Nov. 24, 1953 P. R. FECHHEIMER 2,660,350

APPARATUS AND METHOD FOR ACCURATELY FILLING CONTAINERS

Filed May 27, 1950

3 Sheets-Sheet 1

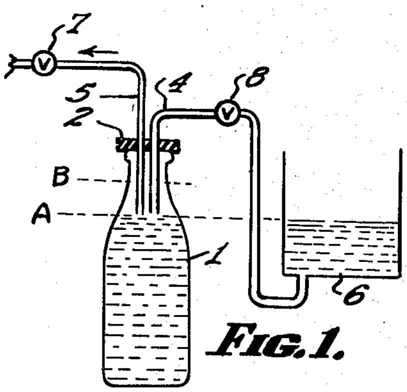


FIG. 1.

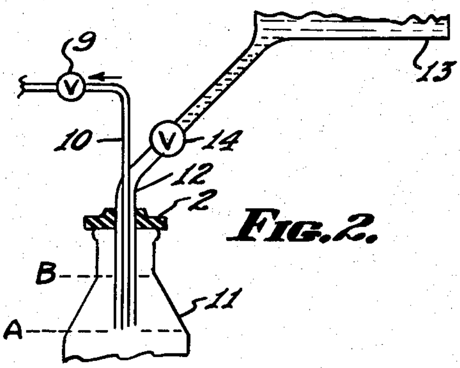
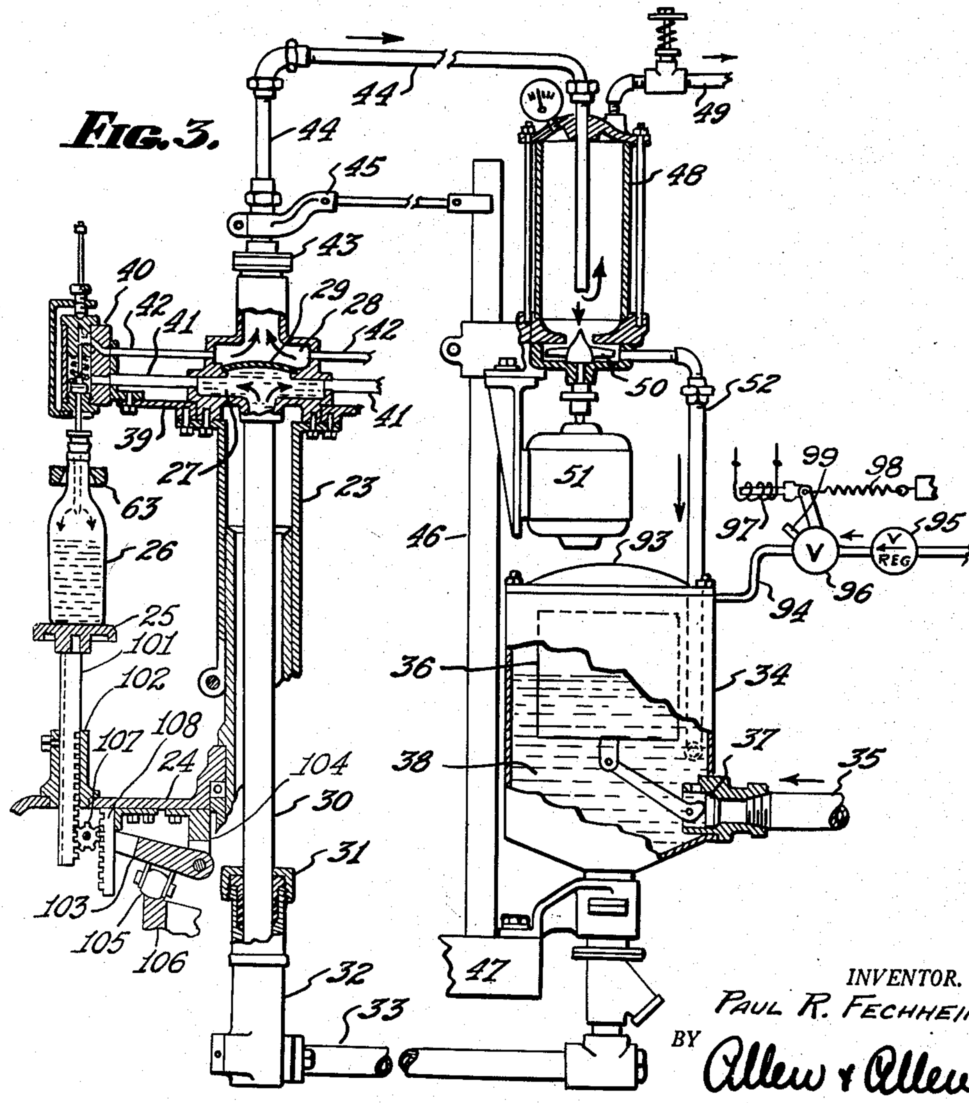


FIG. 2.

