein the ports comprise a resilient valve seat and the valves comprise a resilient self-cleaning head.

10. A filling machine comprising a support, a hopper mounted thereon for rotation, a filling head depending from the hopper, a pulsator having ports, ducts connecting said filling head with said ports of said pulsator, means for positioning a container in filling relationship with the filling head; said pulsator comprising a hollow engine block having a plurality of ports, a plurality of valves equipped with resilient valve heads controlling said ports, said valves being mounted for reciprocation in said block, timing means operable when said hopper is rotating for reciprocating said valves when a container is in filling position which includes means for opening the valves and means for closing the valves, resilient diaphragm means within said hollow block through which the valve stems extend, means for attaching the diaphragm means to the valve stems, and other means for attaching the diaphragm to the block, both in gas tight relationship, one of said ports being connectable to a source of vacuum and one communicating with the atmosphere, and means for removing filled containers from filling position.

11. A filling machine comprising a support, a hopper mounted thereon, a filling head depending from the hopper, a pulsator having ports, ducts connecting said filling head with said ports of said pulsator, a rotatable dial means for positioning a container in filling relationship with the filling head, mounted on said dial, said pulsator comprising a hollow engine block having a plurality of ports, a plurality of valves equipped with resilient valve heads controlling said ports, said valves being mounted for reciprocation in said block, timing means operable when said dial is rotating for reciprocating said valves when a container is in filling position which includes means for opening the valves and means for closing the valves, resilient diaphragm means within the hollow block through which the valve stems extend, means for attaching the diaphragm means to the valve stems, and other means for attaching the diaphragm to the block, both in gas tight relationship, one of said ports being connectable to a source of vacuum and one communicating with the atmosphere; and means for removing filled containers from filling position.

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