FIG. 3.



INVENTOR.
PAUL R. FECHHEIMER,
BY Allen & Allen
ATTORNEYS.

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Filed May 27, 1950   3 Sheets-Sheet 2

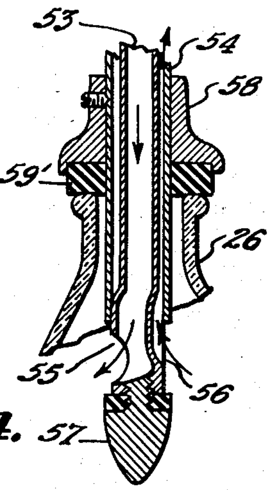

FIG. 4.

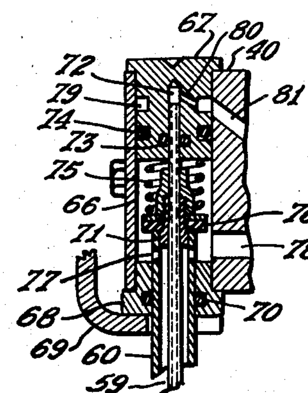

FIG. 5.

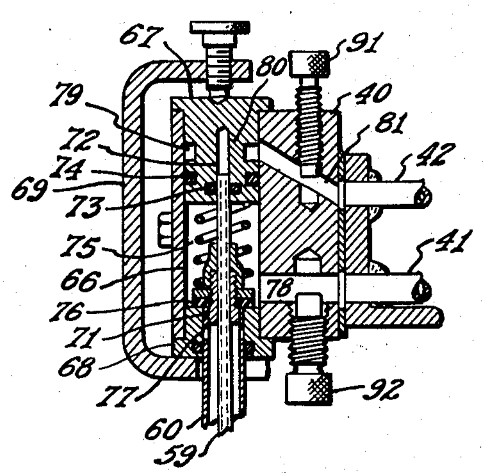

FIG. 6.

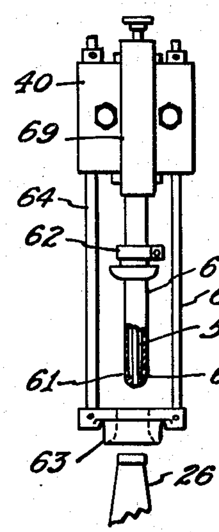

FIG. 7.

INVENTOR.
PAUL R. FECHHEIMER,
BY Allen & Allen
ATTORNEYS.

Nov. 24, 1953 P. R. FECHHEIMER 2,660,350

APPARATUS AND METHOD FOR ACCURATELY FILLING CONTAINERS

Filed May 27, 1950 3 Sheets-Sheet 3

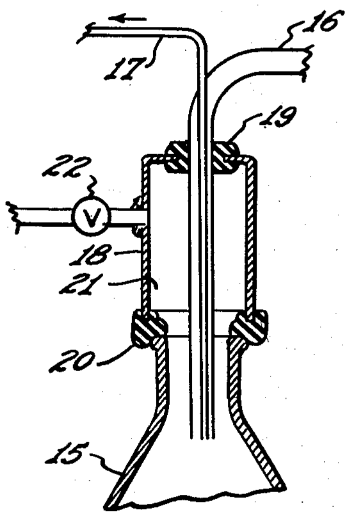

Fig. 8.

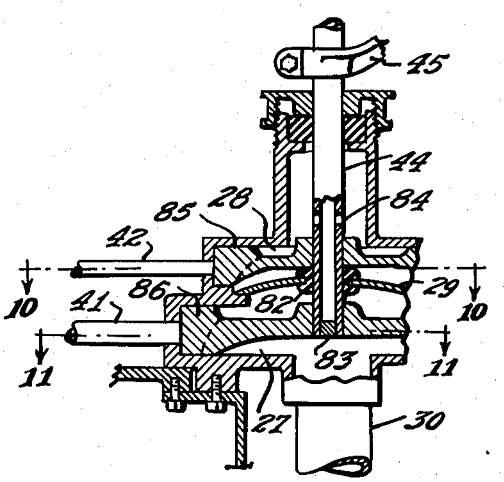

Fig. 9.

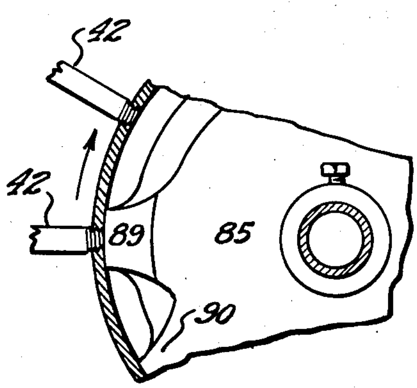

Fig. 10.

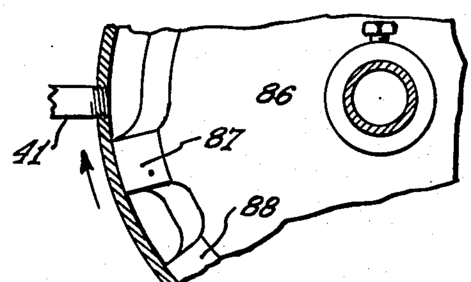

Fig. 11.

INVENTOR.
PAUL R. FECHHEIMER,
BY Allen & Allen
ATTORNEYS.

Patented Nov. 24, 1953

2,660,350

UNITED STATES PATENT OFFICE

2,660,350

APPARATUS AND METHOD FOR ACCURATELY FILLING CONTAINERS

Paul R. Fechheimer, Cincinnati, Ohio, assignor to The Karl Kiefer Machine Company, Cincinnati, Ohio, a corporation of Ohio

Application May 27, 1950, Serial No. 164,714

10 Claims. (Cl. 226—22)

1

My invention relates to machines and methods of filling containers such as bottles wherein a seal is made with the top of the bottle through which seal a filling tube and an exhaust tube extend, and hence are inserted into the bottle, and in which the air in the bottle is exhausted through the vent tube while the contents flow into the bottle through the filling tube under a head produced wholly or in part by the exhaustion of the tube. A principal object of my invention is the attainment of extreme accuracy of fill in machines of this type by simpler, less expensive and more expeditious means.

In my copending application Serial No. 8,885 filed February 17, 1948 and entitled Machine for Filling Containers, I have shown a filling machine in which, through a filling tube extending downwardly to a position near their bottoms, the bottles or other containers are filled to the level of the end of the exhaust tube lying near their mouths, this fill, taking into account the displacement produced by the filling tube, amounting to a substantial overfill. When the overfilling has been accomplished, the bottles or other containers are lowered to a point at which the end of the filling tube lies exactly at the desired height of fill, the seal at the tops of the bottles being broken or relieved at the time of such lowering. The connections are then reversed, vacuum is applied to the filling tube, and the excess liquid, constituting the overfill, is drawn off. Such a procedure has many advantages. The filling height can be adjusted by positioning an adjustable cam, determining the point to which the bottles will be lowered for withdrawing overfill. This is very much simpler than attempting to adjust all of a plurality of filling spout structures (frequently as many as 24) on the filling machine; and the cam adjustment can be accomplished while the machine is running. On the other hand, the reversal of the connections aforesaid requires a relatively complicated and expensive valving mechanism, and also a long rise and fall of the containers in the machine. Thus the capacity of the machine, as to the variety of containers it can fill, becomes limited to a relatively narrow range of container heights.

Hitherto in a filling machine in which the containers are exhausted, there has not been any mode of dependably securing an overfill excepting that just described, namely, the use of a relatively long filling tube and a relatively short exhaust tube so that the height of the overfill is determined by the position of the end of the exhaust tube, this arrangement in turn necessitating a reversal of connections, so that the excess filling material can be drawn off through the filling tube.

2

It is an object of my invention to provide a mode of operation and a mechanism wherein the height of the overfill is not determined by the position of the ends of the filling and exhaust tubes during the filling operation. Specifically, it is an object of the invention to provide a mode and apparatus for filling a sealed container beyond the level established by the end of the vent tube and without a reversal of connections to the vent and filling tubes.

It is an object of my invention to provide a mode of operation and an apparatus involving the use of a filling spout having exhaust and filling tubes (usually but not necessarily concentric), in which the ends of the tubes may be substantially coterminous, and in which the container may be overfilled beyond the ends of the tubes, after which the container may be lowered and the excess drawn off through the vent tube.

It is an object of my invention to provide an apparatus for the purposes described which, while providing extreme accuracy of fill, will not suffer in rapidity of operation, and will be cheaper, simpler and less likely to fail than accurate fill apparatus hitherto available.

These and other objects of my invention, which will be set forth hereinafter or will be apparent to one skilled in the art upon reading these specifications, I accomplish in that procedure and apparatus, of which I shall now describe an exemplary embodiment. Reference is made to the accompanying drawings, wherein:

Figure 1 is a diagrammatic representation of a filling operation in which the container is exhausted and the filling material is drawn into it at a pressure below atmospheric pressure.

Figure 2 is a diagrammatic representation of an operation in which a withdrawal tube is provided to withdraw the air from the container, but the contents are introduced under superatmospheric pressure.

Figure 3 is a diagrammatic representation of a filling machine employing the principles of this invention.

Figure 4 is a partial sectional view of a filling spout, seal and container in filling assembly.

Figure 5 is a partial sectional view of a filling spout assembly.

Figure 6 is a more complete view of a filling spout assembly.

Figure 7 is an elevational view of a filling spout assembly including a centering bell.

Figure 8 is a partial sectional view of a filling mechanism in which a chamber, for purposes hereinafter described, is formed in the sealing mechanism.

Figure 9 is a partial vertical sectional view of a filling head in which the filling and exhaust chambers are provided with internal valve means.

Figure 10 is a partial horizontal section taken along the line 10—10 of Figure 9.

Figure 11 is a partial horizontal section taken along the line 11—11 of Figure 9.

Referring to Figure 1, which is purely diagrammatic in nature, it will be seen that if a container 1 is sealed, as at 2, at the neck with the introduction of a filling tube 4 and a withdrawal or vacuum tube 5, contents from a reservoir 6 may be drawn into the container through the filling tube 4 as the air is exhausted from it by the vent tube. If the relative sizes of the tubes, i. e. their specific resistances to the flow of materials, considering the degree of vacuum in the tube 5 and the negative head if any of the liquid in the tube 4, are such that the exhaust tube can carry away just as much fluid as is introduced by the filling tube, the container will fill to the lower end of the exhaust tube and no further, the pressure of the air remaining in the container above the liquid being that required to counterbalance the negative head of the liquid at the filling tube orifice. If, however, the exhaust tube is so arranged as to be capable of withdrawing the air from the container at a more rapid rate than the liquid is introduced by the filling tube 4 (as can be accomplished by enlarging the effective diameter of the exhaust tube as compared with the effective diameter of the filling tube, or by restricting the flow of liquid through the filling tube, or by employing a more viscous liquid which encounters greater resistance in filling through the filling tube), then depending upon the vacuum source connected to the exhaust tube 5, a greater degree of vacuum will be drawn into the container than that required to counterbalance the negative head of the liquid in the filling tube 4. The container will again fill to a level demarked by the end of the exhaust tube; but if after this happens a valve 7 in the exhaust line is closed, the liquid will continue to flow until the negative pressure of the air above the liquid in the container 1 becomes equal to the negative head of the liquid in the filling tube 4. Thus the level of the liquid will rise above the end of the exhaust tube 5 and the container will be overfilled to some height such as that indicated at B, as compared with the level A at the orifice of the exhaust tube. A valve 8 in the filling line may then be closed, and the seal 2 broken by lowering the bottle to some predetermined position at which the desired height of fill will be demarked by the lower end of the vacuum tube 5. The desired height of fill and hence the position of the lower end of the tube 5 will, of course, lie somewhere between the levels A and B. If the valve 7 be now opened, excess fluid contents will be withdrawn from the container through the exhaust tube 5 to establish exactly the predetermined height of fill.

The same effect may be secured by certain variants of procedure. For example, if at a time when the liquid level in the container approaches or lies at the level A, the valve 8 be closed so that no more filling material can enter the container, air or liquid will continue to be withdrawn through the tube 5, rarefying the atmosphere remaining in the container until the degree

of vacuum therein substantially equals that of the vacuum source connected with the exhaust tube 5 less the effect of restrictions in the vacuum line. At this point, if the valve 7 be closed and the valve 8 opened, liquid will again flow into the container until the degree of vacuum therein counterbalances the negative head of the liquid filling material in the filling tube 4, and in this way, the liquid level may be caused to rise within the container, as at B, above the ends of the filling and exhaust tubes. Then the valve 8 may be closed, the seal broken by lowering the container, and the excess filling material drawn off as described above, upon the opening of the valve 7.

Filling machines, in which the contents are introduced into a container under greater than atmospheric pressure while at the same time the container is exhausted through a vent tube, are known in the art. The principles of this invention can be applied to such filling machines with a variant of procedure. Under the particular circumstances outlined, whether any air remaining in the container is at atmospheric pressure or at a lesser or greater pressure will, during the filling operation, depend upon the rates of flow of the filling material into the container and of the contained atmosphere out of the container through the vent tube. These rates of flow can be controlled, as above, by controlling the effective diameters of the filling and exhaust tubes, by placing adjustable control valves in these lines, and in other ways. But if the rate of withdrawal of the atmosphere during filling tends to be equal to or greater than the rate of introduction of the contents, then any atmosphere remaining in the container will be either at atmospheric pressure or at somewhat less than atmospheric pressure. Under these circumstances, if after the liquid has reached the ends of the filling and exhaust tubes at the level A in Figure 2, a valve 9 in the exhaust tube 10 is closed, liquid under greater than atmospheric pressure will continue to flow into the container 11 through the filling tube 12 until the positive pressure of the remaining atmosphere in the container counterbalances the positive head of the filling material represented in Figure 2 diagrammatically as coming from an elevated reservoir 13. Thus the liquid level in the container will rise beyond the ends of the tubes to some level B. At this point a valve 14 in the filling line may be closed and the seal 2 broken by lowering the container. If a spitting difficulty is encountered by reason of the excess pressure within the container, this may be alleviated in various ways, such as by opening the valve 9 in the exhaust line substantially coincidentally with the breaking of the seal, or by venting the container to the atmosphere before breaking the seal through a valve in the seal, not shown in Figure 2.

The spitting to which reference has been made may be caused by bubbles of air which have not broken up when the time arrives to lower the container away from the seal and also by the fact that the interior of the container at the time is under superatmospheric pressure. When the pressure is lowered to atmospheric by the breaking of the seal, these bubbles may expand, burst, and throw some liquid upward through the neck. It is quite possible to keep the vacuum or exhaust line open or partially open so long as a container is in position on an elevated or partially elevated tray or platform. Keeping the exhaust open in this way, a variant of procedure is to cut the pressure of the incoming liquid, first, when the container is partially full, so as to permit the rarefication of the remaining air in it, and second, just before the seal is broken and the container lowered to the intermediate or draw-off position. When the pressure on the incoming liquid is cut as by restricting the filling line, the vacuum quickly exhausts the pressure in the container so that no spitting occurs when the seal is broken. In the various ways set forth above, a dependable and adequate overfill can normally be obtained. In filling operations there is time enough to accomplish this because the actual overfilling does not take longer than the normal dwell which is provided to permit foam to subside. The overfill, of course, occurs above the lower end of the filling tube, and hence the material introduced to produce the overfill is not itself susceptible to foaming.

One other factor may affect operations such as hereinabove described. This factor is the actual volume of the atmosphere remaining in the container after the liquid level has reached the ends of the filling and exhaust tubes. In containers such as bottles having relatively wide and elongated necks, a sufficient volume of air is ordinarily present to give an adequate overfill in the methods taught above. It will be understood that the overfill must be sufficient to accommodate the displacement of the filling and exhaust tubes as the container is lowered to the predetermined position, and still provide an excess of contents to be drawn off through the exhaust tube to lower the liquid level to an exact and predetermined height. In containers such as bottles having elongated necks of relatively very small internal diameter, or in bottles having very short necks, which bottles must nevertheless be filled quite full to attain the desired volume of contents, an inadequate air space may be provided. Under these circumstances it is within the scope of my invention to augment the air space by providing additional enclosed air space outside the container but in communication therewith. In Figure 8 I have shown a bottle 15 being filled through the agency of a filling tube 16 and an exhaust tube 17. These tubes are concentric, as is conventional, and they form a filling stem. This stem bears a sealing element having a hollow elongated body 18, a seal 19 against the stem and a seal 20 against the neck of the bottle. It will be seen that this element provides an internal air space 21 of substantial volume and in communication with the air space inside the bottle 15. For pressure filling operations the body 18 may be provided, if desired, with a valved vent 22 whereby pressure can be relieved on the container prior to the breaking of the seal to avoid spitting. It will be understood, of course, that the processes hereinabove should not be carried on with the apparatus of Figure 8 in such a way as to cause liquid to enter the body 18 of the sealing element. If a container, in order to get into it the desired volume of contents, must be filled to a point so close to the upper end of the neck of the bottle that no room is left for an actual effective overfill, then the teachings of this application do not apply.

I shall now describe certain specific embodiments of apparatus with which the processes hereinabove set forth may be practiced. Reference is made to Figure 3 wherein 23 represents the main column of a filling machine, rotating with a table 24 bearing a plurality of platform elements 25 for the reception of bottles 26. The platforms, during the rotation of the table, may be raised and lowered to and from various heights by mechanisms such as are shown in the copending application referred to above. In the embodiment illustrated in Figure 3, the platform element 25 is mounted on rod 101 having teeth 102 at its lower end, the rod being vertically slidable through table 24. A bifurcated lever arm 103 is pivoted at one end in bracket 104 beneath the table 24. Intermediate its ends the lever arm 103 carries cam following roller 105 engaging a cam 106 on the frame of the machine. At its opposite end, the lever arm contains pinion 107, which not only meshes with the teeth 102 on the vertically reciprocable rod 101, but also with the teeth of rack member 108, depending from table 24 and fixed thereto. In this way, the movement of the outer end of lever arm 103 is multipled in producing up-and-down movement of the tray-carrying vertically movable rod 101.

The head is divided into two compartments in the specific embodiment, the lower compartment 27 being a compartment for the filling fluid, and the upper compartment 28 being a vacuum or overflow compartment, the two being separated by a diaphragm 29. To accommodate containers of varying heights, the central column element 23 is made adjustable up and down by known means. Centrally of the column there is a conduit 30 connecting with the chamber 27 and movable up and down with the adjustment of the height of the column in a gland 31 in a fitting 32. The conduit 30 is also rotatable in the fitting 32 to permit rotation of the column and head. A conduit 33 connects the fitting 32 with a reservoir 34 for the filling material. This reservoir may be fed from a source of supply, not shown, through a conduit 35; and it is usual to provide a float 36 actuating a valve 37 in communication with the conduit 35 so that the height of the fluid 38 in the reservoir may be maintained and controlled.

The head element having the chambers 27 and 28 is provided with an annular supporting element 39 carrying various holders 40 for the filling spout mechanisms hereinafter described. Conduits such as 41 connect the head filling chamber 27 with these holders. Likewise, conduits such as 42 connect the vacuum or exhaust chamber 28 with the holders. The vacuum or exhaust chamber is provided with a gland 43 rotatably and slidably engaging a vacuum conduit 44, the lower end of which is customarily held by a bracket 45 engaging a post 46 on the frame 47 of the machine. The reservoir 34 may also be mounted on this frame as well as a trap element 48 connected with the vacuum or exhaust conduit 44 and also through a conduit 49 and a pressure controlling valve, if desired, with a vacuum pump (not shown).

An impeller 50 may be located in the bottom of the trap 48 and driven by a motor 51 so as to transfer fluid coming over in the exhaust conduit 44 through a conduit 52 back to the reservoir 34.

In Figure 4 I have shown in section one form of filling stem construction comprising concentric tubes 53 and 54. These tubes have respective orifices 55 and 56 located substantially at the same level. Either tube may be a filling or an exhaust tube as desired; and the stem may be provided at its end with a fitting 57 for facilitating the entry of the stem into the bottle 26. The stem carries, preferably adjustably, an element

58 which bears a sealing element 59′ for contacting the top of the neck of the bottle, as shown.

A somewhat different stem is indicated in Figure 7 having a central exhaust tube 59 opening through the tapered bottom end of an outer filling tube 60. This tube is closed by the tube 59 at its lower end, but passageways for the exit of the filling fluid are formed, as at 61. This stem will also be provided with a suitable form of adjustable sealing element 62.

It is frequently of assistance in filling machines of this type to provide for each filling head and each platform 25 a centering bell for insuring the proper positioning of the necks of the containers. Such a centering bell is shown at 63 in Figure 7. It is mounted on rods 64 and 65 which are vertically slidable in the filling head mechanism.

In filling machines of the type described, it is a general practice to provide valving means for connecting the filling and exhaust tubes to the respective filling and exhaust conduits 41 and 42, and disconnecting them therefrom, so that the bottle will actuate these valving means. Such an arrangement has the advantage that neither the filling nor the exhaust conduit will be opened up if no container happens to rest upon the platform 25. I may employ such devices in the practice of my invention. Many arrangements have been suggested, and I am not limited to any one of them. I will herein describe a particular construction, it being understood that this construction does not constitute a limitation upon my invention. As shown most clearly in Figures 5 and 6, each of the holder elements 40 is perforated vertically, as at 66. Upper and lower plug elements 67 and 68 are employed, fitting in either end of the bore 66. A C-clamp element 69 is employed to hold the plugs in the bore. The filling tube 60 has a sliding fit in the lower plug 68 rendered liquid-tight by a sealing ring or gasket 70. The inner or exhaust tube 59 in this instance extends through the filling tube 60 and through an element 71 closing the upper end of the filling tube. The exhaust tube 59 has a sliding engagement in a bore 72 in the upper plug 67 and a sealing gasket 73 may be provided to seal the plug against the exhaust tube, while another sealing gasket 74 may be provided to seal the plug against the walls of the holder 40 at the bore 66.

A compression spring 75 is placed within the bore engaging the upper plug and a flange formed on the head 71. A sealing gasket 76 is placed beneath this flange, and perforations 77 are formed in the filling tube 60 adjacent its upper end. It will be seen from this construction that as the neck of a bottle 26 engages the sealing element 59′ or 62 on the filling stem and the bottle is raised by the platform 25, the filling stem will be driven upwardly. This raises the gasket 76 from its seat against the top of the plug 68 and also brings the perforations 77 above the top of this plug so that the filling tube 60 now is placed in communication with the chamber between the plugs formed by the bore 66. This chamber is connected by a passageway 78 with the filling conduit 41.

An annular groove 79 is formed about the upper plug 67 and is connected by a passageway 80 with the bore 72 in the upper plug within which the exhaust stem 59 slides. A passageway 81 connects the annular groove with the exhaust conduit 42.

The above described filling stem construction is exemplary only of constructions which I may use, and does not furnish all of the elements needed for the practice of my invention. It will be noted from the explanation above that certain valving actions must occur without vertical change in the position of the container. Hence, it becomes necessary to provide for these valving actions in the automatic operation of the machine. Depending upon which of the several processes outlined above is adopted, means may be required to close and open the vacuum or exhaust line, to close and open the filling line, or both. These means also may take various forms. One form, not herein illustrated, contemplates the provision of valves in the vacuum and filling lines 42, 41, or in the continuations of these, 81 and 78 in the holder element 40, which valves have resiliently biased operating elements so located as to be actuated at the proper times by stationary fingers or abutments on the machine. Valving arrangements actuated by stationary abutments on the machine are shown and described in my copending application, Serial No. 8,885, filed February 17, 1948, and entitled Machine for Filling Containers.

It is also possible to valve the heads individually by means actuated from the specific position of the containers. In Figures 5 and 6 herein, if draw-off of the overfill were not required with the container and hence the stem in an intermediately lowered position, the vacuum source could be cut off from vacuum tube 59 by having this tube closed at its upper terminus and by providing it with radial perforations which would coact with the aperture 80 when the tube is in elevated position. Since it is desirable to have the vacuum or exhaust effective in the intermediate or draw-off position, and since it is desirable to conserve vacuum when there is no container in position, it is possible to disconnect the vacuum source from the vacuum tube 59 by valve means controlled from the centering bell 63, the valve means being actuated by the bell suspending rods 64. Arrangements of this type are shown in the copending application Serial No. 8,885 referred to above. In the arrangements there shown and described, the sliding bell rods are wet by the liquid flowing through the vacuum line and in their vertical reciprocation carry some of this liquid to the outside of the stem casing. Therefore, a valve located in the vacuum passageway 81 in a similar position to the micrometer valve 91 hereinafter described, but arranged to be vertically slidable, can be actuated by a member attached to the bell suspending rods 64 in such a way that it will be open in the intermediate or draw-off position, while it will be closed in the extreme downward position of the bell. The valve, of course, will be open when the bell is in its uppermost position.

Another and preferable way of accomplishing the valving is by means of stationary elements located within the chambers 27 and 28 which, sliding against the surfaces of these chambers through which the conduits 41 and 42 are threaded, act directly as valves to close off these conduits at particular rotative positions of the machine. In Figures 9, 10 and 11, I have shown respectively an enlarged vertical section of the machine head and horizontal sections of the upper or vacuum chamber 28 and of the lower or filling chamber 27. The vacuum conduit 44, which is maintained in fixed, non-rotative position in the chambers by means of the bracket 45, in spite of the rotation of the head, extends into both chambers, and where it passes through the diaphragm or septum 29, a gland 82 will be provided to keep the chambers 27 and 28 isolated from each other. The lower end of the conduit 44 is closed by a plug 83, and perforations 84 are provided in the conduit within the chamber 28.

In each chamber a valve element 85 or 86 is affixed to the conduit 44 and slides with reference to inside annular surfaces of the chambers of the head, as will be clear from Figures 10 and 11. The valve element 86 in the lower chamber 27 (Figure 11) may have a portion to close off the filling line 41, as at 87, during the time in which a further rarefication of the atmosphere in the container is being attained in accordance with the second of the above described processes. This portion has a limited circumferential extent so that it will again open up the filling conduit 41, so as to permit the overfill hereinabove described, followed by another portion 88 closing off the filling tube 41 during the time when the container is lowered, the excess or overfill drawn off, and the bottle 26 removed from the platform. Similarly, as in Figure 10, the valve element 85 in the vacuum chamber 28 may have a portion 89 for cutting off the vacuum during the breaking of the seal, and for reestablishing it on the exhaust tube for the purpose of drawing off the overfill, followed by a portion 90 for closing off the exhaust tube 42 when the bottle is removed from the platform. Different configurations of the valve elements 84 and 85 may be provided for the practice of any of the processes outlined above, as will be readily understood.

The effective internal diameters of the filling and exhaust tubes of the stem, such as the tubes 53 and 54 of Figure 4 or the tubes 59 and 60 of Figure 7, may be so proportioned, taking into account their length, the viscosity of the filling material, and the resistances to flow provided by the several exhaust and filling connections, as to give the desired ratio of flow for the practice of my processes. However, it is more convenient to provide adjustable means for this purpose, especially since the over-all diameter of a filling stem must usually be limited to that which will easily fit in the neck opening of the smallest container to be filled. Accordingly, in Figure 6 I have indicated micrometer valves 91 and 92 arranged in each holder 40 and respectively adjustably controlling the passage of fluid through the passageways 78 and 81 in the head.

If the filling material is to be introduced into the containers under superatmospheric pressure, I close the reservoir 34 by means of a lid 93, and I apply pressure to the interior of the reservoir 34, as by means of a conduit 94 connecting the reservoir with a source of air under pressure (not shown). A pressure regulating valve 95 may be placed in this line, as desired. The impeller 50 will in this event be so designed and powered as to empty the trap 48 against the pressure inside the reservoir 34. I also prefer to provide a valve 96 in the line 94 which is a three-way valve actuated by a solenoid 97. The solenoid 97 may be connected into the circuit of the main motor driving the filling machine so that so long as this motor is energized, the solenoid will also be energized to connect the line 94 with the source of air under pressure. But if the machine should be stopped, as by de-energization of the main driving motor, the valve 96 will be released by the solenoid 97, whereupon a spring 98 will move the valve to a second position in which the reservoir 34 is vented to the atmosphere, as at 99 for the immediate relief of superatmospheric pressure in said reservoir.

An advantage of this arrangement is that if the machine for any reason is stopped, all of the containers then on the machine will ultimately fill and begin overflowing through the vent tube 59, and it is advisable to reduce this overflow as much as possible since otherwise a large volume of liquid would have to be handled through the overflow line including the automatic trap, and a large automatic trap would have to be provided. Reducing the pressure behind the incoming fluid when the machine is stopped, reduces the overflow under these circumstances.

Modifications may be made in my invention without departing from the spirit of it. Having thus described my invention in certain exemplary embodiments, what I claim as new and desire to secure by Letters Patent is:

1. A process of filling containers which comprises introducing a liquid filling substance into a container through a filling stem having a seal and comprising filling and exhaust tubes, said stem extending into the container and serving normally to determine a height of fill, producing an overfill of the container by establishing a condition of lower pressure of atmosphere remaining in the container after the liquid has reached the end of said stem than the pressure under which liquid seeks to enter said container by exhausting sufficient air through said exhaust tube, closing said exhaust tube thereby producing an overfill of the container and, when such overfill has been attained, moving the container and said stem relative to each other accompanied by the breaking of said seal, and withdrawing excess liquid from said container through said exhaust tube.

2. The process claimed in claim 1 in which the effectively lower pressure of said atmosphere is attained by withdrawing air from said container at a faster rate than liquid is permitted to enter it through the filling tube and, when the liquid level reaches the end of the exhaust tube, shutting off the said exhaust tube while permitting liquid to flow into the container to equalize said pressures.

3. The process claimed in claim 1 in which said effectively lower pressure of said atmosphere is attained by filling the container substantially to the level of the end of said stem, then closing off the filling tube while permitting the pressure of said atmosphere within the container to be lowered through said exhaust tube, afterward closing off said exhaust tube, and reopening said filling tube to permit said overfill through said equalization of pressures.

4. The process claimed in claim 1 wherein said lower pressure of the atmosphere within said container is attained, while introducing contents into the container under superatmospheric pressure by exhausting said container at so rapid a rate as to lower the pressure therein below said superatmospheric pressure until the liquid level in said container reaches the end of said stem, afterward closing off the exhaust tube and permitting material under superatmospheric pressure to enter said container and compress the atmosphere therein whereby to attain an overfill, and then closing of the filling tube prior to the breaking of said seal.

5. In container filling apparatus, a head ele-

ment formed to provide two chambers one for filling material and the other for suction, at least one filling spout structure associated with said head, said filling spout having filling and exhaust tubes with lower openings at substantially the same horizontal level and a seal for closing the mouth of a container, said seal so located as to permit entry of said spout into a container with said openings lower than a desired level of fill, means to present a container to said spout so as to seal the mouth of said container for filling and afterward to lower said container to a second position at which said openings determine the said desired level of fill, a reservoir for filling material in communication with said first mentioned chamber and a connection between said first-mentioned chamber and said filling tube, a vacuum pump in communication with said second mentioned chamber and a connection between said second mentioned chamber and said exhaust tube, and valve means in said chambers for selectively closing off and opening the connections between said filling spout and said chambers, said valve means acting to establish a lower pressure of atmosphere remaining in said container after a filling substance introduced therein through said filling tube has reached the level of said openings than the pressure under which said filling substance seeks to enter said container, and to cause entry of additional filling substance into said container to equalize said pressure and establish an overfill.

6. The structure claimed in claim 5 wherein the inner surfaces of said chamber are annular in configuration and said valve means comprises valve elements slidable with reference to the annular surface of said chambers.

7. The structure claimed in claim 6 wherein said valve elements are connected to a common fixed shaft, and said head element is rotatable with respect to said valve elements.

8. In container filling apparatus, a head element formed to provide two chambers one for filling material and the other for suction, a filling spout structure associated with said head, said filling spout having filling and exhaust tubes with lower openings at substantially the same horizontal level and a seal for closing the mouth of a container, said seal so located as to permit entry of said spout into a container with said openings lower than a desired level of fill, a connection between said first mentioned chamber and said filling tube and a connection between said second mentioned chamber and said exhaust tube, means to present a container to said spout in a filling position at which the mouth of the container is sealed for filling and afterwards to lower said container to a second position at which said openings determine the desired level of fill, valve means in the connections between said filling and exhaust tubes and said chambers, said valve means acting to open both connections upon movement of a container to said first position, and acting upon movement of said container to the second position to close the connection between said first mentioned chamber and said filling tube, and additional valve means for closing and opening said connections when said container is in said first position.

9. The structure claimed in claim 8 wherein the inner surfaces of said chambers are annular in configuration and said additional valve means comprises valve elements slidable with reference to the annular surfaces of said chambers.

10. The structure claimed in claim 8 wherein the connections between said chambers and said tubes include adjustment valves to control the rate of flow of fluid through said tubes.

PAUL R. FECHHEIMER.

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